# 2027
# Evolent Clinical Guidelines for Medical Necessity Review

Advanced Imaging Guidelines

Effective January 1, 202 – December 31, 202

# Guidelines for Clinical Review Determination

**Preamble**

Evolent is committed to the philosophy of supporting safe and effective treatment for patients. The medical necessity criteria that follow are guidelines for the provision of diagnostic imaging. These criteria are designed to guide both providers and reviewers to the most appropriate diagnostic tests based on a patient's unique circumstances. In all cases, clinical judgment consistent with the standards of good medical practice will be used when applying the guidelines. Determinations are made based on both the guideline and clinical information provided at the time of the request. It is expected that medical necessity decisions may change as new evidence-based information is provided or based on unique aspects of the patient's condition. The treating clinician has final authority and responsibility for treatment decisions regarding the care of the patient.

**Guideline Development Process**

These medical necessity criteria were developed by Evolent for the purpose of making clinical review determinations for requests for therapies and diagnostic procedures. The developers of the criteria sets included representatives from the disciplines of radiology, internal medicine, nursing, cardiology, and other specialty groups. Evolent's guidelines are reviewed yearly and modified when necessary following a literature search of pertinent and established clinical guidelines and accepted diagnostic imaging practices.

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# Evolent Clinical Guideline 2014 for Breast Magnetic Resonance Imaging (MRI)

| **Guideline Number:** Evolent_CG_2014 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:** September 1997 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Magnetic resonance imaging (MRI) of the breast is a useful tool for the detection and characterization of breast disease, assessment of local extent of disease, evaluation of treatment response, and guidance for biopsy and localization. Breast MRI is typically bilateral to allow for assessment of symmetry between the breasts. MRI findings should be correlated with clinical history, physical examination, and the results of mammography and any other prior breast imaging.

# INDICATIONS

For screening examination to detect breast cancer in any of the following situations.

**NOTE:** It is appropriate to perform screening breast MRI at routine intervals in patients at increased risk who are lactating but not during pregnancy.

## High-Risk Breast Cancer Screening *(1,2)*

**NOTE:** The age to start screening is specific to the reason the individual qualifies for screening with Breast MRI. For **ALL** of the indications below, screening may start 10 years prior to the earliest family member's age at diagnosis.

Annual screening with Breast MRI for any **ONE** of the following:

- Lifetime risk of developing breast cancer ≥ 20% based on a validated risk assessment model (eg, Tyrer-Cuzick, Gail model, BRCAPro, CanRisk/BOADICEA) starting at age 30 (3)
- 5-year risk of invasive breast cancer ≥ 1.7% in individuals ≥ age 35 based on either the Gail model or an imaging-based risk assessment model

- Personal history of atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH), or lobular carcinoma in situ (LCIS) (LCIS starting at diagnosis of ADH/ALH/LCIS but not prior to age 25) [4]
- Patients with history of extensive chest irradiation (usually as treatment for Hodgkin's or other lymphoma between ages 10 and 30) starting 8 years after radiation, but not prior to age 25
- Increased breast density characterized as "extremely dense" (American College of Radiology (ACR) Category D) starting at age 50 [1]

  **NOTE:** Screening starting at age 40 may be considered on a case-by-case basis
- Increased breast density characterized as "heterogeneously dense" (ACR Category C) **AND** intermediate lifetime risk of 15-20% based on a validated risk assessment model starting at age 50

  **NOTE:** Screening starting at age 40 may be considered on a case-by-case basis
- Inconclusive screening mammogram when category 0 has been specifically assigned due to breast characteristics limiting the sensitivity of mammography (eg, extremely or heterogeneously dense breast, implants obscure breast tissue)

## For Evaluation of Identified Lesion, Mass or Abnormality

- For any **ONE** of the following:
  - Biopsy proven atypical ductal hyperplasia (ADH) or atypical lobular hyperplasia (ALH)
  - Biopsy proven lobular carcinoma in situ (LCIS)
  - Skin biopsy positive for Paget Disease [5]
  - Follow-up of a BI-RADS 3 lesion on prior MRI **AND** not present on ultrasound or mammogram. Short-term follow-up intervals are typically at 6, 12, and 24 months following the initial assessment. [6]
- For any **ONE** of the following:
  - New nipple inversion or retraction without palpable mass and **ONE** of the following criteria are met:
    - Age < 30: breast ultrasound with negative, benign, or probably benign findings (BIRADS 1-3) and clinically suspicious
    - Age ≥ 30 breast ultrasound **AND** mammogram with negative, benign, or probably benign findings (BIRADS 1-3) and clinically suspicious [1]
  - Suspected breast cancer and biopsy cannot be performed (e.g. seen only in single view mammogram without ultrasound correlation) [1]
  - Skin changes suspicious for breast cancer (peau d'orange, skin thickening, edema, erythema, nipple excoriation, scaling, ulceration, or skin discoloration) **AND** completed mammogram with negative, benign, **OR** probably benign findings (BIRADS 1-3) [1]

- Spontaneous, unilateral, single duct, clear/serous, or bloody nipple discharge and no palpable mass and **ONE** of the following criteria are met [7]:
  - Age < 30: breast ultrasound with negative, benign, or probably benign findings (BIRADS 1-3) and clinically suspicious
  - Age ≥ 30 breast ultrasound AND mammogram with negative, benign, or probably benign findings (BIRADS 1-3) and clinically suspicious

  **NOTE:** This criteria does not apply to nipple discharge that is non-spontaneous or multi-duct

## Known Breast Cancer [8]

**Initial Staging:**

- New ductal carcinoma in situ (DCIS) diagnosis
- New invasive breast cancer diagnosis
- Axillary nodal carcinoma and unidentified primary tumor
- Borderline or malignant phyllodes tumor [9]

**Restaging:**

- Prior to neoadjuvant chemotherapy for invasive breast cancer
- Following neoadjuvant chemotherapy for invasive breast cancer
- Prior to breast surgery for invasive breast cancer
- Borderline or malignant phyllodes tumor [9]

**Surveillance:**

- For breast cancer, indicated with **EITHER** of the following:
  - Annually when breast cancer was diagnosed at age < 50
  - Annually with history of breast conservation surgery **AND** radiation **AND** dense breasts
- Borderline phyllodes tumor at the following intervals [9]:
  - Every 6 months for 2 years then
  - Annually for years 3-5
- Malignant phyllodes tumor at the following intervals [9]:
  - Every 3-6 months for 3 years then
  - Every 6 months for 2 years then
  - Annually after year 5

## Silicone Implants [10]

Surveillance of asymptomatic **silicone** implants at the following intervals:

- 5 years after placement (no prior imaging required)
  - If initial MRI is negative: Every 2-3 years
  - If initial MRI is indeterminate or abnormal: As clinically indicated
- Following abnormal or indeterminant mammography or ultrasound
- Evaluation of suspected silicone implant complication:
  - Following abnormal or indeterminant mammography or ultrasound
  - For suspected silicone breast implant complication

**NOTE:** MRI is used for silicone implant evaluation. MRI is **NOT** indicated for evaluation of saline implant complications

## Preoperative or Postoperative Assessment

- Preoperative Evaluation [8]:
  - Known breast cancer when surgery planned within thirty (30) days may be considered on a case-by-case basis
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation [11,12]:
  - When not addressed in specific indications and any **ONE** of the following criteria are met:
    - Known or suspected complications
    - A clinical reason is provided how imaging may change management

    **NOTE:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Indeterminate Findings

Unless follow up is otherwise specified within the guideline:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred (No further surveillance unless specified as highly suspicious or a change was found on the last follow-up exam).

## Genetic Conditions

**NOTES:** When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Breast MRI**

- ATM (Ataxia-Telangiectasia) [4,13]:
  - Annually starting at age 25 years in females
- BARD1 [4]:
  - Annually starting at age 40 in females (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- CDH1 [4]:
  - Annually starting at age 30 in females (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- CHEK2 [4]:
  - Annually starting at age 30 in females (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- PALB2 [4]:
  - Annually starting at age 30 (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- PTEN [14]:
  - Annually starting at age 30 (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- RAD51C [4]:
  - Annually starting at age 40 (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier)
- RAD51D [4]:
  - Annually starting at age 40 (or 10 years younger than the earliest breast cancer diagnosis in the family, whichever is earlier
- STK11 (Peutz-Jeghers Syndrome) [15]:
  - Annually starting at age 30

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Breast/Whole Body MRI** and **Chest CT** (or low-dose CT)

- Li Fraumeni (TP53) [16,17]:
  - Annually

    **NOTE**: Can also include Abdomen MRI annually starting at age 50 when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant. This may start 10 years younger than the earliest pancreatic cancer diagnosis in the family.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [18]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

IMAGING MODALITY: Any combination of the following studies are indicated when the study-specific criteria below are met at the interval specified for that study: **Breast/Abdomen/Pelvis MRI**.

- BRCA 1 [19]
  - **Breast MRI:** Annually starting at age 25
    - **NOTE**: May start at any age with positive family history of breast cancer diagnosed at age < 30
  - **Abdomen MRI:** Annually starting at age 50 AND ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant
    - **NOTE**: May start 10 years younger than the earliest pancreatic cancer diagnosis in the family
  - **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family
    - **NOTE**: If no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50

- BRCA 2 [19]
  - **Breast MRI:** Annually starting at age 25
    - **NOTE**: May start at any age with positive family history of breast cancer diagnosed at age < 30
  - **Abdomen MRI:** Annually starting at age 50
    - **NOTE**: May start 10 years younger than the earliest pancreatic cancer diagnosis in the family
  - **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family

**NOTE**: If no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50

# CODING AND STANDARDS

## Codes

| Codes | Description |
|---|---|
| 77046 | Magnetic resonance imaging, breast, without contrast material; unilateral |
| 77047 | Magnetic resonance imaging, breast, without contrast material; bilateral |
| 77048 | Magnetic resonance imaging, breast, without and with contrast material(s), including computer-aided detection (CAD real-time lesion detection, characterization and pharmacokinetic analysis), when performed; unilateral |
| 77049 | Magnetic resonance imaging, breast, without and with contrast material(s), including computer-aided detection (CAD real-time lesion detection, characterization and pharmacokinetic analysis), when performed; bilateral |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester).
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds wight limit/dimensions of MRI machine.

# SUMMARY OF EVIDENCE

These guidelines are developed using evidence-based and peer-reviewed resources from medical publications and societal organization guidelines, ensuring that the indications for Breast MRI are grounded in the best available evidence and standard of care.

- **High-Risk Breast Cancer Screening** [1,2]: Annual screening with Breast MRI is recommended for individuals with a lifetime risk of developing breast cancer of 20% or higher, based on validated risk assessment models. This includes individuals with a personal history of atypical hyperplasia or lobular carcinoma in situ, those with a history of extensive chest irradiation, and those with increased breast density.
- **Evaluation of Identified Lesion, Mass, or Abnormality** [5–7]: Breast MRI is indicated for the evaluation of biopsy-proven atypical hyperplasia, lobular carcinoma in situ, Paget Disease, and other specific conditions. It is also used for follow-up of BI-RADS 3 lesions and for further evaluation after inconclusive mammogram and ultrasound.
- **Known Breast Cancer** [5]: Breast MRI is used for initial staging, restaging prior to and following neoadjuvant chemotherapy, and surveillance in specific cases such as when breast cancer was diagnosed at a young age or in individuals with dense breasts.

- **Silicone Implants** [10]: MRI is used for the surveillance of asymptomatic silicone implants and for suspected silicone breast implant complications.

# Analysis of Evidence:

When choosing Breast MRI, several factors should be considered to ensure it is the appropriate imaging modality for the patient. These considerations ensure that Breast MRI is used effectively for screening, diagnosis, and management of breast conditions.

- **High-Risk Breast Cancer Screening** [1,2]: Annual screening with Breast MRI is recommended for individuals with a lifetime risk of developing breast cancer of 20% or higher, based on validated risk assessment models. This includes those with a personal history of atypical hyperplasia or lobular carcinoma in situ, a history of extensive chest irradiation, or increased breast density.
- **Evaluation of Identified Lesion, Mass, or Abnormality** [5–7]: Breast MRI is used for evaluating biopsy-proven atypical hyperplasia, lobular carcinoma in situ, skin biopsy positive for Paget Disease, and follow-up of BI-RADS 3 lesions on prior MRI.
- **Known Breast Cancer** [5]: MRI is used for initial staging, restaging prior to neoadjuvant chemotherapy, following neoadjuvant chemotherapy, and prior to breast surgery. It is also used for surveillance in patients diagnosed with breast cancer at a young age or those with dense breasts.
- **Silicone Implants** [10]: MRI is used for surveillance of asymptomatic silicone implants and for suspected silicone breast implant complications.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Indications added in High-Risk Breast Cancer Screening section for 5- year risk of invasive breast cancer and atypical hyperplasia, lifetime risk of developing breast starting age changed to 30<br>• Indications added to Evaluation of Identified Lesion, Mass or Abnormality section: atypical lobular hyperplasia, ages to nipple inversion, skin changes, and nipple discharge<br>• Indications added to Known Breast Cancer section: DCIS and borderline or malignant phyllodes tumor<br>• Indications added to Silicone Implants section: Abnormal or indeterminate mammograph or ultrasound and evaluation of suspected silicone implant |

| Date | Summary |
|---|---|
| | • Added a Genetic Conditions section and moved clinical content from sections of the guideline there<br>• Preoperative or Postoperative Assessment section updated<br>• Updated references<br>• CPT code table and descriptions added<br>• Removed legislative language |
| July 2025 | • Added a Summary of Evidence and Analysis of Evidence |
| June 2025 | • This guideline number changed from 023 to 2014<br>• Adjusted high-risk breast cancer screening section for:<br>  ○ Timing and age of screening throughout sections including within sections for dense breast and genetic mutations<br>  ○ Updated societal guidance regarding dense breasts<br>• Simplified and restructured the section for evaluation of identified lesion, mass, or abnormality<br>• Simplified and restructured the section for known breast cancer into initial staging, restating, and surveillance<br>• Simplified and restricted the section for silicone implants<br>• Updated language in the preoperative/postoperative section<br>• Added in general information statement regarding guideline criteria development by reputable sources, standard of care, and best practices<br>• Medicare line of business checked<br>• The State of Connecticut was removed from regulatory language |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer Screening and Diagnosis Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
2. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer Risk Reduction Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
3. Yeh ED, Brown A, Freer PE, et al. ACR Appropriateness Criteria® Female Breast Cancer Screening: 2025 Update. *Journal of the American College of Radiology*. 2025;22(11):S508-S530. doi:10.1016/j.jacr.2025.08.044
4. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate Version 3.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
5. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer Version 3.2025 © National Comprehensive Cancer Network, Inc. 2025. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
6. Spick C, Szolar DHM, Baltzer PA, et al. Rate of malignancy in MRI-detected probably benign (BI-RADS 3) lesions. *American Journal of Roentgenology*. 2014;202(3):684-689. doi:10.2214/AJR.13.10928
7. Sanford MF, Slanetz PJ, Lewin AA, et al. ACR Appropriateness Criteria® Evaluation of Nipple Discharge: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S304-S318. doi:10.1016/j.jacr.2022.09.020
8. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
9. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Soft Tissue Sarcoma Version 3.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
10. Chetlen A, Niell BL, Brown A, et al. ACR Appropriateness Criteria® Breast Implant Evaluation: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S329-S350. doi:10.1016/j.jacr.2023.08.019
11. American College of Radiology. ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF CONTRAST- ENHANCED MAGNETIC RESONANCE IMAGING

(MRI) OF THE BREAST. *American College of Radiology*. Published online 2023. https://gravitas.acr.org/PPTS/DownloadPreviewDocument?ReleaseId=2&DocId=6

12. Mehta TS, Lourenco AP, Niell BL, et al. ACR Appropriateness Criteria® Imaging After Breast Surgery. *Journal of the American College of Radiology*. 2022;19(11):S341-S356. doi:10.1016/j.jacr.2022.09.003
13. Veenhuis S, van Os N, Weemaes C, Kamsteeg EJ, Willemsen M. Ataxia-Telangiectasia. *GeneReviews*®. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK26468/
14. Yehia L, Eng C. PTEN Hamartoma Tumor Syndrome. *GeneReviews*®. Published online August 7, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1488/
15. McGarrity TJ, Amos CI, Baker MJ. Peutz-Jeghers Syndrome. *GeneReviews*®. Published online September 2, 2021. https://www.ncbi.nlm.nih.gov/books/NBK1266/
16. Schneider K, Zelley K, Nichols KE, Schwartz Levine A, Garber J. Li-Fraumeni Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1311/
17. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate Version 3.2025. © National Comprehensive Cancer Network, Inc. 2025. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
18. Friedman J. Neurofibromatosis 1. *GeneReviews*®. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/
19. Petrucelli N, Daly MB, Pal T. BRCA1- and BRCA2-Associated Hereditary Breast and Ovarian Cancer. *GeneReviews*®. Published online March 25, 2026. https://www.ncbi.nlm.nih.gov/books/NBK1247/

# Evolent Clinical Guideline 2022 for CT (Virtual) Colonoscopy - Diagnostic

| **Guideline Number:**<br>Evolent_CG_2022 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.***<br>***© 2007 - 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:**<br>July 2007 | **Last Revised Date:**<br>June 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Computed tomographic colonography (CTC), also referred to as virtual colonoscopy, is a minimally invasive structural examination of the colon and rectum to evaluate for colorectal polyps or neoplasms.

# INDICATIONS

## For diagnostic evaluation

Symptomatic patients when conventional colonoscopy is contraindicated or could not be completed and ONE of the following [1–3]:

- Patient had failed or incomplete colonoscopy
- Patient has an obstructing colorectal cancer
- When colonoscopy is medically contraindicated or not possible (e.g., patient is unable to undergo sedation or has medical conditions such as a recent myocardial infarction, recent colonic surgery, a bleeding disorder, or severe lung and/or heart disease) [1]

## Follow-Up Studies

- For a 3-year follow-up when 1-2 polyps that are 6-9 mm in diameter detected at CTC if patient does not undergo polypectomy (or is unwilling or unable to undergo colonoscopy) [2]

**NOTE:** CT (Virtual) Colonoscopy is not indicated in routine follow-up of inflammatory bowel disease, hereditary polyposis or non-polyposis cancer syndromes, evaluation of anal disease, or the pregnant or potentially pregnant patient. [1]

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 74261 | Computed tomographic (CT) colonography, diagnostic, including image postprocessing; without contrast material |
| 74262 | Computed tomographic (CT) colonography, diagnostic, including image postprocessing; with contrast material(s) including non-contrast images, if performed |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# SUMMARY OF EVIDENCE

**ACR-SABI SAR Practice Parameter for the Performance of Computed Tomography (CT) Colonography in Adults** [(1)]

**Study Design:** This document outlines the practice parameters for the performance of CT colonography in adults. It includes guidelines for screening, surveillance, and diagnostic examinations.

**Target Population:** The target population includes adults at average or moderate risk for developing colorectal carcinoma. This includes individuals with a preceding positive stool-based test or positive family history.

**Key Factors:**

**Indications:** CT colonography is indicated for screening individuals at average or moderate risk of colorectal cancer and diagnostic examination in symptomatic patients.

**Contraindications:** Conditions requiring caution include symptomatic acute colitis, recent colorectal surgery, and known or suspected colonic perforation.

**Preparation:** Colon preparation involves a combination of cleansing laxatives, tagging agents, and iodinated contrast material.

**Technique:** The examination technique includes mechanical insufflation using carbon dioxide, imaging in multiple positions, and use of low-dose, non-enhanced CT techniques.

**Quality Control:** Quality control measures include ensuring complete anatomic coverage of the colon and rectum, adequate colon cleansing and distention, and tracking radiation dose.

### NCCN Clinical Practice Guidelines for Colorectal Cancer Screening [2]

#### Study Design

The document outlines the practice parameters for the performance of CT colonography in adults. It includes guidelines for screening, surveillance, and diagnostic examinations.

#### Target Population

The target population includes adults at average or moderate risk for developing colorectal carcinoma. This includes individuals with a preceding positive stool-based test or positive family history.

#### Key Factors

**Indications:** CT colonography is indicated for screening individuals at average or moderate risk of colorectal cancer and diagnostic examination in symptomatic patients.

**Contraindications:** Conditions requiring caution include symptomatic acute colitis, recent colorectal surgery, and known or suspected colonic perforation.

**Preparation:** Colon preparation involves a combination of cleansing laxatives, tagging agents, and iodinated contrast material.

**Technique:** The examination technique includes mechanical insufflation using carbon dioxide, imaging in multiple positions, and use of low-dose, non-enhanced CT techniques.

**Quality Control:** Quality control measures include ensuring complete anatomic coverage of the colon and rectum, adequate colon cleansing and distention, and tracking radiation dose.

# ANALYSIS OF EVIDENCE

### Shared Conclusions [1,2]

Both documents emphasize the importance of CT colonography in colorectal cancer screening, particularly for individuals at average or moderate risk. They agree that CT colonography is a valuable tool for detecting colorectal neoplasia and improving patient outcomes.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Removed State Specific Regulatory Language<br>• Added technical description to codes<br>• Edited Summary of Evidence<br>• Updated references |
| June 2025 | • This guideline replaces Evolent Clinical Guideline 033-1 for CT (Virtual) Colonoscopy – Diagnostic<br>• Removed irrelevant citations<br>• Updated Follow-Up Indications per NCCN guidance<br>• Added third bullet to General Information<br>• Added Summary of Evidence and Analysis of Evidence<br>• Added legislative language for Rhode Island |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. American College of Radiology, Society for Advanced Body Imaging, Society for Abdominal Radiology. *ACR-SABI-SAR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) COLONOGRAPHY IN ADULTS*.; 2024.
2. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colorectal Cancer Screening Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
3. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

# Evolent Clinical Guideline 2023 for CT (Virtual) Colonoscopy - Screening

| **Guideline Number:** Evolent_CG_2023 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2007 - 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** July 2007 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Computed tomographic colonography (CTC), also referred to as virtual colonoscopy, is a minimally invasive structural examination of the colon and rectum and can be used as a screening tool to evaluate for colorectal polyps or neoplasms in the asymptomatic patient.

# INDICATIONS [1–5]

Computer tomographic colonography (CTC) is considered medically appropriate as an **alternative** to colonoscopy for screening asymptomatic individuals in the following two situations:

- **Asymptomatic** Individuals at **Average Risk** for colorectal cancer (CRC)
  - Every 5 years starting at age 45
    - **Average risk** is defined as presence of ALL of the following:
      - No personal history of any of the following:
        - Adenoma or serrated sessile polyp/lesion (SSP/SSL)
        - Colorectal cancer
        - Inflammatory bowel disease (IBD)
        - Known hereditary CRC syndrome
        - Cystic Fibrosis
        - Childhood cancer
      - **AND**

- No known family history of any of the following:
  - Advanced adenoma or serrated sessile polyp/lesion (SSP/SSL) in a first degree relative
  - Colorectal cancer
- NOTE: Any **ONE** of the above personal or family history risk factors places the patient at increased risk for colorectal cancer and screening is with colonoscopy rather than CTC unless a contraindication to colonoscopy is provided
- NOTE: Generally screening for colorectal cancer stops at age 75, however, it is reasonable to continue screening above age 75 if the patient's life expectancy is ≥ 10 years

- Patients at **Increased Risk** (one or more risk factors above) for colorectal cancer:
  - As an alternative to colonoscopy in individuals at **increased risk** for colorectal cancer **AND** a contraindication to colonoscopy has been provided:
    - Contraindications to colonoscopy include known obstructing colonic lesion, anatomic abnormality preventing passage of the scope, technical difficulty, patient is unable to undergo sedation or has medical conditions such as recent myocardial infarction, recent colonic surgery, a bleeding disorder, or severe lung and/or heart disease **OR**
    - A relative contraindication to colonoscopy such as symptomatic acute colitis, acute diarrhea, recent acute diverticulitis, recent colorectal surgery, symptomatic colon-containing abdominal wall hernia, small bowel obstruction.

**NOTE:** If a polyp 6-9 mm is detected at screening CTC and polypectomy is not done, then the follow-up CTC is considered diagnostic rather than screening (See Evolent Clinical Guideline 2022 for CT (Virtual) Colonoscopy - Diagnostic).

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 74263 | Computed tomographic (CT) colonography, screening, including image postprocessing |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, and pregnancy (depending on trimester).
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine.

# SUMMARY OF EVIDENCE

**ACR-SABI-SAR Practice Parameter for the Performance of Computed Tomography (CT) Colonography in Adults** [(2)]

**Study Design:** This document outlines the practice parameters for the performance of CT colonography in adults. It includes guidelines for screening, surveillance, and diagnostic examinations.
**Target Population:** The target population includes adults at average or moderate risk for developing colorectal carcinoma. This includes individuals with a preceding positive stool-based test or positive family history.
**Key Factors:**

- **Indications:** CT colonography is indicated for screening individuals at average or moderate risk of colorectal cancer and diagnostic examination in symptomatic patients.
- **Contraindications:** Conditions requiring caution include symptomatic acute colitis, recent colorectal surgery, and known or suspected colonic perforation 1.
- **Preparation:** Colon preparation involves a combination of cleansing laxatives, tagging agents, and iodinated contrast material.

- **Technique:** The examination technique includes mechanical insufflation using carbon dioxide, imaging in multiple positions, and use of low-dose, non-enhanced CT techniques.
- **Quality Control:** Quality control measures include ensuring complete anatomic coverage of the colon and rectum, adequate colon cleansing and distention, and tracking radiation dose.

**Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement** [(1)]

**Study Design:** This document provides the US Preventive Services Task Force (USPSTF) recommendation statement on screening for colorectal cancer. It includes a systematic review of the benefits and harms of screening strategies.
**Target Population:** The target population includes asymptomatic adults aged 45 years or older at average risk of colorectal cancer.
**Key Factors:**

- **Screening Tests:** The recommended screening tests include stool-based tests (high-sensitivity guaiac fecal occult blood test, fecal immunochemical test, stool DNA test) and direct visualization tests (colonoscopy, CT colonography, flexible sigmoidoscopy).
- **Benefits:** Screening for colorectal cancer in adults aged 50 to 75 years has substantial net benefit, while screening in adults aged 45 to 49 years has moderate net benefit.
- **Harms:** The harms of screening include bleeding and perforation from colonoscopy, and potential evaluation and treatment of incidental extracolonic findings from CT colonography.
- **Screening Intervals:** Recommended intervals for CT colonography are every 5 years.

**Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society** [(4)]

**Study Design**

- The guideline update is based on a systematic evidence review of CRC screening literature and microsimulation modeling analyses.
- Modeling included new evaluations of the optimal age to begin screening by race and sex, and incorporated recent changes in US CRC incidence.
- The ACS Guideline Development Group applied the GRADE (Grades of Recommendations, Assessment, Development, and Evaluation) criteria to develop and rate recommendations.

**Target Population**

- **Adults aged 45 years and older** with average risk for CRC.
- "Average risk" excludes individuals with a history of adenomatous polyps or CRC, increased risk due to family history, hereditary CRC syndromes (e.g., familial adenomatous polyposis, Lynch syndrome), prior abdominal/pelvic radiation, or inflammatory bowel disease.

**Key Factors & Evidence**

- **Screening Options:** Multiple modalities are recommended, including:
  - High-sensitivity stool-based tests (fecal immunochemical test [FIT], guaiac-based fecal occult blood test [gFOBT], multitarget stool DNA test)
  - Structural (visual) examinations (colonoscopy, computed tomography colonography [CTC], flexible sigmoidoscopy)
- **Screening Intervals:**
  - FIT or gFOBT: annually
  - Multitarget stool DNA: every 3 years
  - Colonoscopy: every 10 years
  - CTC: every 5 years
  - Flexible sigmoidoscopy: every 5 years
- **Evidence for Effectiveness:**
  - Screening with any recommended option significantly reduces CRC incidence (by detecting and removing adenomatous polyps and precancerous lesions) and mortality (through early detection).
  - Randomized controlled trials (RCTs) support mortality reduction for stool-based tests and flexible sigmoidoscopy.
  - Other tests (colonoscopy, CTC, multitarget stool DNA) are supported by test performance data and observational studies.
  - Modeling analyses identified efficient strategies, particularly those starting screening at age 45.
- **Recommendations:**
  - Begin screening at age 45 (qualified recommendation).
  - Strong recommendation for regular screening in adults aged 50 and older.
  - Continue screening through age 75 for healthy adults with >10 years life expectancy.
  - Individualize decisions for ages 76–85 based on preferences, health status, and prior screening history.
  - Discourage screening after age 85.
- **Follow-up:** All positive results on noncolonoscopy tests should be followed up with timely colonoscopy.
- **Patient Preference:** Choice of screening test should be based on patient preference and test availability, as offering options increases adherence.

# ANALYSIS OF EVIDENCE

**Shared Conclusions** [1,2,4]

- Lowering the Starting Age for Screening
  - All three documents now recommend initiating CRC screening at age 45 for average-risk adults, reflecting rising incidence in younger cohorts and modeling analyses showing improved benefit-burden balance.
- Multiple Screening Modalities
  - Stool-based tests (FIT, high-sensitivity gFOBT, multitarget stool DNA), structural exams (colonoscopy, CT colonography, flexible sigmoidoscopy) are all considered acceptable options for CRC screening, with choice guided by patient preference, test availability, and local resources.
  - Positive results on noncolonoscopy tests should be followed by timely colonoscopy.
- Evidence for Efficacy
  - All modalities are associated with significant reductions in CRC incidence and mortality, primarily through detection/removal of adenomatous polyps and early-stage cancers.
  - Colonoscopy and CT colonography have high sensitivity for advanced neoplasia; stool-based tests are less sensitive for advanced adenomas but are effective for cancer detection.
- Emphasis on Patient Choice
  - Guidelines stress the importance of offering patients a choice among high-quality screening options to improve adherence and uptake.

**Summary** [1,2,4]

All three articles now recommend CRC screening for average-risk adults starting at age 45, using a range of modalities that consider the patient's preferences and ensure follow-up for abnormal results.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Clarified indication requirements for Asymptomatic individuals at average risk<br>• Removed State Specific Regulatory Language<br>• Added technical description to codes |

| Date | Summary |
|---|---|
| | • Updated Summary of Evidence and Analysis of Evidence |
| June 2025 | • This guideline replaces Evolent Clinical Guideline 033-2 for CT (Virtual) Colonoscopy – Screening<br>• Updated citations<br>• Updated screening recommendation per ACS<br>• Added third bullet to General Information<br>• Checked Medicare Advantage Line of Business<br>• Added Summary of Evidence and Analysis of Evidence<br>• Removed legislative language for Virginia |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Davidson KW, Barry MJ, Mangione CM, et al. Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2021;325(19):1965. doi:10.1001/jama.2021.6238
2. American College of Radiology, Society for Advanced Body Imaging, Society for Abdominal Radiology. *ACR-SABI-SAR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) COLONOGRAPHY IN ADULTS*.; 2024.
3. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colorectal Cancer Screening Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
4. Wolf AMD, Fontham ETH, Church TR, et al. Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society. *CA Cancer J Clin*. 2018;68(4):250-281. doi:10.3322/caac.21457
5. American Cancer Society Guideline for Colorectal Cancer Screening. American Cancer Society. January 29, 2024. https://www.cancer.org/cancer/types/colon-rectal-cancer/detection-diagnosis-staging/acs-recommendations.html

# Evolent Clinical Guideline 2024 for Computed Tomography (CT) Bone Density Study

| Guideline Number: | Applicable Codes | |
|---|---|---|
| Evolent_CG_2024 | | |
| *"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.* <br> *© 1999 - 2027 Evolent. All rights Reserved.* | | |
| **Original Date:** | **Last Revised Date:** | **Implementation Date:** |
| April 1999 | May 2026 | January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines, and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Bone mineral density (BMD) measurement identifies patients with low bone density and increased fracture risk. Methods for measuring BMD are non-invasive, painless, and available on an outpatient basis. Dual X-ray absorptiometry (DXA) (previously referred to as DEXA) scanning is the gold standard initial study for measuring BMD. A computed tomography (CT) Bone Density Study (Quantitative CT (QCT)) is an enhanced technique that is indicated to measure BMD when DXA is contraindicated or cannot be performed.

# INDICATIONS

## Screening for Asymptomatic Low Bone Mineral Density (BMD) (1)

A CT bone density study (QCT) is indicated for screening for asymptomatic low BMD after meeting any **ONE** of the following general criteria:

- DXA scanning is contraindicated or cannot be performed
- Advanced degenerative changes of the spine
- Severe obesity (body mass index (BMI) > 35 kg/m)
- Extreme height (ie, very tall or very small body frame)
- For monitoring parathyroid hormone or glucocorticoid treatments, when an increased sensitivity to small changes in trabecular BMD is desired

**AND** meeting any **ONE** of the following clinical criteria:

- Women ≥ 65 years of age

- Men ≥ 70 years of age

## Suspected Low BMD (Osteopenia or Osteoporosis)

A CT bone density study (QCT) is indicated for suspected osteopenia or osteoporosis after meeting any **ONE** of the following general criteria [1]:

- DXA scanning is contraindicated or cannot be performed
- Advanced degenerative changes of the spine
- Severe obesity (BMI > 35 kg/m$^2$)
- Extreme height (ie, very tall or very small body frame)

**AND** meeting any **ONE** of the following clinical criteria [1]:

- Women < 65 years of age who exhibit any **ONE** of the following risk factors:
  - History of estrogen deficiency
  - History of fracture without a clear etiology (eg, fall or known trauma) [2]
  - History of maternal hip fracture that occurred after the age of 50 years
  - Low body weight (< 127 lbs. (57.6 kg), or BMI < 18.5 kg/m$^2$) [2]
  - History of amenorrhea for > 1 year, before the age of 42
  - Current use of cigarettes
  - Excessive alcohol use [2]
  - Loss of body height (> 4 cm (1.5 in.)), increasing thoracic kyphosis [2]
- Men < 70 years of age who exhibit any **ONE** of the following risk factors:
  - Current use of cigarettes
  - Excessive alcohol use [2]
  - Loss of body height (> 4 cm (1.5 in.)), increasing thoracic kyphosis [2]
- Individuals who exhibit any **ONE** of the following risk factors [2]:
  - High-risk medications (eg, steroids, medroxyprogesterone acetate, anticonvulsants, heparin, lithium, estrogen receptor modulators, calcitonin, bisphosphonates, thyroid hormone therapy, or chemotherapy)
  - Conditions that cause or contribute to osteoporosis and fractures (eg, malabsorption syndromes, gastrointestinal conditions, metabolic bone disease, hyperparathyroidism, hypogonadism, hyperthyroidism, autoimmune diseases, renal failure, hematologic disorders, multiple myeloma, chronic alcoholism, cerebral palsy)
  - Fragility fracture
  - Wrist, hip, spine, or proximal humerus fracture with minimal or no trauma, excluding pathologic fractures
  - Eating disorders

- Bariatric surgery
- Advanced degenerative changes of the spine or other conditions that may falsely elevate BMD measurements

## Known Osteopenia or Osteoporosis

- Postmenopausal women who meet any **ONE** of the following [3,4]:
  - Known low-to-moderate overall fracture risk, to reassess risk every 2-4 years
  - On treatment, with low BMD and at high risk for fractures, to monitor the spine and hip every 1-3 years
- For patients on bisphosphonates, to reassess fracture risk every 3-5 years [3,4]
- For patients on a RANK ligand inhibitor, to reassess fracture risk every 5-10 years [3,4]
- For patients ≥ 50 years of age who meet any one of the risk factors listed under the above section titled "Suspected Low Bone Mineral Density (Osteopenia or Osteoporosis)," repeat QCT is indicated every 2 years [1]

  **NOTE:** More frequent BMD testing may be warranted in certain clinical situations and should be considered on a case-by-case basis.

## Indications for Pediatric Patients (≤ 18 Years Old) [2]

Pediatric patients who meet any **ONE** of the following:

- Receiving (or expected to receive) glucocorticoid therapy for > 3 months
- Receiving radiation or chemotherapy for malignancies
- With an endocrine disorder known to adversely affect BMD (eg, hyperparathyroidism, hyperthyroidism, growth hormone deficiency, or Cushing's syndrome)
- With bone dysplasia known to have excessive fracture risk (eg, osteogenesis imperfecta, osteopetrosis) or high BMD
- With medical conditions that could alter BMD, such as:
  - Primary bone disorders
  - Potential secondary bone diseases (eg, juvenile idiopathic arthritis, celiac disease, cystic fibrosis)
  - Chronic immobilization (eg, Cerebral palsy, myopathic disease)
  - Endocrine disturbances (eg, Turner's syndrome, anorexia nervosa)
  - Cancer and therapies with adverse effects on bone health
  - Hematologic disorders (eg, Thalassemia, Sickle cell disease)
  - Genetic disorders (eg, Ehlers-Danlos syndrome, Marfan syndrome)

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 77078 | Computed tomography, bone mineral density study, 1 or more sites, axial skeleton (eg, hips, pelvis, spine) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

Patients who have a BMD that is 2.5 standard deviations below that of a "young normal" adult (T-score at or below -2.5) are deemed to have osteoporosis. Osteopenia is considered a precursor to osteoporosis, which is a more severe stage of bone loss. DXA scanning, previously referred to as a DEXA scan, is the most commonly used method of evaluating BMD. QCT is an enhanced technique that measures volumetric integral, trabecular, and cortical bone density at the spine and hip and can be used to determine bone strength.

Axial BMD measurements of the hip and spine provide the "gold standard" for clinical assessment. Peripheral DXA or QCT measures BMD at peripheral sites, generally at the heel or wrist. It is relatively cheap and portable and is an option when there is limited access to axial DXA/QCT. It is also frequently used in children to avoid radiation exposure to the torso.

# SUMMARY OF EVIDENCE

**ACR-SPR-SSR Practice Parameter for the Performance of Quantitative Computed Tomography (QCT) Bone Mineral Density** [(2)]

**Study Design:** This document outlines the practice parameters and technical standards for performing QCT for BMD assessment. It includes guidelines for indications, contraindications, and the qualifications and responsibilities of personnel involved in the procedure.

**Target Population:** The guidelines apply to both adult and pediatric patients. For adults, QCT is indicated for individuals with suspected abnormal bone metabolism, including postmenopausal women, men over 70 years, individuals with risk factors for osteoporosis, and those receiving long-term therapy affecting BMD 1. For children, QCT is indicated for those with conditions affecting BMD, such as endocrine disorders, bone dysplasia, and chronic immobilization.

**Key Factors:**

- **Advantages of QCT:** QCT allows volumetric assessment of BMD, which can eliminate confounding factors such as overlapping anatomy and quantify trabecular and cortical BMD 1. It is particularly useful in patients with severe degenerative changes, high or low body mass index, and those undergoing therapies affecting bone metabolic activity.
- **Indications:** QCT is recommended for clinical decisions influenced by BMD results, including screening for osteoporosis in older adults and monitoring therapy effectiveness.
- **Contraindications:** There are no absolute contraindications, but certain conditions may limit the value of QCT, such as pregnancy and severe degenerative changes.

### Pharmacological Management of Osteoporosis in Postmenopausal Women: An Endocrine Society Clinical Practice Guideline [4]

**Study Design:** This clinical practice guideline focuses on the pharmacological management of osteoporosis in postmenopausal women. It evaluates evidence from clinical trials and incorporates patient preferences, adherence data, and risk-benefit profiles.

**Target Population:** Postmenopausal women at high risk of fractures, especially those who have experienced a recent fracture.

**Key Factors:**

- **Pharmacological Therapies:** The guideline recommends bisphosphonates, denosumab, teriparatide, abaloparatide, selective estrogen receptor modulators, menopausal hormone therapy, tibolone, calcitonin, calcium, and vitamin D.
- **Fracture Risk Assessment:** The risk of future fractures should be determined using country-specific assessment tools, and patient preferences should be incorporated into treatment planning.
- **Monitoring:** Bone mineral density should be monitored by DXA at the spine and hip every 1 to 3 years.

### ACR Appropriateness Criteria Osteoporosis and Bone Mineral Density: 2022 Update [1]

**Study Design:** This document provides the ACR Appropriateness Criteria for osteoporosis and bone mineral density assessment. It includes evidence-based guidelines reviewed annually by a multidisciplinary expert panel.

**Target Population:** Adults over 50 years of age, particularly those with risk factors for osteoporosis, such as advanced degenerative changes in the spine.

**Key Factors:**

- **Imaging Modalities:** DXA is the primary imaging modality for screening and monitoring osteoporosis. QCT is useful in patients with advanced degenerative changes in the spine.
- **Indications for BMD Testing:** The criteria include screening for osteoporosis in women over 65 years and men over 70 years, as well as individuals with risk factors such as estrogen deficiency, low body mass, and history of fractures.
- **Follow-up Imaging:** Follow-up DXA scanning is important for monitoring patients with low BMD, either for progression or therapeutic response.

# ANALYSIS OF EVIDENCE

**Shared Conclusions** [1,2,4]**:**

- **Advantages of QCT:** All three documents highlight the advantages of QCT, such as volumetric assessment of BMD, which eliminates confounding factors like overlapping anatomy and quantifies trabecular and cortical BMD.
- **Use in Patients with Severe Degenerative Changes:** QCT is particularly useful in patients with severe degenerative changes, high or low body mass index, and those undergoing therapies affecting bone metabolic activity.
- **Importance of Accurate Imaging:** Accurate imaging and monitoring are crucial in managing osteoporosis and related conditions.
- **Use of QCT in Specific Populations:** QCT is beneficial for patients with severe degenerative changes and those undergoing therapies affecting bone metabolic activity

In summary, QCT is recognized for its advantages in volumetric assessment of BMD and its usefulness in patients with severe degenerative changes and those undergoing therapies affecting bone metabolic activity. However, DXA remains the primary imaging modality for screening and monitoring osteoporosis, with QCT serving as a valuable secondary tool in specific populations.

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | • Updated indications under screening asymptomatic low bone mineral density and known osteopenia or osteoporosis<br>• Removed Washington State Regulatory Language |
| June 2025 | • Guideline name updated from CT Bone Density Study to Computed Tomography (CT) Bone Density Study<br>• Guideline number changed from 060-2 to 2024 |

| Date | Summary |
|---|---|
| | • Added new bullet-point to the General Statement section<br>• Checked the Medicare Advantage box in the Applicable Lines of Business table<br>• Added a Summary of Evidence and Analysis of Evidence<br>• Clarified indications for screening and suspected osteoporosis<br>• Updated references<br>• Reduced background |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Yu JS, Krishna NG, Fox MG, et al. ACR Appropriateness Criteria® Osteoporosis and Bone Mineral Density: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S417-S432. doi:10.1016/j.jacr.2022.09.007
2. American College of Radiology. *ACR-SPR-SSR PRACTICE PARAMETER FOR THE PERFORMANCE OF QUANTITATIVE COMPUTED TOMOGRAPHY (QCT) BONE MINERAL DENSITY*.; 2023. https://zscore.research.chop.edu/.
3. Shoback D, Rosen CJ, Black DM, Cheung AM, Murad MH, Eastell R. Pharmacological Management of Osteoporosis in Postmenopausal Women: An Endocrine Society Guideline Update. *J Clin Endocrinol Metab*. 2020;105(3):587-594. doi:10.1210/clinem/dgaa048
4. Eastell R, Rosen CJ, Black DM, Cheung AM, Murad MH, Shoback D. Pharmacological Management of Osteoporosis in Postmenopausal Women: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab*. 2019;104(5):1595-1622. doi:10.1210/jc.2019-00221

# Evolent Clinical Guideline 2026 for Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) Guidance for Needle Placement

| **Guideline Number:**<br>Evolent_CG_2026 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:**<br>March 2009 | **Last Revised Date:**<br>May 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines, and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

The Current Procedural Terminology (CPT) codes describe the computed tomography (CT) or magnetic resonance imaging (MRI) “guidance” component of a diagnostic procedure. Requests for these services should always be approved. This organization does not review these for medical necessity.

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 77011 | Computed tomography guidance for stereotactic localization |
| 77012 | Computed tomography guidance for needle placement (eg, biopsy, aspiration, injection, localization device), radiological supervision and interpretation |
| 77013 | Computed tomography guidance for, and monitoring of, parenchymal tissue ablation |
| 77021 | Magnetic resonance imaging guidance for needle placement (eg, for biopsy, needle aspiration, injection, or placement of localization device) radiological supervision and interpretation |

| Code | Description |
|---|---|
| 77022 | Magnetic resonance imaging guidance for, and monitoring of, parenchymal tissue ablation |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | ● No changes to clinical content |
| December 2025 | ● Code within the Coding section were edited to reflect changes made by the American Medical Association<br>○ Deleted: 77014 |
| July 2025 | ● Guideline name changed from CT or MRI Guidance for Needle Placement to Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) Guidance for Needle Placement |
| June 2025 | ● Guideline number changed from 105 to 2026<br>● Added new bullet-point to the General Statement section |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# Evolent Clinical Guideline 2027 for Fetal Magnetic Resonance Imaging (MRI)

| **Guideline Number:** Evolent_CG_2027 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:** January 2016 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Fetal MRI should be performed only for a valid medical reason and only after careful consideration of sonographic findings or family history of an abnormality for which screening with MRI might be beneficial. Before 18 weeks gestational age, a fetal MRI may not provide additional diagnostic information due to the small size of the fetus and fetal movement when compared with sonography. The need for early diagnosis should be balanced against the advantages of improved resolution later in pregnancy, with the choice dependent on the anomalies to be assessed.

## Special Note

For evaluating the placenta or imaging the maternal pelvis without need for fetal assessment, use Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging.

# INDICATIONS FOR FETAL MRI

To better define or confirm any of the following [1,2]:

- Known or suspected abnormality of the fetus after ultrasound has been performed
- When fetal surgery is planned
- To make a decision about therapy, delivery, or to advise the family about prognosis

## Combination Studies

### *Pelvis/Fetal MRI*

- When medical necessity has been met for Pelvis MRI (such as for suspected placenta

accreta or percreta when ultrasound is indeterminate [3]) AND medical necessity has been met for Fetal MRI (such as suspected abnormality of the fetus after ultrasound has been performed [1]), two separate authorizations are required: Pelvis MRI (CPT codes 72195, 72196, or 72197) and Fetal MRI (CPT codes 74712 or +74713).

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 74712 | Magnetic resonance (eg, proton) imaging, fetal, including placental and maternal pelvic imaging when performed; single or first gestation |
| +74713 | Magnetic resonance (eg, proton) imaging, fetal, including placental and maternal pelvic imaging when performed; each additional gestation (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine.

# SUMMARY OF EVIDENCE

**MRI of Placenta Accreta, Placenta Increta, and Placenta Percreta: Pearls and Pitfalls** [3]

**Study Design:** This study provides a primer for radiologists performing MRI for suspected placenta accreta, increta, and percreta. It discusses imaging protocols, normal placental appearance, elements for reporting, and diagnostic features of invasive placentation.

**Target Population:** The study focuses on high-risk patients, particularly women with previous cesarean sections and placenta previa, which are major risk factors for placenta accreta.

**Key Factors:**

- **Imaging Protocols:** MRI sequences with high temporal resolution and good contrast-to-noise ratios are used to freeze underlying fetal motion. The examination is typically performed on a 1.5-T system with a multichannel phased-array surface coil.
- **Diagnostic Features:** MRI is indicated when ultrasound evaluation is equivocal or for patients with high clinical risk factors for placenta accreta. It is often used to plan cesarean section delivery and peripartum hysterectomy.
- **Safety:** Pelvic MRI has been in use for over 30 years with no evidence of adverse effects to the fetus in both clinical and laboratory investigations.

**ISUOG Practice Guidelines (updated): performance of fetal magnetic resonance imaging** [1]

**Study Design:** This study provides updated practice guidelines for the performance of fetal MRI by the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG). It aims to complement expert ultrasound examinations by confirming ultrasound findings or acquiring additional information.

**Target Population:** The guidelines are intended for healthcare practitioners performing fetal MRI, particularly in high-risk cases such as those at risk for brain abnormalities due to affected first-degree relatives.

**Key Factors:**

- **Purpose:** Fetal MRI is used to complement expert ultrasound examinations, either by confirming ultrasound findings or acquiring additional information. It is not used as a primary screening tool in prenatal care.
- **Safety:** MRI is not associated with known adverse fetal effects at any point in pregnancy when performed without administration of contrast media. Both 1.5-T and 3-T systems may be used.
- **Indications:** Fetal MRI is indicated following an expert ultrasound examination in which diagnostic information about an abnormality is incomplete or if there is a suspicion of an abnormality that cannot be confirmed by ultrasound alone.
- **Performance:** The guidelines recommend performing fetal MRI between 26 and 32 weeks of pregnancy, when pathologies related to abnormal development are more fully evolved.

## ACR–SPR PRACTICE PARAMETER FOR THE SAFE AND OPTIMAL PERFORMANCE OF FETAL MAGNETIC RESONANCE IMAGING (MRI) [2]

### Study Design

- The evidence base for fetal MRI is drawn from a combination of prospective cohort studies, comparative studies, and surveys of clinical practice. These studies often compare MRI to sonography (ultrasound) for the diagnosis of fetal anomalies, using MRI as an adjunct or problem-solving tool when sonography is inconclusive or limited.
- References include multicenter prospective cohort studies (e.g., MERIDIAN study), comparative diagnostic accuracy studies, and surveys of pediatric radiologists regarding current practices.

### Target Population

- The primary population includes pregnant patients whose fetuses are suspected to have anomalies based on sonographic findings, or where sonography is limited by factors such as fetal position, maternal body habitus, oligohydramnios, or overlying bone/gas.
- MRI is indicated for fetuses with suspected congenital anomalies of the brain, spine, face, neck, thorax, abdomen, pelvis, musculoskeletal system, and in cases of multiple gestation pregnancies or when fetal interventions are being considered.
- MRI may also be used for screening in select circumstances, such as family history of specific abnormalities (e.g., tuberous sclerosis, corpus callosal dysgenesis, lissencephaly).

### Key Factors

- **Indications:** MRI is used when sonography is inconclusive or limited, and for detailed assessment of suspected anomalies in various fetal systems (brain, spine, thorax, abdomen, musculoskeletal, etc.).
- **Safety:** Current data do not show deleterious effects of MRI at 1.5T or 3T on the developing fetus. MRI can be performed at any stage of pregnancy if the risk-benefit ratio warrants it, as determined by a qualified radiologist.
- **Contraindications:** MRI contrast agents are not routinely administered in fetal MRI due to lack of documented fetal indications and potential risks. Any use of contrast must be justified by a risk-benefit analysis.
- **Technique:** MRI protocols are tailored to gestational age, fetal size, and the region of interest. Rapid acquisition sequences are used to minimize motion artifacts. Imaging protocols include T2-weighted, T1-weighted, diffusion-weighted, and cine sequences for dynamic assessment.
- **Clinical Impact:** MRI findings guide diagnosis, treatment planning, delivery management, and parental counseling. MRI is particularly valuable for volumetric assessment (e.g., lung volumes in congenital diaphragmatic hernia), anatomical delineation in complex cases, and planning for fetal interventions.

# ANALYSIS OF EVIDENCE

**Shared Conclusions** [1–3]

Ultrasound is the first-line screening tool for fetal anomalies. Fetal MRI is indicated when ultrasound is inconclusive, limited, or when additional information is needed for diagnosis, management, or delivery planning. Fetal MRI also improves diagnostic accuracy and confidence, especially in high-risk cases, and facilitates multidisciplinary planning to optimize maternal and fetal outcomes.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Added technical description to codes<br>• Updated Summary of Evidence and Analysis of Evidence<br>• Updated references |
| June 2025 | • This guideline replaces Evolent Clinical Guideline 110 for Fetal MRI<br>• Added third bullet to General Information<br>• Checked Medicare Advantage Line of Business<br>• Added Summary of Evidence and Analysis of Evidence per Medicare requirements |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

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# REFERENCES


1. Prayer D, Malinger G, De Catte L, et al. ISUOG Practice Guidelines (updated): performance of fetal magnetic resonance imaging. *Ultrasound in Obstetrics & Gynecology*. 2023;61(2):278-287. doi:10.1002/uog.26129
2. ACR–SPR. *PRACTICE PARAMETER FOR THE SAFE AND OPTIMAL PERFORMANCE OF FETAL MAGNETIC RESONANCE IMAGING (MRI)*.; 2025.
3. Kilcoyne A, Shenoy-Bhangle AS, Roberts DJ, Sisodia RC, Gervais DA, Lee SI. MRI of Placenta Accreta, Placenta Increta, and Placenta Percreta: Pearls and Pitfalls. *American Journal of Roentgenology*. 2017;208(1):214-221. doi:10.2214/AJR.16.16281

# Evolent Clinical Guideline 2029 for Follow Up, Limited or Localized Computed Tomography (CT)

| **Guideline Number:** Evolent_CG_2029 | **Applicable Codes** | |
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| **Original Date:** January 2026 | **Last Revised Date:** May 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Limited or localized follow-up Computed Tomography (CT) imaging is used when there is a known imaging finding for which follow-up will potentially alter management and full diagnostic imaging of that body part is not needed.

# INDICATIONS

## For Follow-Up Imaging [1–3]

- Limited CT scan of a localized anatomic area (any body part) is indicated when there is a known previous imaging finding for which follow-up imaging of that finding is reasonably expected to alter management and this is the CPT specifically requested by the ordering provider (i.e. full diagnostic imaging of that body part is not needed). Clinical scenarios where this study is indicated include but are not limited to the following:
    - Re-evaluation of an advanced infection (such as focal osteomyelitis, abscess)
    - Confirming location of a stent, a brachytherapy treatment medium, or a treatment-related substance [4]
    - Limited CT performed intra-procedurally (such as during an angiogram) [5]
    - Re-evaluation of nephrolithiasis

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 76380 | Computed tomography, limited or localized follow-up study |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# SUMMARY OF EVIDENCE

### ACR-AAPM-SPR PRACTICE PARAMETER FOR DIAGNOSTIC REFERENCE LEVELS AND ACHIEVABLE DOSES IN MEDICAL X-RAY IMAGING [1]

**Study Design**: This practice parameter document provides guidance on the implementation of diagnostic reference levels (DRLs) and achievable doses (ADs) in medical X-ray imaging.

**Target Population**: The document is intended for physicians, nonphysician radiology providers, other ancillary personnel, and qualified medical physicists.

**Key Factors**: The document summarizes relevant existing US national DRL and AD values and provides guidance on optimizing patient radiation dose and image quality. It emphasizes the importance of cooperation and communication between the clinical team, medical physicists, and radiologic technologists. The document also discusses the qualifications and responsibilities of personnel involved in medical X-ray imaging and provides benchmarks for comparing X-ray dose estimates.

### Standardization and optimization of CT protocols to achieve low dose [2]

**Study Design**: This paper summarizes approaches to reduce radiation dose in computed tomography (CT) scans, as discussed in the 2013 UCSF Virtual Symposium on Radiation Safety in Computed Tomography.

**Target Population**: The study is aimed at healthcare professionals involved in CT imaging, including radiologists, technologists, and medical physicists.

**Key Factors**: The paper addresses the importance of justifying the medical need for each scan, tailoring scans to patients, minimizing scan length, and using tube current modulation. It also emphasizes the role of professional societies in standardizing and optimizing CT protocols. The study discusses the roles of physicians and technologists in CT protocol review and management and provides strategies for achieving low-dose CT in various body regions.

**Digital radiography: The balance between image quality and required radiation dose** [3]

**Study Design**: This study discusses the transition from conventional screen-film imaging to digital radiography (DR) and computed radiography (CR). It explores the balance between image quality and required radiation dose, emphasizing the importance of optimizing imaging parameters.

**Target Population**: The study is relevant to radiologists and medical physicists who are involved in digital radiography.

**Key Factors**: The paper highlights the flexibility of digital systems in reducing acquisition dose at the expense of image quality and vice versa. It discusses the implementation of dose indicators and dose monitoring as mandatory for digital radiography. The study also introduces the concept of image quality classes and strategies for dose containment.

# ANALYSIS OF EVIDENCE

**Analysis** [1–3]:

In summary, while all three articles share a common goal of optimizing radiation doses and ensuring patient safety, they differ in their focus on specific imaging modalities, techniques, and protocols. Together, these articles provide a robust framework for understanding and implementing dose reduction strategies in medical imaging.

**Shared Findings**

- **Radiation Dose Management**: All three articles emphasize the importance of managing and optimizing radiation doses to ensure patient safety while maintaining diagnostic image quality. They discuss various strategies for dose reduction, including the use of dose indicators, dose monitoring, and the implementation of diagnostic reference levels (DRLs) and achievable doses (ADs).
- **ALARA Principle**: The principle of As Low As Reasonably Achievable (ALARA) is a common theme across the articles. This principle aims to minimize radiation exposure while achieving the necessary image quality for accurate diagnosis.
- **Technological Advancements**: The articles highlight the role of technological advancements in reducing radiation doses. These include digital radiography, computed radiography, iterative reconstruction algorithms, and adaptive beam filtration.

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | • Added technical description to codes |
| July 2025 | • Adjusted guideline title<br>• Added in a Summary of Evidence and Analysis of Evidence |
| June 2025 | • New Guideline |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# REFERENCES


1. ACR–AAPM–SPR. *ACR-AAPM-SPR PRACTICE PARAMETER FOR DIAGNOSTIC REFERENCE LEVELS AND ACHIEVABLE DOSES IN MEDICAL X-RAY IMAGING*.; 2023.
2. Trattner S, Pearson GDN, Chin C, et al. Standardization and optimization of CT protocols to achieve low dose. *Journal of the American College of Radiology*. 2014;11(3):271-278. doi:10.1016/j.jacr.2013.10.016
3. Uffmann M, Schaefer-Prokop C. Digital radiography: The balance between image quality and required radiation dose. *Eur J Radiol*. 2009;72(2):202-208. doi:10.1016/j.ejrad.2009.05.060
4. Berger D, Van Dyk S, Beaulieu L, Major T, Kron T. Modern Tools for Modern Brachytherapy. *Clin Oncol*. 2023;35(8):e453-e468. doi:10.1016/j.clon.2023.05.003
5. Hell MM, Achenbach S. *Ct Support of Cardiac Structural Interventions*.; 2019.

# Evolent Clinical Guideline 2031 for Low Field Magnetic Resonance Imaging (MRI)

| **Guideline Number:**<br>Evolent_CG_2031 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:**<br>July 2009 | **Last Revised Date:**<br>May 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Special Note

Low Field MRI (< 1 Tesla) services are not considered to be medically necessary.

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| S8042 | Magnetic resonance imaging (MRI), low-field |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## MRI Scanners

MRI scanners with a field strength of greater than 1.0 Tesla (T) are considered high field. The typical high field MRI units in clinical practice range between 1.0 – 3.0 Tesla.

The definition of mid and low field MRI is more variable with mid field units having a lower field strength range of 0.3 to 0.5 and an upper limit under 1.0 T. Low field units have field strengths below 0.3 to 0.2 T.

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | • Added technical description to codes<br>• No clinical changes |
| June 2025 | • This guideline number changed from 064 to 2031<br>• Added in general information statement regarding guideline criteria development by reputable sources, standard of care, and best practices<br>• Background section reduced<br>• No significant content changes |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-*

*covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# Evolent Clinical Guideline 2038 for Magnetic Resonance Elastography (MRE)

| **Guideline Number:** Evolent_CG_2038 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:** October 2024 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Magnetic resonance elastography (MRE) combines magnetic resonance imaging (MRI) with low-frequency vibrations to map the stiffness of tissue (elastogram).

# INDICATIONS FOR ABDOMEN MR ELASTOGRAPHY

## Evaluation of Hepatic Fibrosis [1–3]

- Indicated after intermediate findings (between 8-12.5 kPa) on ultrasound elastography (such as Vibration-controlled transient elastography (VTCE) or point shear wave elastography (pSWE) testing)
- Indicated in an individual with known Non-Alcoholic Fatty Liver Disease (NAFLD) [4] **and one** or more of the following:
  - Abdominal obesity [5]
    - BMI > 35 or
    - BMI ≥ 25 and waist circumference ≥ 90 cm in men/ 80 cm in women
  - Diabetes Mellitus
  - Elevated liver enzymes
  - Fibrosis-4 index (FIB-4) score ≥ 2.67 (when provided or calculated, see **Background**) [6,7]
  - NAFLD Fibrosis Score (NFS) ≥ 0.676 (when provided or calculated, see **Background**) [7]
  - Enhanced Liver Fibrosis (ELF) test ≥ 9.8 (when provided, see **Background**) [8]

## Genetic Conditions

NOTES: When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and/or **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed. Chest CT is additionally indicated ONCE at diagnosis

- Alpha-1 Anti-Trypsin Deficiency (AATD) [9]:
  - Every 6 months

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and/or **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- HFE-Related Hemochromatosis [10,11]:
  - At diagnosis

## Combination Studies

### *Abdomen MRI and MR Elastography*

- This combination is indicated when the guideline criteria for BOTH Abdomen MRI and Abdomen MR Elastography have been met
  - Medical necessity criteria for Abdomen MRI are covered in Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging
  - Medical necessity criteria for MR Elastography for evaluation of hepatic fibrosis are covered in Evolent Clinical Guideline 2038 for MR Elastography

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 76391 | Magnetic resonance (eg, vibration) elastography |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Liver Elastography

Patients with an increased risk for development of hepatic fibrosis (such as individuals with hepatic steatosis) are typically first assessed with non-invasive liver disease assessment (NILDA) tools which include blood work and imaging studies.

The FIB-4 score, NAFLD Fibrosis Score (NFS), and ELF score are clinical indices that measure metabolic abnormalities that may be associated with development of liver fibrosis. [8,12,13]

In most types of liver disease, non-advanced imaging elastography techniques such as vibration-controlled transient elastography (VCTE), point shear wave elastography (pSWE) and 2-dimensional shear wave elastography (2DSWE) are the starting point for diagnosis after risk assessment. If the VCTE is < 8, there is low risk for development of fibrosis and that individual would have continued monitoring with risk tools such as the FIB-4 score. When the VTCE is > 12.5, [1,2,14] the diagnosis of cirrhosis/fibrosis can be made. Magnetic resonance elastography (MR Elastography) is indicated when the VTCE (or similar tool) shows an indeterminant value (between 8-12.5).

NAFLD refers to hepatic steatosis on imaging in an individual who drinks little to no alcohol. When there is metabolic dysfunction present (such as obesity, diabetes and/or elevated LFTs), this may be referred to as MAFLD (metabolic associated fatty liver disease) or MASH (metabolic dysfunction associated steatohepatitis). When provided, an elevated FIB-4 (≥ 2.67) or NFS (≥ 0.676) can be used to determine if the patient has MAFLD rather than NAFLD. [6]

# SUMMARY OF EVIDENCE

**American Gastroenterological Association Institute Guideline on the Role of Elastography in the Evaluation of Liver Fibrosis** [1]

**Study Design**: This is a guideline from the American Gastroenterological Association (AGA) on the role of elastography in the evaluation of liver fibrosis.

**Target Population**: The guideline is aimed at healthcare providers managing patients with chronic liver diseases, including hepatitis C, hepatitis B, NAFLD, and chronic alcoholic liver disease.

**Key Factors**: The guideline evaluates the use of vibration-controlled transient elastography (VCTE) and magnetic resonance elastography (MRE) for diagnosing liver fibrosis and cirrhosis. It provides recommendations on liver stiffness cutoffs for diagnosing cirrhosis and advanced fibrosis and discusses the limitations and diagnostic performance of VCTE and MRE. The guideline emphasizes the importance of considering clinical context and other available information when interpreting elastography results.

**AASLD Practice Guideline on imaging-based noninvasive liver disease assessment of hepatic fibrosis and steatosis** [2]

**Study Design**: This document is a practice guideline developed by the American Association for the Study of Liver Diseases (AASLD) on imaging-based noninvasive liver disease assessment of hepatic fibrosis and steatosis.

**Target Population**: The guidelines are intended for healthcare providers who manage patients with chronic liver disease (CLD), including adults and children with conditions such as hepatitis B, hepatitis C, NAFLD, alcohol-associated liver disease (ALD), primary sclerosing cholangitis (PSC), and primary biliary cholangitis (PBC).

**Key Factors**: The guidelines provide recommendations on the use of various imaging-based noninvasive liver disease assessments (NILDA), such as transient elastography (TE), acoustic radiation force impulse (ARFI), and magnetic resonance elastography (MRE). The document discusses the diagnostic performance of these techniques, their accuracy in staging liver fibrosis, and their use in combination with blood-based NILDA. The guidelines also address the role of NILDA in predicting fibrosis progression or regression and provide specific recommendations for different liver diseases.

**Magnetic resonance elastography of liver current update** [3]

**Study Design**: This is a review article that discusses the current state and advancements in Magnetic Resonance Elastography (MRE) for evaluating liver stiffness and fibrosis.

**Target Population**: The review focuses on patients with chronic liver disease (CLD), including those with conditions such as hepatitis B, hepatitis C, nonalcoholic fatty liver disease (NAFLD), and other liver diseases.

**Key Factors**: The article highlights the robustness of MRE as a non-invasive imaging technique for assessing liver stiffness and fibrosis. It discusses the principles and techniques of MRE, including the use of spin echo MRE and three-dimensional MRE to reduce technical limitations. The review also covers the clinical applications of MRE, such as its use in detecting and staging liver fibrosis, evaluating treatment response, and assessing liver stiffness in various liver diseases.

# ANALYSIS OF EVIDENCE

**Analysis** [1–3]:

In summary, MRE is a highly accurate and reliable tool for assessing liver fibrosis, with broad clinical applications and advantages over other non-invasive methods. However, technical limitations and the need for standardized protocols and further research are important considerations for its use in clinical practice.

**Shared Conclusions:**

- **Accuracy and Reliability of MRE**: All three articles agree that Magnetic Resonance Elastography (MRE) is a highly accurate and reliable non-invasive imaging technique for assessing liver fibrosis. MRE is praised for its ability to provide detailed stiffness maps of the liver, which correlate well with histological findings of fibrosis.
- **Advantages Over Other Methods**: MRE is consistently highlighted as superior to other non-invasive methods like transient elastography (TE) and serum biomarkers. It is noted for its ability to assess a larger portion of the liver and provide more comprehensive data.
- **Clinical Applications**: The articles emphasize the clinical utility of MRE in diagnosing and staging liver fibrosis in various chronic liver diseases, including hepatitis B, hepatitis C, non-alcoholic fatty liver disease (NAFLD), and alcoholic liver disease.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Reorganized Genetics section and Combination Studies section for increased readability<br>• No changes to clinical content<br>• Added code descriptions |
| July 2025 | • Added a Summary of Evidence and Analysis of Evidence |
| June 2025 | • Added in general information statement regarding guideline criteria development by reputable sources, standard of care, and best practices<br>• Segment added to combinations studies about if the required use of conscious sedation is needed the entire combination is indicated<br>• Defined BMI parameters<br>• Added ELF test |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# REFERENCES


1. Lim JK, Flamm SL, Singh S, et al. American Gastroenterological Association Institute Guideline on the Role of Elastography in the Evaluation of Liver Fibrosis. *Gastroenterology*. 2017;152(6):1536-1543. doi:10.1053/j.gastro.2017.03.017
2. Sterling RK, Duarte-Rojo A, Patel K, et al. AASLD Practice Guideline on imaging-based noninvasive liver disease assessment of hepatic fibrosis and steatosis. *Hepatology*. 2025;81(2):672-724. doi:10.1097/HEP.0000000000000843
3. Hoodeshenas S, Yin M, Venkatesh SK. Magnetic resonance elastography of liver current update. *Topics in Magnetic Resonance Imaging*. 2018;27(5):319-333. doi:10.1097/RMR.0000000000000177
4. Zhang YN, Fowler KJ, Boehringer AS, et al. Comparative diagnostic performance of ultrasound shear wave elastography and magnetic resonance elastography for classifying fibrosis stage in adults with biopsy-proven nonalcoholic fatty liver disease. *Eur Radiol*. 2022;32(4):2457-2469. doi:10.1007/s00330-021-08369-9
5. Bosomworth NJ. Normal-weight central obesity: Unique hazard of the toxic waist. *Canadian Family Physician*. 2019;65(6):399-408. http://www.ncbi.nlm.nih.gov/pubmed/31189627
6. Wang T, Xi Y, Raji A, et al. Overall and subgroup prevalence of non-alcoholic fatty liver disease and prevalence of advanced fibrosis in the United States: An updated national estimate in National Health and Nutrition Examination Survey (NHANES) 2011-2018. *Ann Hepatol*. 2024;29(1). doi:10.1016/j.aohep.2023.101154
7. Kjaergaard M, Lindvig KP, Thorhauge KH, et al. Using the ELF test, FIB-4 and NAFLD fibrosis score to screen the population for liver disease. *J Hepatol*. 2023;79(2):277-286. doi:10.1016/j.jhep.2023.04.002
8. Saarinen K, Färkkilä M, Jula A, et al. Enhanced liver Fibrosis® test predicts liver-related outcomes in the general population. *JHEP Reports*. 2023;5(7):100765. doi:10.1016/j.jhepr.2023.100765
9. Stoller JK, Hupertz V, Aboussouan LS. Alpha-1 Antitrypsin Deficiency. *GeneReviews®*. Published online June 1, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1519/
10. Piperno A, Bertola F, Bentivegna A. Juvenile Hemochromatosis. *GeneReviews®*. Published online January 9, 2020. https://www.ncbi.nlm.nih.gov/books/NBK1170/
11. Chalasani N, Younossi Z, Lavine JE, et al. The diagnosis and management of nonalcoholic fatty liver disease: Practice guidance from the American Association for the Study of Liver Diseases. *Hepatology*. 2018;67(1):328-357. doi:10.1002/hep.29367
12. Tamaki N, Kurosaki M, Huang DQ, Loomba R. Noninvasive assessment of liver fibrosis and its clinical significance in nonalcoholic fatty liver disease. *Hepatology Research*. 2022;52(6):497-507. doi:10.1111/hepr.13764
13. Tacke F, Horn P, Wai-Sun Wong V, et al. EASL–EASD–EASO Clinical Practice Guidelines on the management of metabolic dysfunction-associated steatotic liver disease (MASLD). *J Hepatol*. 2024;81(3):492-542. doi:10.1016/j.jhep.2024.04.031

# Evolent Clinical Guideline 2046 for Positron Emission Tomography (PET) Scan, PET Scan with Computed Tomography (CT) for Attenuation

| **Guideline Number:**<br>Evolent_CG_2046 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:**<br>September 1997 | **Last Revised Date:**<br>June 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Oncologic PET is generally indicated for biopsy-proven cancer or strongly suspected cancer based on other diagnostic testing. The appropriateness of an ordered PET/Computed Tomography (CT) study is dependent on the type of cancer, and which radiopharmaceutical will be used for the PET/CT.

## Definitions

The following definitions apply to all oncologic indications in this guideline unless otherwise specified.

- **INITIAL STAGING** refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**
- **RESTAGING** refers to imaging that is performed during treatment to determine response to treatment/monitor treatment, a single end of treatment study done within 6 months of completion of treatment, or when there is clinical concern for recurrence (ie, new imaging, new signs, rising labs/tumor markers or symptoms relative to type of cancer and entire clinical picture). Recurrence is not required to be biopsy proven.
    - Imaging is typically performed 6-12 weeks after surgery
    - Imaging is typically performed 12 weeks after radiation (to avoid false positive findings that can be caused by treatment changes or healing).
        - PET/CT can be performed 1-3 weeks after neoadjuvant chemotherapy or neoadjuvant chemoradiation if done for presurgical planning to evaluate for distant metastatic disease or to evaluate known metastatic disease located in areas separate from the site(s) being radiated.
    - When an end of treatment PET scan performed at an appropriate post-treatment

interval (see above) shows indeterminate findings, one additional repeat PET in 3 months is indicated.

- Common exceptions are noted in the guideline. If not noted in the guideline, a valid clinical reason explaining why the interval needs to be shorter is needed.

- **TREATMENT** includes surgery, chemotherapy, immunotherapy, radiation, as well as patients on “maintenance therapy” who have known, or existing, metastatic disease being controlled by this treatment. Allogenic bone marrow transplant and Chimeric Antigen Receptor (CAR) T-cell therapy should be considered ‘active’ treatment for at least 6 months after infusion/transplant and as such is indicated at 30 days, 100 days, and 6 months after the most recent infusion.
- **INDETERMINATE IMAGING:**
  - When indeterminate imaging is required prior to PET, this typically means conventional imaging (CT, Magnetic Resonance Imaging (MRI), or Nuclear Medicine Scan (ie, bone scan)) shows a finding that is indeterminate AND clarification of that finding with PET will potentially change management.
  - The information provided should clearly explain why conventional imaging is insufficient to determine treatment or management.
  - When requested for biopsy guidance, with any ONE of the following:
    - To determine the best location to biopsy either within a tumor that has necrosis on imaging
    - To determine the best location to biopsy when there are findings on standard imaging that would require a significantly invasive procedure (such as laparoscopic or open surgical procedures) AND malignancy is highly suspected based on imaging.
- **SURVEILLANCE:**
  - Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above.

# INDICATIONS

## Bone Tumors and Sarcomas

### *Alveolar Soft Parts Sarcoma* [1]

Alveolar soft parts sarcoma is a rare and aggressive cancer that originates in the deep soft tissues of the extremities. Most patients undergo both conventional imaging with CT or MRI of

the primary site of disease, CT Chest and MRI Brain, in addition to PET/CT to determine the extent of disease and response to treatment.

- Initial Staging, Restaging, and Surveillance
  - Indicated

## *Angiosarcoma* [1]

Angiosarcoma is a rare and aggressive cancer that originates in the lining of blood vessels and lymph nodes. Most patients undergo both conventional imaging with CT or MRI of the primary site of disease, CT Chest and MRI Brain, in addition to PET/CT to determine the extent of disease and response to treatment.

- Initial Staging, Restaging, and Surveillance
  - Indicated

## *Chondrosarcoma* [2]

De-differentiated chondrosarcoma is treated according to the **Osteosarcoma** section. Mesenchymal chondrosarcoma is treated according to the **Ewing Sarcoma** section.

- Initial Staging, Restaging, and Surveillance
  - NOT Indicated

## *Chordoma* [2]

Poorly differentiated or de-differentiated chordoma is treated according to the **Soft Tissue Sarcoma** section. Chondroid chordomas are treated as described below.

- Initial Staging
  - Indicated to clarify inconclusive conventional imaging
- Restaging
  - Indicated to clarify inconclusive conventional imaging
  - When previous PET demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Clear Cell Sarcoma, Epithelioid Sarcoma, Rhabdomyosarcoma* [1]

Most patients undergo both conventional imaging with CT or MRI of the primary site of disease and CT Chest in addition to PET/CT to determine the extent of disease and response to treatment.

- Initial Staging, Recurrence, and Surveillance
  - Indicated

## *Ewing Sarcoma* [2]

This section includes the following cancer types: osseous and extraosseous Ewing sarcoma, mesenchymal chondrosarcoma, and desmoplastic small round cell tumors. Given that treatment for the disease is intensive and multi-modal (chemotherapy, surgery and/or radiation therapy) and requires extensive coordination across medical specialties, multiple imaging studies are appropriate throughout the treatment course to facilitate appropriate and timely care delivery.

- Initial Staging
  - Indicated (in addition to Chest CT and primary site CT/MRI)
- Restaging
  - Indicated (in addition to Chest CT and primary site CT/MRI)
- Surveillance
  - For patients with a history of metastatic disease: indicated (in addition to Chest CT and primary site CT/MRI) every 3 months for 2 years, then every 4 months up to year 3 post completion of treatment

## *Giant Cell Tumor of Bone* [2]

Malignant transformation is treated according to the **Osteosarcoma** section.

- Initial Staging, Restaging, and Surveillance
  - NOT Indicated

## *Leiomyosarcoma* [1]

- Initial Staging, Restaging, and Surveillance
  - Indicated (in addition to Chest CT and Abdomen and Pelvis CT/MRI)

## *Liposarcoma* [1]

This section includes atypical lipomatous tumor/well differentiated liposarcoma (ALT/WDLPS), myxoid/round cell liposarcoma, and dedifferentiated/pleomorphic liposarcoma (ddLPS).

- Initial Staging, Restaging, and Surveillance
  - Indicated (in addition to Chest CT, Abdomen and Pelvis CT/MRI and total spine MRI)

## *Malignant Peripheral Nerve Sheath Tumor (MPNST)* [1]

MPNST is a rare and aggressive tumor that can occur either spontaneously or in individuals with Neurofibromatosis Type 1 (NF1). PET/CT is used in confirmed MPNST in addition to conventional imaging with a CT or MRI of the primary disease site, with or without Chest CT. There are additional indications for PET when transformation of a neurofibroma to MPNST occurs as detailed below.

- Initial Staging - biopsy confirmed diagnosis (regardless of NF1 Status) for any ONE of the following:

- If considering neoadjuvant therapy
- To clarify inconclusive conventional imaging

- Initial Staging - suspected diagnosis in setting of known NF1
  - If there is concern for malignant transformation of neurofibroma to MPNST based on any ONE of the following:
    - Change in conventional imaging (eg, growth or change in characteristics of mass)
    - Change in texture on exam
    - Change in symptoms (new or worsening pain)
- Restaging (for confirmed MPNST, regardless of NF1 status) for any ONE of the following:
  - If being treated with chemotherapy
  - To clarify inconclusive conventional imaging
- Surveillance
  - NOT indicated

## *Osteosarcoma* [2]

This section includes the following cancer types: osteosarcomas, giant cell tumor of the bone with malignant transformation, and high-grade undifferentiated pleomorphic sarcoma of the bone. Given that treatment for the disease is intensive and multi-modal (chemotherapy, surgery and/or radiation therapy) and requires extensive coordination across medical specialties, multiple imaging studies are appropriate throughout the treatment course to facilitate most appropriate and timely care delivery.

- Initial Staging
  - Indicated (in addition to Chest CT and primary site CT/MRI)
- Restaging
  - Indicated (in addition to Chest CT and primary site CT/MRI)
- Surveillance
  - For patients with a history of metastatic disease
    - Indicated every 3 months for 2 years and every 6 months for 3 years for a total 5 years after treatment (in addition to Chest CT and primary site CT/MRI)

## *Phyllodes Tumors* [1,3]

These tumors are sarcomas that occur in the breast. Benign phyllodes tumors have no metastatic potential whereas malignant phyllodes tumors can metastasize to bone, lung, and other viscera.

- Initial Staging

- Benign and Borderline Phyllodes tumors: NOT indicated
- Malignant phyllodes tumor:
  - To clarify indeterminate findings after Chest CT and Breast MRI

- Restaging with any ONE of the following:
  - Benign and Borderline Phyllodes tumors:
    - Local recurrence with pathology showing benign or borderline phyllodes tumor: NOT indicated
    - Local or distant recurrence with pathology showing malignant phyllodes tumor:
      - To clarify indeterminate findings after Chest CT and Breast MRI
  - Malignant phyllodes tumor:
    - To clarify indeterminate findings after Chest CT and Breast MRI
    - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

### *Soft Tissue Sarcoma - All Other Histologies* [1]

Soft tissue sarcomas include more than 50 types of tumors that are treated with a combination of surgery, radiation therapy, and chemotherapy. For all soft tissue sarcoma sub-types not specifically mentioned, patients undergo conventional imaging of primary site of disease with CT or MRI, Chest CT, and with or without Abdomen and Pelvis CT.

- Initial Staging
  - Indicated if considering neoadjuvant systemic therapy or radiation
  - To clarify inconclusive conventional imaging
- Restaging
  - Indicated if being treated with radiation or systemic therapy
  - To clarify inconclusive conventional imaging
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## Breast Cancer [3]

For Phyllodes Tumors, see **Phyllodes Tumors** within the Soft Tissue Sarcoma section.

### *FDG PET*

- Initial Staging

- To clarify indeterminate distant findings after complete staging with Chest CT, Abdomen (+/- Pelvis) CT, and bone scan
- To clarify any ONE of the following findings on advanced imaging after negative complete staging with Chest CT, Abdomen (+/- Pelvis CT), and bone scan:
  - Indeterminate internal mammary, infraclavicular, or supraclavicular lymph nodes
- For suspicion of undetected metastatic disease after complete staging (Chest CT, Abdomen (+/- Pelvis) CT, and bone scan) that is negative for metastatic disease in any ONE of the following high-risk situations:
  - pN2-3 (≥ 4 positive nodes) on surgical axillary staging (sentinel lymph node biopsy +/- targeted axillary dissection or axillary lymphadenectomy)
  - Any ONE of the following prior to preoperative systemic therapy
    - Inflammatory breast cancer
    - ≥ cT2 (> 2 cm) breast cancer
    - Biopsy-proven node positive breast cancer
    - cT1c (> 1 cm) node negative ER- PR- HER2- breast cancer
    - cT1c (> 1 cm) node negative HER2+ breast cancer

- Restaging
  - To clarify indeterminate distant findings after complete staging with Chest CT, Abdomen (+/- Pelvis) CT, and bone scan
  - To clarify any ONE of the following findings on breast MRI after negative complete staging with Chest CT, Abdomen (+/- Pelvis) CT, and bone scan:
    - Internal mammary, infraclavicular, or supraclavicular lymph nodes
  - When previous staging PET demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Fluoroestradiol (FES) PET [(3,4)]*

FES PET/CT is indicted for use in select patients with a previous diagnosis of estrogen-receptor positive (ER+) breast cancer who experience recurrence or progression. Specific indications are detailed below.

- Initial Staging, Restaging, Pre-surgical evaluation, Surveillance
  - NOT Indicated
- Restaging
  - Fluoroestradiol (FES) PET is indicated for restaging of recurrent or metastatic breast cancer when ALL of the following are present:

- Biopsy of recurrent or metastatic site is indeterminate for ER status OR unable to be performed
- ER status is needed to make a treatment decision

# Central Nervous System (CNS) Cancers [5]

## *All Histologies*

When an oncologic PET using FDG (using CPT codes 78811 and 78814) is requested for a primary brain malignancy, it should be reordered as a Brain PET (CPT 78608, see Evolent Clinical Guideline 2070 for Brain Imaging).

When a tracer other than FDG is used (such as SSTR (Dotatate) for meningioma), the CPT codes covered by this guideline (78811 and 78814) apply when medical necessity is met (see indications below) rather than the Brain PET code (CPT code 78608, see Evolent Clinical Guideline 2070 for Brain Imaging).

NOTE: See non-malignant disease section for **Dementia** indications.

## *Meningioma*

**SSTR (Dotatate) PET**

- Initial Staging:
  - Indicated if diagnosis in question after Brain MRI (biopsy not needed)
- Restaging
  - Indicated if presence of residual disease in question after Brain MRI (biopsy not needed)
  - For radiation planning
- Surveillance
  - Indicated for grade 2, grade 3 or recurrent grade 1 meningioma (in addition to Brain MRI)
    - Every 2-4 months for 3 years
    - Every 3-6 months thereafter

NOTE: See above **All Histologies** section regarding FDG

## *Primary CNS Lymphoma*

Oncologic PET/CT is used to determine the extent of disease and to monitor response to treatment.

- Initial Staging:
  - Indicated (in addition to Brain MRI and total spine MRI)
- Restaging:

- Indicated (in addition to Brain MRI and total spine MRI)

- Surveillance
  - NOT indicated

# Gastrointestinal Tract Cancers

## *Anal Carcinoma (including perianal carcinoma)* [6]

Anal melanoma is treated according to the **Cutaneous Melanoma** section. Anal adenocarcinoma is treated according to the **Rectal Cancer** section. Perianal carcinoma is treated according to the Anal carcinoma section, and the perianal region starts at the anal verge (squamous mucocutaneous junction) and extends outward over a 5-cm radius. Lesions more than 5 cm from the anal verge are treated according to the **Squamous Cell Skin Cancer** section.

- Initial Staging
  - To clarify indeterminate findings after complete staging with Chest CT, Abdomen CT, and Pelvis CT/MRI
  - To verify staging before treatment after Chest CT, Abdomen CT, and Pelvis CT/MRI show absence of distant metastatic disease

    NOTE: Mesorectal, pelvic, and inguinal lymph nodes denote stage II-III disease and are not consistent with distant metastatic disease.

- Restaging
  - To clarify indeterminate findings after complete staging with Chest CT, Abdomen CT, and Pelvis CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging

    NOTE: PET/CT is NOT indicated for local recurrence or for inguinal node recurrence.

- Surveillance
  - NOT indicated

## *Appendiceal Neoplasms and Cancers* [7]

Most patients with this disease undergo conventional imaging with Abdomen and Pelvis CT, with or without Chest CT depending on the subtype. PET/CT is usually not indicated and may under-appreciate the disease burden for mucinous tumors. This section includes the following: low-grade appendiceal mucinous neoplasm (LAMN), high-grade appendiceal mucinous neoplasm (HAMN), appendiceal adenocarcinoma, goblet cell adenocarcinoma, and undifferentiated carcinoma not otherwise specified. Appendiceal neuroendocrine tumors are managed according to the **Neuroendocrine Tumor** section.

- Initial Staging
  - Imaging suggesting appendiceal neoplasm or cancer: NOT indicated
  - Confirmed appendiceal neoplasm appropriate for resection: NOT indicated

- Resected appendiceal neoplasm or cancer incidentally seen on pathology: NOT indicated

- Restaging
  - Indicated for any ONE of the following:
    - While on systemic therapy:
      - Indicated for indeterminate findings after complete restaging with Chest CT and Abdomen and Pelvis CT.
    - Resected disease with serial tumor marker (eg, CEA, CA 19-9, or CA 125) elevation and normal Abdomen and Pelvis CT
    - With radiographic progression on conventional imaging and documentation that PET/CT needed for decision making about cytoreductive surgery and/or hyperthermic intraperitoneal chemotherapy (HIPEC)
    - In patients considered for image-guided liver-directed therapy, or to assess response after image-guided liver directed therapy
- Surveillance: NOT indicated

## *Colon Cancer* [8]

When there are known or suspected liver metastases at any stage in treatment and criteria are met for PET/CT, Abdomen MRI also is indicated in addition to PET/CT.

- Initial Staging, with any ONE of the following:
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
  - If complete staging with Chest CT and Abdomen and Pelvis CT shows potentially surgically curable metastatic disease
  - In patients considered for image-guided liver-directed therapies
- Restaging, with any ONE of the following:
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
  - If complete staging with Chest CT and Abdomen and Pelvis CT shows potentially surgically curable metastatic disease
  - In patients considered for image-guided liver-directed therapy, or to assess response after image-guided liver directed therapy
  - With serial carcinoembryonic antigen (CEA) elevation and no evidence of disease on complete staging with Chest CT and Abdomen and Pelvis CT
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Esophageal and EG Junction Cancers (squamous cell carcinoma and adenocarcinoma)* [9]

- Initial Staging, with any ONE of the following:
  - To clarify indeterminate findings after staging with Chest CT and Abdomen (+/- Pelvis) CT
  - To verify staging before treatment after Chest CT and Abdomen (+/- Pelvis) CT show absence of distant metastatic disease
- Restaging, with any ONE of the following:
  - Once for surgical restaging after preoperative chemotherapy, immunotherapy, or chemoradiation (can be done as soon as ≥ 5 weeks after completion of therapy)
  - Once for end-of-treatment restaging after definitive chemoradiation (≥ 12 weeks after completion of radiation)
    - May be done earlier than 12 weeks post-treatment if there is documentation of plans to start maintenance immunotherapy
  - To clarify indeterminate findings after restaging with Chest CT and Abdomen (+/- Pelvis) CT
  - Once for locoregional recurrence to verify stage after Chest CT and Abdomen (+/- Pelvis) CT show absence of distant metastatic disease
  - If previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Gastric Cancer* [10]

- Initial Staging
  - Indicated
- Restaging
  - Once for surgical restaging after preoperative chemotherapy or immunotherapy (as early as ≥ 5 weeks after completion of therapy)
  - Peritoneal-only metastatic disease (including positive cytology with no metastatic disease seen on imaging)
    - Once after at least 3 months of initial systemic therapy, to determine candidacy for cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (HIPEC)
  - To clarify indeterminate findings after restaging with Chest CT and Abdomen and Pelvis CT
  - If previous PET/CT demonstrated disease not seen on conventional imaging

- Surveillance
  - NOT indicated

## *Gastrointestinal Stromal Tumors* [10]

- Initial Staging, with any ONE of the following:
  - To clarify indeterminate findings after staging with Abdomen and Pelvis CT/MRI

  NOTE: Chest CT is optional
  - As a baseline in patients being treated with tyrosine kinase inhibitors (TKI)
  - In patients who are not candidates for up front surgical resection or those in whom resection would be associated with significant morbidity
- Restaging, with any ONE of the following:
  - Once 2-4 weeks after initiation of tyrosine kinase inhibitor (TKI) therapy
  - When Abdomen and Pelvis CT/MRI and metastatic site-appropriate conventional imaging is indeterminate for assessment of either response or progression in patients on TKIs
  - To clarify indeterminate findings after staging with Abdomen and Pelvis CT/MRI

  NOTE: Chest CT is optional
  - If needed to determine surgical resectability
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Rectal Cancer* [11]

When there are known or suspected liver metastases at any stage in treatment and criteria are met for PET/CT, Abdomen MRI is also indicated in addition to PET. Historically, treatment for rectal cancer has involved surgical resection. Nonoperative management (NOM) is an evolving paradigm for patients treated with initial chemoradiation who have a complete clinical response. More frequent conventional imaging with Pelvis MRI is appropriate in patients managed non-operatively. The same indications for PET/CT apply for patients managed with chemoradiation and observation rather than surgery.

- Initial Staging, with any ONE of the following:
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
  - If complete staging with Chest CT, Abdomen CT/MRI, and Pelvis MRI shows potentially surgically curable metastatic disease
  - In patients considered for image-guided liver-directed therapy
- Restaging, with any ONE of the following:

- To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
- If complete staging with Chest CT and Abdomen and Pelvis CT shows potentially surgically curable metastatic disease
- In patients considered for image-guided liver-directed therapy, or to assess response after image-guided liver directed therapy
- With serial carcinoembryonic antigen (CEA) elevation and no evidence of disease on complete staging with Chest CT and Abdomen and Pelvis CT
- When previous PET/CT demonstrated disease not seen on conventional imaging

- Surveillance
  - NOT indicated

### *Small Bowel Adenocarcinoma* [12]

- Initial Staging
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
- Restaging, with any ONE of the following:
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
  - With serial CA 19-9 or carcinoembryonic antigen (CEA) elevation and no evidence of disease after restaging with Chest CT and Abdomen and Pelvis CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## Genitourinary Cancers

### *Bladder Cancer* [13]

This section includes urothelial carcinoma of the entire urinary tract and follows the bladder cancer section regardless of what part of the urinary tract the tumor is in.

- Initial Staging
  - Non-muscle invasive bladder cancer (NMIBC):
    - NOT indicated
  - Muscle-invasive bladder cancer (MIBC) with any ONE of the following:
    - To verify staging before treatment after Chest CT and Abdomen and Pelvis CT show absence of distant metastatic disease
    - To clarify indeterminate conventional imaging outside of the urinary tract after

complete staging with Chest CT and Abdomen and Pelvis CT

- Restaging
  - Non-muscle invasive bladder cancer (NMIBC):
    - NOT indicated
  - Muscle-invasive bladder cancer (MIBC) with any ONE of the following:
    - To clarify indeterminate conventional imaging outside of the urinary tract after complete restaging with Chest CT and Abdomen and Pelvis CT
    - When previous PET/CT demonstrated disease not seen on conventional imaging
    - Indicated prior to cystectomy to verify staging after pre-surgical restaging with Chest CT and Abdomen and Pelvis CT are complete

## *Kidney Cancer* [14]

Patients with this disease undergo conventional imaging with CT scans of the chest, abdomen and pelvis. PET/CT has several limitations in this disease and is not routinely used. If there are signs or symptoms of bone or brain metastases, bone scan and/or MRI of the brain may also be performed. For upper tract urothelial/transitional cell carcinoma see **Bladder Cancer**.

- Initial Staging, Restaging, Surveillance
  - NOT indicated

## *Penile Cancer* [15]

- Initial Staging or Restaging with any ONE of the following:
  - T1b tumor (defined by presence of lymphovascular invasion, perineurial invasion, grade 3 histology, sarcomatoid histology)
  - ≥ T2 tumor (defined by invasion into corpus spongiosum, urethra, corpora cavernosum, scrotum, prostate, or pubic bone)
  - Palpable lymph nodes (any T stage)
  - Abnormal lymph nodes on imaging
  - Suspected metastatic disease
  - To clarify indeterminate findings after complete staging with Abdomen and Pelvis CT/MRI and Chest x-ray or CT
  - For restaging, when previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Prostate Cancer* [16]

Prostate cancer is typically diagnosed on biopsy. Localized disease may be treated with radiation, surgery or observed on an active surveillance protocol. Following definitive treatment to the prostate with surgery (radical prostatectomy (RP)), the PSA level should be undetectable after 3 months post-surgery. Following radiation to the prostate, the PSA may fluctuate. Following definitive treatment to the prostate (radiation or surgery), patients are monitored with PSA levels. When the PSA indicates a concern (see recurrence) this may be called a biochemical recurrence. Metastatic disease may be treated with systemic therapy (which may be continuous or intermittent) and is typically followed by monitoring PSA levels and conventional imaging. When requested in addition to Prostate-Specific Membrane Antigen (PSMA) PET, Pelvis MRI may be considered for initial staging and biochemical recurrence.

**FDG PET**

- Initial Staging, Restaging, and Surveillance:
  - Small cell variant:
    - Indicated to clarify inconclusive conventional imaging after Chest CT, Abdomen and Pelvis CT, and bone scan
  - All other patients:
    - NOT indicated

**PSMA PET**

- Initial Staging (PSMA is the only tracer appropriate for initial staging)
  - Known distant metastatic disease:
    - NOT indicated
  - Indicated for any ONE of the following:
    - Patients with newly diagnosed very high risk, high risk, or unfavorable intermediate risk prostate cancer (see **Background**)
    - Patients on active surveillance when disease progresses to very high risk, high risk or unfavorable intermediate risk using ALL of the following: recent clinical stage, recent PSA, and highest Gleason score/biopsy result (see **Background**)
    - With prior imaging that is indeterminate for either lymph node involvement or metastatic disease AND clarification of that finding will change treatment
- Restaging (PSMA):
  - Known metastatic disease
    - To verify presence of PSMA-positive lesions prior to administration of Lutetium-177-PSMA)
  - Recurrence (PSMA)
    - Post radical prostatectomy biochemical recurrence, with any ONE of the following:

- PSA persistence defined as detectable PSA (≥ 0.1 ng/mL) at 3 months post-operatively (only one level required)
- Rising PSA and > 0.1 ng/mL on two or more occasions
- PSA rise to > 0.1 ng/mL if PSA was previously undetectable
- PSA has doubled since last negative PSMA PET (repeat level verifying doubling required if PSA is not progressively rising)

- Post prostate whole gland radiation biochemical recurrence, with any ONE of the following:
  - PSA increase of ≥ 2 ng/mL above the nadir when increase is verified on repeat level
  - Progressively rising PSA above the nadir (two separate levels above nadir required)
  - PSA has doubled since last negative PSMA PET (repeat level verifying doubling required if PSA is not progressively rising)
  - Salvage prostatectomy is planned and PSMA PET has not recently been done
- Imaging recurrence:
  - Indicated for previous non-metastatic disease when prior complete restaging imaging with Chest CT, Abdomen and Pelvis CT, AND bone scan has been completed and stage of disease remains unclear

- Surveillance
  - NOT indicated

  NOTE: see Initial Staging for indications related to active surveillance. See Restaging for indications related to patients with known metastatic disease who are not on active treatment.

## *Testicular Cancer* [17]

Testicular germ cell tumors are divided into two groups - seminomas and non-seminomas (embryonal carcinoma, yolk sac tumor, choriocarcinoma, teratoma). Staging is completed with Chest CT and Abdomen and Pelvis CT.

- Initial Staging
  - NOT indicated
- Restaging
  - Non-seminoma:
    - NOT indicated
  - Pure seminoma:
    - Residual mass (> 3 cm) with normal tumor markers (serum Alpha-Fetoprotein

(AFP) and beta Human Chorionic Gonadotropin (hCG)) following chemotherapy and it has been at least 6 weeks since completion of chemotherapy

NOTE: If this PET is equivocal or borderline for residual disease, an additional repeat PET > 6 weeks later is appropriate to identify patients that can be safely observed without additional surgery. If a persistently FDG-avid mass is present on the second PET, resection or biopsy is recommended.

- Surveillance
  - NOT indicated

# Gynecological Cancers

## *Cervical Cancer* [18]

This section includes the following cancer types: squamous cell carcinoma, adenocarcinoma, and small cell neuroendocrine carcinoma of the cervix (NECC). Brain MRI is indicated in addition to PET for patients with NECC at all timepoints.

- Initial Staging
  - Indicated (in addition to Pelvis MRI)
- Restaging, with any ONE of the following:
  - During treatment
  - Once 3-6 months after completion of therapy (in addition to Pelvis MRI)
  - If the post-treatment PET/CT is indeterminate, one additional PET/CT is indicated 3 months later
  - Recurrence, including clinical concern for recurrence (in addition to Pelvis MRI)
- Surveillance
  - Indicated for patients with a history of stage IV cervical cancer or small cell NECC

## *Uterine Neoplasms* [19]

Uterine neoplasms are divided into pure endometrioid carcinoma, high-risk endometrial carcinoma histology (including serous carcinoma, clear cell carcinoma, undifferentiated/ dedifferentiated carcinoma, carcinosarcoma, and mesonephric-like adenocarcinoma), and malignant mesenchymal tumors/ sarcomas (including low-grade endometrial stromal sarcoma (ESS) or adenosarcoma, high-grade ESS, undifferentiated uterine sarcoma (UUS), leiomyosarcoma, perivascular epithelioid cell tumor [PEComa], and other sarcomas)

- Initial Staging
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
- Restaging
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen

and Pelvis CT

- When previous PET/CT demonstrated disease not seen on conventional imaging

- Surveillance
  - NOT indicated

## *Gestational Trophoblastic Neoplasia [20]*

Gestational trophoblastic neoplasia (invasive moles, choriocarcinomas, placental-site trophoblastic tumors (PSTT), epithelioid trophoblastic tumors (ETT)) arise from abnormal growth of trophoblastic cells (cells that normally develop into the placenta during pregnancy). Treatment is often multimodal (chemotherapy, surgery, and/or radiation therapy).

- Initial Staging
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
  - To evaluate for potentially surgically curable metastatic disease
- Restaging, with any ONE of the following:
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT
  - To evaluate for potentially surgically curable metastatic disease
  - When previous PET/CT demonstrated disease not seen on conventional imaging
  - For intermediate trophoblastic tumors including placental site trophoblastic tumor (PSTT) and epithelioid trophoblastic tumor (ETT) once upon completion of chemotherapy
- Surveillance
  - For intermediate trophoblastic tumors including placental site trophoblastic tumor (PSTT) and epithelioid trophoblastic tumor (ETT)
    - Indicated every 6-12 months for 2-3 years

    NOTE: NOT indicated for low-risk gestational trophoblastic neoplasia, post-molar gestational trophoblastic neoplasia, and choriocarcinoma

## *Ovarian, Fallopian Tube, and Primary Peritoneal Cancer [21]*

- Documented suspicion of ovarian cancer and ALL of the following:
  - Abdomen and Pelvis CT/MRI show an indeterminate ovarian lesion
  - Signs or symptoms of ovarian cancer
  - There is documentation of how results will alter management
- Initial Staging
  - Indicated for all histologic subtypes except benign teratoma

NOTE: Abdomen and Pelvis CT/MRI is indicated in addition to PET when surgery is being considered.

- Restaging
  - Indicated for all histologic subtypes except benign teratoma

    NOTE: Abdomen and Pelvis CT/MRI is indicated in addition to PET when surgery is being considered.
- Surveillance
  - Benign teratoma: NOT indicated
  - Small cell carcinoma of the ovary: indicated every 3-6 months for 2 years and then annually
  - All other types of ovarian cancer when tumor markers are unreliable, the physical exam is unreliable, and/or there is a high risk of recurrence: indicated every 3-6 months for 2 years and on a case-by-case basis thereafter

## *Vaginal Cancer* [22]

Most patients with this disease are treated with radiation although a minority of patients are eligible for surgery.

- Initial Staging
  - Indicated (in addition to Pelvis MRI)
- Restaging
  - Indicated
- Surveillance
  - NOT indicated

## *Vulvar Cancer* [23]

This section includes vulvar squamous cell carcinoma and adenocarcinoma. Vulvar and vulvovaginal melanoma follow the **Cutaneous Melanoma** section.

- Initial Staging, with any ONE of the following:
  - Clinical stage II (eg, T2) or higher tumor, which can be demonstrated by any ONE of the following on imaging or exam:
    - Extension to the urethra, vagina, anus, or rectum
    - Regional lymph node involvement
    - Distant metastases
  - In patients with positive sentinel lymph node biopsy to evaluate for undissected nodal disease in the groin/pelvis
  - To clarify indeterminate findings after staging with Abdomen and Pelvis CT/MRI

- Restaging, with any ONE of the following:
  - To clarify indeterminate findings after restaging with Abdomen and Pelvis CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging
  - Once 3-6 months after completion of primary therapy
    - Pelvis MRI is indicated in addition to PET
  - When there is clinical concern for recurrence
    - Pelvis MRI is indicated in addition to PET
- Surveillance
  - NOT indicated

## Head and Neck Cancer [24]

This section includes the following cancer types: cancers of the oral cavity, nasopharynx, oropharynx, hypopharynx, larynx (glottic and supraglottic), paranasal sinuses, salivary glands, and mucosal melanoma.

- Initial Staging
  - Indicated (in addition to primary site CT/MRI and Neck CT/MRI)

    NOTE: For initial staging requests where there is concern for head and neck cancer based on symptoms, exam, or pathology (eg, positive biopsy of lymph nodes within the neck) without a confirmed primary tumor site - patients should undergo conventional imaging. If conventional imaging does not reveal an obvious primary, PET/CT can be considered before exam under anesthesia, biopsies and tonsillectomy to help identify potential primary sites.
- Restaging with any ONE of the following:
  - During treatment
  - Once ≥ 12 weeks following completion of treatment

    NOTE: Given the overlapping time intervals for primary site imaging and end of treatment FDG PET/CT imaging, both primary site and PET/CT imaging can be performed at the same time without being considered overlapping imaging.
- Surveillance
  - Once 6 months after end-of-treatment PET (9 months after completion of treatment)

## Leukemias and Lymphomas

### *Acute Lymphoblastic Leukemia (ALL) (Pediatric and Adult)* [25,26]

Most patients with this disease do not require routine imaging evaluations to determine and/or monitor the extent of disease (bone marrow evaluation is used to monitor disease response). For patients with physical exam findings or imaging findings suggestive of lymphomatous

involvement (palpable lymphadenopathy and/or hepatosplenomegaly), PET/CT is the preferred imaging modality.

- Initial Staging
  - Indicated with findings concerning for lymphomatous involvement (ie, on imaging or physical exam)
- Restaging
  - Indicated if lymphomatous involvement was present at diagnosis
  - With new signs or symptoms of disease progression during treatment now concerning for lymphomatous involvement
- Surveillance
  - NOT indicated

## *Acute Myeloid Leukemia (AML) (Pediatric and Adult)* [27]

This section includes the following cancer types: AML, acute promyelocytic leukemia (APML), and acute blastic plasmacytoid dendritic cell neoplasm (BPDCN). Most patients with this disease do not require routine imaging evaluations to determine and/or monitor the extent of disease (bone marrow evaluation is used to monitor disease response). For patients with clinical suspicion for extramedullary disease (eg, lymph nodes, spleen liver, skin, gingiva, CNS), conventional imaging with CT scans or PET/CT are used.

- Initial Staging
  - Indicated with clinical suspicion for extramedullary disease (eg, myeloid sarcoma) on exam or prior imaging
- Restaging
  - Indicated if extramedullary disease was present at diagnosis
  - If there is clinical suspicion for progression during treatment now concerning for extramedullary disease
- Surveillance
  - For acute blastic plasmacytoid dendritic cell neoplasm (BPDCN), as clinically indicated
  - All other histologies
    - NOT indicated

## *B-Cell Lymphomas – Adult* [28]

This section includes the following cancer types: follicular lymphoma, marginal zone lymphoma, primary mediastinal large B-cell lymphoma, mantle cell lymphoma, diffuse large B-cell lymphoma, Burkitt lymphoma, B-lymphoblastic lymphoma, and all others.

- Initial Staging

- Indicated
- Restaging
  - Indicated
- Surveillance
  - Follicular lymphoma, primary mediastinal large B-cell lymphoma, diffuse large B-cell lymphoma, and nodal marginal zone lymphoma:
    - Indicated in rare situations where disease was only visible on PET/CT (eg, without anatomic correlate, extensive bone disease that would be difficult to follow with conventional imaging every 6 months for 2 years
  - All other histologies
    - NOT indicated

## *Pediatric Aggressive Mature B-Cell Lymphomas* [29]

This section includes the following cancer types: Burkitt lymphoma, diffuse large B-cell lymphoma (DLBCL), primary mediastinal large B-cell lymphoma (PMBCL), large B-cell lymphoma, high grade B-cell lymphoma, B-lymphoblastic lymphoma.

- Initial Staging
  - Indicated (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)
- Restaging
  - Indicated (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)
- Surveillance
  - NOT indicated

NOTE: This portion of the guideline should be applied to patients treated at a pediatric institution on a pediatric protocol which can include young adults into their 20s.

## *Castleman's Disease* [30]

- Initial Staging
  - Indicated
- Restaging
  - Indicated
- Surveillance
  - NOT indicated

## *Chronic Lymphocytic Leukemia (CLL) and Small Lymphocytic Lymphoma (SLL)* [31]

Most patients with this disease do not require routine imaging evaluations to determine and/or monitor the extent of disease (blood tests and bone marrow evaluation are used to monitor disease response). PET/CT is useful to direct nodal biopsy if histologic transformation is suspected (if disease is suspected of evolving from indolent disease into a high-grade lymphoma). Histologic transformation may be considered with progressive lymphadenopathy, B symptoms, lactate dehydrogenase (LDH) elevation, or electrolyte disturbances.

- Initial Staging
  - Indicated to direct nodal biopsy if histologic transformation is suspected
- Restaging, with any ONE of the following:
  - To direct nodal biopsy if histologic transformation is suspected
  - With accelerated CLL (significant increase in lymphocyte count, worsening symptoms)
- Surveillance
  - NOT indicated

## *Chronic Myeloid Leukemia (CML)* [32]

Most patients with this disease do not require routine imaging evaluations to determine and/or monitor the extent of disease (blood tests and bone marrow evaluation are used to monitor disease response).

- Initial Staging, Restaging, and Surveillance
  - NOT Indicated

## *Cutaneous Lymphoma* [33]

This section includes primary cutaneous B-cell lymphoma, mycosis fungoides/Sézary syndrome, primary cutaneous CD30+ T-cell lymphoproliferative disorders, subcutaneous panniculitis-like T-cell lymphoma and primary cutaneous indolent T-cell lymphoproliferative disorders (LPD).

- Initial staging
  - Indicated
- Restaging
  - Indicated
- Surveillance
  - NOT indicated

## *Hodgkin Lymphoma (Pediatric and Adult)* [34,35]

- Initial Staging
  - Indicated (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)

    NOTE: Imaging should be performed no more than 4 weeks before starting therapy. In a situation where care has been delayed, repeat initial staging imaging is appropriate.
- Restaging
  - Indicated (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)

    NOTE: One follow up PET is appropriate if the end of treatment PET was positive (Deauville Score 4-5)
- Surveillance
  - NOT indicated

    NOTE: FDG PET/CT is not advised for asymptomatic surveillance due to risk of false positives.

## *Kaposi Sarcoma* [36]

- Initial Staging
  - Indicated to clarify inconclusive conventional imaging
  - If there are concerns for coexisting Kaposi sarcoma-associated herpesvirus (KSHV) associated inflammatory cytokine syndrome (KICS), multicentric Castleman disease, or KSHV+ lymphoma
- Restaging
  - Indicated to clarify inconclusive conventional imaging
  - When previous PET/CT demonstrated disease not seen on conventional imaging
  - If there are concerns for coexisting Kaposi sarcoma-associated herpesvirus (KSHV) associated inflammatory cytokine syndrome (KICS), multicentric Castleman disease, or KSHV+ lymphoma
- Surveillance
  - NOT indicated

## *Post-Transplant Lymphoproliferative Disorders* [28,29]

Post-transplant lymphoproliferative disease (PTLD) is a rare but serious complication that can occur after solid organ or stem cell transplantation.

- Initial Staging
  - Indicated for biopsy proven or suspicion of PTLD (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)

- Restaging
  - Indicated (in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)

    NOTE: First restaging evaluation can be as soon as 2-4 weeks after initiation of therapy.
- Surveillance
  - Indicated (in pediatric patients: in addition to Neck CT/MRI, Chest CT, and Abdomen and Pelvis CT/MRI)

## *Primary CNS Lymphoma*

See **Primary CNS Lymphoma** under the Central Nervous System Cancers section.

## *T-Cell Lymphomas* [37]

Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma.

- Initial Staging
  - Indicated

    NOTE: this includes suspected or known breast implant-associated anaplastic large cell lymphoma (ALCL)
- Restaging
  - Indicated (including known breast implant-associated anaplastic large cell lymphoma)
- Surveillance
  - Peripheral T-cell lymphomas (including but not limited to anaplastic large cell lymphoma (ALCL))
    - Indicated every 6 months for 2 years then annually for 5 years
  - Breast implant associated anaplastic large cell lymphoma (ALCL)
    - Indicated every 6 months for 2 years
  - Other histologies
    - NOT indicated

## *Waldenstrom Macroglobulinemia/Lymphoplasmacytic Lymphoma* [38]

- Initial Staging
  - Indicated
- Restaging
  - Indicated if initial staging PET demonstrated extramedullary disease

- Surveillance
  - NOT indicated

# Liver, Biliary Tract, and Pancreatic Cancers

## *Ampullary Adenocarcinoma* [39]

- Initial Staging, with any ONE of the following:
  - Indicated to clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
  - In patients without clear evidence of distant metastatic disease on conventional imaging who demonstrate high risk features (eg, borderline resectable disease, large regional lymph nodes, markedly elevated CA 19-9, or CEA).
- Restaging, with any ONE of the following:
  - Indicated to clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging
  - To confirm localized disease after neoadjuvant therapy and before proceeding to surgery following complete staging with Chest CT and Abdomen and Pelvis CT/MRI
- Surveillance
  - NOT indicated

## *Biliary Tract Cancers (Cholangiocarcinoma and Gallbladder Cancer)* [40]

Cholangiocarcinoma is a malignancy originating from the bile ducts. It can be intrahepatic or extrahepatic.

- Initial Staging
  - To clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
- Restaging, indicated for any ONE of the following:
  - To clarify indeterminate findings after restaging with Chest CT and Abdomen and Pelvis CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

### *Hepatocellular Carcinoma* [41]

The diagnosis of this disease can be made on imaging alone (LI-RADS 5) or via biopsy. Curative intent treatment for this disease typically requires surgical resection of sites of disease. However, ablation alone may be curative if the tumor is ≤ 3 cm. For patients who are not candidates for up front surgical resection, liver transplantation is potentially curative. Imaging requests for patients who are receiving systemic therapy, local/regional therapies to control disease, and those awaiting transplant should be reviewed under the Restaging indication. Follow Restaging indications for patients with known disease who are not receiving active treatment. Use Surveillance indications for patients who have completed treatment and have no known active disease.

- Initial Staging
  - Indicated to clarify indeterminate findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
- Restaging, for any ONE of the following:
  - To clarify indeterminate findings after restaging Abdomen CT/MRI
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## Pancreatic Cancer [42]

Most patients with this disease undergo conventional imaging with CT chest, abdomen and pelvis, and CT or MRI of the pancreas with a dedicated pancreatic protocol. PET/CT is used to supplement conventional imaging in the scenarios described below.

- Initial Staging, with any ONE of the following:
  - To clarify indeterminant findings after complete staging with Chest CT and Abdomen and Pelvis CT/MRI
  - In patients without clear evidence of distant metastatic disease on conventional imaging who demonstrate high risk features (eg, borderline resectable disease, presence of regional adenopathy, suspicion of peritoneal metastases, markedly elevated CA 19-9)
  - When neoadjuvant chemotherapy is planned
- Restaging, with any ONE of the following:
  - To clarify indeterminant findings after complete restaging with Chest CT and Abdomen and Pelvis CT/MRI
  - Once after neoadjuvant therapy, for assessment of candidacy for surgery
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance

- NOT indicated

### *YTTRIUM-90 (Y90)*

**Y90 PET SCAN:** Indicated when performed immediately after treatment of liver malignancy (primary or metastatic). The Y90 infused during treatment is the tracer detected for this PET scan. The PET scan must be performed within 24 hours of treatment (while Y90 is still detectible) to confirm the final distribution of the Y90.

NOTE: When the medical necessity criteria for Y90 PET is met, Abdomen CT, Abdomen MRI, Abdomen Computed Tomography Angiography (CTA), or Abdomen Magnetic Resonance Angiography (MRA) are also indicated.

## Lung Cancers

### *Non-Small Cell Lung Cancer [43]*

NSCLC is the most common type of lung cancer and includes multiple histologies (eg, adenocarcinoma, squamous cell carcinoma, adenosquamous carcinoma, large cell carcinoma, and sarcomatoid carcinoma). Treatment depends largely on the stage of disease and is typically multimodal, including chemotherapy, surgery, radiation therapy, and immunotherapy.

- Initial Staging
  - Indicated
    - Chest CT is indicated in addition to PET if not already performed
- Restaging, indicated for any ONE of the following:
  - Pre-radiation evaluation

    NOTE: Imaging should be performed no more than 4 weeks before starting radiation. When care has been delayed, repeat imaging is appropriate.
  - Post-radiation evaluation
  - Pre-surgical evaluation
    - Chest CT is indicated in addition to PET

    NOTE: Imaging should be performed no more than 60 days before surgery. When care has been delayed, repeat imaging is appropriate.
  - Evaluation prior to starting maintenance immunotherapy
  - End of treatment evaluation (prior to transitioning to surveillance)
  - For recurrence or progression
    - Brain MRI and Chest CT are indicated in addition to PET
  - To clarify inconclusive conventional imaging
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance

- NOT indicated

### *Small Cell Lung Cancer* [44]

SCLC is the less common type of lung cancer and is aggressive, tending to spread quickly to lymph nodes, bones, brain, and liver. Limited stage disease is defined as non-metastatic (M0) disease that can be encompassed by a tolerable radiation plan. Extensive stage is defined as either distant metastatic disease or an intrathoracic burden of disease that is too extensive to be encompassed in a tolerable radiation plan.

- Initial staging
  - Indicated if complete conventional imaging (Chest CT and Abdomen and Pelvis CT/MRI) does not clearly demonstrate extensive stage disease
  - When complete conventional imaging (Chest CT and Abdomen and Pelvis CT/MRI) shows indeterminant findings that are not definitive for extensive stage
- Restaging with any ONE of the following:
  - Indicated for limited stage disease
  - Prior to chest radiation

    NOTE: Imaging should be performed no more than 4 weeks before starting radiation. When care has been delayed, repeat imaging is appropriate.
  - Prior to surgical resection
  - To clarify inconclusive conventional imaging
- Surveillance
  - NOT indicated

## Lung Nodules [45]

This section does not apply to patients who have a current or past history of cancer. Cases of lung nodule(s) and a current or previous known malignancy should instead be reviewed using the cancer-specific guideline section. Patients with lung nodules seen on other forms of imaging (eg, abdominal imaging, cardiac imaging, and neck imaging) need low dose CT or Chest CT prior to PET. When growth is noted in a nodule that has been previously been imaged with PET, repeat PET can be considered on a case-by-case basis.

- Indicated for a solitary or clearly dominant lung nodule seen on low dose CT or Chest CT when ALL of the following criteria are met:
  - No personal cancer history
  - The nodule in question has not previously been imaged with PET
  - Any ONE of the following criteria are met:
    - The solid component of the dominant nodule is ≥ 8 mm
    - Part solid/mixed nodule with the solid component 6 mm or larger

- Mixed nodule (ie, ground glass and solid nodule) with the solid component of the nodule ≥ 4 mm when any ONE of the following is present:
  - Interval growth of the solid component of at least 1.5 mm
  - Interval development of a new mixed nodule with the solid nodule component ≥ 4 mm

# Neuroendocrine and Adrenal Tumors [46]

## *Adrenocortical Carcinoma*

Adrenocortical Carcinoma (ACC) is a rare, aggressive cancer that is often characterized by excessive hormone production leading to symptoms such as hypertension, weight gain, and virilization. ACC is often diagnosed on imaging rather than biopsy. Features of an adrenal mass on conventional imaging that are suspicious for adrenocortical carcinoma in a patient with no history of another primary malignancy include: size > 4 cm, internally heterogeneous appearance, irregular margins, local invasion, or secretion of multiple hormones.

- FDG PET
  - Initial Staging:
    - Indicated (when either biopsy confirmed or suspected based on imaging)
      - Chest CT and Abdomen CT/MRI are indicated in addition to PET
  - Restaging:
    - Localized resectable disease when any ONE of the following criteria are met:
      - To clarify inconclusive conventional imaging after complete restaging with Chest CT and Abdomen CT/MRI
      - Pre-surgical evaluation
        - Abdomen CT/MRI is indicated in addition to PET
      - Completely resected disease with symptoms, laboratory findings, or imaging findings consistent with recurrence
    - Locoregional unresectable or metastatic disease
      - Indicated
  - Surveillance
    - Completely resected disease:
      - NOT indicated
    - Unresectable or metastatic disease:
      - Indicated every 3-6 months

## *Extrapulmonary Poorly Differentiated Neuroendocrine Tumors*

This portion of the guideline addresses the following extrapulmonary poorly differentiated malignancies/neoplasms: neuroendocrine carcinoma (NEC), large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms (MiNEN). See **Non-Small Cell Lung Cancer** for poorly differentiated neuroendocrine carcinomas with primary site of disease in the lung. See **Cervical Cancer** for primary site of disease in the cervix. See **Prostate Cancer** for primary site of disease in the prostate.

**FDG PET**

- Initial Staging
  - Indicated
- Restaging with any ONE of the following:
  - Prior indeterminate imaging
  - For presurgical evaluation
  - With symptoms, laboratory or imaging findings of recurrence or progression
- Surveillance
  - NOT indicated

**SSTR (Dotatate) PET**

- Initial Staging, Restaging, and Surveillance
  - NOT Indicated

## *Paraganglioma and Pheochromocytoma*

These are neuroendocrine tumors that require both conventional imaging with CT or MRI of areas of disease and functional imaging with FDG or SSTR PET/CT. Abdomen MRI (to evaluate the liver) is appropriate in addition to PET/CT at all time points (when medical necessity criteria are met for PET/CT). Treatment typically involves surgical resection of the tumor with pre-operative medical preparation to manage hormone levels.

**FDG PET or SSTR (Dotatate) PET**

NOTE: Both SSTR (Dotatate) and FDG PET can be used in certain circumstances. When the opposite tracer is requested shortly after a PET scan, these can be considered on a case-by-case basis

- Initial Staging with any ONE of the following:
  - Biopsy-proven disease
  - Prior to biopsy or resection when there is a high clinical suspicion based on imaging and biochemical evaluation
    - Chest CT and site-specific imaging are indicated in addition to PET
- Restaging

- Localized resectable disease when any ONE of the following criteria are met:
  - To clarify inconclusive conventional imaging after complete restaging with Chest CT and Abdomen CT/MRI
  - Presurgical evaluation
    - Primary site-specific imaging is indicated in addition to PET
  - Completely resected disease with symptoms, laboratory findings, or imaging findings consistent with recurrence
- Unresected disease:
  - Indicated

- Surveillance
  - Completely resected disease:
    - NOT indicated
  - Unresectable disease:
    - Indicated every 3-6 months

## *Well-Differentiated Neuroendocrine Tumors (NET)*

Surgical resection of primary and metastatic sites of disease is a mainstay of treatment for well-differentiated NETs. Conventional imaging of primary sites of disease in addition to functional imaging with SSTR PET/CT is used for all patients to determine the extent of disease. SSTR PET/CT is used more extensively throughout treatment for individuals with unresected or metastatic disease. FDG PET/CT is used in select patients. SSTR (Dotatate) PET plus FDG PET are used in rare circumstances and can be considered on a case-by-case basis. SSTR PET/CT to evaluate for possible NET based on labs and/or symptoms can be considered on a case-by-case basis.

**SSTR (Dotatate) PET**

- Initial Staging:
  - Indicated
    - Primary site-specific imaging and Abdomen MRI (liver) are indicated in addition to PET
- Restaging:
  - Completely resected disease for any ONE of the following:
    - To clarify inconclusive conventional imaging
    - With symptoms, laboratory or imaging findings of recurrence after previous definitive treatment
  - Unresected disease:
    - Indicated

NOTE: When done for presurgical evaluation, primary site-specific imaging and Abdomen MRI (liver) are indicated in addition to PET

- Surveillance:
  - Completely resected disease:
    - NOT indicated (followed with conventional imaging)
  - Unresectable disease:
    - Indicated every 6 months

**FDG PET**

- Initial Staging:
  - Indicated for high-grade (grade 3) well-differentiated NET when ALL of the following criteria are met:
    - High Ki67 (≥ 55%)
    - Negative initial staging SSTR PET
- Restaging (including as presurgical evaluation or for restaging of recurrence), with any ONE of the following:
  - Recent negative SSTR PET
  - Prior positive FDG PET
- Surveillance
  - Completely resected disease:
    - NOT indicated (followed with conventional imaging)
  - Unresectable disease:
    - Indicated every 3-6 months

# Non-Malignant Disease

## *Dementia* *(47–52)*

- Amyloid PET for initial evaluation of mild cognitive impairment or dementia when ALL of the following criteria are met:
  - Reason for the request is either early Alzheimer's detection, differentiating dementia types, and/or the patient is under consideration for anti-amyloid therapy
  - There is evidence of objective mild cognitive impairment (MCI) based on ONE of the following:
    - Objective impairment on a standardized memory assessment test (MMSE/MoCA < 26 or SLUMS < 27)
    - Mild cognitive impairment on neuropsychological testing

NOTE: When anti-amyloid therapy is clearly documented as planned in a patient with a MMSE/MoCA 27-30 and has objective memory impairment on alternative testing such as the Wechsler Memory Scale, these requests can be considered on a case-by-case basis

- Brain MRI has been completed and does not show a cause for MCI. When MRI is contraindicated or cannot be performed, Brain CT can be accepted to fulfill this criteria
- Lab evaluation including thyroid function tests, CBC, CMP (including LFTs) and B12 have been completed and if abnormal, have been treated and cognitive difficulty persists
- Medication side effects and medical causes, such as vascular or traumatic or inflammatory etiologies have been excluded

- Amyloid PET for patients on an anti-amyloid medication for which repeat amyloid PET is part of FDA labeling
  - Every 6 months for up to 1.5 years after starting treatment, to decide whether to stop treatment

  NOTE: Not indicated once treatment is stopped or if changed to another medication.
- Tau PET for evaluation for mild cognitive impairment or dementia as a one-time study only when ALL of the following criteria are met:
  - The criteria above for amyloid PET are met
  - Recent Amyloid PET shows amyloid pathology (≥37 Centiloids)
  - Treatment with an FDA-approved anti-amyloid medication is being considered which includes use of Tau PET in FDA labeling to predict response to treatment

## *Sarcoidosis* *(53,54)*

- Known sarcoidosis:
  - ONLY if conventional testing (CXR, CT and inflammatory serology) are indeterminate to determine:
    - If treatment might be helpful
    - Extent of disease, if it will potentially change management
    - Response to treatment
- Suspected sarcoidosis:
  - To determine most suitable site to biopsy after appropriate initial workup consisting of chest imaging (Chest x-ray or Chest CT) and laboratory workup (calcium, creatinine, and alkaline phosphatase)

## *Vasculitis*

- In limited circumstances for patients with known vasculitis, PET is indicated after

conventional imaging (MRA/CTA/MR/CT) is insufficient to determine treatment [55]

# Other Malignancies

## *Histiocytic Neoplasms* [56]

- Langerhans cell histiocytosis, Erdheim Chester disease, Rosai-Dorfman disease
  - Initial Staging
    - Indicated (in addition to CT/MRI of known or suspected site(s) of disease)
  - Restaging
    - Indicated (in addition to CT/MRI of known or suspected site(s) of disease)
  - Surveillance
    - Every 6 months for 2 years then annually

## *Melanoma: Uveal* [57]

Uveal melanoma is a rare type of melanoma that originates in the uvea (iris, ciliary body, choroid). Most patients with this disease undergo conventional imaging evaluation with MRI of the orbit and CT or MRI of the chest, abdomen and pelvis. The most frequent site of metastasis is the liver, and other sites include skin/soft tissue, and bones. PET/CT is occasionally used to supplement conventional imaging in the scenarios described below.

- Initial Staging
  - Indicated to clarify indeterminate conventional imaging
- Restaging
  - Indicated to clarify indeterminate conventional imaging
  - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
  - NOT indicated

## *Merkel Cell Carcinoma* [58]

Merkel cell carcinoma is a rare and aggressive type of skin cancer that originates in the epidermis.

- Initial Staging
  - Indicated
- Restaging
  - Indicated
- Surveillance
  - Truncal primary: NOT indicated

- Extremity primary: Indicated at clinically reasonable intervals during the first 5 years

## *Mesothelioma: Peritoneal* [59]

- Initial Staging
  - Indicated (in addition to Chest CT and Abdomen and Pelvis CT/MRI)
- Restaging
  - Indicated
- Surveillance
  - NOT indicated

## *Mesothelioma: Pleural* [60]

- Initial Staging with any ONE of the following:
  - Biopsy-proven pleural mesothelioma (in addition to Chest CT)
  - To guide subsequent biopsy site selection after initial non-diagnostic biopsy (either CT-guided or surgical biopsy)
- Restaging
  - Indicated
- Surveillance
  - NOT indicated

## *Neuroblastoma* [61]

Neuroblastoma is a rare cancer for which functional imaging with iodine 123 (123I-MIBG) is routinely used given the high specificity and sensitivity to identify metastatic disease. When tumors are not MIBG avid, or when MIBG imaging and anatomic imaging do not correlate, FDG PET/CT is appropriate. PET can be used in addition to other imaging studies, including CT, MRI, CTA, or MRA of the primary tumor site, chest, abdomen and pelvis, and brain. Due to the complexity of these tumors, the intensity and complexity of treatment, and the young age of patients requiring sedation for imaging, multiple overlapping imaging studies and modalities are often necessary.

- Initial Staging, indicated for any ONE of the following:
  - If there are discordant findings between MIBG scan and anatomic imaging
  - Indeterminate findings on MIBG
- Restaging, indicated for any ONE of the following:
  - When FDG PET was used for initial staging
  - If there are discordant findings between MIBG scan and anatomic imaging
  - If MIBG has become indeterminate

- Surveillance
  - If PET is used for functional imaging evaluation in place of MIBG during treatment, surveillance PET is indicated every 3-6 months for 1 year, then every 6 months for 1 year, then annually in addition to appropriate cross-sectional imaging

## *Occult Primary* [62]

An occult primary tumor refers to a tissue diagnosis of cancer where the primary tumor site cannot be identified.

- Initial Staging
  - Indicated to clarify inconclusive conventional imaging following complete staging with Chest CT and Abdomen and Pelvis CT/MRI and additional workup if indicated based on tissue diagnosis (eg, tumor markers, mammography, colonoscopy)

    NOTE: See **Head and Neck Cancer** section for occult primary in the lymph nodes of the neck
- Restaging
  - Refer to cancer-specific section (based on initial biopsy and/or treatment regimen)
- Surveillance
  - NOT indicated

## *Thymomas and Thymic Carcinomas* [63]

- Initial Staging for any ONE of the following:
  - Biopsy proven
  - Mediastinal mass (non-nodal) on Chest CT/MRI and concern for malignancy
- Restaging:
  - Indicated (in addition to Chest CT/MRI)
- Surveillance
  - NOT indicated

## *Thyroid Carcinoma* [64]

**Papillary and Follicular (differentiated and poorly differentiated):**

Papillary and follicular thyroid carcinomas (poorly differentiated and differentiated) can concentrate iodine, express TSH receptors and produce thyroglobulin (Tg). Most patients with this disease undergo whole body iodine imaging (I-123 or I-131) when there is a suspicion of disease or confirmed disease. PET/CT has limited uses in these types of thyroid cancer unless the disease is non-iodine avid or has a high likelihood of not being iodine avid, PET/CT is used to supplement other imaging in the scenarios described below:

- Initial Staging:

- Post biopsy: NOT Indicated
- Post lobectomy/partial thyroidectomy: NOT indicated

- Restaging (following total/completion thyroidectomy and/or radioactive iodine (RAI) for any ONE of the following:
  - With known or suspected metastases AND I-123/131 is negative (or was previously negative in the setting of known disease)
  - Rising thyroglobulin or new thyroglobulin antibody (TgAb)
- Surveillance
  - NOT indicated

**Oncocytic:**

- Initial Staging:
  - Post biopsy: NOT Indicated
  - Post lobectomy/partial thyroidectomy: NOT indicated
- Restaging for any ONE of the following:
  - Once following total thyroidectomy with any ONE of the following:
    - Gross residual disease (including extension outside of the thyroid)
    - When radioactive iodine (RAI) ablation is planned with BOTH of the following:
      - Elevated post-op thyroglobulin (Tg)
      - Negative neck imaging
  - Following thyroidectomy and radioactive iodine (RAI) ablation with any ONE of the following:
    - Rising thyroglobulin (Tg)
    - New or rising thyroglobulin antibody (TgAb)
  - Following thyroidectomy and radioactive iodine (RAI) ablation is not planned or previously performed:
    - Rising thyroglobulin (Tg) or new or rising thyroglobulin antibody (TgAb)
    - Concern for recurrence on imaging and with negative biopsy
- Surveillance
  - NOT indicated

**Anaplastic or De-Differentiated:**

Anaplastic thyroid cancer (ATC) is a highly aggressive form of thyroid malignancy, characterized by rapid growth and a high propensity for metastasis. These tumors are not typically iodine avid.

Most patients with this disease undergo conventional imaging and PET/CT to define the extent of disease and to monitor response to treatment

- Initial Staging:
  - Indicated
- Restaging:
  - Indicated
- Surveillance:
  - Indicated 3-6 months after initial therapy

**Medullary:**

This type of thyroid cancer can be sporadic or linked with multiple endocrine neoplasia type 2 (MEN2). SSTR PET/CT is used to supplement conventional imaging in the situations described below:

**SSTR (Dotatate) PET:**

- Initial Staging:
  - Indicated
- Restaging, when ALL of the following apply:
  - With calcitonin ≥ 150 pg/mL and/or elevated CEA
  - Conventional imaging is negative

  NOTE: If tumor markers continue to rise after a negative PET, repeat negative conventional imaging needs to be provided prior to consideration for a repeat PET
- Surveillance:
  - NOT indicated

**FDG PET**

- Initial Staging:
  - NOT indicated
- Restaging, when ALL of the following apply:
  - With calcitonin ≥ 150 pg/mL and/or elevated CEA
  - Conventional imaging is negative

  NOTE: If tumor markers continue to rise after a negative PET, repeat negative conventional imaging needs to be provided prior to consideration for a repeat PET
- Surveillance
  - NOT indicated

### *Wilms Tumor*

Wilms tumor (nephroblastoma) is a rare kidney cancer that primarily affects children.

- Initial Staging:
  - Indicated to clarify inconclusive conventional imaging
- Restaging:
  - Indicated to clarify inconclusive conventional imaging
- Surveillance
  - NOT indicated

## Plasma Cell Dyscrasias

This section includes monoclonal gammopathy of undetermined significance (MGUS), smoldering multiple myeloma (SMM), multiple myeloma, and other rare plasma cell dyscrasia which are all stages in the spectrum of plasma cell disorders.

### *MGUS* [(65)]

MGUS is characterized by < 10% clonal plasma cells in the bone marrow and is observed without treatment.

- Initial Staging, Restaging, and Surveillance
  - NOT Indicated

NOTE: Whole Body Low Dose CT (CPT 76497) or Bone Marrow MRI (CPT 77084) is used rather than PET - see Evolent Clinical Guideline 2076 for Whole Body Magnetic Resonance Imaging (MRI) and Computed Tomography (CT)

### *Multiple Myeloma* [(65)]

Multiple myeloma is characterized by ≥ 10% clonal plasma cells in the bone marrow with myeloma-defining events. Myeloma-defining events are any of the following: at least 60% clonal plasma cells in the bone marrow, serum involved/uninvolved free light chain ratio of 100 or greater, hypercalcemia, renal insufficiency, anemia, or bone lesions.

- Initial Staging:
  - Indicated

    NOTE: When there is concern for CNS involvement including confusion, headache, visual symptoms, weakness, cranial nerve palsies, brain and spine MRIs are appropriate in addition to PET.
- Restaging
  - Active treatment
    - Indicated every 2-3 cycles of therapy, during evaluation for stem cell transplantation or CAR-T therapy, and at 1 (day +30), 3 (day +100), 6 and 12

months post-transplant or CAR-T

- Maintenance treatment:
  - Indicated annually or as clinically indicated (including for patients who do not have measurable levels of M protein or free light chains)
- Indicated at any phase in treatment or surveillance with signs, symptoms, lab or imaging studies concerning for recurrence

- Surveillance:
  - Indicated annually (including for patients who do not have measurable levels of M protein or free light chains)

## *Rare Plasma Cell Dyscrasias* [65]

Rare plasma cell dyscrasias include monoclonal gammopathy of renal significance (MGRS) and polyneuropathy, organomegaly, endocrinopathy, monoclonal protein, skin changes (POEMS).

- Initial Staging, Restaging, and Surveillance
  - Indicated

## *Smoldering Myeloma (suspected or confirmed)* [65]

Smoldering multiple myeloma is characterized by 10-60% clonal plasma cells in the bone marrow and has a higher risk of progression to multiple myeloma. Patients with confirmed smoldering myeloma based on bone marrow evaluation should undergo imaging evaluation to look for lesions that would meet criteria for the diagnosis of multiple myeloma.

- Initial Staging:
  - Indicated
- Restaging:
  - Indicated with signs, symptoms or lab values suggestive of progression to multiple myeloma
- Surveillance
  - Indicated annually due to risk of progression to multiple myeloma

## *Solitary Plasmacytoma* [65]

- Initial Staging:
  - Indicated
- Restaging with any ONE of the following:
  - During active treatment
  - With signs, symptoms, or lab values suggestive of progression to multiple myeloma
- Surveillance:

- Indicated once within 3-12 months post-treatment then annually for 5 years

### *Systemic Light Chain Amyloidosis* [66]

- Initial Staging:
  - Indicated (biopsy proven or with high clinical suspicion based on labs, symptoms and other imaging findings)
- Restaging:
  - Indicated
- Surveillance
  - NOT indicated

## Skin Cancers

### *Basal Cell Skin Cancer* [67]

- Initial Staging
  - Indicated to clarify inconclusive conventional imaging when needed to direct treatment
- Restaging
  - Indicated to clarify inconclusive conventional imaging when needed to direct treatment
- Surveillance
  - NOT indicated

### *Melanoma: Cutaneous* [68]

- Initial Staging
  - Stage III-IV disease
  - Dermal-based melanoma
  - Any stage: To clarify indeterminate distant findings after complete staging with Chest CT and Abdomen and Pelvis CT
- Restaging
  - Stage III-IV
  - To clarify indeterminate distant findings after complete staging with Chest CT and Abdomen and Pelvis CT
  - When previous PET demonstrated disease not seen on conventional imaging
  - Restaging of recurrence in any ONE of the following specific situations:
    - True scar recurrence (persistent disease)

        - Indicated to clarify indeterminate conventional imaging
    - In-Transit, satellite, microsatellite, nodal, or metastatic recurrence
        - Indicated
- Surveillance
    - Stage I-II: NOT indicated
    - Stage III-IV: Indicated every 6 months for 2 years from completion of treatment, then every 12 months for 3 additional years

### *Squamous Cell Skin Cancer* [(69)]

- Initial Staging for any ONE of the following:
    - Biopsy-proven lymph node involvement
    - Biopsy-proven satellite/in-transit metastasis
    - To clarify inconclusive conventional imaging when needed to direct treatment
- Restaging for any ONE of the following:
    - Recurrence with biopsy-proven lymph node involvement or recurrence with biopsy-proven satellite/in-transit metastasis
    - To clarify inconclusive conventional imaging when needed to direct treatment
    - When previous PET/CT demonstrated disease not seen on conventional imaging
- Surveillance
    - NOT indicated

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 78811 | Positron emission tomography (PET) imaging; limited area (eg, chest, head/neck) |
| 78812 | Positron emission tomography (PET) imaging; skull base to mid-thigh |
| 78813 | Positron emission tomography (PET) imaging; whole body |
| 78814 | Positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization imaging; limited area (eg, chest, head/neck) |

| Code | Description |
|---|---|
| 78815 | Positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization imaging; skull base to mid-thigh |
| 78816 | Positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization imaging; whole body |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Prostate Cancer Risk Groups

- Any of the following criteria make PSMA PET indicated for initial staging:
  - Gleason score 8, 9 or 10
  - Primary pattern 4 (Gleason 4+3=7)
  - PSA > 20 **AND** Gleason score 3+3=6 or higher
  - PSA > 10 **AND** Gleason score 3+4=7
  - PSA > 10 **AND** Gleason score 3+3=6 **AND** clinical stage ≥ T2b
  - Clinical stage ≥ T3a **AND** Gleason score 3+3=6 or higher
  - Clinical stage ≥ T2b **AND** Gleason score 3+4=7 or higher
  - ≥ 50% of cores positive for cancer in a random, non-targeted prostate biopsy
  - Grade group 3, 4 or 5 disease

## Further Information

**PET with CONTRAINDICATIONS to contrasted CT AND MRI**: The inability to image with contrasted conventional imaging includes contraindications to both CT (such as chronic renal failure with GFR < 30 **OR** significant iodinated contrast allergy) **AND** to MRI (such as gadolinium allergy, implanted device that is not MRI compatible, or GFR < 40). When requested for initial staging, restaging or during the first two years of surveillance, PET can be considered when contraindications to both CT and MRI exist.

**PET/MR**: When PET/MR is requested and medical necessity criteria are met for PET, one additional MRI is indicated. This additional MRI can either be site-specific or an unlisted MRI.

# SUMMARY OF EVIDENCE

Positron emission tomography (PET) is an advanced medical imaging technique that measures radioactivity in tissues following venous injection of specialized tracers. Briefly, tracers are produced by attaching radioactive isotopes to substances that are commonly utilized by a tissue of interest, such as the fluorine-18 isotope that is attached to glucose to create the fluorodeoxyglucose F18 (FDG) tracer. [70,71] Radioactive decay of the tracer produces pairs of gamma-photons that are emitted from the tissue in opposite directions. Specialized detectors in PET scanners measure where these photon emissions originate, thereby producing 2D or 3D images of the tissues that absorbed the tracer. [72,73] For example, FDG is commonly used in oncology because cancer cells thrive on glucose, which causes cancerous tumors to appear brighter than the surrounding non-malignant tissues.

PET is highly sensitive for detecting metabolic and functional changes, often identifying disease before anatomical changes are visible, and excels in oncology, neurology, and cardiology applications, enabling early detection and monitoring of tumors, brain disorders, and heart disease. PET scanners can also image the entire body in a single session, with scan ranges up to 198 cm and axial fields of view up to 21.6 cm. [72,73] However, PET spatial resolution is affected by detector size, positron range, noncollinearity, and depth of interaction. Moreover, high infrastructure and operational costs restrict PET access, and tracers require on-site or nearby production due to short half-lives (eg, F18: 110 min), complicating logistics and limiting access.

In addition to PET imaging of the primary site, additional imaging with computed tomography (CT) and magnetic resonance imaging (MRI) is also sometimes indicated because they improve anatomical localization and diagnostic accuracy. [72,73] CT is based on the differential absorption of x-rays by various tissues and uses X-rays to create cross-sectional images of the body. In contrast, MRI is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. Both imaging modalities are indicated for identifying and/or staging of cancerous tumors. However, PET/CT provides rapid attenuation correction and high-contrast images; PET/MR offers superior soft tissue contrast and no CT radiation dose. [72,73]

# ANALYSIS OF EVIDENCE

PET is highly sensitive for detecting, staging, restaging, and monitoring therapy response in a broad range of malignancies. It is also essential for surgical and radiation treatment planning, as well as to differentiate between viable tumor tissue and post-treatment changes. [74] PET is especially effective for imaging cancers with high glucose metabolism that readily uptake [18F] fluorodeoxyglucose (FDG), a cornerstone in oncological imaging due to its ability to visualize increased glucose metabolism. [74]

However, tumor biology dictates tracer selection, and tumors with low FDG uptake are often better imaged with alternative tracers. For example, most prostate cancers have low FDG uptake and are therefore better imaged with Prostate-Specific Membrane Antigen (PSMA) tracers, such as [18F] PSMA. [75] For well-differentiated neuroendocrine tumors, somatostatin receptor-targeted (SSTR) PET tracers, such as Dotatate, are preferred because they provide superior detection. Yttrium-90 (Y-90) PET imaging is valuable in the context of liver cancer because it can visualize the actual distribution of Y-90 microspheres within the liver. [76] The radiopharmaceutical Iodine-123 (I-123) metaiodobenzylguanidine (MIBG) mimics norepinephrine and is therefore useful for imaging neuroendocrine tumors that originate from adrenergic tissue because they express high levels of the norepinephrine transporter. [77] Similarly, fluoroestradiol is an 18F-labeled estradiol analog that binds specifically to estrogen receptors (ER) in the nucleus of ER-expressing cells. [78]

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Moved Definitions from the Background to Statement section<br>• Phases of treatment condensed to initial staging, restaging and surveillance<br>• Conventional imaging required prior to consideration of PET clarified more explicitly for each cancer.<br>• Alveolar soft parts sarcomas and phyllodes tumors added to guideline; including clarification when chest CT and primary site imaging is needed in addition to PET<br>• Breast Cancer: Added indications for PET following negative conventional imaging in certain high risk situations<br>• Meningioma: Added indications for radiation planning and for surveillance in high grade tumors<br>• Appendiceal Cancer: Indication added in certain situations after conventional imaging<br>• Esophageal and EG Junction Cancer, Gastric Cancer: Defined discrete intervals for restaging PET |

| Date | Summary |
|---|---|
| | • Small Bowel Cancer: Added indication for biomarker elevation following negative conventional imaging<br>• Prostate Cancer: Removed note about exception with no biopsy and elevated PSA, removed indications for imaging discordance and indeterminate for restaging<br>• Uterine Cancer: Removed indication for certain subtypes of cancer<br>• Ovarian Cancer: removed indication for benign teratoma, added indications for suspected ovarian cancer, clarified surveillance indications for specific subtypes<br>• Vaginal Cancer indication separated out of cervical cancer<br>• Head and Neck Cancer: added surveillance indication (one time)<br>• Cutaneous Lymphoma indication added<br>• T-cell lymphomas: Clarification about inclusion of breast implant associated anaplastic large cell lymphoma added<br>• NSCLC: Added intervals for PET before radiation and surgery<br>• SCLC: Added intervals for PET before radiation and surgery<br>• Thyroid Cancer: Created section for oncocytic subtype, indication changed to include new or rising Tg Ab, created indications for restaging of medullary subtype for FDG<br>• Rare plasma cell dyscrasia indication added<br>• Dementia: clarification added regarding definition of MCI, updated indications for repeat PET on anti-amyloid therapy and added indication for tau PET<br>• Removed State Specific Regulatory Language<br>• Updated references |
| July 2025 | • Added a Summary of Evidence and analysis of Evidence<br>• Guideline name was adjusted from PET Scan to; Positron Emission Tomography (PET) Scan, PET Scan with Computed Tomography (CT) for Attenuation |
| June 2025 | • This guideline replaces Evolent Clinical Guideline 070-1 for PET Scan |

| Date | Summary |
|---|---|
| | • Added in general information statement regarding guideline criteria development by reputable sources, standard of care, and best practices<br>• Surveillance PET section added to all disease types<br>• Recurrence PET section added to all disease types<br>• Pre-surgical evaluation section added to all disease types<br>• Following Cancers to be consistent with updated version of NCCN<br>• B-cell lymphomas: condensed disease types<br>• Bladder cancer: added indications for MIBC<br>• Breast cancer: clarified imaging recommendations by stage<br>• Gastric cancer: added imaging recommendations for patients with localized disease<br>• Melanoma: clarified imaging recommendations by stage<br>• Neuroendocrine: clarified imaging indications based on completely resected vs unresected disease<br>• Non-malignant disease: added infection section<br>• Non-small cell lung cancer: added clarification for restaging indications<br>• Ovarian cancer: added indications for PET<br>• Penile cancer: clarified indications for initial staging imaging based on clinical features of disease<br>• Prostate cancer: Removed tracers other than PSMA<br>• Testicular cancer: clarified indications for non-seminomatous germ cell tumors<br>• Uterine neoplasms: added indications for high-grade carcinomas<br>• Applicable Line of Business adjusted – Medicare checked |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

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# REFERENCES


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4. U.S. Food and Drug Administration. *Labeling-Package Insert CERIANNA (Fluoroestradiol F 18) Injection*.; 2024. https://www.accessdata.fda.gov/drugsatfda_docs/label/2024/212155s021lbl.pdf
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47. Albert MS, DeKosky ST, Dickson D, et al. The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's and Dementia*. 2011;7(3):270-279. doi:10.1016/j.jalz.2011.03.008

48. Frey KA, Lodge MA, Meltzer CC, et al. ACR–ASNR Practice Parameter for Brain PET/CT Imaging Dementia. *Clin Nucl Med*. 2016;41(2):118-125. doi:10.1097/RLU.0000000000001037

49. Oldan JD, Jewells VL, Pieper B, Wong TZ. Complete evaluation of dementia: PET and MRI correlation and diagnosis for the neuroradiologist. In: *American Journal of Neuroradiology*. Vol 42. American Society of Neuroradiology; 2021:998-1007. doi:10.3174/ajnr.A7079

50. Rabinovici GD, Knopman DS, Arbizu J, et al. Updated Appropriate Use Criteria for Amyloid and Tau PET: A Report from the Alzheimer's Association and Society for Nuclear Medicine and Molecular Imaging Workgroup. *Journal of Nuclear Medicine*. 2025;66(Supplement 2):S5-S31. doi:10.2967/jnumed.124.268756

51. Sims JR, Zimmer JA, Evans CD, et al. Donanemab in Early Symptomatic Alzheimer Disease. *JAMA*. 2023;330(6):512. doi:10.1001/jama.2023.13239

52. van Dyck CH, Swanson CJ, Aisen P, et al. Lecanemab in Early Alzheimer's Disease. *New England Journal of Medicine*. 2023;388(1):9-21. doi:10.1056/NEJMoa2212948

53. Crouser ED, Maier LA, Baughman RP, et al. Diagnosis and Detection of Sarcoidosis An Official American Thoracic Society Clinical Practice Guideline. *Am J Respir Crit Care Med*. 2020;201(8):E26-E51. doi:10.1164/RCCM.202002-0251ST

54. Soto-Gomez N, Peters JI, Nambiar AM. *Diagnosis and Management of Sarcoidosis*. Vol 93.; 2016. www.aafp.org/afp.

55. Joseph G, Goel R, Thomson VS, Joseph E, Danda D. Takayasu Arteritis. *J Am Coll Cardiol*. 2023;81(2):172-186. doi:10.1016/j.jacc.2022.09.051

56. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Histiocytic Neoplasms Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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70. Berger A. Positron emission tomography. *BMJ*. 2003;326(7404):1449. doi:10.1136/bmj.326.7404.1449

# Evolent Clinical Guideline 2052 for Radiopharmaceutical Tumor Localization

## *Single Proton Emission Computed Tomography (SPECT)*

| **Guideline Number:** Evolent_CG_2052 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2008 - 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** July 2008 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

SPECT: Single-Photon Emission Computed Tomography (SPECT) is a nuclear medicine imaging technique used to localize data from gamma ray emitting injected radiopharmaceuticals to specific anatomical locations within the patient. The resulting 3D images can be reconstructed in multiple planes. Much like a Computed Tomography (CT) scan uses x-rays, SPECT utilizes nuclear scintigraphy.

SPECT can be used to localize a tumor, inflammatory process, or radioactive tracer distribution. Vascular flow and blood pool imaging are included if performed. The 78803 code represents single–day imaging of a single area, such as the head, neck, chest, or pelvis, or a single acquisition on one day.

SPECT/CT: (Single-photon emission computed tomography combined with Computed Tomography) is now available in many centers. The CT portion helps correct the attenuation (decrease) of photons from the target as they get absorbed/reflected by the soft tissues before reaching the detector. CT helps with anatomic localization, much like the CT of PET/CT.

When SPECT/CT is requested, additional CT approvals are NOT needed/provided (unless approvable for other separate indications per guidelines for that body part). The CT portion of a SPECT/CT is included in the specific CPT (i.e., 78830 – SPECT/CT, single area, single day and 78832 – SPECT/CT, multiple areas).

This guideline includes both SPECT and SPECT/CT when routine dynamic and planar imaging is, or is projected to be, insufficient for the following indications. Planar imaging includes techniques such as x-ray, ultrasound, and various nuclear medicine scans that provide 2-dimensional views. This is compared to “cross sectional imaging” techniques such as CT and magnetic resonance imaging (MRI) that provide 3-dimensional views.

# INDICATIONS

## Bone/Joint

### *Bone Viability* [1]

- Detection of early avascular necrosis, bone infarct, or bone graft viability: with prior x-ray completed AND MRI is indeterminate, contraindicated, OR cannot be performed.

### *Extremities* [2,3]

- For evaluation of unexplained extremity pain (such as differentiating complex regional pain syndrome from other causes of pain) when prior x-ray **AND** MRI or Ultrasound or CT is indeterminate

### *Follow-Up*

- A follow-up study is indicated to evaluate a progress after treatment, procedure, intervention, or surgery. Documentation of a clear medical reason why additional imaging is needed for the type and area(s) requested is required.

### *Infection* [4,5]

- Osteomyelitis: when prior imaging has been completed with both a plain x-ray **AND** MRI of the affected area is contraindicated or cannot be performed
- Discitis: When MRI is indeterminate, contraindicated, OR cannot be performed

### *Malignancy* [6]

**Note: For known bone metastases, whole body planar bone scan for staging and restaging is typically sufficient.** For patients with impaired renal function who cannot receive iodinated or gadolinium-based contrast agents or undergo MRI for other reasons, SPECT imaging can improve the performance of conventional planar nuclear bone imaging.

- Screening evaluation of patients with malignancy for possible bony metastases presenting with elevated alkaline phosphatase, bone pain, or new pathological fracture when CT/MRI are indeterminate/contraindicated/not available.
- Staging or Restaging evaluation of known or suspected bony metastases when recent overlapping whole-body imaging (CT or positron emission tomography (PET)/CT of the neck, chest, abdomen and pelvis) has not been performed, cannot be performed, or is inconclusive in evaluation of bone metastases.
- Staging and restaging for radionuclide bone therapy for known predominant bone metastases

### *Persistent Symptoms of Joint or Spine Pain*

- Persistent clinical symptoms and/or lack of improvement with active conservative therapy AND prior indeterminate MRI/CT [7,8]

### *Trauma*

- Extremities: Detection of stress fractures and other occult skeletal trauma when there is persistent pain in the suspected area after negative or inconclusive x-ray AND MRI is indeterminate, contraindicated, OR cannot be performed. [3]
- Spine:
  - For indications such as spondylolysis or determination of age of fracture after prior CT/MRI is inconclusive [9]
  - Spondylolysis evaluation in a child: to determine future treatment plan with persistent pain after prior conservative treatment AND prior negative or indeterminate MRI [10]

## Neck

- Evaluation of Parathyroid Adenoma is indicated with ALL of the following [11]:
  - Clinical or laboratory proven hyperparathyroidism (such as elevated parathyroid hormone – PTH)
  - Prior indeterminate or abnormal ultrasound. If CT and/or MRI have been completed, it should also be inconclusive
- For evaluation of thyroid carcinoma [12]:
  - Evaluation of a Thyroid nodule is indicated when prior planar imaging is inconclusive for the location of a focal thyroid lesion
  - Iodine (I-131 or I-123) imaging for subsequent post-thyroidectomy staging of differentiated thyroid cancers with any ONE of the following:
    - Post-thyroidectomy neck CT/MR showing residual unresectable thyroid tissue/ disease in the neck
    - Distant metastases as seen on CT/MR
    - Post-thyroidectomy unstimulated thyroglobulin > 5-10ng/ml
    - Radioactive iodine therapy is being considered for high risk or recurrent tumor.
    - Post radioiodine treatment (post therapy scan)
    - During post-thyroidectomy surveillance, with rising thyroglobulin or stable / rising antithyroglobulin antibodies or abnormal ultrasound neck

## Lung [13]

- Quantification of lung function prior to lung resection/radiation
- Evaluation of:
  - Congenital cardiac, thoracic, or pulmonary disease
  - Lung transplants
  - Bronchopleural fistulae

- Assessment of acute or chronic thromboembolic pulmonary disease
- Suspected acute pulmonary embolism with comorbidities (such as chronic obstructive pulmonary disease (COPD), left heart failure, pneumonia, tumor) **AND** chest x-ray has been performed, AND chest computed tomography angiography (CTA) cannot be performed or limited
- Calculation of lung shunt fraction prior to hepatic radioembolization

## Brain

- For preoperative localization of epileptic foci after prior EEG, Brain MRI and PET are insufficient [14]
- Dopamine Transporter (DAT) scan (used to diagnose Parkinsonian syndromes by visualizing the dopamine transporter (DAT) system in the brain) [15,16]
    - To differentiate essential tremor and drug-induced parkinsonism from parkinsonian syndromes
    - For early/inconclusive parkinsonian features
    - For dementia: differentiating Dementia with Lewy Bodies (DLB) from other dementia types, if FDG PET was inconclusive. [17]
- To evaluate cerebrovascular reserve in planning appropriate endovascular/vascular intervention or neurovascular surgical approach for any ONE of the following:
    - Evaluation for vascular diseases such as Moyamoya [18]
    - Carotid balloon occlusion [19]
    - Hyperperfusion syndromes [20]
    - Shunting for idiopathic normal pressure hydrocephalus [21]
- Brain perfusion study for evaluation of brain death when planar (2 dimensional) imaging AND CT or MRI are inconclusive [22]
- Initial evaluation of adults with cognitive impairment with memory deficits for possible Alzheimer disease (AD) (typical or atypical presentation), frontotemporal dementia (FTD), or dementia with Lewy bodies when MRI brain, CT head, FDG PET, and Amyloid PET are contraindicated or not available. [17]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation of a clear medical reason why additional imaging is needed for the type and area(s) requested is required.

## Renal

Complex clinical scenarios for which cross-sectional imaging (CT/MRI) AND routine dynamic planar imaging has been or is clearly expected to be insufficient:

- Evaluation of the renal collecting system after prior trauma, surgery, or obstruction in ADULTS [23]

- Evaluation of renal collecting system with suggestive signs, symptoms, and laboratory findings (such as flank pain, hematuria, elevated creatinine, renal failure) in ADULTS **AND** CT has been performed and is inconclusive, contraindicated, OR not available

- For evaluation of renal collecting system for obstruction or vesicoureteral reflux in children and young females [24]:
  - After ultrasound and VCUG (voiding cystourethrography) / VUS (voiding urosonography) are inconclusive or discordant with clinical impression
- For diagnosis of possible reno-vascular hypertension with suggestive signs, symptoms, laboratory findings (such as labile and refractory hypertension, abdominal bruit, edema, elevated creatine, elevated plasma Aldosterone/Renin Ratio) with ALL of the following [23]:
  - Duplex ultrasound is inconclusive; **AND**
  - CTA or magnetic resonance angiography (MRA) cannot be performed or are contraindicated; **AND**
  - The patient has adequate renal function (GFR >30) mL/min/1.73 $m^2$) to undergo the study
- Further evaluation of renal perfusion and split function in the setting of surgery, trauma, infection, congenital and mass abnormalities after prior indeterminate or abnormal ultrasound
- Diagnosis of renal transplant complications after prior ultrasound has been completed and is indeterminate or abnormal [24]
- Evaluation of renal infections to discriminate pyelonephritis from cortical scarring [23]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation of a clear medical reason why additional imaging is needed for the type and area(s) requested is required.

# Abdomen/Pelvis

- Hepatic radioembolization [25]
  - For evaluation of pulmonary and gastrointestinal shunts or dosimetry calculations prior to procedure (typically utilizing Tc MAA) (78835 – Radiopharmaceutical quantification measurement)
  - Post-procedure imaging in lieu of PET to determine dose effect/dose toxicity (using the Y90 radiation itself) [26] (78835 – Radiopharmaceutical quantification measurement)
- For evaluation of the following [27–29]:
  - Intermittent/occult gastrointestinal bleeding after initial workup is indeterminate/contraindicated/not available (endoscopy, CTA)
  - Indeterminate or vascular hepatic lesions or bleed when CT/MRI are indeterminate/contraindicated/not available

- Indeterminate accessory splenic tissue/asplenia when CT/MRI are indeterminate/contraindicated/not available

- Liver transplant (and other hepatic surgery/radiation) preoperative and postoperative function and complications when ultrasound/CT/MR are indeterminate/contraindicated/not available [27]
- Localization of [28]:
  - Suspected ectopic/residual gastric tissue (such as Meckel's diverticulum)
  - Abnormalities in hepatobiliary scintigraphy (such as biliary abnormalities/leaks) when ultrasound (in infants) or CT is indeterminate/contraindicated/not available
- Peritoneal imaging for evaluation of complications of shunts, dialysis, or peritoneal integrity, when CT is indeterminate/contraindicated/not available [28]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

## Other Neoplasm / Malignancy

- For initial or restaging of Neuroendocrine tumors (typically In111-octreotide and Iodine-123 MIBG), for any part of the body with any ONE of the following [30]:
  - When CT/MRI OR PET imaging is indeterminate/contraindicated/not available
  - I-131 MIBG: when I131 MIBG therapy is being considered.
  - In111- octreotide: Somatostatin analog therapy is being considered and Ga68 Dotatate PET is not available.
  - Patient with neuroblastoma
  - Patient with paraganglioma or pheochromocytoma with suspected locally unresectable, metastatic, or multifocal disease
- Imaging during/post therapy with radiotherapeutic agents when it will potentially change management.
- Lymphoscintigraphy with sentinel node localizations, for preoperative planning in melanoma, breast, head and neck, and gynecological cancers

## Preoperative or Postoperative Assessment [9,31,32]

IMAGING MODALITY**:** When any ONE of the below criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:

- Imaging of the area requested is needed to develop a surgical plan and prior CT and/or MRI was indeterminate

- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications or persistent symptoms after spine, joint, or bone surgery and prior X-ray, CT, or MRI was negative or inconclusive

  NOTE**:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Findings on Prior Imaging

Unless follow up is otherwise specified within the guideline:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (no further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 78803 | Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT), single area (eg, head, neck, chest, pelvis) or acquisition, single day imaging |
| 78830 | Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT) with concurrently acquired computed tomography (CT) transmission scan for anatomical review, localization and determination/detection of pathology, single area (eg, head, neck, chest, pelvis) or acquisition, single day imaging |
| 78831 | Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT), minimum |

| Code | Description |
|---|---|
| | 2 areas (eg, pelvis and knees, chest and abdomen) or separate acquisitions (eg, lung ventilation and perfusion), single day imaging, or single area or acquisition over 2 or more days |
| 78832 | Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT) with concurrently acquired computed tomography (CT) transmission scan for anatomical review, localization and determination/detection of pathology, minimum 2 areas (eg, pelvis and knees, chest and abdomen) or separate acquisitions (eg, lung ventilation and perfusion), single day imaging, or single area or acquisition over 2 or more days |
| +78835 | Radiopharmaceutical quantification measurement(s) single area (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# SUMMARY OF EVIDENCE [2,33]

SPECT is a nuclear medicine imaging technique that uses gamma ray-emitting radiopharmaceuticals to create 3D images of specific anatomical locations within the patient. This technique is particularly useful for localizing tumors, inflammatory processes, or radioactive tracer distribution.

The indications for SPECT are supported by various evidence-based and peer-reviewed resources from medical publications and societal organization guidelines. Here are some key indications and their rationale:

Bone/Joint/Spine: SPECT is indicated for screening and staging of bone metastases, especially when CT/MRI are indeterminate or contraindicated. It is also useful for patients with impaired renal function who cannot receive iodinated or gadolinium-based contrast agents. SPECT is useful for detecting early avascular necrosis, bone infarct, or bone graft viability when MRI is indeterminate or contraindicated. SPECT is indicated for detecting stress fractures and other

occult skeletal trauma when x-ray and MRI are inconclusive. SPECT is indicated for osteomyelitis and discitis when MRI is indeterminate or contraindicated. SPECT is used for identifying the primary etiology of pain when multiple etiologies are identified on prior MRI/CT. SPECT is indicated for evaluating persistent symptoms in postoperative spine/joints/bones when x-ray and/or CT/MRI are negative or inconclusive. SPECT is used for staging and restaging of bony metastases when recent overlapping whole-body imaging is inconclusive.

Soft tissue: SPECT is indicated for initial or restaging of neuroendocrine tumors when CT/MRI or PET imaging is indeterminate. SPECT is used for evaluating fever of unknown origin and infections related to transplant and vascular grafts. SPECT is indicated for evaluating parathyroid adenoma and thyroid nodules when prior imaging is inconclusive. SPECT is used for quantifying lung function prior to lung resection/radiation and evaluating congenital cardiac, thoracic, or pulmonary disease. SPECT is indicated for preoperative localization of epileptic foci, differentiating Parkinsonian syndromes, and evaluating cerebrovascular reserve. SPECT is used for evaluating the renal collecting system after trauma, surgery, or obstruction, and diagnosing renal transplant complications. SPECT is indicated for evaluating hepatic radioembolization, gastrointestinal bleeding, and liver transplant complications.

# ANALYSIS OF EVIDENCE [2,33]

When choosing Single Photon Emission Computed Tomography (SPECT), several factors should be considered to ensure its appropriateness and effectiveness for the patient's condition. Here are some key considerations:

Clinical Indications: SPECT is indicated for various conditions such as bone/joint issues, malignancy, infection, bone viability, trauma, persistent symptoms of joint or spine pain, post-operative evaluation, extremities, follow-up studies, cardiac, neck, lung, brain, radionuclide cisternography (CSF), renal, abdomen/pelvis, non-bone infection/inflammation, other neoplasm/malignancy, and further evaluation of indeterminate findings on prior imaging. It is essential to ensure that the patient's condition aligns with these indications.

Prior Imaging: SPECT is often used when prior imaging techniques such as X-ray, MRI, CT, or ultrasound are indeterminate, contraindicated, or not available. It is important to review the patient's previous imaging results and determine if SPECT is necessary for further evaluation.

Medical Necessity: The guidelines emphasize that medical necessity determination should be based on widely accepted standard of care criteria supported by evidence-based or peer-reviewed sources. Clinicians should ensure that the use of SPECT is medically necessary and justified for the patient's condition.

Patient's Health Status: Consider the patient's overall health status, including any contraindications for other imaging modalities. For example, patients with impaired renal function who cannot receive iodinated or gadolinium-based contrast agents may benefit from SPECT.

Follow-Up: SPECT may be indicated for follow-up studies to evaluate progress after treatment, procedure, intervention, or surgery. Clear medical reasons for additional imaging should be documented.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • Removed indications for Cardiac<br>• Removed indications for Radionuclide Cisternography<br>• Removed indications for Non-Bone Infection/Inflammation<br>• Moved the position of the Preoperative or Postoperative Assessment section and edited indications<br>• Added an indication for patients with paraganglioma or pheochromocytoma to Other Neoplasm/Malignancy section<br>• Added technical description to codes |
| July 2025 | • Updated names and numbers of referenced cardiac guidelines<br>• Guideline name changed to Radiopharmaceutical Tumor Localization Single Proton Emission Computed Tomography (SPECT) |
| June 2025 | • Updated citations<br>• Checked Medicare Advantage Line of Business<br>• Added third bullet to General Information<br>• Added Summary of Evidence and Analysis of Evidence<br>• Guideline name changed from Evolent Clinical Guideline 078 for Single Proton Emission Computed Tomography (SPECT) Radiopharmaceutical Tumor Localization to Evolent Clinical Guideline 2052 for Radiopharmaceutical Tumor Localization (SPECT)<br>• Guideline number changed from 078 to 2052<br>• Clarified SPECT imaging terminology<br>• Clarified indications for various neoplasms and infection |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. ACR–ACNM–SNMMI–SPR. *PRACTICE PARAMETER FOR THE PERFORMANCE OF SKELETAL SCINTIGRAPHY (BONE SCAN)*.; 2023.
2. Israel O, Pellet O, Biassoni L, et al. Two decades of SPECT/CT – the coming of age of a technology: An updated review of literature evidence. *Eur J Nucl Med Mol Imaging*. 2019;46(10):1990-2012. doi:10.1007/s00259-019-04404-6
3. Morrison WB, Deely D, Fox MG, et al. ACR Appropriateness Criteria® Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S490-S503. doi:10.1016/j.jacr.2024.08.019
4. Pierce JL, Perry MT, Wessell DE, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot): 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S473-S487. doi:10.1016/j.jacr.2022.09.013
5. Baker JC, Northrup BE, Ahlawat S, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis of the Foot in Patients With Diabetes Mellitus: 2025 Update. *Journal of the American College of Radiology*. 2025;22(11):S713-S737. doi:10.1016/j.jacr.2025.08.031
6. Orcajo-Rincon J, Muñoz-Langa J, Sepúlveda-Sánchez JM, et al. Review of imaging techniques for evaluating morphological and functional responses to the treatment of bone metastases in prostate and breast cancer. *Clinical and Translational Oncology*. 2022;24(7):1290-1310. doi:10.1007/s12094-022-02784-0
7. Cohen SP, Bhaskar A, Bhatia A, et al. Consensus practice guidelines on interventions for lumbar facet joint pain from a multispecialty, international working group. *Reg Anesth Pain Med*. 2020;45(6):424-467. doi:10.1136/rapm-2019-101243
8. Tender GC, Davidson C, Shields J, et al. Primary pain generator identification by CT-SPECT in patients with degenerative spinal disease. *Neurosurg Focus*. 2019;47(6):E18. doi:10.3171/2019.9.FOCUS19608
9. Hutchins TA, Peckham M, Shah LM, et al. ACR Appropriateness Criteria® Low Back Pain: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S361-S379. doi:10.1016/j.jacr.2021.08.002
10. Goetzinger S, Courtney S, Yee K, Welz M, Kalani M, Neal M. Spondylolysis in Young Athletes: An Overview Emphasizing Nonoperative Management. *Journal of Sports Medicine*. 2020;2020:1-15. doi:10.1155/2020/9235958
11. Itani M, Middleton WD. Parathyroid Imaging. *Radiol Clin North Am*. 2020;58(6):1071-1083. doi:10.1016/j.rcl.2020.07.006
12. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Thyroid Carcinoma Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
13. ACR-ACNM-SNMMI-SPR-STR. *Practice Parameter for the Performance of Pulmonary Scintigraphy*.; 2023.

14. von Oertzen TJ. PET and ictal SPECT can be helpful for localizing epileptic foci. *Curr Opin Neurol*. 2018;31(2):184-191. doi:10.1097/WCO.0000000000000527

15. Buchert R, Buhmann C, Apostolova I, Meyer PT, Gallinat J. Nuclear Imaging in the Diagnosis of Clinically Uncertain Parkinsonian Syndromes. *Dtsch Arztebl Int*. Published online November 1, 2019. doi:10.3238/arztebl.2019.0747

16. Hustad E, Aasly JO. Clinical and Imaging Markers of Prodromal Parkinson's Disease. *Front Neurol*. 2020;11. doi:10.3389/fneur.2020.00395

17. American College of Radiology. *ACR Appropriateness Criteria® Dementia*.; 2024.

18. White T, Gandhi S, Langer DJ, Katz JM, Dehdashti AR. Does Advanced Imaging Aid in the Preoperative Evaluation of Patients With Moyamoya Disease? *Cureus*. Published online October 1, 2022. doi:10.7759/cureus.29816

19. Tansavatdi K, Dublin A, Donald P, Dahlin B. Combined Balloon Test Occlusion and SPECT Analysis for Carotid Sacrifice: Angiographic Predictors for Success or Failure? *J Neurol Surg B Skull Base*. 2015;76(04):249-251. doi:10.1055/s-0035-1547363

20. Richardson TE, Beech P, Cloud GC. Limb-shaking TIA: a case of cerebral hypoperfusion in severe cerebrovascular disease in a young adult. *BMC Neurol*. 2021;21(1):260. doi:10.1186/s12883-021-02296-4

21. Thavarajasingam SG, El-Khatib M, Vemulapalli K, et al. Radiological predictors of shunt response in the diagnosis and treatment of idiopathic normal pressure hydrocephalus: a systematic review and meta-analysis. *Acta Neurochir (Wien)*. 2022;165(2):369-419. doi:10.1007/s00701-022-05402-8

22. Suthar PP, Jhaveri MD, Kounsal A, Pierce LD, Singh JS. Role of Clinical and Multimodality Neuroimaging in the Evaluation of Brain Death/Death by Neurologic Criteria and Recent Highlights from 2023 Updated Guidelines. *Diagnostics*. 2024;14(12):1287. doi:10.3390/diagnostics14121287

23. ACR-ACNM-SPR. *Practice Parameter for the Performance of Renal Scintigraphy*.; 2022.

24. ACR-ACNM-SNMMI-SPR. *Practice Parameter for the Performance of Radionuclide Cystography*.; 2020.

25. ACR-ABS-ACNM-ARS-SIR-SNMMI. *Practice Parameter for Selective Internal Radiation Therapy (SIRT) or Radioembolization for Treatment of Liver Malignancies*.; 2024.

26. Kim SP, Cohalan C, Kopek N, Enger SA. A guide to 90Y radioembolization and its dosimetry. *Physica Medica*. 2019;68:132-145. doi:10.1016/j.ejmp.2019.09.236

27. ACR-ACNM-SNMMI-SPR. *Practice Parameter for the Performance of Hepatobiliary Scintigraphy*.; 2021.

28. ACR-ACNM-SNMMI-SPR. *Practice Parameter for the Performance of Gastrointestinal Tract, Hepatic, and Splenic Scintigraphy*.; 2020.

29. Chernyak V, Horowitz JM, Kamel IR, et al. ACR Appropriateness Criteria® Liver Lesion-Initial Characterization. *Journal of the American College of Radiology*. 2020;17(11):S429-S446. doi:10.1016/j.jacr.2020.09.005

30. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Neuroendocrine and Adrenal

Tumors Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

31. Bäcker HC, Steurer-Dober I, Beck M, et al. Magnetic resonance imaging (MRI) versus single photon emission computed tomography (SPECT/CT) in painful total hip arthroplasty: a comparative multi-institutional analysis. *Br J Radiol*. 2020;93(1105). doi:10.1259/bjr.20190738

32. Peters MJMM, Bastiaenen CHGG, Brans BT, Weijers RE, Willems PC. The diagnostic accuracy of imaging modalities to detect pseudarthrosis after spinal fusion—a systematic review and meta-analysis of the literature. *Skeletal Radiol*. 2019;48(10):1499-1510. doi:10.1007/s00256-019-03181-5

33. Smith H, Hacking C, Chieng R. Single photon emission computed tomography (SPECT). In: *Radiopaedia.Org*. Radiopaedia.org; 2018. doi:10.53347/rID-62599

# Evolent Clinical Guideline 2058 for Tumor Imaging Positron Emission Tomography (PET)

## *Any Site, Breast Cancer, Melanoma*

| **Guideline Number:** Evolent_CG_2058 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2026 - 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** January 2026 | **Last Revised Date:** May 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Special Note

- Positron Emission Tomography (PET) imaging, any site, not otherwise specified, is a non-covered CPT code.
- PET scan imaging, full and partial-ring PET scanners only, for initial diagnosis of breast cancer and/or surgical planning for breast cancer (e.g., initial staging of axillary lymph nodes) is not medically necessary and is therefore a non-covered study [1,2]
- PET scan for whole body; melanoma for non-covered indications is not medically necessary and is therefore a non-covered study [3–5]

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| G0219 | PET imaging whole body; melanoma for noncovered indications |
| G0235 | PET imaging, any site, not otherwise specified |
| G0252 | PET imaging, full and partial-ring PET scanners only, for initial diagnosis of breast cancer and/or surgical planning for breast cancer (e.g., initial staging of axillary lymph nodes) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# SUMMARY OF EVIDENCE

**Ultrasound, CT, MRI, or PET-CT for staging and re-staging of adults with cutaneous melanoma (Review)** [4]

**Study Design**: This is a systematic review published in the Cochrane Database of Systematic Reviews. It evaluates the diagnostic accuracy of imaging tests (Ultrasound, CT, MRI, PET-CT) for staging and re-staging adults with cutaneous melanoma.

**Target Population**: Adults with confirmed cutaneous invasive melanoma undergoing imaging for staging purposes.

**Key Factors**:

- **Objectives**: To determine the diagnostic accuracy of imaging tests for detecting nodal and distant metastases before sentinel lymph node biopsy (SLNB) and for whole-body imaging.
- **Methods**: Comprehensive search of multiple databases up to August 2016, including studies of any design that evaluated the imaging tests compared with histological confirmation or imaging with clinical follow-up.
- **Results**: 39 publications reporting on 5204 study participants. The accuracy of imaging for detection of regional nodal metastases before SLNB was evaluated in 18 studies. Summary sensitivity of ultrasound alone was 35.4% and specificity was 93.9%. Combining ultrasound with FNAC revealed summary sensitivity of 18.0% and specificity of 99.8%. Limited test accuracy data were available for whole-body imaging via PET-CT for primary staging or re-staging for disease recurrence.
- **Conclusions**: There is a lack of evidence on the accuracy of imaging in people with melanoma at different points on the clinical pathway. Imaging with ultrasound combined with FNAC before SLNB may identify around one-fifth of those with nodal disease, but further work is needed to establish cost-effectiveness.

**The role of FDG-PET/CT in preoperative staging of sentinel lymph node biopsy-positive melanoma patient** [3]

**Study Design**: This is a retrospective multicenter cohort study conducted in the Region of Southern Denmark.

**Target Population**: Malignant melanoma (MM) patients with a positive sentinel lymph node biopsy (SLNB) who subsequently underwent FDG-PET/CT prior to lymph node dissection (LND).

**Key Factors**:

- **Objectives**: To determine FDG-PET/CT's efficacy in finding distant metastasis and its influence on subsequent diagnostic testing and treatment.
- **Methods**: Patient information was acquired from the Danish Melanoma Database and cross-referenced with OUH's patient records. The study included 46 patients from April 1, 2015 to April 1, 2016.
- **Results**: FDG-PET/CT did not uncover any distant metastases or lead to any alterations in treatment strategy. However, it provided false positive findings in 13% of patients, triggering additional procedures that did not impact the therapeutic strategy.
- **Conclusions**: The new diagnostic strategy did not find any MM metastases or uncover anything else of relevance. FDG-PET/CT provided false positive findings, indicating a need for re-evaluation of this strategy and further clinical trials.

**PET Molecular Imaging in Breast Cancer: Current Applications and Future Perspectives** [1]

**Study Design**: This is a review article published in the Journal of Clinical Medicine.

**Target Population**: Breast cancer patients.

**Key Factors**:

- **Objectives**: To address the role of PET imaging in breast cancer care, focusing on the utility of 18F-fluorodeoxyglucose (FDG) PET in staging, recurrence detection, and treatment response evaluation.
- **Methods**: The review discusses current applications and future perspectives of PET molecular imaging in breast cancer, including novel radiopharmaceuticals and the integration of AI.
- **Results**: PET/CT is not routinely recommended for primary diagnosis due to high cost and limited sensitivity. However, it offers superior performance in detecting extra-axillary nodal and distant metastases in newly diagnosed stage III breast cancer. PET/CT is valuable for evaluating response to neoadjuvant chemotherapy and detecting recurrence. Novel PET radiotracers like 68Ga-FAPI and 18F-FES show promise in assessing various tumor behaviors and enhancing detection precision.
- **Conclusions**: PET/CT plays a crucial role in breast cancer management, with advancements in imaging techniques and precision medicine tracers offering significant improvements in diagnostic accuracy

# ANALYSIS OF EVIDENCE

**Shared Findings** [1,3,4]:

- **Diagnostic Accuracy**: All three studies highlight the diagnostic accuracy of PET imaging in detecting metastases. Dinnes et al 2019 and Frary et al 2016 focus on melanoma, while Katal et al 2024 discusses breast cancer. PET imaging is recognized for its ability to detect distant metastases, although its accuracy varies depending on the cancer type and stage.
- **False Positives**: Both Frary et al 2016 and Dinnes et al 2019 mention the occurrence of false positives in PET imaging. Frary et al 2016 reports a 13% false positive rate, while Dinnes et al 2019 notes the limited accuracy data available for PET-CT21.
- **Need for Further Research**: All studies emphasize the need for further research to establish the cost-effectiveness and clinical utility of PET imaging. Dinnes et al 2019 calls for more studies on the accuracy of imaging tests, Frary et al 2016 suggests re-evaluation of the diagnostic strategy, and Katal et al 2024 highlights the potential of novel radiotracers.

**Conclusion** [1,3,4]:

In summary, while all three studies recognize the importance of PET imaging in cancer management, they differ in their focus on specific cancer types, patient populations, and the integration of innovative imaging techniques. Further research is needed to address the limitations and validate the findings across different clinical settings.

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | • Added technical description to codes<br>• Updated references |
| June 2025 | • Added a subtitle: Any Site, Breast Cancer, Melanoma |
| May 2025 | • This guideline replaces Evolent Clinical Guideline 070-2 for Tumor Imaging PET Any Site (Unlisted PET)<br>• This guideline replaces Evolent Clinical Guideline 070-3 for Tumor Imaging PET - Breast Cancer - Initial Diagnosis<br>• This guideline replaces Evolent Clinical Guideline 070-4 for Tumor Imaging PET Melanoma (Noncovered Indications) |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Katal S, McKay MJ, Taubman K. PET Molecular Imaging in Breast Cancer: Current Applications and Future Perspectives. *J Clin Med*. 2024;13(12):3459. doi:10.3390/jcm13123459
2. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
3. Frary EC, Gad D, Bastholt L, Hess S. The role of FDG-PET/CT in preoperative staging of sentinel lymph node biopsy-positive melanoma patients. *EJNMMI Res*. 2016;6(1):73. doi:10.1186/s13550-016-0228-1
4. Dinnes J, Ferrante di Ruffano L, Takwoingi Y, et al. Ultrasound, CT, MRI, or PET-CT for staging and re-staging of adults with cutaneous melanoma. *Cochrane Database of Systematic Reviews*. 2019;2019(7):CD012806. doi:10.1002/14651858.CD012806.pub2
5. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Melanoma: Cutaneous Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

# Evolent Clinical Guideline 2066 for Urgent/Emergent Criteria

| Guideline Number: | Applicable Codes | |
|---|---|---|
| Evolent_CG_2066 | | |
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| **Original Date:** | **Last Revised Date:** | **Implementation Date:** |
| November 2009 | May 2026 | January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Evolent reviews certain imaging studies for the existence of an urgent/emergent situation. This type of medical necessity review is only conducted for those requests where the date of service has passed (a retrospective review).

# INDICATIONS FOR EMERGENT STUDIES

## Emergent Studies

The requested study is required to render immediate medical attention needed to prevent loss of life, limb, or risk of significant morbidity/permanent disability such as [1–3]:

- Conditions that impair bodily functions that support life (airway, breathing and circulation)
- Conditions that are consistent with a disorder that damages tissue in a substantial fashion (e.g., compartment syndrome or thrombus/embolus)

# INDICATIONS FOR URGENT STUDIES

## Urgent Studies

For the evaluation of a condition that requires prompt medical intervention to prevent additional consequences to the health/wellbeing of the member. This includes preventing the medical condition from precipitating an emergent situation such as [2]:

- Any condition that cannot be postponed for a period of time (24 hours) without risking progression to an emergent condition [4]

- Any condition that cannot be postponed for a period of time (24 hours) without risking loss of life, limb, or risk of permanent disability [4]

# CODING AND STANDARDS

## Codes

Not Applicable for this Guideline

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Urgent/Emergent Situations

The indications above can be applied to all imaging modalities managed by Evolent.

The indications presented herein are not intended to limit the peer clinical reviewer from using his/her independent clinical judgment. A case-by-case evaluation of the member's clinical presentation should be conducted when determining the presence of an emergent or urgent clinical situation.

# SUMMARY OF EVIDENCE

**ESR guidelines for the communication of urgent and unexpected findings** [2]

**Study Design**: This document is a guideline issued by the European Society of Radiology (ESR) for the communication of urgent and unexpected radiological findings. It emphasizes the importance of timely communication of radiological findings to ensure patient care and safety.

**Target Population**: The guidelines are intended for radiologists, imaging providers, and referring doctors who are involved in the communication and management of radiological findings.

**Key Factors**: The document outlines the responsibilities of institutions, referrers, and radiologists in ensuring effective communication. It discusses the need for clear protocols, the importance of direct communication in emergency cases, and the use of electronic systems for timely report delivery. It also highlights the advantages and disadvantages of enhanced communication methods and provides recommendations for improving communication practices.

**Current Standards for and Clinical Impact of Emergency Radiology in Major Trauma** [3]

**Study Design**: This is a review article published in the International Journal of Environmental Research and Public Health. It discusses the current standards and clinical impact of emergency radiology in major trauma.

**Target Population**: The review focuses on patients who have sustained major trauma, particularly those with high-energy injuries.

**Key Factors**: The article highlights the role of imaging, particularly computed tomography (CT), in the assessment and management of major trauma. It discusses the indications for CT, the importance of early and accurate imaging, and the role of interventional radiology in treating vascular injuries. The review also covers the advancements in CT technology, the development of CT protocols, and the importance of detecting vascular injuries. It emphasizes the role of radiologists within the trauma team and the impact of timely imaging on patient outcomes.

# ANALYSIS OF EVIDENCE

Analysis [2,3]:

In summary, both articles emphasize the importance of timely communication and the role of radiologists in managing urgent and emergent situations. However, "ESR 2012" focuses more on communication protocols, while "Iacobellis 2022" highlights the advancements in imaging technology and its impact on trauma management. The shared conclusions reinforce the need for effective communication and standardized protocols, while the differing conclusions provide insights into the specific areas of focus for each article.

**Shared Conclusions:**

- **Importance of Timely Communication**: Both articles emphasize the critical need for timely communication of radiological findings to ensure appropriate and prompt medical action. The "ESR 2012" guidelines stress the importance of clear protocols and procedures for communicating urgent and unexpected findings to improve patient safety. Similarly, "Iacobellis 2022" highlights the role of rapid imaging and communication in managing major trauma, particularly in life-threatening situations.
- **Role of Radiologists**: Both articles underline the significant responsibility of radiologists in ensuring that critical findings are communicated effectively. "ESR 2012" discusses the radiologist's duty to follow protocols and use appropriate alert mechanisms. "Iacobellis 2022" emphasizes the radiologist's role in the trauma team, particularly in the early detection and management of vascular injuries.

- **Protocols and Procedures**: Both articles advocate for the development and adherence to standardized protocols. "ESR 2012" recommends that radiology departments have written protocols for handling emergency and unexpected findings. "Iacobellis 2022" discusses the importance of having robust CT protocols for trauma patients to ensure accurate and timely diagnosis.

# POLICY HISTORY

| Date | Summary |
|---|---|
| May 2026 | ● No clinical changes<br>● Removed the following reference:<br>○ American College of Emergency Physicians. Emergency Care, Urgent Care - What's the Difference? American College of Emergency Physicians. October 17, 2024. https://www.acep.org/siteassets/sites/acep/media/advocacy/value-of-em/urgent-emergent-care.pdf |
| July 2025 | ● Added a Summary of Evidence and Analysis of Evidence |
| June 2025 | ● This guideline number changed from 100 to 2066<br>● Added in general information statement regarding guideline criteria development by reputable sources, standard of care, and best practices<br>● Deleted conditions that are consistent with (or precipitate) any type of shock (e.g., hypovolemic or cardiogenic) |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Chaturvedi A, Vargas D, Ocazionez D. CT for evaluation of acute pericardial emergencies in the ED. *Emerg Radiol*. 2018;25(3):321-328. doi:10.1007/s10140-018-1590-2
2. European Society of Radiology (ESR). ESR guidelines for the communication of urgent and unexpected findings. *Insights Imaging*. 2012;3(1):1-3. doi:10.1007/s13244-011-0135-y
3. Iacobellis F, Abu-Omar A, Crivelli P, et al. Current Standards for and Clinical Impact of Emergency Radiology in Major Trauma. *Int J Environ Res Public Health*. 2022;19(1):539. doi:10.3390/ijerph19010539
4. American Academy of Urgent Care Medicine (AAUCM). What is Urgent Care Medicine? AAUCM. October 17, 2024. https://aaucm.org/what-is-urgent-care-medicine/

# Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging

| **Guideline Number:**<br>Evolent_CG_2069 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:**<br>January 2027 | **Last Revised Date:**<br>June 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Imaging of the abdomen and pelvis generates images of the organs and structures within the abdomen and/or pelvis. Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crests. Pelvic imaging begins at the umbilicus or iliac crests and extends to the level of the lesser trochanters. Computed Tomography (CT) uses ionizing radiation to generate images of organs and structures. Magnetic Resonance Imaging (MRI) generates images of organs and structures without the use of ionizing radiation. Computed tomography angiography (CTA) generates images of vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Magnetic resonance angiography (MRA) generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without ionizing radiation.

**NOTE:** Authorizations for CT Angiography and MR Angiography cover both arterial and venous imaging. The term *angiography* refers to both arteriography and venography.

## Special Note

When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

## Adrenal [1,2]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT** or **Abdomen MRI**.

- Indeterminate adrenal lesion seen on prior imaging.
- For follow-up of known adrenal mass when a change in tumor is suspected by either imaging, laboratory evaluation, and/or symptoms.
- Adrenal mass 1 - 4 cm incidentally discovered with benign characteristics (homogenous, regular borders, Hounsfield units < 10) at one of the following surveillance intervals (incidental adrenal masses < 1 cm in short axis generally do not require radiographic follow-up):
    - 6 months, then
    - Annually for next 2 years, then no further imaging if stable

    **NOTE:** Growth or suspicious interval change may warrant continued or more frequent surveillance.
- Adrenal mass ≥ 4 cm and any **ONE** of the following criteria:
    - Preoperative planning
    - Repeat imaging in 6-12 months, then as clinically indicated.
- For further evaluation of suspected adrenal tumors and/or endocrine disorders when there is clinical and laboratory evidence to suggest an abdominal source
    - Suspected adrenocortical carcinoma
        - E.g. elevated adrenal androgens (DHEA-S, androstenedione, testosterone, or 17-hydroxyprogesterone)
    - Cushing's Syndrome when laboratory evaluation shows any **ONE** of the following:
        - ACTH < 5 following dexamethasone suppression
        - ACTH 5-20 (i.e. indeterminate) with CRH/desmopressin stimulation test and ACTH < 5 (post-stimulation)
    - Hyperaldosteronism: Aldosterone > 20 (or Aldosterone: Renin ratio > 20:1) and Low Plasma Renin Activity
    - See **Genetic Conditions** for additional screening indications.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen CT, Abdomen MRI,** Abdomen and Pelvis CT, or Abdomen MRI and Pelvis MRI.

- Suspected Pheochromocytoma or Paraganglioma with elevated plasma or urine catecholamines, metanephrines, or normetanephrines

## Biliary Tree [3]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI (including MRCP)**.

- To confirm choledocholithiasis in patients in the acute setting after ultrasound has been completed.

- Evaluation of pancreaticobiliary disease in pregnant patients after ultrasound has been done.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI (including MRCP)** or Abdomen CT.

- Suspected choledochal cyst after ultrasound has been done [4]
- Long-term postoperative surveillance for patients with history of choledochal cyst [4]
- Post-surgical biliary anatomy and complications when Endoscopic Retrograde Cholangiopancreatography (ERCP) is not possible or is contraindicated
- Assessment of benign or malignant biliary strictures
- Evaluation of biliary abnormalities (such as dilated bile duct) identified on prior imaging (e.g. ultrasound, CT or MRI) when there are symptoms and/or clinical concern for pancreaticobiliary disease
- Jaundice or abnormal liver function tests after abnormal or indeterminant ultrasound

# Gastrointestinal Tract

## *Appendicitis [5]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT.**

- Suspected acute appendicitis in a non-pregnant adult with any ONE of the following:
  - WBC Elevated
  - Fever
  - Anorexia
  - Nausea and vomiting

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen MRI and Pelvis MRI.** Abdomen and Pelvis CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected acute appendicitis in a pregnant patient with any ONE of the following:
  - WBC Elevated
  - Fever
  - Anorexia
  - Nausea and vomiting

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT.**

- Suspected appendicitis in a child (< age 18 years) with BOTH of the following [6]:
  - Ultrasound is inconclusive or cannot be completed (e.g. due to body habitus or inability to cooperate)
  - Any ONE of the following is present:
    - WBC Elevated
    - Fever
    - Anorexia
    - Nausea or vomiting
    - Peritoneal signs (e.g. rigid abdomen, involuntary guarding, rebound tenderness)
    - Documented suspicion of complications (e.g. abscess, bowel obstruction).

## *Benign Anorectal Conditions [7]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI** (may be described as MRI defecography).

- For defecation disorders (difficulty evacuating stool in patients with chronic or recurring symptoms of constipation) to confirm diagnosis if other testing is equivocal (both anorectal manometry and rectal balloon expulsion testing)
- For fecal incontinence after anorectal manometry showing weak pressures and/or if surgery is being considered
- For symptomatic rectal prolapse, rectocele, sigmoidocele, enterocele, or uterovaginal prolapse with findings documented on physical examination and documentation that surgical repair is being considered.

## *Bleeding [8–10]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen CTA**.

- Acute nonvariceal upper gastrointestinal (GI) bleed when esophagogastroduodenoscopy (EGD) has been done with need for further assessment
- Acute nonvariceal upper GI bleed when EGD is contraindicated due to postsurgical status, traumatic etiology of bleed, hemodynamic instability, or large volume bleeding.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA.**

- Known or suspected active lower GI bleed (e.g. with hematochezia or melena)
- Suspected occult or intermittent small bowel bleeding when endoscopy and capsule endoscopy are inconclusive or negative

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or **Abdomen CT** (may be referred to as CT enterography), Abdomen and Pelvis CTA, or Abdomen CTA.

- Nonvariceal upper GI bleeding with negative EGD
- Nonlocalized intermittent lower GI bleed after previous colonoscopy and EGD

## *Diverticulitis*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Suspected diverticulitis for initial imaging when there is left lower quadrant tenderness on exam AND at least ONE of the following [(11)]:
  - WBC Elevated
  - Fever
  - Anorexia
  - Nausea and vomiting
  - Patient is immunocompromised
- Known diverticulitis and one of the following:
  - Suspicion of recurrent diverticulitis when symptoms are similar to prior episodes, and patient is not responding to treatment (treatment could be liquid diet or antibiotic)
  - Complications of diverticulitis (diagnosed either clinically or by imaging) with severe abdominal/pelvic pain, severe tenderness, or mass not responding to antibiotic treatment [(12)]
  - Concern for smoldering diverticulitis in an individual not responding to antibiotic treatment

## *Inflammatory Bowel Disease [(13,14)]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** (may be referred to as CT Enterography) or **Abdomen MRI** and **Pelvis MRI** (may be referred to as MRI Enterography).

- For suspected inflammatory bowel disease (i.e. Crohn's disease or ulcerative colitis) with ALL of the following:
  - Recently completed colonoscopy
  - Recently completed lab workup including CBC and fecal calprotectin
- For initial assessment of newly diagnosed inflammatory bowel disease
- Known inflammatory bowel disease with any **ONE** of the following:
  - For monitoring response to therapy

- Recurrence or worsening signs/symptoms requiring re-evaluation

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI**.

- For patients with Crohn's disease and known or suspected perianal abscesses or fistula [15]

### *Small Bowel Obstruction*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Suspicion of small bowel obstruction because of factors such as crampy pain, vomiting, distention, high pitched or absent bowel sounds, prior history of abdominal surgery, or based on initial x-ray [16]

### *Suspected Colorectal or Other Gastrointestinal Cancer [17,18]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Persistently elevated carcinoembryonic antigen (CEA) in a patient with ALL of the following:
  - No cancer history
  - Laboratory workup completed (including CBC, CMP, and repeat CEA)
  - No cause is identified on colonoscopy
  - CEA is >10 ng/ml, or fails to drop below 5 ng/ml after 3-6 months

### *Suspected Gastrointestinal Neuroendocrine Tumors*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT, Abdomen MRI, Abdomen and Pelvis CT**, or Abdomen MRI and Pelvis MRI.

- For suspected or newly diagnosed functional gastrointestinal neuroendocrine (i.e. carcinoid) tumor with elevated tumor markers, including chromogranin A, 24-hour urine 5-HIAA, or elevated plasma 5-HIAA [2]:
- For suspected or newly diagnosed gastrinoma with elevated gastrin [2]:
- See **Pancreas** and **Adrenal** sections for other suspected neuroendocrine tumor indications.

## Genitourinary

### *Complicated Urinary Tract Infection and Pyelonephritis [19,20]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Evaluation of cause of complicated UTI, as evidenced by any **ONE** of the following:

- Male gender (any UTI is considered complicated in males) [21]
- Immunocompromised host
- Persistence of bacteria or symptoms after culture specific treatment
- Rapid recurrence with same bacteria after treatment
- Multidrug resistant bacteria
- When there is suspicion of renal calculi or obstruction [22]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- For suspected or known complicated pyelonephritis, as defined by any **ONE** of the following factors (imaging is not required in uncomplicated pyelonephritis, which typically responds rapidly to antibiotics):
  - For a patient who remains febrile after 72 hours of treatment or who has deterioration in clinical status
  - With one of the following co-morbid conditions: personal history of stone disease or renal obstruction, recurrent pyelonephritis, vesicoureteral reflux, immune compromise, prior renal transplant with native kidneys in place, advanced age or lack of response to initial therapy (based on culture)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen MRI and Pelvis MRI**. Abdomen and Pelvis CT can be considered on a case-by-case basis if ultrasound is inconclusive or insufficient.

- For suspected or known uncomplicated or complicated pyelonephritis in a pregnant patient.

## *Hematuria [23]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT** (may be referred to as CT Urography [CTU]). Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed.

- For evaluation of hematuria when kidney stone and urinary tract infection are not suspected (see **NOTE**) and any **ONE** of the following are present:
  - Gross hematuria
  - > 25 RBC/hpf on urine microscopy
  - 3-25 RBC/hpf on urine microscopy and any **ONE** or more of the following:
    - > 30 pack-year smoking history
    - Male ≥ age 60
    - Abnormal renal ultrasound
    - Negative renal ultrasound and repeat sample shows persistence of ≥ 3 RBC/hpf

- Findings that are indeterminate for tumor/lesion on CT when delayed (i.e. post-contrast) images of the urinary system are needed for clarification (may be referred to as CT Urography)

**NOTE:** If urinary tract infection (UTI) is suspected, urine culture should either be negative OR repeat urine microscopy after treatment of the UTI shows ≥ 3 RBC/hpf

## *Hydronephrosis* [24]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT** (may be referred to as CT Urography). Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed, including during pregnancy.

- Unilateral hydronephrosis with unclear cause after initial ultrasound or other imaging.

## *Kidney*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT** or **Abdomen MRI**.

- Indeterminate renal mass on other imaging [25]
- Active surveillance for solid renal mass(es) at one of the following surveillance intervals:
  - Every 6 months x2, then
  - Annually [26]

  **NOTE:** Growth or suspicious interval change may warrant more frequent surveillance.
- Active surveillance for follow-up of a Bosniak IIF, III and IV complex cystic renal lesion(s) (Bosniak I and II cysts need no further follow-up. See **background** for details of Bosniak classification) at the following intervals [27]:
  - Every 6 months for the first year, then
  - Annually for 5 years if no progression

  **NOTE:** Growth or suspicious interval change may warrant more frequent surveillance
- Surveillance of known angiomyolipoma (AML) at any **ONE** of the following intervals [28–30]:
  - Size > 4 cm
    - Annually
  - Size 3-4 cm
    - Every 2 years

    **NOTE:** if < 3 cm, monitoring with advanced imaging (CT/MRI) is not needed unless the patient has known Tuberous Sclerosis
  - AML (any size) in an individual with known tuberous sclerosis complex (TSC): Annually, including at diagnosis [26,28]
  - Post-embolization imaging for AML:

- One study within the first 6 months, then
- At one-year post-embolization

**NOTE:** If stable at one-year post-embolization, further imaging reverts to the above imaging frequency for monitoring (based on size and/or presence of known TSC) [31,32]

- See **Genetic Conditions** for additional indications

## *Known or Suspected Kidney or Ureteral Stone [33–35]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Known or suspected kidney or ureteral stone in any ONE of the following situations:
  - Acute flank pain (< 2 weeks) and documentation of high suspicion for stone after completion of urinalysis
  - Subacute or chronic flank pain and any ONE of the following:
    - Abnormal ultrasound
    - Fever or WBC > 15,000
    - Inadequate analgesia
    - KUB shows possible kidney stone
  - Known stones with recent indeterminate imaging (ultrasound or KUB) when additional imaging may change management

## *Preoperative Urinary Stone Planning [36]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- No CT has been performed within the past 6 weeks
- If passage or movement of stones is suspected and imaging may change management

## *Postoperative Urinary Stone Follow-up [37]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**.

- Symptomatic patients following:
  - Ureteroscopic extraction of an intact stone
  - Ureteroscopy with lithotripsy/fragmentation of a radiolucent stone
  - Percutaneous Nephrolithotomy
- Hydronephrosis seen on post-operative ultrasound

## *Ureteropelvic Junction Obstruction*

IMAGING MODALITY: When following criteria are met, the indicated study is **Abdomen CTA**.

- For surgical planning in a patient with ureteropelvic junction (UPJ) obstruction, to look for a lower pole crossing vessel [38]

## *Prostate*

### Suspected Prostate Cancer

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI**.

- Prior to prostate biopsy when notes indicate that biopsy is planned [39]
- In individuals with previous negative biopsy and ongoing concerns of increased risk of prostate cancer (i.e., rising or persistently elevated PSA or suspicious digital rectal exam (DRE))
- For evaluation of elevated PSA (on two separate levels) when ALL of the following have been provided [40]:
  - Workup with urinalysis (with urine culture if concern for infection) and/or digital rectal exam has excluded a benign cause for the PSA elevation
  - Imaging is requested to assist with whether to proceed with biopsy
  - Documentation has been provided that there is concern for prostate cancer or ordering provider is a Urologist

    **NOTE:** If the patient is on a 5-alpha reductase inhibitor, the PSA should be doubled for interpretation in this context. If the rate of rise of PSA or age-matched PSA is the concern, rather than PSA elevation, advanced imaging is indicated if all the above criteria above are met.
- For evaluation of a very suspicious prostate nodule on exam when biopsy is under consideration [40]
- Follow-up MRI can be approved at the following intervals [41,42]:
  - PI-RADS 3-5 lesions: 12-month interval
  - PI-RADS 1-2 lesions: 24-month interval
    - Earlier for PI-RADS 1-2 if biopsy is clearly planned, progressive rise in PSA, or other risk factors exist

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI and/or Pelvis CTA.**

- Evaluation of prostate prior to or after embolization (Pelvis CTA may be approved in addition to Pelvis MRI for preprocedural planning)

### *Other Genitourinary Indications*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI** or Pelvis CT.

- To diagnose or guide treatment of suspected urachal anomalies (including patent urachus) when ultrasound is non-diagnostic [43]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI.** Pelvis CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist [44]
- Scrotal or penile mass: when ultrasound is inconclusive [45]
- Investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticulum and any **one** of the following criteria are met:
  - Other imaging (e.g. ultrasound) is inconclusive
  - With findings on exam or cystoscopy that are highly suggestive of urethral diverticulum (i.e., ostia on cystoscopy or tender cystic lesion on anterior vaginal wall overlying the urethra) [46,47]
  - For preoperative planning
- Suspected urethral stricture or periurethral pathology when any one of the following criteria are met:
  - After initial evaluation with cystoscopy or urethroscopy and additional imaging is needed (e.g. for suspected malignancy, fistula, or extensive fibrosis)
  - For preoperative planning [48]
- Transient or episodic hematospermia and age ≥ 40 [49,50]
- Persistent hematospermia (duration > 1 month, any age) [51]

## Gynecologic Indications

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis CT** or Abdomen and Pelvis CT.

- To locate an intrauterine device after ultrasound and plain x-ray are equivocal or non-diagnostic [52]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI.** Pelvis CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Following abnormal pelvic ultrasound showing uterine or adnexal mass(es) or congenital

uterine abnormality [53]

- Abnormal uterine bleeding when ultrasound findings are indeterminate [54]
  - Age ≤ 50 – Vascular stalk or focal doppler signal on US
  - Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US
- Evaluation of endometriosis when preliminary imaging has been completed or to follow-up known endometriosis [55]
- Further evaluation of suspected adenomyosis when ultrasound is inconclusive, such as the following [56]:
  - Uterine abnormality on ultrasound including ANY of the following:
    - Anechoic spaces/cysts in myometrium
    - Heterogeneous echotexture
    - Obscured endometrial/myometrial border
    - Sub-endometrial echogenic linear striations
    - Thickening of the transition zone
    - Uterine enlargement
    - Uterine wall thickening
- Suspected placenta accreta or percreta when ultrasound is indeterminate (See **Combination Studies** for other indicated studies) [57]
- Prior to uterine surgery if there is an abnormality suspected on prior ultrasound

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT [58]**.

- Suspected hydatidiform mole with possible or definite metastases seen on chest x-ray or chest CT
- Known or suspected gestational trophoblastic neoplasia

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI**, Pelvis CT, or Abdomen and Pelvis CT.

- Elevated CA-125 with abnormal or indeterminate ultrasound and suspicion for gynecologic malignancy [59]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI, Pelvis CTA, or Pelvis MRA** (Pelvis CTA or Pelvis MRA are reasonable in addition to Pelvis MRI for preprocedural planning) [60]**.**

- Evaluation of uterus prior to or after embolization

## Hernia [61]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT**. Abdomen MRI is appropriate only when the preferred study is contraindicated or cannot be performed, or based on surgeon preference.

- Suspected initial or recurrent umbilical hernia and both exam and ultrasound do not clearly demonstrate a hernia
- Suspected initial, recurrent, or incisional ventral hernia, and exam and ultrasound do not clearly demonstrate a hernia
- Known umbilical hernia or ventral hernia and requested for surgical planning
- Known or suspected diaphragmatic hernia (e.g. Bochdalek, Morgagni or congenital) or large type IV hiatal hernia (See **Combination Studies** for other indicated studies) [62,63]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis CT** or Pelvis MRI.

- Suspected initial, recurrent, or incisional inguinal or femoral hernia and exam and ultrasound do not clearly demonstrate a hernia
- Known inguinal or femoral hernia and requested for surgical planning

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**. Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed, or based on surgeon preference.

- Known umbilical or inguinal/femoral hernia and requested for surgical planning when a specific clinical reason is provided for imaging the entire abdomen and pelvis
  - For example, for an inguinal hernia planned for laparoscopic surgery, abdominal imaging would be reasonable if there was previous upper abdominal surgery and documented concerns regarding laparoscopic port placement
- Suspected umbilical or inguinal/femoral hernia when ALL of the following are present:
  - Exam and ultrasound are non-diagnostic or equivocal
  - A specific clinical reason is provided for imaging the entire abdomen and pelvis
- Known ventral hernia in setting of previous surgery (i.e. incisional hernia) and ordered for surgical planning
- Known or suspected hernia and complications suspected based on ANY of the following:
  - Symptoms such as severe pain, vomiting, diarrhea, or blood in stool
  - Exam findings such as inability to reduce hernia, severe tenderness, guarding, or rebound tenderness
  - Complication was suggested on prior imaging
- Any of the following types of hernia are suspected or known (ultrasound not required):

- Deep intraabdominal/pelvic hernia (e.g. post-Roux-en-Y, obturator, sciatic or perineal)
- Non-midline ventral hernia (including Spigelian hernia) (64)
- Parastomal hernia

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI**.

- Suspected athletic pubalgia (i.e. sports hernia) when ALL of the following are present:
  - Persistent groin pain that occurs with exertion
  - Pain is unresponsive to 4 weeks of active conservative treatment (physical therapy, chiropractic care, or physician-supervised home exercise plan (HEP)) received within the past six 6 months
  - Prior imaging (either ultrasound or CT) is inconclusive

# Inflammation and Infection

## *Fistula*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI** or Pelvis CT.

- Suspected perianal fistula or occult anorectal abscess (65)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT, Abdomen CT, Pelvis CT, Abdomen MRI and Pelvis MRI, Abdomen MRI, or Pelvis MRI**, depending on the involved area.

- Any history of fistula in the abdomen and/or pelvis that requires re-evaluation or is suspected to have recurred

## *Infection*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT.** Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected peritonitis when abdominal pain and tenderness to palpation are present, and any **ONE** of the following:
  - Rebound, involuntary guarding or rigid abdomen
  - Severe tenderness to palpation over the entire abdomen
- Concern for enteric perforation due to new onset severe abdominal pain within 1 week of esophagogastroduodenoscopy (EGD) or colonoscopy
- For fever of unknown origin (temperature of ≥ 101 degrees for a minimum of 3 weeks) after **ALL** of the following have been completed and a source is not identified: complete blood count with differential, three sets of blood cultures, chest x-ray, complete

metabolic panel, urinalysis, ESR, ANA, RA, serologic testing (EBV, EMV, HIV and hepatitis), tuberculin test. [66]

- Follow-up of lymphadenitis when another diagnosis is suspected or there is a failure of symptom resolution [66]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT.** Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed. If requested, isolated abdomen or pelvis imaging studies can be considered on a case-by-case basis if the symptoms and/or previous site of infection is localized to the abdomen or pelvis.

- Other suspected infection in the abdomen and/or pelvis (based on elevated WBC, fever, anorexia, or nausea and vomiting)
- Any known infection to have created an abscess in the abdomen and/or pelvis that requires re-evaluation

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI.** Pelvis CT is appropriate only when there are contraindications to MRI or presence of hardware that would be expected to cause artifact.

- Suspected pelvic or sacral osteomyelitis or septic arthritis after initial X-ray

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or Pelvis CT.

- Suspected necrotizing soft tissue infection with physical exam or previous imaging suggesting crepitus or soft tissue gas

### Pancreatitis [67]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT** or **Abdomen MRI**. Addition of pelvic imaging can be considered on a case-by-case basis if there is prior imaging suggesting there is involvement of the pelvis.

- Initial imaging for suspected acute pancreatitis due to epigastric pain with elevated amylase and/or lipase [68]:
  - Mild presentation when symptom improvement is not seen after 72 hours of treatment and either:
    - Ultrasound has been performed and did not show an abnormality such as gallstones, dilated bile duct
    - Ultrasound suggests complications (such as fluid collection)
  - Severe presentation (such as fever, elevated WBC)
  - Decline in clinical status and/or suspected complication
- History of known pancreatitis with any ONE of the following:

- Worsening abdominal pain
- Signs/symptoms of infection (e.g. fever, elevated WBC)
- Decline in clinical status (e.g. hypovolemia, organ failure, tachycardia, fever)
- Severe presentation (e.g. fever, jaundice, elevated WBC, tachycardia)

- Known necrotizing pancreatitis requiring follow-up [68]
- Pancreatitis by history (including pancreatic pseudocyst) with continued abdominal pain, early satiety, nausea, vomiting, or signs of infection for more than 4 weeks after initial presentation
- In patients > 40 years of age who had recent pancreatitis not attributable to a clear cause (e.g. gallstones, alcohol)

  **NOTE:** The purpose of this is to exclude malignancy, which can sometimes be associated with new onset pancreatitis with no clear etiology.

### *Other Inflammatory Conditions*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or **Abdomen MRI and Pelvis MRI.**

- Follow-up of mesenteric panniculitis when another diagnosis is suspected or there is a failure of symptom resolution [69,70]
- Suspected retroperitoneal fibrosis after complete workup and ultrasound [71]
- For known retroperitoneal fibrosis to determine extent of disease

## Liver

**NOTE:** Magnetic Resonance Elastography (CPT 76391) for evaluation of hepatic fibrosis is not covered by this guideline. See Evolent Clinical Guideline 2038 for Magnetic Resonance Elastography.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI** or **Abdomen CT**.

- Indeterminant liver lesion and no personal history of cirrhosis or hepatitis B [72]
- Indeterminant liver lesion in patients at high risk of hepatocellular carcinoma (HCC) due to personal history of cirrhosis or hepatitis B, including any ONE of the following:
  - New nodule ≥ 1 cm on ultrasound
  - New non-nodular parenchymal distortion ≥ 1 cm on ultrasound
  - New thrombus in portal or hepatic vein on ultrasound

    **NOTE:** Patients at high risk of HCC and a nodule < 1 cm on ultrasound should have repeat ultrasound and AFP in 3-6 months rather than advanced imaging [66]
- Elevated or rising Alpha-fetoprotein (AFP) in patients at high risk of HCC due to personal history of cirrhosis or hepatitis B, regardless of ultrasound results [73]

- Screening in patients at high risk for HCC due to history of cirrhosis or hepatitis C every 6 months when prior ultrasound was insufficient to evaluate the liver due to steatosis/fatty liver or nodular liver

  **NOTE:** The finding of steatosis/fatty liver and/or nodular liver alone on an ultrasound report is insufficient; the report must specify that those findings prevent adequate visualization of the liver by ultrasound.

- Jaundice or acute changes in liver function tests not due to cirrhosis, after abnormal or indeterminant ultrasound [74]
- Follow-up of suspected hepatocellular adenomas at the following intervals [75,76]:
  - Every 6-12 months for two years then
  - Annually

  **NOTE:** Growth or suspicious interval change may warrant continued or more frequent surveillance
- Follow-up of focal nodular hyperplasia (FNH) at the following interval:
  - Once 6-12 months after diagnosis to ensure stability

    **NOTE:** Additional imaging would be justified only if there were atypical features or if the diagnosis remained in question. [75]
- Prior to Yttrium-90 (Y90) treatment (i.e. radioembolization or chemoembolization)
- Prior to transjugular intrahepatic portosystemic shunt (TIPS)
- See **Genetic Conditions** for additional screening indications

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen MRI**. Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Screening in patients at high risk of cholangiocarcinoma due to personal history of primary sclerosing cholangitis (PSC) at the following interval:
  - Every 6-12 months beginning at age 20 [77]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI, Abdomen CT, Abdomen CTA, or Abdomen MRA**, which may be in addition to PET when medical necessity criteria for PET have separately been met.

- Prior to Yttrium-90 (Y90) treatment (i.e. radioembolization or chemoembolization)

# Malignancy

## *Suspected Malignancy*

**NOTE:** Click hyperlinks below for other specific suspected malignancy indications:

- **Adrenal**

- **Biliary Tree**
- **Gynecologic Indications**
- **Liver**
- **Pancreas**
- **Suspected Gastrointestinal Cancer**
- **Suspected Gastrointestinal Neuroendocrine Tumors**
- **Suspected Prostate Cancer**

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT.** Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed. Requests for isolated abdominal or pelvic imaging can be considered on a case-by-case basis based on the location of the patient's mass or tumor.

- Unconfirmed diagnosis of cancer, for further evaluation of indeterminate or questionable findings
- Initial evaluation of non-lymph node suspicious mass or tumor found on physical exam and after initial imaging (ultrasound for subcutaneous or muscular mass, x-ray for osseous lesions).

  **NOTE:** When physical exam findings are documented as highly suspicious for malignancy, then omission of initial imaging can be considered on a case-by-case basis.
- One follow-up exam to ensure no suspicious change has occurred in a tumor. No further surveillance imaging unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- Abnormal incidental abdominopelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month FU) [78]
- For acute unilateral (or asymmetric) lower extremity edema with negative or inconclusive doppler US [79]
- For chronic (greater than 3 months) unilateral (or asymmetric) lower extremity edema and suspicion of malignant cause [79]
- Further evaluation of a new onset or non-reducible varicocele [80]
- Weight loss and any ONE of the following:
  - Clinically significant unintentional weight loss, i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month), with signs or symptoms suggestive of an abdominal cause
  - Ongoing unexplained clinically significant weight loss, i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month) [81] after initial workup (Chest x-ray, age appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C))

has been completed, no cause identified, and second visit documenting further decline in weight [82]

- Documentation of concern for malignancy (i.e. lymphoma) and any **ONE** of the following B symptoms (See **Combination Studies** for other indicated studies):
  - Fevers > 101°F
  - Drenching night sweats
  - Unexplained weight loss of > 10% body weight
- Suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done
- Hypercalcemia: Elevated serum calcium, low-normal PTH, high PTHrP, and bone imaging (nuclear medicine bone scan) does not reveal a source
- For evaluation of thrombocytosis or thrombocytopenia when any **ONE** of the following are present:
  - Any additional cytopenia (i.e., leukopenia, anemia)
  - LDH elevation
  - Splenomegaly on exam or imaging
  - Palpable lymphadenopathy
  - Bone marrow biopsy has been completed and concern for myeloproliferative disorder persists
  - Genetic mutation increasing risk of myeloproliferative disorder (such as JAK-2 mutation) on peripheral smear or bone marrow biopsy [83]

## *Known Malignancy*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or Abdomen MRI and Pelvis MRI. Abdomen CT and Pelvis MRI is an indicated alternative when the primary tumor is in the pelvis.

- For initial staging of malignancies when either biopsy proven or strongly suspected based on prior imaging.
- For evaluation of any hematologic malignancy prior to planned bone marrow transplant or stem cell transplant [84,85]

IMAGING MODALITY: When the following criteria are met; the indicated study is **Abdomen CT, Abdomen and Pelvis CT, Abdomen MRI**, or Abdomen and Pelvis MRI**.**

- For initial staging of uveal melanoma, esophageal cancer, gastroesophageal junction (GEJ) cancer, or breast cancer [86–88]

IMAGING MODALITY: When any ONE the following criteria are met, **Abdomen MRI** is indicated in addition to other imaging that meets medical necessity criteria.

- For any malignancy with other imaging demonstrating liver metastasis, including prior to liver-directed therapy
- For initial staging of any ONE of the following cancers:
  - Primary Liver Cancers (Hepatocellular Carcinoma, Hepatoblastoma, Sarcoma) [73]
  - Biliary Tract Cancers (Cholangiocarcinoma or Gallbladder Cancer) [89]
- For all other malignances, for further evaluation of indeterminate findings on other imaging (including for suspected liver metastases), for radiation planning, or for surgical planning.

IMAGING MODALITY: When any ONE the following criteria are met, **Pelvis MRI** is indicated in addition to other imaging meeting medical necessity criteria.

- For initial staging of any ONE of the following cancers:
  - Anal Cancer [90]
  - Cervical Cancer [91]
  - Colon or Rectal Cancer [17,18]
  - Gestational Trophoblastic Neoplasia [58]
  - Penile Cancer [92]
  - Prostate Cancer (if not recently done during workup for suspected prostate cancer) [40]
  - Pediatric soft tissue sarcoma (i.e. rhabdomyosarcoma) with primary site in the pelvis [93]
  - Uterine Neoplasms (Endometrial Carcinoma or Uterine Sarcoma) [94]
  - Vaginal Cancer [95]
  - Vulvar Cancer [96]
- For all other malignances, for further evaluation of indeterminate findings on other imaging, for radiation planning, or for surgical planning.

IMAGING MODALITY: For initial staging of ANY one of the following cancers, **Abdomen and Pelvis CT** or **Abdomen MRI** and **Pelvis MRI** is indicated, which may be in addition to PET when medical necessity criteria for PET have separately been met.

- Adrenocortical Carcinoma [2]
- Extrapulmonary Poorly Differentiated Neuroendocrine Tumor [2]
- Leiomyosarcoma, Liposarcoma [97]

- Ovarian, Fallopian Tube, and Primary Peritoneal Cancer: when surgery is being considered [98]
- Paraganglioma or Pheochromocytoma [2]
- Pediatric Aggressive Mature B-Cell Lymphomas (Burkitt lymphoma, diffuse large B-cell lymphoma, primary mediastinal B-cell lymphoma, high grade B-cell lymphoma, B-lymphoblastic lymphoma) [99]
- Hodgkin Lymphoma (Pediatric and Adult) [100,101]
- Post-Transplant Lymphoproliferative Disease [102]
- Peritoneal mesothelioma [103]
- Well-Differentiated Neuroendocrine Tumor [2]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA, Abdomen MRA and Pelvic MRA, Abdomen CTA, Abdomen MRA, Pelvis CTA,** or **Pelvis MRA.**

**NOTE:** This is indicated in addition to non-vascular imaging (CT or MRI) of the same body parts.

- When needed for clarification of vascular involvement from tumor (including suspected renal vein thrombosis) [104,105]

## Active Surveillance

Active surveillance refers to a strategy of clinical and imaging surveillance of selected early-stage cancers rather than immediate treatment.

IMAGING MODALITY: For active surveillance of the following cancer, the indicated study is **Abdomen CT** or **Abdomen MRI**

- Stage I kidney cancer at the following intervals [26]:
  - Once 6 months after initiation of active surveillance then
  - Annually

IMAGING MODALITY: For active surveillance of the following cancer, the indicated study is **Abdomen and Pelvis CT, Abdomen MRI and Pelvis MRI, Abdomen CT, or Abdomen MRI**.

- Pancreatic well-differentiated neuroendocrine tumor ≤ 2 cm at the following intervals [2]:
  - Once 3-9 months after diagnosis then
  - Annually

IMAGING MODALITY: For active surveillance of the following cancer, the indicated study is **Pelvis MRI**.

- Prostate cancer [40]:

- Annually

IMAGING MODALITY: For active surveillance of the following cancer, the indicated study is **Abdomen and Pelvis CT, Abdomen MRI and Pelvis MRI, Abdomen CT, or Abdomen MRI**.

- Testicular cancer: Stage I Non-seminomatous germ cell tumor (NSGCT) at the following intervals [106]:
  - Every 4 months during year 1 then
  - Every 4-6 months during year 2 then
  - Every 6 months during year 3 then
  - Annually during year 4 then
  - As clinically indicated thereafter

## Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. “Active treatment” includes surgery, radiation, systemic therapy (e.g. chemotherapy, immunotherapy), CAR T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: During active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (e.g. chemotherapy, targeted therapy, or immunotherapy) is typically every 2-3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or Abdomen MRI and Pelvis MRI. Abdomen CT and Pelvis MRI is an indicated alternative when the primary tumor is in the pelvis.

- For restaging of malignancies
- For restaging of any hematologic malignancy prior to planned bone marrow transplant or stem cell transplant [84,85]

IMAGING MODALITY: When the following criteria are met; the indicated study is **Abdomen CT, Abdomen and Pelvis CT, Abdomen MRI**, or Abdomen and Pelvis MRI**.**

- For restaging of uveal melanoma, esophageal cancer, gastroesophageal junction (GEJ) cancer, or breast cancer [86–88]

IMAGING MODALITY: When any ONE the following criteria are met, **Abdomen MRI** is indicated in addition to other imaging meeting medical necessity criteria.

- For all malignances, for further evaluation of indeterminate findings on other imaging (including for suspected liver metastases), for radiation planning, or for surgical planning.
- Known liver metastases under consideration for liver-directed therapies, or to assess response after liver-directed therapies [17,18]

IMAGING MODALITY: When any ONE the following criteria are met, **Pelvis MRI** is indicated in addition to other imaging meeting medical necessity criteria.

- For restaging of any ONE of the following cancers, at the specified time point(s):
  - Cervical Cancer [91]:
    - Stage I disease treated with fertility sparing (i.e. conization; simple or radical trachelectomy**):** once 6 months after completion of treatment
    - Stage II**-**IV**:** once 3-6 months after completion of treatment
  - Colon or Rectal Cancer: at all restaging time points [17,18]
  - Gestational Trophoblastic Neoplasia: at all restaging time points [58]
  - Penile Cancer: at all restaging time points [92]
  - Pediatric soft tissue sarcoma (i.e. rhabdomyosarcoma) with primary site in the pelvis: at all restaging time points [93]
  - Prostate Cancer: for suspected recurrence [40]
  - Uterine Neoplasms [94]
    - Endometrial cancer with fertility sparing: once 6-9 months after treatment
    - Uterine sarcoma: at all restaging time points
  - Vaginal Cancer: for suspected recurrence [95]
  - Vulvar Cancer [96]
    - Once 3-6 months after completion of treatment
    - For suspected recurrence
- For all other malignances, for further evaluation of indeterminate findings on other imaging, for radiation planning, or for surgical planning

IMAGING MODALITY: When the following criteria are met, **Abdomen and Pelvis CT** or **Abdomen MRI** and **Pelvis MRI** is indicated, which may be in addition to PET when medical necessity criteria for PET have separately been met.

- For restaging of any ONE of the following cancers, at the specified time point(s):
  - Adrenocortical Carcinoma: when surgery is planned [2]

- Leiomyosarcoma, Liposarcoma: at all restaging time points [97]
- Ovarian, Fallopian Tube, and Primary Peritoneal Cancer: when surgery is being considered [98]
- Paraganglioma or Pheochromocytoma: when surgery is planned [2]
- Pediatric Aggressive Mature B-Cell Lymphomas (Burkitt lymphoma, diffuse large B-cell lymphoma, primary mediastinal B-cell lymphoma, high grade B-cell lymphoma, B-lymphoblastic lymphoma): at all restaging time points [99]
- Hodgkin Lymphoma (Pediatric and Adult): at all restaging time points [100,101]
- Post-Transplant Lymphoproliferative Disease: at all restaging time points [102]
- Peritoneal mesothelioma: at all restaging time points [103]
- Well-Differentiated Neuroendocrine Tumor: when surgery is planned [2]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA, Abdomen MRA and Pelvic MRA, Abdomen CTA, Abdomen MRA, Pelvis CTA,** or **Pelvis MRA.**

**NOTE:** This is indicated in addition to non-vascular imaging (CT or MRI) of the same body parts.

- When needed for clarification of vascular involvement from tumor (including suspected renal vein thrombosis) [104,105]

## Surveillance

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the time frame for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

Refer to the **Surveillance Imaging Table** for specific indications. For cancers where there is not specific guidance about stage IV disease, see below.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT.**

- Patients in remission or on a treatment break with a type of stage IV cancer that is not addressed by the Cancer Surveillance Table
  - Every 3-6 months

### Pre-Procedural Imaging for Known Malignancy

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen CTA** or **Abdomen MRA.**

- Prior to liver tumor radioembolization (often called Yttrium-90) or chemoembolization [38]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA, Abdomen MRA and Pelvic MRA, Abdomen CTA,** or **Abdomen MRA.**

- For imaging of the deep inferior epigastric arteries prior to breast reconstructive surgery [107]

# Pain

## *Abdominal Pain of Unknown Etiology*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**. Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed. While imaging of both the abdomen and pelvis is generally most appropriate for undifferentiated abdominal pain, requests for isolated abdominal or pelvic imaging can be considered on a case-by-case basis based on the location of the patient's symptoms.

- After initial workup of abdominal pain, including laboratory evaluation, and initial imaging has not revealed a cause and ALL of the following are provided [108]:
    - Appropriate laboratory testing for the patient's presentation
        - E.g., urinalysis for suprapubic pain, complete blood count (CBC) and liver function tests for right upper quadrant pain, or CBC for crampy abdominal pain and hematochezia
    - Initial imaging that is appropriate to the patient's symptoms
        - E.g., upper endoscopy or abdominal ultrasound for epigastric pain, abdominal ultrasound for right upper quadrant pain, or x-ray for generalized abdominal pain with distention on exam and clinical concern for bowel obstruction

    **NOTE:** Not all of the above tests need to be performed, but both labs and initial imaging need to be performed
- For acute abdominal pain in a patient over the age of 65 (preliminary labs and imaging not required) [109]

## *Right Upper Quadrant Pain*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen CT.**

- Right upper quadrant pain for suspected biliary disease with negative or equivocal ultrasound and liver function tests [110]

### *Pelvic Pain*

IMAGING MODALITY: When any ONE the following criteria are met, the indicated study is **Pelvis MRI or Pelvis CT.**

- Pelvic pain when a gynecologic cause is suspected after initial ultrasound and laboratory evaluation has been completed [53]
- For acute pelvic pain in a patient over the age of 65 [109]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI.**

- Chronic pelvic pain syndrome (CPPS) once, after an initial workup including imaging (such as ultrasound and endoscopy) and laboratory evaluation does not reveal a clear cause

## Pancreas

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT** or **Abdomen MRI**.

- For further characterization of pancreatic cystic lesion found on other imaging [111]
- When functional pancreatic neuroendocrine tumor is suspected based on any **ONE** of the following laboratory abnormalities [2]:
    - Glucagonoma: Elevated serum glucagon
    - Insulinoma: when there is hypoglycemia and **ALL** of the following is present:
        - Elevated serum insulin, proinsulin and c-peptide **ALL** drawn during a period of hypoglycemia (72 hour fast)
    - Non-Islet Cell Tumor Hypoglycemia: Low serum insulin, low C-peptide, and/or elevated IGF-2:IGF-1 ratio
    - PPoma: Elevated serum pancreatic polypeptide
    - Somatostatinoma: Elevated serum somatostatin
    - VIPoma: Elevated serum VIP

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI**. Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Follow-up of pancreatic cyst (including Intraductal Papillary Mucinous Neoplasm (IPMN)) at any ONE of the following intervals [112,113]:
    - Incidental and asymptomatic cysts < 1.5 cm, AND:
        - Age < 65
            - Annually x 5 years then

### *Pelvic Pain*

IMAGING MODALITY: When any ONE the following criteria are met, the indicated study is **Pelvis MRI or Pelvis CT.**

- Pelvic pain when a gynecologic cause is suspected after initial ultrasound and laboratory evaluation has been completed [53]
- For acute pelvic pain in a patient over the age of 65 [109]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI.**

- Chronic pelvic pain syndrome (CPPS) once, after an initial workup including imaging (such as ultrasound and endoscopy) and laboratory evaluation does not reveal a clear cause

## Pancreas

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen CT** or **Abdomen MRI**.

- For further characterization of pancreatic cystic lesion found on other imaging [111]
- When functional pancreatic neuroendocrine tumor is suspected based on any **ONE** of the following laboratory abnormalities [2]:
    - Glucagonoma: Elevated serum glucagon
    - Insulinoma: when there is hypoglycemia and **ALL** of the following is present:
        - Elevated serum insulin, proinsulin and c-peptide **ALL** drawn during a period of hypoglycemia (72 hour fast)
    - Non-Islet Cell Tumor Hypoglycemia: Low serum insulin, low C-peptide, and/or elevated IGF-2:IGF-1 ratio
    - PPoma: Elevated serum pancreatic polypeptide
    - Somatostatinoma: Elevated serum somatostatin
    - VIPoma: Elevated serum VIP

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI**. Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Follow-up of pancreatic cyst (including Intraductal Papillary Mucinous Neoplasm (IPMN)) at any ONE of the following intervals [112,113]:
    - Incidental and asymptomatic cysts < 1.5 cm, AND:
        - Age < 65
            - Annually x 5 years then

        - Every 2 years if stable
    - Age 65-79
        - Every 2 years x 5 years, then stop if stable.
- Cysts 1.5-1.9 cm with main pancreatic duct (MPD) communication
    - Annually x 5 years, then
    - Every 2 years x 2 years, then stop if stable at year 9.
- Cysts 2.0-2.5 cm with MPD communication,
    - Every 6 months x 4, then
    - Annually x 2, then
    - Every 2 years x 3, then stop if stable at year 10.
- Cysts 1.5-2.5 cm with no MPD communication (or cannot be determined),
    - Every 6 months x 4, then
    - Annually x 2, then
    - Every 2 years x 3, then stop if stable at year 10.
- Cyst > 2.5 cm on surveillance (i.e., has not been surgically removed)
    - Every 6 months x 4, then
    - Annually x 2 years then
    - Every 2 years x 3 then stop if stable at year 10.
- Patients > 80 years of age at presentation regardless of size if surveillance is chosen (i.e. has not been surgically removed)
    - Every 2 years x 2, then stop if stable at year 4 (Imaged less frequently, and intervals are the same regardless of size when surveillance is chosen)

  **NOTE:** Growth or suspicious interval change on a surveillance imaging scan may warrant more frequent surveillance

- Evaluation of suspected congenital anomaly of the pancreaticobiliary tract, e.g., aberrant ducts, pancreas divisum, or related complications
- After confirmed diagnosis of exocrine pancreatic insufficiency (EPI), one-time imaging to exclude a secondary cause.

  **NOTE:** Imaging is not indicated for workup of suspected pancreatic insufficiency; fecal elastase level < 100 µg/g is consistent with EPI [(114)]
- See **Genetic Conditions** for additional screening indications.
- See **Pancreatitis** section for indications related to pancreatitis.

## Pelvic Musculoskeletal Conditions

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI.**

- Initial evaluation of suspicious mass/tumor of the bones of the pelvis found on physical exam or an imaging study after appropriate initial imaging:
  - X-ray for bony mass/tumor
  - Ultrasound for muscle or soft tissue mass/tumor
- Evaluation of suspected fracture and/or injury when initial imaging is completed or for confirmed stress (fatigue) fracture for 'return to play' evaluation [115]
- For evaluating the lumbosacral plexus [116] with any ONE of the following:
  - Confirm involvement in symptomatic patients with known tumor.
  - Assess extent of injuries in the setting of pelvic trauma.
  - Exclude the presence of masses in patients with unilateral changes, or inconclusive or abnormal findings on EMG when there are persistent symptoms.
  - Evaluation when lumbar spine MRI is suspicious or indeterminate.
- Diagnosed or strongly suspected pudendal neuralgia in the setting of chronic pelvic pain when ALL the following are present [117]:
  - Numbness and/or pain in the region between the anus and genitals
  - Pain that worsens with sitting
  - No objective sensory impairment on physical exam
- Suspicion of meralgia paresthetica when prior testing is inconclusive (diagnostic nerve block; electrodiagnostic testing; and somatosensory evoked potentials) [118]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Pelvis MRI.** Pelvis CT is appropriate for surgical planning or when the preferred study is contraindicated or cannot be performed.

- For evaluation of known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray [119]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis MRI.** Pelvis CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Known or suspected sacroiliitis (infectious or inflammatory) after completion of x-ray and rheumatologic workup [120]
- Persistent musculoskeletal pelvic pain (including sacroiliac joint dysfunction and piriformis syndrome) with **ALL** of the following [121,122]:

- Initial x-ray completed
- Pain is unresponsive to 4 weeks of active conservative treatment (physical therapy, chiropractic care, or physician-supervised home exercise plan (HEP)) received within the past 6 months.

- Evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip

  **NOTE:** If labral tear is suspected due to a positive anterior impingement sign or posterior impingement sign, or if bilateral hip arthrograms are requested and otherwise meet medical necessity criteria, then bilateral hip MRIs are the preferred studies (not Pelvis MRI).

- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis CT.**

- When non-diagnostic imaging is requested for anatomic guidance for hip surgery, a Pelvis CT is appropriate since measurements of both hips may be needed (only one non-diagnostic request is indicated, and it should include the surgical site) [123,124]
- Evaluation of physical or radiological evidence of complex or occult pelvic fracture, or for pre-operative planning of complex pelvic fractures [125,126]

## Spleen

IMAGING MODALITY: When any ONE of the following criteria are met the appropriate study is **Abdomen MRI** or Abdomen CT.

- Incidental findings of the spleen that are indeterminate on previous imaging [127,128]
- See **Genetic Conditions** for additional indications.

## Transplants

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT, Abdomen CT, Pelvis CT, Abdomen MRI, Pelvis MRI, Abdomen and Pelvis CTA, Abdomen CTA, Pelvis CTA, Abdomen MRA, or Pelvis MRA.**

- Prior to solid organ transplantation
  - For operative planning
  - When needed for initial placement on transplant list
  - Repeat imaging as often as every 3 months to maintain transplant eligibility (or earlier if an organ becomes available)
- For suspected complications following solid organ transplantation

  **NOTE:** See **Known Malignancy** for indications prior to and after bone marrow transplant and stem cell transplant.

# Trauma (Injuries) and Other Forms of Hemorrhage

## *Trauma*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or Abdomen and Pelvis CTA**.**

- Major blunt injury with suspicion of multisystem trauma [(129)]
- Penetrating abdominal injury with suspicion of multisystem trauma [(130)]
- Known or suspected intraperitoneal, retroperitoneal, or abdominal wall (e.g. rectus sheath) hematoma or hemorrhage based on lab or physical findings.
- Known or suspected upper or lower gastrointestinal (GI) bleed (see **Gastrointestinal Bleeding** section)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA**, Abdomen CTA, or Pelvis CTA

- Other imaging (typically CT) shows a clinically significant bleed and arterial phase imaging is needed to localize the source.

# Vascular Disease

## *Abdominal Aortic Disease*

### Asymptomatic Abdominal Aortic Aneurysm

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT**. Abdomen MRI and Pelvis MRI are appropriate only when the preferred study is contraindicated or cannot be performed. Abdomen and Pelvis CTA or Abdomen MRA and Pelvis MRA are only indicated for complex vascular anatomy or suspected complications, but they are also reasonable when the threshold for operative repair is reached (see below).

- Asymptomatic suspected abdominal aortic aneurysm (AAA) if prior ultrasound was inconclusive or insufficient.
- Asymptomatic known AAA surveillance if prior ultrasound was inconclusive or insufficient AND the study is ordered at any ONE of the following AAA surveillance intervals [(131,132)]:
    - Aneurysm size 2.5-2.9 cm, every 10 years
    - Aneurysm size 3.0-3.9 cm, every 3 years
    - Aneurysm size 4.0-4.9 cm in men or 4.0-4.5 cm in women, annually
    - Aneurysm size ≥ 5.0 in men or ≥ 4.5 cm in women, every 6 months

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or Abdomen and Pelvis CTA. Abdomen MRI and Pelvis MRI or Abdomen MRA and

Pelvis MRA are appropriate only when the preferred study is contraindicated or cannot be performed.

- Asymptomatic known AAA that has reached the threshold for operative repair (no ultrasound required), which is demonstrated by any ONE of the following (See **Combination Studies** for other indicated studies) [131,132]:
  - Aneurysm size of 5.5 cm in men or 5.0 cm in women
  - Saccular aneurysm of any size

### Symptomatic Abdominal Aortic Aneurysm

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen and Pelvis CT**. If requested, other abdomen and pelvis imaging studies can be considered on a case-by-case basis based on the urgency of the presenting complaint.

- Known or suspected symptomatic AAA [131,132]
  - Signs and symptoms may include:
    - Abrupt onset of severe sharp or stabbing pain in the chest, back or abdomen (could indicate aneurysm rupture)
    - Acute abdominal or back pain with a pulsatile epigastric mass
    - Acute abdominal or back pain and at high risk for aortic aneurysm and/or aortic syndrome (risk factors include hypertension, atherosclerosis, prior cardiac or aortic surgery, underlying aneurysm, connective tissue disorder (e.g., Marfan syndrome, vascular form of Ehlers-Danlos syndrome, Loeys-Dietz syndrome), and bicuspid aortic valve) [133]

## *Acute Aortic Syndromes*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA**. If requested, other abdominal imaging studies can be considered on a case-by-case basis based on the urgency of the presenting complaint.

- For initial diagnosis of suspected acute aortic syndromes or for follow-up of these conditions as clinically indicated. These conditions may include [131,134]:
  - Abdominal aortic rupture
  - Abdominal aortic dissection (See **Combination Studies** for other indicated studies)
  - Abdominal aortic penetrating atherosclerotic ulcer
  - Abdominal aortic intramural hematoma
  - Malperfusion of one or both renal arteries, manifesting as oliguria or hematuria and suspected to be due to an acute abdominal aortic syndrome.
  - Abdominal aortic thrombosis or lower extremity ischemia due to suspected aortic or iliac thrombosis

### *Postoperative Follow-up of Aortic Repair* *(131,132)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CT** or **Abdomen MRI** and **Pelvis MRI**. Abdomen and Pelvis CTA or Abdomen MRA and Pelvis MRA are appropriate for complex vascular anatomy or suspected complications.

- Routine follow-up after open repair of AAA.
  - Within 1 year of surgery
  - Every 5 years thereafter
- Routine follow-up after endovascular aneurysm repair (EVAR) of AAA or abdominal extent of iliac artery aneurysms at the following intervals:
  - One month after EVAR
  - Long-term follow-up imaging:
    - If no endoleak or sac enlargement is seen on one-month post-EVAR imaging:
      - Annually when previous postoperative ultrasound was inconclusive or insufficient.
      - Every 5 years

      **NOTE:** Annual follow-up is typically with ultrasound. Advanced imaging is performed every 5 years.
    - If type II endoleak or sac enlargement is seen at any point in time:
      - Every 6 months x 2 years, then annually instead of ultrasound (does not require prior ultrasound)
    - More frequently as clinically indicated after complex EVAR (i.e. EVAR with stenting of ≥ 1 of the renovisceral vessels) or for monitoring of known post-EVAR indeterminant finding
- Suspected complications including any ONE of the following:
  - Aneurysm sac enlargement or any type of endoleak on ultrasound
  - Stent graft problems on ultrasound (i.e. fracture, migration, or separation)
  - Symptoms concerning for lower extremity embolism or other lower extremity complication after EVAR (e.g. ischemia, claudication, or reduction in ankle brachial index)
  - Evaluation for luminal patency when there is concern for restenosis.
  - Other suspected postoperative or late complications
- Follow-up for known complications as clinically indicated.

## Isolated Iliac Artery Aneurysms *(135)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA.**

- Newly identified isolated iliac artery aneurysm
- Asymptomatic known isolated iliac aneurysm surveillance if prior ultrasound was inconclusive or insufficient AND the study is ordered at any ONE of the following surveillance intervals:
    - Aneurysm size 2.0-2.49 cm, every 3 years
    - Aneurysm size 5.9-2.99 cm, every 2 years
    - Aneurysm size ≥ 3.0 cm, annually
- Aneurysms size ≥ 3.5 cm, for preoperative planning.
- Every 5 years (regardless of size, and no requirement for inconclusive or insufficient ultrasound)
- Known iliac artery aneurysm and suspected acute complication (e.g. severe pain, hypotension, signs or symptoms of leg ischemia)

  **NOTE:** Patients with iliac artery aneurysm and concomitant abdominal aortic aneurysm are managed according to the **Asymptomatic Abdominal Aortic Aneurysm** section. Follow-up after open or endovascular repair is managed using the **Postoperative Follow-Up of Aortic Repair** section.

## Mesenteric Ischemia [136]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA**. If requested, other abdominal imaging studies can be considered on a case-by-case basis based on the urgency of the presenting complaint.

- Suspected acute mesenteric ischemia

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen MRA** and **Pelvis MRA**. Abdomen and Pelvis CT or Abdomen MRI and Pelvis MRI are not appropriate for this indication.

- Suspected chronic mesenteric ischemia
- Follow-up of known mesenteric ischemia (including for preoperative planning)

## Renal Artery Stenosis

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen CTA** or **Abdomen MRA**.

- In a patient with hypertension unrelated to recent medication use and BOTH of the following criteria are met:
    - Prior abnormal or inconclusive ultrasound
    - Any ONE of the following criteria are met [137,138]:
        - Onset of hypertension prior to the age of 30 without a family history of hypertension and when there is suspicion of fibromuscular dysplasia or another

type of vasculitis.

- Failure to obtain adequate blood pressure control on 3 antihypertensive medications, including one diuretic.
- Recurrent episodes of sudden onset of congestive heart failure (also known as cardiac disturbance syndrome; may have normal left ventricular function)
- Renal failure of uncertain cause with normal urinary sediment and < 1g of urinary protein per day
- Coexisting diffuse atherosclerotic vascular disease, especially in heavy smokers
- Acute elevation of creatinine after initiation of an angiotensin converting enzyme inhibitor (ACE inhibitor) or angiotensin receptor blocker (ARB)
- Malignant or difficult to control hypertension and unilateral small kidney size (noted on prior imaging)
- New onset of difficult-to-control or labile hypertension after age 55
- Abdominal bruit lateralizing to one side of the abdomen
- Diagnosis of a syndrome with a higher risk of vascular disease, such as neurofibromatosis [139] and Williams' syndrome [140]

## Visceral Artery Aneurysms [141]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen CTA**. Abdomen MRA or Abdomen MRA and Pelvis MRA are appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected visceral artery aneurysm (including renal artery, splenic artery, celiac artery gastric and gastroepiploic artery, hepatic artery, superior mesenteric artery, jejunal/ileal/colic artery, pancreaticoduodenal, and gastroduodenal artery aneurysms)
- Known visceral artery aneurysm and suspected acute complication (e.g. acute onset severe pain, hypotension)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen CTA** or Abdomen CT. Abdomen MRA is appropriate only when the preferred study is contraindicated or cannot be performed.

- Surveillance of known visceral artery aneurysm managed nonoperatively at any ONE of the appropriate intervals below:
  - Renal artery aneurysm: every 12 months until 2 consecutive studies are stable, and then every 2-3 years.
  - Splenic artery aneurysm: annually
  - Celiac artery aneurysm or hepatic artery aneurysm: annually

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA, Abdomen CTA, Abdomen MRA,** or **Abdomen MRA** and **Pelvis MRA.**

- Surveillance after endovascular repair of visceral artery aneurysm as clinically indicated, but typically not more often than annually.

## Venous Disease

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA**, **Abdomen CTA, Abdomen MRA** and **Pelvis MRA, Abdomen and Pelvis CT, or Abdomen CT.**

- Suspected venous thrombosis (including renal vein thrombosis and/or portal venous thrombosis) if previous studies (such as ultrasound) have not resulted in a clear diagnosis [105,142]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Pelvis CTA**, **Pelvis MRA**, **Abdomen and Pelvis CTA**, or **Abdomen MRA** and **Pelvis MRA**.

- Suspected pelvic congestion syndrome (including May-Thurner and nutcracker syndromes) when ultrasound is indeterminant [143]
- For acute unilateral (or asymmetric) lower extremity edema with negative or inconclusive doppler US and CT [79]
- For chronic (greater than 3 months) unilateral (or asymmetric) lower extremity edema and suspicion of malignant cause when Abdomen and Pelvis CT (or Pelvis CT) is negative or inconclusive [79]

## Peripheral Vascular Disease [144–146]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdominal Aorta CTA with Lower Extremity Runoff**. Abdomen MRA and Lower Extremity MRA are appropriate only when the preferred study is contraindicated or cannot be performed. A separate Pelvis MRA authorization is not required (in addition to the Abdomen MRA). Only one Lower Extremity MR Angiography authorization is required (not two).

**NOTE:** There is no single CPT code for MRA of the abdomen and pelvis with bilateral lower extremity runoff as there is for CTA (CPT Code 75635).

- For known or suspected atherosclerotic peripheral vascular disease-when any ONE of the following non-invasive studies are abnormal or indeterminate:
  - Ankle brachial index (< 0.9 is the cutoff for diagnosis of peripheral arterial disease and > 1.4 is considered inconclusive)
  - Toe brachial index (< 0.7 is the cutoff for diagnosis of peripheral arterial disease)
  - Segmental pressure test (a pressure gradient > 20 mmHg is considered abnormal)
  - Doppler ultrasound
  - Treadmill test

- 6-minute walking test

- For acute critical limb ischemia with any ONE of the following clinical signs of peripheral vascular disease [131,132]:
  - Ischemic rest pain
  - Tissue loss
  - Gangrene

  **NOTE:** Prior ultrasound is not needed
- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism (See **Combination Studies** for other indicated studies)[147]
- After prior stenting or surgery (arterial and/or venous) with any ONE of the following:
  - Recurrent symptoms
  - Signs of recurrent disease on examination
  - Abnormal / indeterminate non-invasive testing or imaging (e.g., ankle brachial index (ABI), ultrasound)

## Systemic Vascular Disease

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen MRA** and **Pelvis MRA.**

- For patients with fibromuscular dysplasia (FMD) (See **Combination Studies** for other indicated studies) [148,149]::
  - One-time evaluation
  - New symptoms or abnormal exam findings
- Takayasu's Arteritis (See **Combination Studies** for other indicated studies) [150–153]:
  - At diagnosis (including for suspected disease) [150,153]
  - New symptoms or abnormal exam findings [150–152,154]
  - Every 6-12 months for the first 2 years while on therapy
  - Annually after the first 2 years

## Other Vascular Abnormalities

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen and Pelvis CTA** or **Abdomen MRA** and **Pelvis MRA.**

- Initial evaluation of inconclusive vascular findings on prior imaging
- For assessment in patients with spontaneous coronary artery dissection (SCAD) (See **Combination Studies** for other indicated studies)

- One-time evaluation [155,156]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Abdomen and Pelvis CTA.** Abdomen MRA and Pelvis MRA are indicated only if the preferred study is contraindicated or cannot be performed. (See **Combination Studies** for other indicated studies).

- Prior to Transcatheter Aortic Valve Replacement (TAVR) [157]

## Preoperative or Postoperative Assessment

IMAGING MODALITY**:** When any ONE of the following criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - Prior to the following procedures:
    - Preoperative **urinary stone planning**
    - Prior to **UPJ (ureteropelvic junction) obstruction surgery**
    - Prior to **prostate artery embolization**
    - Prior to **uterine surgery**
    - Prior to **uterine artery embolization**
    - Prior to **hernia surgery**
    - Prior to **hip surgery**
    - Prior to surgery for **hip fractures**
    - Prior to **transplant**
    - Prior to surgery for **abdominal aortic aneurysms**
    - Imaging of the deep inferior epigastric arteries prior to breast reconstructive surgery (see **Pre-Procedural Imaging for Known Malignancy**) [107]
    - Prior to Transcatheter Aortic Valve Replacement (TAVR) (See **Genetic Conditions**
    - **NOTES: When medical necessity is met for an** individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI**. Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- ADPKD (Autosomal Dominant Polycystic Kidney Disease) [159]:
  - Annually (including at diagnosis) OR
  - Prior to treatment
- ATM (Ataxia-Telangiectasia) [59]:
  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
- BAP1-TPDS (BAP-1 tumor predisposition syndrome) [26,160]:
  - Every 2 years starting at age 30 (or 10 years younger than the earliest kidney cancer diagnosis in the family, whichever is earlier)
- Beckwith-Wiedemann syndrome [161]:
  - When ultrasound is abnormal, or AFP is rising
- Beta-Thalassemia [162]:
  - Annually
- CDKN2A [59]:
  - Annually starting at age 40 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
- Gaucher Disease [163]:
  - Annually (including at diagnosis)
- HLRCC (hereditary leiomyomatosis and renal cell cancer) [26,164]:
  - Annually starting at age 8
- HPRC (hereditary papillary renal carcinoma) [26]:
  - Annually starting at age 30
- Li-Fraumeni (TP53) [59]
  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant
- Lynch Syndrome [165]
  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (BRCA1, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)

- Multiple Endocrine Neoplasia type 2 (MEN2) [166]:
  - With abnormal biochemical results suggestive of adrenal tumor
- PALB2 [59]
  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (BRCA1, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
- PRSS1 (Hereditary Pancreatitis; including PRSS1, SPINK1 and other hereditary pancreatitis genes) [59]:
  - Annually starting 20 years after onset of pancreatitis OR at age 40 years, whichever is earlier
- PTEN [167]:
  - Annually (including at diagnosis) starting at age 40 (or 10 years younger than the earliest renal cell cancer diagnosis in the family, whichever is earlier)
- Sickle Cell Disease [168]:
  - Annually
- Tuberous sclerosis [26,28]:
  - Annually (including at diagnosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine MRI** AND **Abdomen MRI** or **CT**

- Von Hippel-Lindau (VHL) [169]:
  - Annually (including at diagnosis) starting at age 11
  - IAC MRI with or without Brain MRI is additionally indicated at the onset of hearing loss, tinnitus or vertigo

  **NOTE:** If it has been > 9 months since the last brain MRI, then brain MRI with IAC is more appropriate in order to bundle IAC evaluation with needed annual screening. If there has been a brain MRI without IAC within the last 9 months, then MRI IAC is more appropriate.

IMAGING MODALITY: Any combination of the following studies are indicated when the study-specific criteria below are met at the interval specified for that study: **Breast/Abdomen/Pelvis MRI**.

- BRCA 1 [59]
  - **Breast MRI:** Annually starting at age 25

**NOTE:** May start at any age with positive family history of breast cancer diagnosed at age < 30

- **Abdomen MRI:** Annually starting at age 50 AND ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant

**NOTE:** May start 10 years younger than the earliest pancreatic cancer diagnosis in the family

- **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family)

**NOTE:** if no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50

- BRCA 2 [59]
  - **Breast MRI:** Annually starting at age 25

  **NOTE:** May start at any age with positive family history of breast cancer diagnosed at age < 30
  - **Abdomen MRI:** Annually starting at age 50

  **NOTE:** May start 10 years younger than the earliest pancreatic cancer diagnosis in the family
  - **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family)

  **NOTE:** if no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen** and **Pelvis CT** or **Abdomen MRI** and **Pelvis MRI**

- BHDS (Birt-Hogg-Dube) [26,170]:
  - Every 3 years starting at age 20 (or 10 years younger than the earliest kidney cancer diagnosis in the family, whichever is earlier)
- FAP (Familial Adenomatous Polyposis) [171]:
  - Annually
- STK11 (including Peutz-Jeghers) [59,165,172]:
  - At diagnosis and annually starting at age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Neck/Chest/Abdomen/Pelvis MRA** or **CTA**

- Loeys-Dietz [173]:

- Every two years (including at diagnosis) OR
- More frequently if abnormalities are found

- Vascular Ehlers-Danlos syndrome (vEDS) [174]:
  - Every 18 months (including at diagnosis) OR
  - As clinically indicated to follow known vascular abnormalities

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRA** or **CTA**

- Marfan Syndrome [175]:
  - Every 3 years (including at diagnosis)
  - More frequently (annually) if **EITHER** history of dissection, dilation of aorta beyond aortic root **OR** aortic root/ascending aorta are not adequately visualized on TTE (i.e., advanced imaging is needed to monitor the thoracic aorta)
- Williams Syndrome [140]:
  - Abdominal vascular exam or imaging findings (such as diminished pulses, bruits or signs of diffuse thoracic aortic stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [139]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- HFE-Related Hemochromatosis [176,177]:
  - At diagnosis

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRI** or **CT**

- Multiple Endocrine Neoplasia type 1 (MEN1) [2,178]:
  - Annually starting at age 8

**NOTE:** Brain MRI is included in the above every 3 years starting at age 5 rather than age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **Whole Body MRI.** Neck/Chest/Abdomen/Pelvis CT is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Hereditary PGL/PCC Syndromes (including SDHx mutations) [26,179]:
  - Every 2 years (including at diagnosis) starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and/or **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed. Chest CT is additionally indicated ONCE at diagnosis

- Alpha-1 Anti-Trypsin Deficiency (AATD) [180]:
  - Every 6 months
    - Combination Studies for other indicated studies) [157]
    - Y90 treatment (see **Pre-Procedural Imaging for Known Malignancy** [38]
    - Trans jugular intrahepatic portosystemic shunt (TIPS) (see **Liver**) [158]
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan.

- Postoperative Evaluation:
  - Postoperative **urinary stone follow-up**
  - After **prostate artery embolization**
  - After **uterus after embolization**
  - After **aortic aneurysm repair**
  - After previous **peripheral vascular disease surgery or stenting**
  - Evaluation of post-operative complications, (e.g., pseudoaneurysms), following interventional vascular procedures (e.g., surgical bypass grafts, vascular stents, trans jugular intrahepatic portosystemic shunt (TIPS), and IVC filters)
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications

- A clinical reason is provided for how imaging may change management.

**NOTE:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this time frame may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Findings

Unless follow-up is otherwise specified within the guideline

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

## Genetic Conditions

**NOTES**: When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Abdomen MRI**. Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

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  - When ultrasound is abnormal, or AFP is rising
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diagnosis in the family, whichever is earlier)

- Gaucher Disease [163]:
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  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (BRCA1, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
- Multiple Endocrine Neoplasia type 2 (MEN2) [166]:
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- PALB2 [59]
  - Annually starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (BRCA1, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
- PRSS1 (Hereditary Pancreatitis; including PRSS1, SPINK1 and other hereditary pancreatitis genes) [59]:
  - Annually starting 20 years after onset of pancreatitis OR at age 40 years, whichever is earlier
- PTEN [167]:
  - Annually (including at diagnosis) starting at age 40 (or 10 years younger than the earliest renal cell cancer diagnosis in the family, whichever is earlier)
- Sickle Cell Disease [168]:
  - Annually
- Tuberous sclerosis [26,28]:
  - Annually (including at diagnosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine MRI** AND **Abdomen MRI** or **CT**

- Von Hippel-Lindau (VHL) [169]:
  - Annually (including at diagnosis) starting at age 11
  - IAC MRI with or without Brain MRI is additionally indicated at the onset of hearing loss, tinnitus or vertigo

  **NOTE:** If it has been > 9 months since the last brain MRI, then brain MRI with IAC is more appropriate in order to bundle IAC evaluation with needed annual screening. If there has been a brain MRI without IAC within the last 9 months, then MRI IAC is more appropriate.

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  - **Breast MRI:** Annually starting at age 25

  **NOTE:** May start at any age with positive family history of breast cancer diagnosed at age < 30
  - **Abdomen MRI:** Annually starting at age 50 AND ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant

  **NOTE:** May start 10 years younger than the earliest pancreatic cancer diagnosis in the family
  - **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family)

  **NOTE:** if no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50
- BRCA 2 [59]
  - **Breast MRI:** Annually starting at age 25

  **NOTE:** May start at any age with positive family history of breast cancer diagnosed at age < 30
  - **Abdomen MRI:** Annually starting at age 50

  **NOTE:** May start 10 years younger than the earliest pancreatic cancer diagnosis in the family
  - **Pelvis MRI:** Once for baseline prostate MRI at age 50 (or 10 years younger than the earliest prostate cancer diagnosis in the family)

**NOTE:** if no baseline mpMRI was done at age 50, a one-time prostate MRI can be done later than age 50

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen** and **Pelvis CT** or **Abdomen MRI** and **Pelvis MRI**

- BHDS (Birt-Hogg-Dube) [26,170]:
  - Every 3 years starting at age 20 (or 10 years younger than the earliest kidney cancer diagnosis in the family, whichever is earlier)
- FAP (Familial Adenomatous Polyposis) [171]:
  - Annually
- STK11 (including Peutz-Jeghers) [59,165,172]:
  - At diagnosis and annually starting at age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Neck/Chest/Abdomen/Pelvis MRA** or **CTA**

- Loeys-Dietz [173]:
  - Every two years (including at diagnosis) OR
  - More frequently if abnormalities are found
- Vascular Ehlers-Danlos syndrome (vEDS) [174]:
  - Every 18 months (including at diagnosis) OR
  - As clinically indicated to follow known vascular abnormalities

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRA** or **CTA**

- Marfan Syndrome [175]:
  - Every 3 years (including at diagnosis)
  - More frequently (annually) if **EITHER** history of dissection, dilation of aorta beyond aortic root **OR** aortic root/ascending aorta are not adequately visualized on TTE (i.e., advanced imaging is needed to monitor the thoracic aorta)
- Williams Syndrome [140]:
  - Abdominal vascular exam or imaging findings (such as diminished pulses, bruits or signs of diffuse thoracic aortic stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [139]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- HFE-Related Hemochromatosis [176,177]:
  - At diagnosis

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRI** or **CT**

- Multiple Endocrine Neoplasia type 1 (MEN1) [2,178]:
  - Annually starting at age 8

**NOTE:** Brain MRI is included in the above every 3 years starting at age 5 rather than age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **Whole Body MRI.** Neck/Chest/Abdomen/Pelvis CT is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Hereditary PGL/PCC Syndromes (including SDHx mutations) [26,179]:
  - Every 2 years (including at diagnosis) starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and/or **MR Elastography.** Abdomen CT is appropriate only when the preferred study is contraindicated or cannot be performed. Chest CT is additionally indicated ONCE at diagnosis

- Alpha-1 Anti-Trypsin Deficiency (AATD) [180]:
  - Every 6 months

# Combination Studies

## *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

## *Pelvis/Fetal MRI*

- When medical necessity has been met for Pelvis MRI (such as for suspected placenta accreta or percreta when ultrasound is indeterminate [181]) AND medical necessity has been met for Fetal MRI (such as suspected abnormality of the fetus after ultrasound has been performed [182]), two separate authorizations are required: Pelvis MRI (CPT codes 72195, 72196, or 72197) and Fetal MRI (CPT codes 74712 or +74713).

## *Abdomen MRI and MR Elastography*

- This combination is indicated when the guideline criteria for BOTH Abdomen MRI and Abdomen MR Elastography have been met.
    - Medical necessity criteria for Abdomen MRI are covered in Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging
    - Medical necessity criteria for MR Elastography for evaluation of hepatic fibrosis are covered in Evolent Clinical Guideline 2038 for MR Elastography

## *Chest/Abdomen and Pelvis CT*

- As numerous disease processes, including but not limited to malignancy, may affect the Chest, Abdomen and Pelvis, this combination is indicated when the guideline criteria for BOTH Chest CT and Abdomen and Pelvis CT have been met.
- Documentation of concern for malignancy (i.e., lymphoma) and any **ONE** of the following B symptoms:
    - Fevers > 101° F
    - Drenching night sweats
    - Unexplained weight loss of > 10% body weight

## *Chest/Abdomen CTA*

- Evaluation of extensive vascular disease involving the chest and abdominal cavities when pelvic imaging is not needed.
- Significant post-traumatic or post-procedural vascular complications when pelvic imaging is not needed.

## *Chest/Abdomen CT*

- Large type IV hiatal hernia or diaphragmatic hernia (e.g. Bochdalek, Morgagni or Congenital) [62,183]

## *Chest/Abdomen and Pelvis CTA (or MRA)*

**NOTE:** MRA is indicated if CTA is contraindicated or cannot be performed

- Evaluation prior to endovascular aneurysm repair (EVAR) when thoracic involvement is present.
- Evaluation prior to Transcatheter Aortic Valve Replacement (TAVR) [157]
- Acute aortic dissection [184]
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest, abdomen and pelvis.

## *Abdomen/Lower Extremity MRA*

- For suspected or known peripheral vascular disease, please see section for Peripheral Vascular Disease.

## *Chest/Abdominal Aorta CTA with Lower Extremity Runoff*

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [147,185]

## *Chest/Abdomen/Lower Extremity MRA*

**NOTE:** MRA is indicated when CTA is contraindicated or cannot be performed.

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [147,185,186]

## *Brain/Neck/Chest/Abdomen/Pelvis CTA (or MRA)*

- For patients with fibromuscular dysplasia (FMD) [148,149]:
  - One-time evaluation
  - New symptoms or abnormal exam findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD) [156]
  - One-time evaluation
- Takayasu's Arteritis [150–153]:
  - At diagnosis (including for suspected disease) [150,153]
  - New symptoms or abnormal exam findings [150–152,154]
  - Every 6-12 months for the first 2 years while on therapy
  - Annually after the first 2 years

## *Brain MRI and Sinus/Chest/Abdomen and Pelvis CT*

- Prior to bone marrow transplant or stem cell transplant

### *Brain (with or without IAC)/Maxillofacial/Face/Orbit/Temporal Bone/Neck/Chest/Abdomen and Pelvis Imaging*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies are Neck CT/MRI and/or Chest CT. When there is a concern for involvement of a specific area Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT may be indicated (individually or in any combination of studies). (See Combination Studies for other indicated studies)

- Suspected Granulomatosis with Polyangiitis (GPA) (Formerly Wegener's Granulomatosis) with any ONE of the following:
  - Clinical signs and symptoms
    - Nasal involvement (bloody discharge, ulcers, crusting, congestion, blockage, septal defect/perforation)
    - Cartilaginous involvement (inflammation of ear/nose cartilage, hoarse voice, stridor, endobronchial involvement, saddle nose deformity)
    - Conductive or sensorineural hearing loss
  - Labs and biopsy findings:
    - Positive cytoplasmic antineutrophil cytoplasmic antibodies (cANCA) or antiprotease 3 (anti-PR3) antibodies
    - Biopsy showing small or medium vessel vasculitis.
    - Biopsy showing granuloma, extravascular granulomatous inflammation, or giant cells.
    - Biopsy showing pauci-immune glomerulonephritis.
  - Imaging findings
    - Inflammation, consolidation, or effusion of nasal/paranasal sinuses, or mastoiditis on imaging

IMAGING MODALITY: When any ONE of the following criteria are met, one or more of the following studies are indicated: Neck CT/MRI, Chest CT, Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT.

- Known GPA when imaging results of a specific area is needed to guide decisions about initial therapy or response to therapy.

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| S8037 | Magnetic resonance cholangiopancreatography (MRCP) |
| 72191 | Computed tomographic angiography, pelvis, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 72192 | Computed tomography, pelvis; without contrast material |
| 72193 | Computed tomography, pelvis; with contrast material(s) |
| 72194 | Computed tomography, pelvis; without contrast material, followed by contrast material(s) and further sections |
| 72195 | Magnetic resonance (e.g., proton) imaging, pelvis; without contrast material(s) |
| 72196 | Magnetic resonance (e.g., proton) imaging, pelvis; with contrast material(s) |
| 72197 | Magnetic resonance (e.g., proton) imaging, pelvis; without contrast material(s), followed by contrast material(s) and further sequences |
| 72198 | Magnetic resonance angiography, pelvis, with or without contrast material(s) |
| 74150 | Computed tomography, abdomen; without contrast material |
| 74160 | Computed tomography, abdomen; with contrast material(s) |
| 74170 | Computed tomography, abdomen; without contrast material, followed by contrast material(s) and further sections |
| 74174 | Computed tomographic angiography, abdomen and pelvis, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 74175 | Computed tomographic angiography, abdomen, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 74176 | Computed tomography, abdomen and pelvis; without contrast material |
| 74177 | Computed tomography, abdomen and pelvis; with contrast material(s) |
| 74178 | Computed tomography, abdomen and pelvis; without contrast material in one or both body regions, followed by contrast material(s) and further sections in one or both body regions |

| Code | Description |
|---|---|
| 74181 | Magnetic resonance (e.g., proton) imaging, abdomen; without contrast material(s) |
| 74182 | Magnetic resonance (e.g., proton) imaging, abdomen; with contrast material(s) |
| 74183 | Magnetic resonance (e.g., proton) imaging, abdomen; without contrast material(s), followed by with contrast material(s) and further sequences |
| 74185 | Magnetic resonance angiography, abdomen, with or without contrast material(s) |
| 75635 | Computed tomographic angiography, abdominal aorta and bilateral iliofemoral lower extremity runoff, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (e.g., fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (e.g., organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |
| +0724T | Quantitative magnetic resonance cholangiopancreatography (QMRCP) including data preparation and transmission, interpretation and report, obtained with diagnostic magnetic resonance imaging (MRI) examination of the same anatomy (e.g., organ, gland, tissue, target structure) (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |

| | |
|---|---|
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds wight limit/dimensions of MRI machine

## Bosniak Cyst Classification

Bosniak I cysts are simple non-enhancing cysts with thin walls, no septa, calcifications or solid components, Bosniak II cysts may contain thin septa, small or fine calcification, minimal enhancement and/or hyperdense and < 3 cm, Bosniak III cysts are indeterminant, and Bosniak IV lesions are malignant. [187]

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the time frame for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** [188,189] | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** [190] | Routine surveillance imaging is not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Adrenocortical Carcinoma (ACC)** [2] | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** [191] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** [90] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** [192] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** [99,102] | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (193) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (89) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for up to 5 years |
| **Bladder Cancer** (194) | **Non-Muscle Invasive (NMIBC)**<br>● Low-intermediate Risk NMIBC treated without cystectomy<br>○ Routine surveillance imaging is not indicated<br>● High Risk* NMIBC treated without cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ Once 12 months after diagnosis then<br>■ Every 1-2 years 9 additional years<br>■ No routine surveillance imaging after 10 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • NMICBC after cystectomy<br>  ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>  ■ 3 months after surgery then<br>  ■ 1 year after surgery then<br>  ■ Annually for 4 additional years<br>  ■ No routine surveillance imaging after 5 years<br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or chemoradiation**<br>• Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>  ○ Every 3-6 months for 2 years then<br>  ○ Annually for 3 additional years<br>  ○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>• Low Risk T1 or < T1<br>  ○ Routine surveillance imaging is not indicated<br>• High Risk T1 or ≥ T2<br>  ○ Chest CT and Abdomen and Pelvis CT/MRI<br>  ■ Every 3-6 months for 2 years then<br>  ■ Annually for 3 additional years<br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** [195] | **Chondrosarcoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Atypical Cartilaginous Tumors<br>  ○ CT or MRI of primary tumor site<br>  ■ Every 6-12 months for 2 years then<br>  ■ Annually as clinically indicated after 2 years<br>• All other types of Chondrosarcoma<br>  ○ CT or MRI of primary tumor site as clinically indicated<br>  ○ Chest CT<br>  ■ Every 3-6 months for 5 years then<br>  ■ Annually for 5 additional years then<br>  ■ As clinically indicated after year 10<br>**Chordoma**<br>• CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>• Chest CT or LDCT<br>  ○ Every 6 months for 5 years then<br>  ○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>• CT or MRI of primary tumor site and Chest CT<br>  ○ Every 3 months for 2 years then<br>  ○ Every 6 months for 3 years then<br>  ○ Annually<br>**Giant Cell Tumor of Bone**<br>• CT or MRI of primary tumor site as clinically indicated<br>• Chest CT<br>  ○ Every 6-12 months for 4 years then<br>  ○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>• CT or MRI of primary tumor site and Chest CT |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 3 months for 2 years then<br>○ Every 4 months for year 3 then<br>○ Every 6 months year 4 and 5 then<br>○ Annually after year 5, as clinically indicated |
| **Breast** (88) | **Phyllodes tumors: see Soft Tissue Sarcoma Soft Tissue Sarcoma Soft Tissue Sarcoma Soft Tissue Sarcoma section**<br>● Stage I-III disease:<br>○ Routine surveillance imaging not indicated (followed with mammography)<br>**NOTE: See Restaging section for recurrence**<br>● Stage IV disease not currently on therapy<br>○ Chest CT and Abdomen and Pelvis CT<br>■ Every 3-6 months |
| **Castleman's Disease** (196) | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>● Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** (91) | **Stage I disease treated with non-fertility sparing**<br>● Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (i.e., conization; simple or radical trachelectomy)**<br>● Pelvis MRI<br>○ Once 6 months after completion of treatment then<br>○ Annually for 2-3 additional years<br>**Stage II-IV**<br>● Pelvis MRI<br>○ Once 3-6 months after completion of treatment<br>○ Routine surveillance imaging not indicated thereafter<br>● Chest CT and Abdomen and Pelvis CT |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>● Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** (197) | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** (198) | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** (199–203) | **Choroid plexus tumors and carcinoma**<br>● Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>● Malignant choroid plexus carcinoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for years 3-5 then<br>■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>● Circumscribed glioma (not otherwise listed) post gross total resection<br>○ Brain MRI<br>■ Every 3-6 months for 5 years then<br>■ Annually after 5 years<br>● Oligodendroglioma and astrocytoma grade 2<br>○ After chemotherapy and radiation<br>■ Brain MRI: Every 6-9 months<br>○ After chemotherapy OR radiation |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Brain MRI: Every 3-4 months<br>○ After surgery only<br>■ Brain MRI: Every 3-4 months<br>**NOTE:** Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma<br>○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then<br>□ As clinically indicated after 5 years<br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **NOTE:** High-grade glioma includes ALL histologies if grade 3 and 4<br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated<br>● MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br>**Primary CNS Lymphoma**<br>● MRI Brain +/- MRI C/T/L Spine<br>○ Every 3 months for 2 years, then<br>○ Every 6 months for 3 years, then<br>○ Annually, indefinitely<br>**Primary Spinal Cord Tumors**<br>● Low grade tumors (grade 1-2)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months indefinitely<br>● High grade tumors (grade 3-4)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Once 2-6 weeks after treatment then<br>○ Every 2-4 months for 3 years then<br>○ Every 3-6 months for 2 years, then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months indefinitely<br>**NOTE:** Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br>**Meningiomas**<br>● Grade 1 and 2 or unresected tumors:<br>○ MRI Brain (include spine if spinal involvement)<br>■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>**NOTE:** SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** [17] | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-** | Routine surveillance imaging is not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** [204] | |
| **Dermatofibrosarcoma Protuberans (DFSP)** [205] | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** [86] | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |
| **Gastric** [206] | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Gastrointestinal Stroma Tumor (GIST)** [207] | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>**NOTE:** More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [58] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [208] | Routine surveillance imaging is not indicated |
| **Head and Neck** [209] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change).<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** [73] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Histiocytic Neoplasms** [210] | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** [100,101] | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** [211] | Routine surveillance imaging is not indicated |
| **Kidney Cancer** [26] | See **Active Surveillance** section for indications related to that management strategy.<br>**After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then<br>○ Annually during year 5 then<br>○ As clinically indicated after year 5<br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br>**Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Baseline within 3-6 months then<br>○ Every 3-6 months for 3 years then<br>○ Annually for 2 additional years<br>○ As clinically indicated beyond 5 years<br>**Stage IV, relapsed, or surgically unresectable disease*** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT and Abdomen and Pelvis CT/MRI<br>  ○ Every 1.5-4 months<br>• Brain MRI (preferred) or brain CT<br>  ○ Annually, or as clinically indicated<br>• Entire spine MRI<br>  ○ As clinically indicated<br>* More frequent follow-up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (212) | **Stage 0/in situ, Stage I, Stage IIA**<br>• No routine imaging needed<br>**Stage IIB-IV**<br>• Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>  ○ Every 3-12 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years<br>• Brain MRI if stage IIIB or higher<br>  ○ Every 3-12 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years<br>**NOTE:** More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |
| **Melanoma: Uveal** (87) | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>• Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>• Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Every 6-12 months for 10 years then<br>  ○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Every 3-6 months for 5 years then<br>  ○ Every 6-12 months for years 6-10 then<br>  ○ As clinically indicated after year 10<br>**NOTE:** Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [213] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>• Every 3-6 months for 3 years then<br>• Every 6-12 months |
| **Mesothelioma: Peritoneal** [103] | Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 5 years then<br>• Annually after 5 years |
| **Mesothelioma: Pleural** [214] | Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 5 years then<br>• Annually after 5 years |
| **Multiple Myeloma** [215] | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>• CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>  ○ Annually for 5 years<br>**Smoldering Myeloma, Multiple Myeloma**<br>• CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>  ○ Annually |
| **Neuroendocrine Tumors (NET)** [2] | **Well-differentiated NET, Grade 1-2**<br>• Chest CT and Abdomen +/- Pelvis CT/MRI<br>  ○ Once 3-12 months after resection then<br>  ○ Every 12-24 months for 10 years then<br>  ○ As clinically appropriate after 10 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |
| **Neuroblastoma** [216] | **All risk groups**<br>● CT or MRI of primary site<br>○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** [217] | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |
| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** [98] | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years then<br>● As clinically indicated after 5 years<br>**NOTE:** These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br>**Benign Teratoma**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years then<br>○ As clinically indicated after 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Small cell carcinoma of ovary**<br>● Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>○ Every 3-6 months for 2 years then<br>○ Annually |
| **Pancreatic Adenocarcinoma** (218) | Chest CT and Abdomen and Pelvis CT<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months for 2 years then<br>● As clinically indicated after 5 years |
| **Penile Cancer** (92) | **pN0 and pN1**<br>● Abdomen and Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually during years 3-4<br>**pN2 and pN3**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3 months for 1 then<br>○ Every 6 months during years 2-4 |
| **Prostate Cancer** (40) | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** (18) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** [219–221] | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** [222] | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |
| **Small Cell Lung Cancer (SCLC)** [223] | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (e.g., neck, spine)<br>**NOTE:** Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** [93,97] | **<u>General surveillance guidelines for other sarcomas, based on site:</u>**<br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Stage II-IV<br>  ○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>  ■ Every 2-6 months for 3 years then<br>  ■ Every 6 months for 2 years then<br>  ■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>• Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>  ○ Every 3-6 months for 3 years then<br>  ○ Every 6 months for 2 additional years then<br>  ○ Annually thereafter<br>**<u>Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)</u>**<br>• **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT<br>• **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>• **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>• **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>• **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>• **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**<u>Specific sarcoma surveillance guidelines (above general guidance does not apply):</u>**<br>**Desmoid tumor (aggressive fibromatosis)**<br>• Site-specific MRI (preferred) or CT<br>  ○ Every 3-6 months for 3 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months<br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br>**Borderline Phyllodes Tumor**<br>● Chest or Breast MRI<br>○ Every 6 months for 2 years then<br>○ Annually for 3 additional years<br>**Malignant Phyllodes Tumor**<br>● Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** (224) | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** (225)<br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** (106) | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Annually for 3 years<br>○ As clinically indicated after year 3<br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3<br>**Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** [106] | See **Active Surveillance** section for indications related to that management strategy.<br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (226) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br>**Thymic Carcinoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** (227) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>● Neck CT/MRI +/- Chest CT<br>○ Once 6-12 post thyroidectomy<br>○ Routine surveillance imaging thereafter not indicated<br>**Medullary Carcinoma**<br>● Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>**NOTE:** Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br>**Anaplastic Carcinoma**<br>● Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (94) | **Endometrial Cancer treated with non-fertility sparing**<br>● Routine surveillance imaging thereafter not indicated<br>**Endometrial Cancer treated with fertility sparing**<br>● Pelvis MRI<br>○ Once 6-9 months after treatment<br>○ Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence.<br>● **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (95) | Chest CT and Abdomen and Pelvis CT/MRI<br>● End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>● Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** (96) | Pelvis MRI (Indicated in addition to PET/CT) |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • End of treatment restaging once 3-6 months after completion of treatment<br>• Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** [228] | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** [229] | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>• Every 3 months for 2 years<br>• Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate 3D renderings that display the nuances of tissue beyond the capability of an x-ray, computed tomographic and magnetic resonance imaging have become integral diagnostic tools.

Computed Tomography (CT) is based on the differential absorption of x-rays by various tissues and uses X-rays to create cross-sectional images of the body. The X-ray source and detectors rotate around the patient, and a computer reconstructs the data into detailed images. [230] Its strengths are rapid image acquisition and high sensitivity and specificity for many conditions. It is excellent for evaluating trauma, acute emergencies, and staging cancers, and can assess multiple organ systems simultaneously. [231]

Magnetic resonance imaging (MRI) is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. It uses strong magnetic fields and radiofrequency pulses to manipulate hydrogen atoms in the body. The resulting signals are detected and converted into images by a computer. [230] MRI provides superior soft tissue contrast, especially for brain, joints, liver, and certain abdominal organs, making it excellent for characterizing focal liver lesions, biliary tract pathology, and rectal tumors, and does not use ionizing radiation, making it safer for repeated imaging and for children and pregnant patients. [231]

### Choosing Between CT and MRI

Because CT is fast, widely available, and good for general organ assessment, it is preferred for [232]:

- Acute abdominal emergencies and evaluation of abdominal trauma and solid organ injuries
- Evaluation of abdominal masses and staging and follow-up of oncologic disease
- Detection of urinary calculi
- Assessment of aneurysms, vascular malformations, and vessel stenosis
- Postoperative complications

Because MRI provides superior soft tissue detail, it is preferred for [232]:

- Detailed soft tissue evaluation, especially for brain, joints, liver, biliary tract, and pelvic organs
- Characterization of focal liver lesions
- Evaluation of biliary tract pathology
- Local staging and characterization of rectal and pancreatic tumors
- Assessment of inflammatory bowel disease
- Evaluation of congenital abnormalities
- Pre and post-procedural vascular mapping

### The Use of Contrast Agents

Contrast agents are used in advanced imaging to enhance visibility of specific organs and structures. The chemical nature of the contrast agent chosen can highlight differences in specific tissue density, composition, perfusion, or vascularity. [232] CT contrast agents are typically iodinated compounds used to highlight differences in tissue density, while MRI contrast agents are usually gadolinium-based, capitalizing on its paramagnetic properties to highlight differences in tissue composition. [230] Contrast agents are employed when diagnosis requires enhanced visualization of blood vessels, organ perfusion, or tissue differentiation, but can present a risk to patients with impaired kidney function. [230] While contrast agents are highly useful in identifying vascular pathologies and mapping vascular anatomy for procedural planning or monitoring vascular conditions, it should be kept in mind that in cases of trauma, acute bleeding, and other emergent situations, contrast agents are not typically necessary. [230,232]

# ANALYSIS OF EVIDENCE

### CT and MRI for the Upper Abdomen

Due to its speed, ready availability, and lower cost, CT is generally preferred over MRI for advanced imaging of structures in the upper abdomen. This is especially true for initial imaging. Additionally, well-established imaging protocols make CT the primary imaging modality for characterizing adrenal masses. [1] The American College of Radiology recommends a dedicated adrenal CT protocol for its superior ability to distinguish between benign and malignant lesions. [1] The risk of complications in acute conditions also makes CT the favored choice for most gastric disorders. It allows for quick evaluation of the entire abdomen, and is excellent for

detecting free air, fluid, and evidence of perforation. When contrast is employed, CT provides differentiation between abnormal pathologies and adequately visualizes ductal anatomy of the pancreas. [4]

A noteworthy exception is in exploration and diagnosis of hepatobiliary pathologies. MRI provides better tissue contrast and characterization than CT, making it better suited for focal liver lesions. This improved tissue contrast is particularly valuable in distinguishing between benign and malignant lesions, and for identifying specific lesion features. This also makes MRI an appropriate tool if CT is indeterminate. [1,3] The ability of MRI to quantify fat is also valuable in liver imaging protocols. Hindman et al [3] further emphasizes the need to make imaging choices based on the clinical scenario. Laboratory findings can be helpful in identifying a likely suspected cause for liver symptoms, which would in turn identify a preferred modality.

MRCP is the preferred modality for evaluation of the biliary tree. Gall stones will not appear on CT but can be readily caught on MRCP. CT with contrast can be useful for detecting biliary obstruction, but the risks associated with contrast make that a secondary option to MRI or MRCP. [3]

MRI's superior tissue characterization similarly makes it preferable to CT for imaging of splenic lesions and pathologies of the ducts of the pancreas, although CT should be implemented over MRI for known or suspected splenic trauma. [112,128]

In the case of renal masses, MRI provides better contrast resolution than CT, making it the better choice for characterizing small renal lesions. It is also less prone to artefacts that could further complicate the characterization of these small and/or ambiguous lesions. This is particularly important because most renal masses are benign cysts and properly identifying them can prevent further unnecessary procedures. [27]

**CT and MRI for the Lower Abdomen and Pelvis**

The lower abdomen and pelvis show similar imaging trends as the upper abdomen, with CT being preferred for initial imaging to rule out acute infection or trauma, and for initial characterization of masses and pathological anatomy. Additionally, the availability of a combined abdomen and pelvis CT scan makes the first choice for diagnosing complaints that span the abdomen and pelvis or cannot be isolated to one region on preliminary exam.

For genitourinary conditions, CT is preferred for initial imaging. It can quickly visualize trauma, infarcts, abscesses, stones and obstructions. CT should be employed for recurrent UTI in older men due to the risk of benign prostatic hyperplasia. [21] Complicated cases of acute pyelonephritis can be caused or aggravated by obstructions or anatomical pathologies that can be visualized on CT. [20] Recurrent infections can in fact be a sign of an anatomical abnormality or obstruction, making CT a valuable diagnostic tool. [20,21] Unlike gall stones, the composition of urinary tract stones makes them easy to detect on CT, making non-contrast the gold standard for symptomatic stones in the urinary tract. [34,35] However, both Akram et al [34] and Skolarikos et al [35] emphasize the value of ultrasound as the primary diagnostic tool, with CT being reserved for cases that are acute, severe, complicated, or poorly defined by prior ultrasound. CT urography is the standard modality for staging bladder cancer and identifying malignancy in the collecting system and ureters. Upon identification of masses, the superior tissue differentiation provided by MRI makes it ideal for their characterization. [20] It is also sometimes preferred for pelvic imaging in patients with female pelvic anatomy, to allow for radiation avoidance.

Pelvis MRI is the modality of choice for most other genitourinary conditions. MRI is appropriate for suspected prostate cancer or to evaluate complex prostate anatomy. [39,42] Combining it with

clinical markers can reduce the frequency of unnecessary biopsies. [42] It is also the primary tool for diagnosing urethral diverticulum in patients with female anatomy [233] and the preferred method for persistent or refractory cases of hematospermia. [51]

CT is the primary modality for most bowel conditions. It can evaluate the bowel wall for masses, thickening, obstruction, and ischemia, and CT enterography is preferred for detailed bowel wall assessment. While CT enterography is also highly successful in diagnosing inflammatory bowel disorders, MRI is preferred for ongoing evaluation, again because it allows for radiation avoidance. MRI Defecography is also preferred for evaluating pelvic floor pathologies and benign anorectal disorders, largely because it provides precise assessment of pelvic floor motion. [7]

When considering suspected appendicitis, CT is preferred over MRI for its speed in acute cases, but also because it demonstrates greater sensitivity than MRI. [5,234] MRI should be reserved for pregnant patients. Kambadakone et al [5] states that the appropriate use of imaging reduced negative appendectomy rates from 25% to < 3%. CT also demonstrates greater sensitivity for diagnosing diverticulitis, [11,235] where MRI is significantly understudied and rarely used for left lower quadrant pain. [235]

For gynecological conditions, MRI is generally preferred over CT in order to spare reproductive organs from radiation exposure. Notable exceptions are to locate an intrauterine device or suspected hydatidiform mole or gestational trophoblastic neoplasia. [58]

Recommendations for hernia imaging follow a similar pattern, with Abdomen or Abdomen and Pelvis CT recommended for abdominal or diaphragmatic hernias, with Pelvis MRI being the preferred modality for groin and deep pelvic hernias, due to their proximity to reproductive structures. [62]

**CTA and MRA**

In the case of abdomen and pelvis advanced imaging, CTA and MRA are recommended only for specific instances requiring greater vascular enhancement. For abdominal aortic disease, while urgency should always be considered, if available, CTA is preferred for suspected symptomatic aneurysms and acute aortic syndromes. [131–133] It is also ideal for providing the detailed anatomical assessment necessary for preoperative planning and postoperative evaluation, especially if complications are suspected. [132,133]

CTA is preferred for initial diagnosis of mesenteric ischemia and evaluation of acute mesenteric ischemia, due to its speed and superior visualization of smaller vessels, but MRA is appropriate for monitoring chronic mesenteric ischemia, and may be preferred for purposes of radiation avoidance. [136] It should also be noted that the Abdomen and Pelvis CTA study allows for a complete evaluation of the mesenteric ischemia, which is a valuable initial imaging modality. [136] There is no equivalent MRA study.

CT and MR are not sensitive enough to be useful tools in diagnosing vascular pathologies, including renal artery stenosis and visceral artery aneurysms. [137,138,141] For these diagnoses, CT would only be appropriate for surveillance of a limited number of visceral artery aneurysms being managed nonoperatively. [138] Furthermore, while CTA is preferred over MRA for most visceral artery aneurysms, [141] the possibility that renovascular pathologies may be associated with renal dysfunction makes non-contrast MRA a valuable tool for those patients. [138]

CT and MR are also not sufficient for peripheral vascular disease, or systemic vascular disease. [144,148] However, other forms of venous disease, specifically pelvic venous disease, can

be detected by most imaging modalities, making CT, MR, CTA and MRA all appropriate choices. [143] Rezaei-Kalantari et al [143] notes that the lack of standardized imaging criteria for pelvic venous disease, combined with the multifactorial etiology, makes correlating modality choice with clinical symptoms essential. Run-off CTA provides a valuable imaging alternative to invasive angiography for the diagnosis of peripheral artery disease, providing reliable diagnostic information. [144]

**In Summary**

Imaging modality recommendations throughout the abdomen and pelvis demonstrate consistent trends, whether from systematic reviews, professional guidelines, or randomized controlled trials. The availability, speed, and affordability of CT make it the preferred modality for a wide range of suspected pathologies, and is typically the recommended initial imaging modality. This recommendation is even more frequent due to the existence of a combined abdomen and pelvis study that allows for the imaging of both regions at once. MR remains the standard for imaging the requires greater detail of tissue composition to characterize lesions and define complex anatomy. The use of contrast is essential for the diagnosis of a range of vascular pathologies, but the risk of suspected acute conditions should always be considered when choosing from available imaging modalities.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | ● This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging<br>○ ECG 2000 for Abdomen Pelvis Computed Tomography (CT)<br>○ ECG 2001 for Abdomen Computed Tomography (CT)<br>○ ECG 2002 for Abdomen Computed Tomography Angiography (CTA)<br>○ ECG 2003 for Abdomen Magnetic Resonance Angiography (MRA)<br>○ ECG 2004 for Abdomen Magnetic Resonance Imaging (MRI) with or without Magnetic Resonance Cholangiopancreatography (MRCP)<br>○ ECG 2005 for Abdomen Pelvis Computed Tomography Angiography (CTA)<br>○ ECG 2006 for Abdominal Aorta Computed Tomography Angiography with Lower Extremity Runoff<br>○ ECG 2042 for Pelvis Computed Tomography (CT)<br>○ ECG 2043 for Pelvis Computed Tomography Angiography (CTA) |

| Date | Summary |
|---|---|
| | ○ ECG 2044 for Pelvis Magnetic Resonance Angiography (MRA)<br>○ ECG 2045 for Pelvis Magnetic Resonance Imaging (MRI)<br>● This guideline also merges the procedure codes from the above guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

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# REFERENCES


1. Mayo-Smith WW, Song JH, Boland GL, et al. Management of Incidental Adrenal Masses: A White Paper of the ACR Incidental Findings Committee. *Journal of the American College of Radiology*. 2017;14(8):1038-1044. doi:10.1016/j.jacr.2017.05.001
2. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Neuroendocrine and Adrenal Tumors Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
3. Hindman N, Arif-Tiwari H, Kamel IR, et al. ACR Appropriateness Criteria® Jaundice. *J Am Coll Radiol*. 2019;16(5S):S126-S140. doi:10.1016/j.jacr.2019.02.012
4. Ronnekleiv-Kelly SM, Soares KC, Ejaz A, Pawlik TM. Management of choledochal cysts. *Curr Opin Gastroenterol*. 2016;32(3):225-231. doi:10.1097/MOG.0000000000000256
5. Kambadakone AR, Santillan CS, Kim DH, et al. ACR Appropriateness Criteria® Right Lower Quadrant Pain: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S445-S461. doi:10.1016/j.jacr.2022.09.011
6. Koberlein GC, Trout AT, Rigsby CK, et al. ACR Appropriateness Criteria® Suspected Appendicitis-Child. *Journal of the American College of Radiology*. 2019;16(5):S252-S263. doi:10.1016/j.jacr.2019.02.022
7. Wald A, Bharucha AE, Limketkai B, et al. ACG Clinical Guidelines: Management of Benign Anorectal Disorders. *American Journal of Gastroenterology*. 2021;116(10):1987-2008. doi:10.14309/ajg.0000000000001507
8. Pasha SF, Leighton JA. Evidence-Based Guide on Capsule Endoscopy for Small Bowel Bleeding. *Gastroenterol Hepatol (N Y)*. 2017;13(2):88-93. http://www.ncbi.nlm.nih.gov/pubmed/28450815
9. Nagpal P, Dane B, Aghayev A, et al. ACR Appropriateness Criteria® Nonvariceal Upper Gastrointestinal Bleeding: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S433-S447. doi:10.1016/j.jacr.2024.08.021
10. Karuppasamy K, Kapoor BS, Fidelman N, et al. ACR Appropriateness Criteria® Radiologic Management of Lower Gastrointestinal Tract Bleeding: 2021 Update. *Journal of the American College of Radiology*. 2021;18(5):S139-S152. doi:10.1016/j.jacr.2021.02.018
11. Peery AF, Shaukat A, Strate LL. AGA Clinical Practice Update on Medical Management of Colonic Diverticulitis: Expert Review. *Gastroenterology*. 2021;160(3):906-911.e1. doi:10.1053/j.gastro.2020.09.059
12. Weinstein S, Kim DH, Fowler KJ, et al. ACR Appropriateness Criteria® Left Lower Quadrant Pain: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S471-S480. doi:10.1016/j.jacr.2023.08.013
13. Rubin DT, Ananthakrishnan AN, Siegel CA, Barnes EL, Long MD. ACG Clinical Guideline Update: Ulcerative Colitis in Adults. *American Journal of Gastroenterology*. 2025;120(6):1187-1224. doi:10.14309/ajg.0000000000003463

14. Lichtenstein GR, Loftus E V., Afzali A, et al. ACG Clinical Guideline: Management of Crohn's Disease in Adults. *American Journal of Gastroenterology*. 2025;120(6):1225-1264. doi:10.14309/ajg.0000000000003465

15. Steinhart AH, Panaccione R, Targownik L, et al. Clinical Practice Guideline for the Medical Management of Perianal Fistulizing Crohn's Disease: The Toronto Consensus. *J Can Assoc Gastroenterol*. 2018;1(4):141-154. doi:10.1093/jcag/gwy047

16. Chang KJ, Marin D, Kim DH, et al. ACR Appropriateness Criteria® Suspected Small-Bowel Obstruction. *Journal of the American College of Radiology*. 2020;17(5):S305-S314. doi:10.1016/j.jacr.2020.01.025

17. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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19. Bonkat G, Bartoletti R, Bruyere F, et al. *EAU Guidelines on Urological Infections*.; 2024. Accessed February 10, 2025. https://d56bochluxqnz.cloudfront.net/documents/full-guideline/EAU-Guidelines-on-Urological-Infections-2024.pdf

20. Smith AD, Nikolaidis P, Khatri G, et al. ACR Appropriateness Criteria® Acute Pyelonephritis: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S224-S239. doi:10.1016/j.jacr.2022.09.017

21. Schaeffer AJ, Nicolle LE. Urinary Tract Infections in Older Men. Solomon CG, ed. *New England Journal of Medicine*. 2016;374(6):562-571. doi:10.1056/NEJMcp1503950

22. Anger J, Lee U, Ackerman AL, et al. Recurrent Uncomplicated Urinary Tract Infections in Women: AUA/CUA/SUFU Guideline. *Journal of Urology*. 2019;202(2):282-289. doi:10.1097/JU.0000000000000296

23. Barocas DA, Lotan Y, Matulewicz RS, et al. Updates to Microhematuria: AUA/SUFU Guideline (2025). *Journal of Urology*. 2025;213(5):547-557. doi:10.1097/JU.0000000000004490

24. Whitworth P, Courtney KG, Oto A, et al. ACR Appropriateness Criteria® Hydronephrosis on Prior Imaging-Unknown Cause. *Journal of the American College of Radiology*. 2024;21(6):S144-S167. doi:10.1016/j.jacr.2024.02.020

25. Wang ZJ, Nikolaidis P, Khatri G, et al. ACR Appropriateness Criteria® Indeterminate Renal Mass. *Journal of the American College of Radiology*. 2020;17(11):S415-S428. doi:10.1016/j.jacr.2020.09.010

26. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Kidney Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

27. Herts BR, Silverman SG, Hindman NM, et al. Management of the Incidental Renal Mass on CT: A White Paper of the ACR Incidental Findings Committee. *Journal of the American College of Radiology*. 2018;15(2):264-273. doi:10.1016/j.jacr.2017.04.028

28. Northrup H, Koenig MK, Pearson DA, Au KS. Tuberous Sclerosis Complex. *GeneReviews®*. Published online August 1, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1220/

29. Flum AS, Hamoui N, Said MA, et al. Update on the Diagnosis and Management of Renal Angiomyolipoma. *Journal of Urology*. 2016;195(4P1):834-846. doi:10.1016/j.juro.2015.07.126

30. Ryan JW, Farrelly C, Geoghegan T. What Are the Indications for Prophylactic Embolization of Renal Angiomyolipomas? A Review of the Current Evidence in the Literature. *Canadian Association of Radiologists Journal*. 2018;69(3):236-239. doi:10.1016/j.carj.2018.01.002

31. Bardin F, Chevallier O, Bertaut A, et al. Selective arterial embolization of symptomatic and asymptomatic renal angiomyolipomas: a retrospective study of safety, outcomes and tumor size reduction. *Quant Imaging Med Surg*. 2017;7(1):8-23. doi:10.21037/qims.2017.01.02

32. Zeid M, Sayedin H, Nabi N, et al. Active Surveillance for Renal Angiomyolipoma Less Than 4 Centimeters: A Systematic Review of Cohort Studies. *Cureus*. 2022;14:e22678. doi:10.7759/cureus.22678

33. Pearle MS, Goldfarb DS, Assimos DG, et al. Medical management of kidney stones: AUA guideline. *Journal of Urology*. 2014;192(2):316-324. doi:10.1016/j.juro.2014.05.006

34. Akram M, Jahrreiss V, Skolarikos A, et al. Urological Guidelines for Kidney Stones: Overview and Comprehensive Update. *J Clin Med*. 2024;13(4):1114. doi:10.3390/jcm13041114

35. Skolarikos A, Jung H, Neisius A, Petrik A, et. al. EAU Guidelines on Urolithiasis. *European Association of Urology*. Published online 2025.

36. Assimos D, Krambeck A, Miller NL, et al. Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART I. *J Urol*. 2016;196(4):1153-1160. doi:10.1016/j.juro.2016.05.090

37. Fulgham PF, Assimos DG, Pearle MS, Preminger GM. Clinical effectiveness protocols for imaging in the management of ureteral calculous disease: AUA technology assessment. *J Urol*. 2013;189(4):1203-1213. doi:10.1016/j.juro.2012.10.031

38. Kim SP, Cohalan C, Kopek N, Enger SA. A guide to 90Y radioembolization and its dosimetry. *Physica Medica*. 2019;68:132-145. doi:10.1016/j.ejmp.2019.09.236

39. Alexander LF, Oto A, Allen BC, et al. ACR Appropriateness Criteria® Lower Urinary Tract Symptoms-Suspicion of Benign Prostatic Hyperplasia. *Journal of the American College of Radiology*. 2019;16(11):S378-S383. doi:10.1016/j.jacr.2019.05.031

40. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Prostate Cancer Version 5.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

41. Boschheidgen M, Schimmöller L, Doerfler S, et al. Single center analysis of an advisable control interval for follow-up of patients with PI-RADS category 3 in multiparametric MRI of the prostate. *Sci Rep*. 2022;12(1). doi:10.1038/s41598-022-10859-9

42. Schoots IG. MRI in early prostate cancer detection: How to manage indeterminate or equivocal PI-RADS 3 lesions? *Transl Androl Urol*. 2018;7(1):70-82. doi:10.21037/tau.2017.12.31

43. Das JP, Vargas HA, Lee A, et al. The urachus revisited: multimodal imaging of benign & malignant urachal pathology. *Br J Radiol*. 2020;93(1110). doi:10.1259/bjr.20190118

44. Kolon TF, Herndon CDA, Baker LA, et al. Evaluation and Treatment of Cryptorchidism: AUA Guideline. *Journal of Urology*. 2014;192(2):337-345. doi:10.1016/j.juro.2014.05.005

45. Parker RA, Menias CO, Quazi R, et al. MR Imaging of the Penis and Scrotum. *RadioGraphics*. 2015;35(4):1033-1050. doi:10.1148/rg.2015140161

46. Wilson SN, Wilson TS. Female Urethral Diverticula*. *American Urological Association*. 2020;39(34).

47. Vaidya R V., Olson K, Wolter C, Khan A. Characterization of Urethral Diverticula in Women. *Female Pelvic Med Reconstr Surg*. 2022;28(1):54-56. doi:10.1097/SPV.0000000000001060

48. Wessells H, Morey A, Souter L, Rahimi L, Vanni A. Urethral Stricture Disease Guideline Amendment (2023). *Journal of Urology*. 2023;210(1):64-71. doi:10.1097/JU.0000000000003482

49. Suh Y, Gandhi J, Joshi G, et al. Etiologic classification, evaluation, and management of hematospermia. *Transl Androl Urol*. 2017;6(5):959-972. doi:10.21037/tau.2017.06.01

50. Harmath C, Allen BC, Turkbey B, et al. ACR Appropriateness Criteria® Hematospermia. *Journal of the American College of Radiology*. 2025;22(11):S539-S549. doi:10.1016/j.jacr.2025.08.042

51. Hosseinzadeh K, Oto A, Allen BC, et al. ACR Appropriateness Criteria® Hematospermia. *Journal of the American College of Radiology*. 2017;14(5):S154-S159. doi:10.1016/j.jacr.2017.02.023

52. Verstraeten V, Vossaert K, Van den Bosch T. Migration of Intra-Uterine Devices. *Open Access J Contracept*. 2024;Volume 15:41-47. doi:10.2147/oajc.s458156

53. Brook OR, Dadour JR, Robbins JB, et al. ACR Appropriateness Criteria® Acute Pelvic Pain in the Reproductive Age Group: 2023 Update. *Journal of the American College of Radiology*. 2024;21(6):S3-S20. doi:10.1016/j.jacr.2024.02.014

54. Robbins JB, Sadowski EA, Maturen KE, et al. ACR Appropriateness Criteria® Abnormal Uterine Bleeding. *Journal of the American College of Radiology*. 2020;17(11):S336-S345. doi:10.1016/j.jacr.2020.09.008

55. Wall DJ, Reinhold C, Akin EA, et al. ACR Appropriateness Criteria® Female Infertility. *Journal of the American College of Radiology*. 2020;17(5):S113-S124. doi:10.1016/j.jacr.2020.01.018

56. Cunningham RK, Horrow MM, Smith RJ, Springer J. Adenomyosis: A Sonographic Diagnosis. *RadioGraphics*. 2018;38(5):1576-1589. doi:10.1148/rg.2018180080

57. Kilcoyne A, Shenoy-Bhangle AS, Roberts DJ, Sisodia RC, Gervais DA, Lee SI. MRI of Placenta Accreta, Placenta Increta, and Placenta Percreta: Pearls and Pitfalls. *American Journal of Roentgenology*. 2017;208(1):214-221. doi:10.2214/AJR.16.16281

58. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Gestational Trophoblastic Neoplasia Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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60. Kubik-Huch RA, Weston M, Nougaret S, et al. European Society of Urogenital Radiology (ESUR) Guidelines: MR Imaging of Leiomyomas. *Eur Radiol*. 2018;28(8):3125-3137. doi:10.1007/s00330-017-5157-5

61. Garcia EM, Pietryga JA, Kim DH, et al. ACR Appropriateness Criteria® Hernia. *Journal of the American College of Radiology*. 2022;19(11):S329-S340. doi:10.1016/j.jacr.2022.09.016

62. Garcia EM, Pietryga JA, Kim DH, et al. ACR Appropriateness Criteria® Hernia. *Journal of the American College of Radiology*. 2022;19(11):S329-S340. doi:10.1016/j.jacr.2022.09.016

63. Laracca GG, Spota A, Perretta S. Optimal workup for a hiatal hernia. *Ann Laparosc Endosc Surg*. 2021;6. doi:10.21037/ALES.2020.03.02

64. Earle D, Roth S, Saber A, et al. Guidelines for Laparoscopic Ventral Hernia Repair. *Society of American Gastrointestinal and Endoscopic Surgeons*. Published online 2025. https://www.sages.org/publications/guidelines/guidelines-for-laparoscopic-ventral-hernia-repair/

65. Levy AD, Liu PS, Kim DH, et al. ACR Appropriateness Criteria® Anorectal Disease. *Journal of the American College of Radiology*. 2021;18(11):S268-S282. doi:10.1016/j.jacr.2021.08.009

66. Katabathina VS, Dasyam AK, Dasyam N, Hosseinzadeh K. Adult bile duct strictures: role of MR imaging and MR cholangiopancreatography in characterization. *Radiographics*. 2014;34(3):565-586. doi:10.1148/rg.343125211

67. Cartwright SL, Knudson MP. Diagnostic imaging of acute abdominal pain in adults. *Am Fam Physician*. 2015;91(7):452-459. http://www.ncbi.nlm.nih.gov/pubmed/25884745

68. Porter KK, Zaheer A, Kamel IR, et al. ACR Appropriateness Criteria® Acute Pancreatitis. *Journal of the American College of Radiology*. 2019;16(11):S316-S330. doi:10.1016/j.jacr.2019.05.017

69. Sulbaran M, Chen FK, Farraye FA, Hashash JG. A Clinical Review of Mesenteric Panniculitis. *Gastroenterol Hepatol (N Y)*. 2023;19(4):211-218. http://www.ncbi.nlm.nih.gov/pubmed/37705847

70. Van Putte Katier N, Van Bommel EFH, Elgersma OE, Hendriksz TR. Mesenteric panniculitis: Prevalence, clinicoradiological presentation and 5 year follow-up. *British Journal of Radiology*. 2014;87(1044). doi:10.1259/bjr.20140451

71. Engelsgjerd JS, Leslie SW, LaGrange CA. Retroperitoneal Fibrosis. *StatPearls*. Published online August 17, 2024. https://www.ncbi.nlm.nih.gov/books/NBK482409/

72. Chernyak V, Horowitz JM, Kamel IR, et al. ACR Appropriateness Criteria® Liver Lesion-Initial Characterization. *Journal of the American College of Radiology*. 2020;17(11):S429-S446. doi:10.1016/j.jacr.2020.09.005

73. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Hepatocellular Carcinoma Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

74. Arif-Tiwari H, Porter KK, Kamel IR, et al. ACR Appropriateness Criteria® Abnormal Liver Function Tests. *Journal of the American College of Radiology*. 2023;20(11):S302-S314. doi:10.1016/j.jacr.2023.08.023

75. Mounajjed T. Hepatocellular Adenoma and Focal Nodular Hyperplasia. *Clin Liver Dis (Hoboken)*. 2021;17(4):244-248. doi:10.1002/cld.1069

76. Singal AG, Llovet JM, Yarchoan M, et al. AASLD Practice Guidance on prevention, diagnosis, and treatment of hepatocellular carcinoma. *Hepatology*. 2023;78(6):1922-1965. doi:10.1097/HEP.0000000000000466

77. Catanzaro E, Gringeri E, Burra P, Gambato M. Primary Sclerosing Cholangitis-Associated Cholangiocarcinoma: From Pathogenesis to Diagnostic and Surveillance Strategies. *Cancers (Basel)*. 2023;15(20):4947. doi:10.3390/cancers15204947

78. Heller MT, Harisinghani M, Neitlich JD, Yeghiayan P, Berland LL. Managing Incidental Findings on Abdominal and Pelvic CT and MRI, Part 3: White Paper of the ACR Incidental Findings Committee II on Splenic and Nodal Findings. *Journal of the American College of Radiology*. 2013;10(11):833-839. doi:10.1016/j.jacr.2013.05.020

79. Gasparis AP, Kim PS, Dean SM, Khilnani NM, Labropoulos N. Diagnostic approach to lower limb edema. *Phlebology: The Journal of Venous Disease*. 2020;35(9):650-655. doi:10.1177/0268355520938283

80. Schlegel PN, Sigman M, Collura B, et al. Diagnosis and Treatment of Infertility in Men: AUA/ASRM Guideline Part I. *Journal of Urology*. 2021;205(1):36-43. doi:10.1097/JU.0000000000001521

81. Gaddey HL, Holder KK. Unintentional Weight Loss in Older Adults. *Am Fam Physician*. 2021;104(1):34-40. http://www.ncbi.nlm.nih.gov/pubmed/34264616

82. Gupta R, Evans AT. Approach to the patient with unintentional weight loss. *UpToDate*. Published online October 8, 2024. https://www.uptodate.com/contents/approach-to-the-patient-with-unintentional-weight-loss?search=unintentional weight loss in older adults&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1

83. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Myeloproliferative Neoplasms

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84. Gerull S, Medinger M, Heim D, Passweg J, Stern M. Evaluation of the Pretransplantation Workup before Allogeneic Transplantation. *Biology of Blood and Marrow Transplantation*. 2014;20(11):1852-1856. doi:10.1016/j.bbmt.2014.06.029

85. Kaste SC, Kaufman RA, Sunkara A, et al. Routine Pre- and Post-Hematopoietic Stem Cell Transplant Computed Tomography of the Abdomen for Detecting Invasive Fungal Infection Has Limited Value. *Biology of Blood and Marrow Transplantation*. 2015;21(6):1132-1135. doi:10.1016/j.bbmt.2015.02.023

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103. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Mesothelioma: Peritoneal Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

104. Čertík B, Třeška V, Moláček J, Šulc R. How to proceed in the case of a tumour thrombus in the inferior vena cava with renal cell carcinoma. *Cor Vasa*. 2015;57(2):e95-e100. doi:10.1016/j.crvasa.2015.02.015

105. Zucker EJ, Ganguli S, Ghoshhajra BB, Gupta R, Prabhakar AM. Imaging of venous compression syndromes. *Cardiovasc Diagn Ther*. 2016;6(6):519-532. doi:10.21037/cdt.2016.11.19

106. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Testicular Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

107. Singh N, Aghayev A, Ahmad S, et al. ACR Appropriateness Criteria® Imaging of Deep Inferior Epigastric Arteries for Surgical Planning (Breast Reconstruction Surgery): 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S357-S363. doi:10.1016/j.jacr.2022.09.004

108. Basta Nikolic M, Spasic A, Hadnadjev Simonji D, Stojanović S, Nikolic O, Nikolic D. Imaging of acute pelvic pain. *Br J Radiol*. 2021;94(1127):20210281. doi:10.1259/bjr.20210281

109. Henrichsen TL, Maturen KE, Robbins JB, et al. ACR Appropriateness Criteria® Postmenopausal Acute Pelvic Pain. *Journal of the American College of Radiology*. 2021;18(5):S119-S125. doi:10.1016/j.jacr.2021.02.003

110. Russo GK, Zaheer A, Kamel IR, et al. ACR Appropriateness Criteria® Right Upper Quadrant Pain: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S211-S223. doi:10.1016/j.jacr.2023.02.011

111. Fábrega-Foster K, Kamel IR, Horowitz JM, et al. ACR Appropriateness Criteria® Pancreatic Cyst. *Journal of the American College of Radiology*. 2020;17(5):S198-S206. doi:10.1016/j.jacr.2020.01.021

112. Megibow AJ, Baker ME, Morgan DE, et al. Management of Incidental Pancreatic Cysts: A White Paper of the ACR Incidental Findings Committee. *Journal of the American College of Radiology*. 2017;14(7):911-923. doi:10.1016/j.jacr.2017.03.010

113. Vege SS, Ziring B, Jain R, Moayyedi P. American gastroenterological association institute guideline on the diagnosis and management of asymptomatic neoplastic pancreatic cysts. *Gastroenterology*. 2015;148(4):819-822. doi:10.1053/j.gastro.2015.01.015

114. Whitcomb DC, Buchner AM, Forsmark CE. AGA Clinical Practice Update on the Epidemiology, Evaluation, and Management of Exocrine Pancreatic Insufficiency: Expert Review. *Gastroenterology*. 2023;165(5):1292-1301. doi:10.1053/j.gastro.2023.07.007

115. Morrison WB, Deely D, Fox MG, et al. ACR Appropriateness Criteria® Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S490-S503. doi:10.1016/j.jacr.2024.08.019

116. Boulter DJ, Job J, Shah LM, et al. ACR Appropriateness Criteria® Plexopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S423-S441. doi:10.1016/j.jacr.2021.08.014

117. Wadhwa V, Hamid AS, Kumar Y, Scott KM, Chhabra A. Pudendal nerve and branch neuropathy: Magnetic resonance neurography evaluation. *Acta radiol*. 2017;58(6):726-733. doi:10.1177/0284185116668213

118. Ally RM, Velleman MD, Suleman FE. Meralgia paresthetica: Now showing on 3T magnetic resonance neurography. *South African Journal of Radiology*. 2019;23(1):1745. doi:10.4102/sajr.v23i1.1745

119. Ha AS, Chang EY, Bartolotta RJ, et al. ACR Appropriateness Criteria® Osteonecrosis: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S409-S416. doi:10.1016/j.jacr.2022.09.009

120. Czuczman GJ, Mandell JC, Wessell DE, et al. ACR Appropriateness Criteria® Inflammatory Back Pain: Known or Suspected Axial Spondyloarthritis: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S340-S360. doi:10.1016/j.jacr.2021.08.003

121. Lee EY, Margherita AJ, Gierada DS, Narra VR. MRI of Piriformis Syndrome. *American Journal of Roentgenology*. 2004;183(1):63-64. doi:10.2214/ajr.183.1.1830063

122. Falowski S, Sayed D, Pope J, et al. A Review and Algorithm in the Diagnosis and Treatment of Sacroiliac Joint Pain. *J Pain Res*. 2020;13:3337-3348. doi:10.2147/JPR.S279390

123. Ogilvie A, Kim WJ, Asirvatham RD, Fontalis A, Putzeys P, Haddad FS. Robotic-Arm-Assisted Total Hip Arthroplasty: A Review of the Workflow, Outcomes and Its Role in Addressing the Challenge of Spinopelvic Imbalance. *Medicina (Lithuania)*. 2022;58(11). doi:10.3390/medicina58111616

124. Colucci PG, Chalmers BP, Miller TT. Imaging of the Hip Prior to Replacement: What the Surgeon Wants to Know. *Seminars in Ultrasound, CT and MRI*. 2023;44(4):240-251. doi:10.1053/j.sult.2023.02.001

125. Fu CY, Teng LH, Liao CH, et al. The diminishing role of pelvic stability evaluation in the era of computed tomographic scanning. *Medicine (United States)*. 2016;95(16). doi:10.1097/MD.0000000000003421

126. Leone E, Garipoli A, Ripani U, et al. Imaging Review of Pelvic Ring Fractures and Its Complications in High-Energy Trauma. *Diagnostics*. 2022;12(2). doi:10.3390/diagnostics12020384

127. Krähling H, Seidensticker M, Heindel WL, Gerwing M. Diagnostic approach to splenic lesions. *RoFo Fortschritte auf dem Gebiet der Rontgenstrahlen und der Bildgebenden Verfahren*. 2024;196(6):573-581. doi:10.1055/a-2193-2292

128. Kim N, Auerbach A, Manning MA. Algorithmic Approach to the Splenic Lesion Based on Radiologic-Pathologic Correlation. *Radiographics*. 2022;42(3):683-701. doi:10.1148/rg.210071

129. Lee JT, Camacho MA, Diercks DB, et al. ACR Appropriateness Criteria® Major Blunt Trauma: Update 2025. *Journal of the American College of Radiology*. Published online February 2026. doi:10.1016/j.jacr.2026.01.030

130. Lee JT, Sobieh A, Bonne S, et al. ACR Appropriateness Criteria® Penetrating Torso Trauma. *Journal of the American College of Radiology*. 2024;21(11):S448-S463. doi:10.1016/j.jacr.2024.08.014

131. Isselbacher EM, Preventza O, Hamilton Black J, et al. 2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. *Circulation*. 2022;146(24):e334-e482. doi:10.1161/CIR.0000000000001106

132. Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *J Vasc Surg*. 2018;67(1):2-77.e2. doi:10.1016/j.jvs.2017.10.044

133. Wanhainen A, Van Herzeele I, Bastos Goncalves F, et al. Editor's Choice -- European Society for Vascular Surgery (ESVS) 2024 Clinical Practice Guidelines on the Management of Abdominal Aorto-Iliac Artery Aneurysms. *European Journal of Vascular and Endovascular Surgery*. 2024;67(2):192-331. doi:10.1016/j.ejvs.2023.11.002

134. Juntermanns B, Bernheim J, Karaindros K, Walensi M, Hoffmann JN. Visceral artery aneurysms. *Gefässchirurgie*. 2018;23(S1):19-22. doi:10.1007/s00772-018-0384-x

135. Steenberge SP, Caputo FJ, Rowse JW, et al. Natural history and growth rates of isolated common iliac artery aneurysms. In: *Journal of Vascular Surgery*. Vol 76. Elsevier Inc.; 2022:461-465. doi:10.1016/j.jvs.2022.01.022

136. Ginsburg M, Obara P, Lambert DL, et al. ACR Appropriateness Criteria® Imaging of Mesenteric Ischemia. *Journal of the American College of Radiology*. 2018;15(11):S332-S340. doi:10.1016/j.jacr.2018.09.018

137. American College of Radiology. ACR–SIR Practice Parameter for the Performance of Angiography, Angioplasty, and Stenting for the Diagnosis and Treatment of Renal Artery Stenosis in Adults. *American College of Radiology*. Published online 2021. https://www.acr.org/-/media/ACR/Files/Practice-Parameters/RenalArteryStenosis.pdf

138. Harvin HJ, Verma N, Nikolaidis P, et al. ACR Appropriateness Criteria® Renovascular Hypertension. *Journal of the American College of Radiology*. 2017;14(11):S540-S549. doi:10.1016/j.jacr.2017.08.040

139. Friedman J. Neurofibromatosis 1. *GeneReviews*®. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

140. Morris CA. Williams Syndrome. *GeneReviews*®. Published online April 13, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1249/

141. Chaer RA, Abularrage CJ, Coleman DM, et al. The Society for Vascular Surgery clinical practice guidelines on the management of visceral aneurysms. *J Vasc Surg*. 2020;72(1):3S-39S. doi:10.1016/j.jvs.2020.01.039

142. Mazhar HR, Aeddula NR. Renal Vein Thrombosis. *StatPearls*. Published online June 12, 2023. https://www.ncbi.nlm.nih.gov/books/NBK536971/

143. Rezaei-Kalantari K, Fahrni G, Rotzinger DC, Qanadli SD. Insights into pelvic venous disorders. *Front Cardiovasc Med*. 2023;10. doi:10.3389/fcvm.2023.1102063

144. Werncke T, Ringe KI, von Falck C, Kruschewski M, Wacker F, Meyer BC. Diagnostic Confidence of Run-Off CT-Angiography as the Primary Diagnostic Imaging Modality in

Patients Presenting with Acute or Chronic Peripheral Arterial Disease. Zhang H, ed. *PLoS One*. 2015;10(4):e0119900. doi:10.1371/journal.pone.0119900

145. Azene EM, Steigner ML, Aghayev A, et al. ACR Appropriateness Criteria® Lower Extremity Arterial Claudication-Imaging Assessment for Revascularization: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S364-S373. doi:10.1016/j.jacr.2022.09.002

146. Conte MS, Pomposelli FB, Clair DG, et al. Society for Vascular Surgery practice guidelines for atherosclerotic occlusive disease of the lower extremities: Management of asymptomatic disease and claudication. *J Vasc Surg*. 2015;61(3):2S-41S.e1. doi:10.1016/j.jvs.2014.12.009

147. Gornik HL, Aronow HD, Goodney PP, et al. 2024 ACC/AHA/AACVPR/APMA/ABC/SCAI/SVM/SVN/SVS/SIR/VESS Guideline for the Management of Lower Extremity Peripheral Artery Disease. *J Am Coll Cardiol*. 2024;83(24):2497-2604. doi:10.1016/j.jacc.2024.02.013

148. Gornik HL, Persu A, Adlam D, et al. First International Consensus on the diagnosis and management of fibromuscular dysplasia. *Vascular Medicine*. 2019;24(2):164-189. doi:10.1177/1358863X18821816

149. Kesav P, Manesh Raj D, John S. Cerebrovascular Fibromuscular Dysplasia – A Practical Review. *Vasc Health Risk Manag*. 2023;Volume 19:543-556. doi:10.2147/VHRM.S388257

150. Dejaco C, Ramiro S, Bond M, et al. EULAR recommendations for the use of imaging in large vessel vasculitis in clinical practice: 2023 update. *Ann Rheum Dis*. 2024;83(6):741-751. doi:10.1136/ard-2023-224543

151. Maz M, Chung SA, Abril A, et al. 2021 American College of Rheumatology/Vasculitis Foundation Guideline for the Management of Giant Cell Arteritis and Takayasu Arteritis. *Arthritis & Rheumatology*. 2021;73(8):1349-1365. doi:10.1002/art.41774

152. Johnson A, Emery D, Clifford A. Intracranial involvement in takayasu's arteritis. *Diagnostics*. 2021;11(11). doi:10.3390/diagnostics11111997

153. Samaan M, Abramyan A, Sundararajan S, et al. Cerebrovascular implications of takayasu arteritis: a review. *Neuroradiology*. 2025;67(1):125-136. doi:10.1007/s00234-024-03472-2

154. Ni R, Kohler MJ. What is new in imaging to assist in the diagnosis of giant cell arteritis and Takayasu's arteritis since the EULAR and ACR/VF recommendations? *Front Med (Lausanne)*. 2024;11. doi:10.3389/fmed.2024.1495644

155. Teruzzi G, Santagostino Baldi G, Gili S, Guarnieri G, Montorsi P, Trabattoni D. Spontaneous Coronary Artery Dissections: A Systematic Review. *J Clin Med*. 2021;10(24):5925. doi:10.3390/jcm10245925

156. Hayes SN, Tweet MS, Adlam D, et al. Spontaneous Coronary Artery Dissection. *J Am Coll Cardiol*. 2020;76(8):961-984. doi:10.1016/j.jacc.2020.05.084

157. Hedgire SS, Saboo SS, Galizia MS, et al. ACR Appropriateness Criteria® Preprocedural Planning for Transcatheter Aortic Valve Replacement: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S501-S512. doi:10.1016/j.jacr.2023.08.009

158. Boike JR, Thornburg BG, Asrani SK, et al. North American Practice-Based Recommendations for Transjugular Intrahepatic Portosystemic Shunts in Portal Hypertension. *Clinical Gastroenterology and Hepatology*. 2022;20(8):1636-1662.e36. doi:10.1016/j.cgh.2021.07.018

159. Harris P, Torres V. Polycystic Kidney Disease, Autosomal Dominant. *GeneReviews*®. Published online September 29, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1246/

160. Pilarski R, Byrne L, Carlo MI, Hanson H, Cebulla C, Abdel-Rahman M. BAP1 Tumor Predisposition Syndrome. *GeneReviews*®. Published online December 5, 2024. https://www.ncbi.nlm.nih.gov/books/NBK390611/

161. Shuman C, Kalish JM, Weksberg R. Beckwith-Wiedemann Syndrome. *GeneReviews*®. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1394/

162. Langer AL. Beta-Thalassemia. *GeneReviews*®. Published online February 12, 2026. https://www.ncbi.nlm.nih.gov/books/NBK1426/

163. Hughes DA, Pastores GM. Gaucher Disease. *GeneReviews*®. Published online December 7, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1269/

164. Kamihara J, Schultz KA, Rana HQ. FH Tumor Predisposition Syndrome. *GeneReviews*®. Published online May 8, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1252/

165. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Colorectal, Endometrial, and Gastric Version 1.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

166. Eng C, Plitt G. Multiple Endocrine Neoplasia Type 2. *GeneReviews*®. Published online August 10, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1257/

167. Yehia L, Eng C. PTEN Hamartoma Tumor Syndrome. *GeneReviews*®. Published online August 7, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1488/

168. Bender M, Carlberg K. Sickle Cell Disease. *GeneReviews*®. Published online February 13, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1377/

169. van Leeuwaarde RS van, Ahmad S, van Nesselrooij B, Zandee W, Giles RH. Von Hippel-Lindau Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1463/

170. Sattler EC, Steinlein OK. Birt-Hogg-Dubé Syndrome. *GeneReviews*®. Published online December 5, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1522/

171. Yen T, Stanich PP, Axell L, Patel SG. APC-Associated Polyposis Conditions. *GeneReviews*®. Published online May 12, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1345/

172. McGarrity TJ, Amos CI, Baker MJ. Peutz-Jeghers Syndrome. *GeneReviews*®. Published online September 2, 2021. https://www.ncbi.nlm.nih.gov/books/NBK1266/

173. Loeys BL, Dietz HC. Loeys-Dietz Syndrome. *GeneReviews*®. Published online September 12, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1133/

174. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews®*. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

175. Dietz H. FBN1-Related Marfan Syndrome. *GeneReviews®*. Published online February 17, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1335/

176. Piperno A, Bertola F, Bentivegna A. Juvenile Hemochromatosis. *GeneReviews®*. Published online January 9, 2020. https://www.ncbi.nlm.nih.gov/books/NBK1170/

177. Barton JC, Parker CJ. HFE-Related Hemochromatosis. *GeneReviews®*. Published online April 11, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1440/

178. Giusti F, Marini F, Brandi ML. Multiple Endocrine Neoplasia Type 1. *GeneReviews®*. Published online March 10, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1538/

179. Else T, Greenberg S, Fishbein L. Hereditary Paraganglioma-Pheochromocytoma Syndromes. *GeneReviews®*. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1548/

180. Stoller JK, Hupertz V, Aboussouan LS. Alpha-1 Antitrypsin Deficiency. *GeneReviews®*. Published online June 1, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1519/

181. Kilcoyne A, Shenoy-Bhangle AS, Roberts DJ, Sisodia RC, Gervais DA, Lee SI. MRI of Placenta Accreta, Placenta Increta, and Placenta Percreta: Pearls and Pitfalls. *American Journal of Roentgenology*. 2017;208(1):214-221. doi:10.2214/AJR.16.16281

182. Prayer D, Malinger G, De Catte L, et al. ISUOG Practice Guidelines (updated): performance of fetal magnetic resonance imaging. *Ultrasound in Obstetrics & Gynecology*. 2023;61(2):278-287. doi:10.1002/uog.26129

183. Laracca GG, Spota A, Perretta S. Optimal workup for a hiatal hernia. *Ann Laparosc Endosc Surg*. 2021;6. doi:10.21037/ALES.2020.03.02

184. Kicska GA, Hurwitz Koweek LM, Ghoshhajra BB, et al. ACR Appropriateness Criteria® Suspected Acute Aortic Syndrome. *Journal of the American College of Radiology*. 2021;18(11):S474-S481. doi:10.1016/j.jacr.2021.09.004

185. Browne WF, Sung J, Majdalany BS, et al. ACR Appropriateness Criteria® Sudden Onset of Cold, Painful Leg: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S565-S573. doi:10.1016/j.jacr.2023.08.012

186. Arnold J, Koyfman A, Long B. High risk and low prevalence diseases: Acute limb ischemia. *American Journal of Emergency Medicine*. 2023;74:152-158. doi:10.1016/j.ajem.2023.09.052

187. Richard PO, Violette PD, Bhindi B, et al. 2023 UPDATE – Canadian Urological Association guideline: Management of cystic renal lesions. *Canadian Urological Association Journal*. 2023;17(6):162-174. doi:10.5489/cuaj.8389

188. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Acute Lymphoblastic Leukemia Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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201. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

202. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

203. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

204. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Cutaneous Lymphomas Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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219. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

220. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

221. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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230. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

231. Caraiani C, Yi D, Petresc B, Dietrich C. Indications for abdominal imaging: When and what to choose? *J Ultrason*. 2020;20(80):e43-e54. doi:10.15557/JoU.2020.0008

232. Catanzano T, ed. *What Radiology Residents Need to Know: Abdominal Radiology*. Springer; 2025.

233. Vaidya R V., Olson K, Wolter C, Khan A. Characterization of Urethral Diverticula in Women. *Female Pelvic Med Reconstr Surg*. 2022;28(1):54-56. doi:10.1097/SPV.0000000000001060

234. Koberlein GC, Trout AT, Rigsby CK, et al. ACR Appropriateness Criteria® Suspected Appendicitis-Child. *Journal of the American College of Radiology*. 2019;16(5):S252-S263. doi:10.1016/j.jacr.2019.02.022

235. Weinstein S, Kim DH, Fowler KJ, et al. ACR Appropriateness Criteria® Left Lower Quadrant Pain: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S471-S480. doi:10.1016/j.jacr.2023.08.013

# Evolent Clinical Guideline 2070 for Brain Imaging

## *Including Neck Vascular Imaging*

| **Guideline Number:** Evolent_CG_2070 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2027 Evolent. All rights Reserved*** | | |
| **Original Date:** January 2027 | **Last Revised Date:** July 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Brain magnetic resonance imaging (MRI) is the procedure of choice for most brain disorders. However, assessment of acute hemorrhage, acute trauma, or bone abnormalities of the calvarium is imaged with computed tomography (CT). CT is also appropriate in an urgent/emergent situation where MRI is not readily available or when MRI is contraindicated. CT angiography (CTA) or MR angiography (MRA) is preferred for certain vascular studies.

CT uses ionizing radiation to generate images of organs and structures. MRI generates images of organs and structures without the use of ionizing radiation. CTA generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. MRA generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without radiation. MR spectroscopy (MRS) is a noninvasive imaging technique that analyzes chemical composition of brain tissue to evaluate metabolism used to answer a specific clinical question when conventional MRI does not answer the question. CT perfusion is used as an adjunct to brain CT/CTA to measure blood flow and evaluate tissue at risk for additional ischemia. Functional MRI (fMRI) of the brain is used to capture blood oxygen levels/blood flow changes, which can be tested while patients are asked to perform tasks (task-based fMRI) or at rest (resting-state fMRI), and is primarily used for presurgical planning.

When brain and IAC imaging is needed, only one authorization is indicated (brain MRI CPT includes the IAC's).

NOTE: Authorizations for CT Angiography and MR Angiography cover both arterial and venous imaging. The term *angiography* refers both to arteriography and venography.

## Special Note

Multiple brain studies are not simultaneously indicated unless they meet the criteria described in the combination studies section.

When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS FOR BRAIN IMAGING

## Acoustic (Vestibulocochlear) Disorder

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** (includes internal auditory canal views when needed). (See Evolent Clinical Guideline 2072 for Head and Neck Imaging for Temporal Bone/IAC CT indications)

- Hearing loss with any ONE of the following [1–4]:
  - Unilateral or sudden (unilateral or bilateral) acquired sensorineural hearing loss documented on audiogram
  - Mixed conductive and sensorineural hearing loss on audiogram
  - Acquired conductive hearing loss secondary to suspected or known cholesteatoma, other mass, or neoplasm
  - Congenital hearing loss (unilateral or bilateral, conductive, or sensorineural)

    NOTE: Hearing loss can be mild initially and progress over time after birth.
  - Surgical planning or cochlear implant candidate [5,6]
- Tinnitus with any ONE of the following:
  - Pulsatile tinnitus (unilateral or bilateral) (see **vascular** for additional indication and workup) [7–10]
  - Non-pulsatile, unilateral or asymmetric tinnitus [7]
  - Unspecified tinnitus associated with ONE of the following:
    - Abnormal neurologic exam
    - One of the hearing loss criteria above has been met
- Complicated otitis externa with concern for suspected necrotizing otitis externa (NOE, also known as malignant otitis externa) or skull base osteomyelitis with any ONE of the following [11–15]
  - Clinical suspicion based on symptoms (eg, otalgia, fever, headache, cranial nerve abnormalities, neurological symptoms, and/or seizures)
  - Treatment response assessment
- Acute otitis media AND concern for extracranial or intracranial complications (eg,

mastoiditis, abscess, empyema) with any ONE of the following [11,16]:

- Persistent infection after antibiotic therapy
- Worsening or new symptoms (eg, headache, vertigo, meningismus/neck rigidity, or fever)
- Worsening or new signs (eg, cranial nerve deficits, stupor/altered mental status, postauricular edema, mastoid tenderness)

- Chronic otitis media (chronic infection and inflammation > 3 months) and ONE of the following [11]
  - Concern for persistent scar tissue, inflamed granulation tissue, and/or cholesteatoma
  - Surgical planning
- Cholesteatoma [11,17]
  - Diagnosis for suspected lesion based on otoscopic examination
  - Post-operatively to evaluate for residual or for suspected recurrence
- Schwannoma or cerebellar pontine angle tumor based on clinical signs and symptoms (ie, unilateral/asymmetric sensorineural hearing loss, vertigo, disturbed balance or gait, unilateral/asymmetric tinnitus, facial weakness, or altered sense of taste) for any ONE of the following [7]:
  - Initial workup of suspected vestibular schwannoma (VS)
  - Known VS (previously acoustic neuromas) surveillance:
    - Unresected:
      - 6 months after initial diagnosis, annually for 5 years, then every 2 years x 4 years, and once 3 years later [18,19]
      - Shorter surveillance intervals for unstable/growth (2 mm or more)
      - 6-12 month intervals for cystic lesions and neurofibromatosis type 2 (NF2) related VS [18,19]
    - Partially resected or radiation treatment: post-operatively, annually for 5 years, then every 2 years [19,20]
    - Gross total resection: post-operatively, then at 2 years, 5 years, and 10 years [20]
    - Signs/symptoms of progression including unilateral sensorineural hearing loss, tinnitus, vertigo, trigeminal dysfunction, or facial nerve dysfunction [20]

# Autoimmune Disease

## *Demyelinating Disorders [21–28]*

The most well-known or studied demyelinating disease is multiple sclerosis (MS), including clinically isolated syndrome (CIS) and radiologically isolated syndrome (RIS). Myelin oligodendrocyte glycoprotein associated disease (MOGAD), neuromyelitis optica spectrum disorder (NMOSD), acute disseminated encephalomyelitis (ADEM), progressive multifocal

leukoencephalopathy (PML), and others are also considered central nervous system (CNS) demyelinating diseases.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**.

- Suspected MS with acute or subacute abnormal neurological symptoms and/or exam findings:
  - For diagnosis and/or to differentiate from other conditions
  - For susceptibility-weighted sequences, if not done initially, can be considered on a case-by-case basis (ie, to evaluate for highly MS specific lesions: central vein sign [CVS] and/or paramagnetic rim lesions [PRL]).
- CIS: single suspicious clinical episode but does not meet criteria for MS diagnosis [29]
  - Every 6-12 months for high-risk CIS (> 2 ovoid lesions on first Brain MRI)
  - Every 12-24 months for low-risk CIS (no brain lesions on MRI)
- RIS: suspicious brain lesions but clinically asymptomatic and does not meet criteria for MS diagnosis
  - Every 12-24 months with RIS
- Established/diagnosed MS:
  - Baseline prior to starting disease modifying therapy or switching therapy, an initial scan 3-6 months after starting or changing treatment, then yearly, less frequently if stable on treatment for the first few years (2-3 years)
    - Pediatric patients with active disease (ie, new/worsening neurological signs/symptoms, new or enlarging lesions, enhancing lesions), brain MRI every 6 months
  - New signs/symptoms suggestive of clinical worsening
  - Once, 2-3 months post-partum, if needed for new baseline
- Documented concern for progressive multifocal leukoencephalopathy (PML) [27]:
  - Screen every 3-4 months for high-risk patients with MS on monoclonal antibody therapy for > 18 months and JC virus positive and ONE of the following:
    - Anti-JC virus antibody index value > 0.9
    - Previously treated with immunosuppressive therapies
  - Screen every 3-4 months for the first 9-12 months in high-risk patients with MS after changing from monoclonal antibody therapy to a different therapy
  - Annual screening for low-risk patients (JC virus negative) with MS on monoclonal antibody therapy
  - Workup for suspected disease in an immunocompromised patient (eg, human immunodeficiency virus [HIV], malignancy, lupus, iatrogenic/medication related) positive for JC virus [30]

- Known PML as clinically indicated (ie, based on clinical symptoms, exam findings, labs)

- Suspected transverse myelitis, NMOSD, or MOGAD with acute or subacute abnormal neurological symptoms and/or exam findings [31–33]
- Established/diagnosed NMOSD:
  - To evaluate treatment response, if no improvement or clinically worsening (based on signs and/or symptoms)
  - New baseline when changing therapies
  - New signs or symptoms, or worsening of pre-existing neurological abnormalities, suggestive of recurrence or clinical worsening/new attack
- Initial workup for other suspected demyelinating diseases with acute or subacute abnormal neurological signs/symptoms and abnormal laboratory/cerebrospinal fluid (CSF) studies
- Established/diagnosed MOGAD or other demyelinating disease:
  - To evaluate treatment response, if no improvement or clinically worsening (based on signs and/or symptoms)
  - New signs or symptoms suggestive of relapse or clinical worsening

## *Other Autoimmune/Inflammatory Disorders*

Autoimmune/inflammatory conditions include N-methyl-D-aspartate receptor encephalitis (NMDAR), glial fibrillar acidic protein meningoencephalitis (GFAP), IgG related disease, paraneoplastic syndromes, neurosarcoidosis, CNS vasculitides (primary or secondary), Susac syndrome, systemic lupus erythematosus (SLE), granulomatosis with polyangiitis, Behcet's, autoimmune encephalitis, and others. All are typically diagnosed by clinical findings, imaging, labs, and/or CSF studies. [34–36]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**.

- Neurosarcoidosis [37,38]
  - Initial evaluation:
    - Suspected based on neurological sign/symptoms and lab work (ACE, CSF analysis)
    - Known history of sarcoidosis with new neurological signs or symptoms
  - Follow-up of known neurosarcoidosis:
    - To assess treatment response
    - Worsening signs or symptoms
- Granulomatosis with polyangiitis (GPA) (previously Wegener's granulomatosis) [39]
  - See **Combination Studies** for all indications

- Initial workup for other suspected autoimmune/inflammatory conditions (based on neurological symptoms and/or exam findings along with laboratory/CSF studies)
- Known autoimmune/inflammatory condition(s) and any ONE of the following:
  - To evaluate treatment response, if no improvement or clinically worsening (based on signs and/or symptoms), and imaging will change management
  - New signs or symptoms suggestive of recurrence or progression

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** and/or **Brain MRA**. Brain CT and/or Brain CTA is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Suspected primary or secondary CNS vasculitis based on neurological signs/symptoms with either infectious/inflammatory lab work (if suspected systemic disease) and/or completed CSF studies [40–42]

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain MRI** and/or **Brain MRA** and/or **Brain CTA** and/or **Neck MRA** and/or **Neck CTA**.

- Large vessel vasculitis
  - Giant cell (temporal) arteritis (GCA): cranial (headaches, temporal scalp tenderness, vision loss or diplopia, and jaw claudication) or extra-cranial (absent pulses and limb claudication from stenosis and/or aneurysms) signs/symptoms [43–45]
    - Workup for GCA when there is a high suspicion (patient ≥ 50, often elevated ESR and CRP, with cranial or extra-cranial signs/symptoms [44]
    - Suspected relapse and any ONE of the following:
      - Symptoms with increased inflammatory markers [43]
      - New ischemic events/worsening of disease related ischemia
      - Laboratory markers not reliable because of treatment related drugs (ie, IL-6 pathway blocking medications)
    - Patients with vision loss or atypical presentations [45]
    - For evaluation of vascular inflammation and/or to monitor structural damage when vascular imaging will alter management [43,44,46,47]
  - Takayasu's arteritis:
    - See **Combination Studies** for all indications

# Cognitive Impairment

## *Acute Altered Mental Status (AMS)*

Altered mental status is a term for acute or chronic disordered mentation including confusion, disorientation, lethargy, drowsiness, somnolence, unresponsiveness, altered behavior, agitation,

hallucinations, delusions, psychosis, and inattention. Causes of AMS are variable including systemic illness, psychiatric illness, toxic/metabolic, etc. Delirium is an acute form of AMS characterized by inattention/arousal that fluctuates and presents with disturbances in consciousness. Delusions and hallucinations are cardinal features of psychosis.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** or **Brain CT**.

- Acute altered mental status with suspected intracranial pathology based on symptoms (ie, delirium/altered consciousness) and/or abnormal neurological exam findings [48]

## *Mild Cognitive Impairment/Dementia*

IMAGING MODALITY: When any ONE of the following criteria are met, the preferred study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Mild cognitive impairment of unknown etiology with ALL of the following [49–52]:
  - Completed lab evaluation for reversible causes (including TSH, CBC, CMP, and B12) and if abnormal, has been treated (or is on treatment) and cognitive impairment persists [53–55]

    NOTE: Abnormal biomarker testing alone in asymptomatic patients is currently not an indication for neuroimaging.
  - Documented cognitive impairment by ONE of the following:
    - Abnormal formal neuropsychological testing that shows impairment in one or more domains (attention, language, visuospatial functions, episodic memory, executive functions, personality/behavior changes)
    - Abnormality on screening objective test such as (list is not all inclusive) [53,56–58]:
      - Montreal Cognitive Assessment (MoCA): score < 26/30
      - Mini-Mental Status Exam (MMSE): score < 26/30
      - General Practitioner Assessment of Cognition (GPCOG) < 5 [59]
      - Mini-Cog: score < 3/5 [58,60]
      - Memory Impairment Screen (MIS) ≤ 4 [59]
      - Saint Louis University Mental Status Examination (SLUMS): score < 27/30
      - Mini Addenbrooke's Cognitive Exam (M-ACE): Once with score < 22/30 or taken twice with < 26/30
      - Functional Activity Questionnaire (FAQ): score ≥ 9/30
      - Clinical Dementia Rating (CDR) ≥ 0.5
    - After evaluation by a dementia specialist with specific documentation of persistent cognitive decline in a previously highly educated/highly functioning individual (ie, no longer able to file a tax return or perform cognitive demands of job that the patient was previously able to perform) despite normal function on

cognitive screening test.

- Unusual behaviors such as disinhibition with hyperorality or hypersexuality and language abnormalities such as aphasia with concern for frontotemporal dementia [49,53]
- Concern for Lewy body dementia with TWO or more of the following: visual hallucinations, REM sleep-disorder, fluctuating cognitive impairment, and parkinsonism (these patients often have visuospatial abnormalities) [49,53]
- Rapidly progressive dementia with onset of dementia within 1-2 years of symptom onset [49]

  NOTE: Basic activities of daily living (eg, bathing, feeding, dressing, toileting, transfers) are impaired in dementia but preserved in mild cognitive impairment.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Functional Brain MRI**.

- Prior to surgery for biomarker mapping in neuropsychiatric diseases (eg, Alzheimer's disease and schizophrenia) [61,62]

### Alzheimer's Disease Treatment

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**.

- New CNS symptoms or suspected complications while on therapy
- Surveillance imaging for amyloid-related imaging abnormalities (ARIA) during anti-amyloid-β monoclonal antibody treatment as per FDA labeling for the medication the patient is receiving (no symptoms needed) [49,63,64]

## *Other* [53]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain FDG PET (CPT 78608)**. (See Evolent Clinical Guideline 2046 for Positron Emission Tomography (PET) Scan, PET Scan with Computed Tomography (CT) for Attenuation for additional indications such as when amyloid or dotatate (SSTR) tracers are needed (CPT codes 78811 and 78814)).

- To differentiate between Alzheimer's, dementia with Lewy body disease (DLB), frontotemporal lobal degeneration (FTD), and other neurodegenerative diseases AND ALL of the following criteria are met:
  - Brain MRI is insufficient or indeterminate
  - Objective impairment on a standardized memory assessment test (eg, MMSE/MOCA < 26) or formal neuropsychological test
  - Completed lab evaluation for reversible causes (including TSH, CBC, CMP, and B12) and if abnormal, has been treated (or is on treatment) and cognitive impairment persists [55]

## Congenital Abnormalities

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CT.** Brain MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Evaluation of craniosynostosis and other skull deformities seen on x-ray and/or exam [65]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Known craniosynostosis and any ONE of the following:
  - Suspected elevated intracranial pressure
  - Complex cases to assess surgical impact on brain development
  - Persistent neurocognitive concerns
- Macrocephaly evaluation in a patient 6-36 months of age and ONE of the following [66–68]:
  - Abnormal neurologic exam
  - Failure to meet developmental milestones

  NOTE: Patients < 6 months of age need an abnormal ultrasound AND meet one of the above criteria
- Evaluation of microcephaly and ONE of the following [69]:
  - Not proportionate to weight and height
  - Proportionate to weight and height and ONE of the following:
    - Neurological signs or symptoms
    - Worsening microcephaly
    - Family history of childhood neurologic disease (ie genetic and/or metabolic syndromes)
  - Once at 2 years of age if Brain MRI was done during infancy for microcephaly and was normal
  - Repeat imaging on case-by-case basis (if new neurological signs/symptoms)
- Cerebral palsy and ONE of the following [70]:
  - Once to establish diagnosis
  - One repeat after 2 years of age if initial MRI was normal but there are unexplained persistent motor abnormalities or other abnormal neurological exam findings
- See **Genetic Conditions** section for additional indications
- See **CSF Abnormalities** section for known or suspected hydrocephalus

- Child < 5 years of age with unexplained global developmental delay with microcephaly, macrocephaly, other abnormal neurological exam findings, epilepsy, or abnormal electroencephalogram (EEG) [71]
- Autism spectrum disorder and ONE of the following [72]:
  - Atypical regression
  - Micro or macrocephaly
  - Seizures and/or abnormal neurological exam findings
- High risk BRUE (age < 60 days, born < 32 weeks gestation, CPR needed, event lasted > 1 minute, more than 1 event) and ONE of the following [73,74]:
  - Concern for child abuse
  - Concern for central sleep apnea
  - Concern for seizures
  - Abnormal neurologic exam

  NOTE: Neuroimaging is not indicated for low risk BRUE, formerly apparent life-threatening event (ALTE).

## CSF Abnormalities

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Evaluation of CSF flow disorders (eg, Dandy-Walker malformations, hydrocephalus, arachnoid cysts, ventriculomegaly) [75,76]
- For diagnosis of suspected Chiari malformations with clinical symptoms and ONE of the following:
  - Short duration headaches (typically occipital or suboccipital) provoked by Valsalva-like maneuvers
  - Signs/symptoms of brainstem or cerebellar dysfunction (eg, nystagmus, dysphagia, sleep apnea, ataxia)
  - Signs/symptoms of cervical dysfunction (eg, muscle atrophy, abnormal motor or sensory exam) [77]
- Follow-up imaging for known Chiari malformations [75,78–80]
  - New or changing neurological symptoms and/or exam findings (eg, signs/symptoms suggestive of brainstem compression, hydrocephalus, syringomyelia, or new exertional headaches)
  - Concern for CSF flow blockage at the craniocervical junction (seen with syringomyelia/hydromyelia)
  - To determine if surgery is indicated
  - Pediatrics (< 18 years of age) during growth as clinically indicated

- Suspected or known CSF leak (spontaneous intracranial hypotension [SIH] or all secondary causes). SIH is suggested by orthostatic headache (absent or mild on waking, onset of HA within 2 hours of being upright, > 50% improvement after lying flat for 2 or more hours, and HA is consistent upon positioning) [81–85]:
    - Intermittent otorrhea, rhinorrhea, or otorhinorrhea (leak suspected from ear, nose, or leak through eustachian tube from petrous temporal bone fracture) AND positive Beta-2 transferrin or Beta-trace testing
    - For diagnosis/work-up of patients without intermittent otorrhea, rhinorrhea, or otorhinorrhea AND suspected spontaneous intracranial hypotension [82,83]
    - Follow-up for new or worsening symptoms (eg, orthostatic headache, dizziness or vertigo, nausea and vomiting, disequilibrium, muffled hearing/aural fullness, posterior neck pain)
    - Post dural puncture or spinal procedure headache when persistent at 1 week post-procedurally AND no resolution with blood patch [85]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** or **Brain CT.**

- Evaluation of suspected and known hydrocephalus:
    - Pediatrics (< 18 years of age), congenital or acquired [86,87]:
        - Concern for hydrocephalus in an infant with closed fontanelles
        - Concern for hydrocephalus in an infant with open fontanelles after abnormal ultrasound
        - Planning for CSF flow diverting procedure (shunt or endoscopic third ventriculostomy [ETV])
        - Follow-up after shunt placement, shunt revision, or ETV:
            - Immediate post-op for distal shunt revision
            - Asymptomatic surveillance after initial shunt placement: 6-12 weeks after initial shunt placement, then at 12-15 months, and then every 5 years
            - Asymptomatic surveillance after ETV: 6-12 weeks after ETV, and then at 12-15 months
            - Symptoms/exam findings concerning for shunt failure and/or complications (eg, headache [HA], vomiting, vision changes, loss of developmental milestones, papilledema, cranial nerve dysfunction)
    - Adults:
        - Once for suspected hydrocephalus (patients may have gait/balance issues, cognitive decline, urinary incontinence, or altered mental status but can be asymptomatic) [48,88]
        - Follow up of known hydrocephalus in adults and ONE of the following [88–90]:
            - Planning for CSF diverting procedures

- □ Concerns for shunt complications (eg, subdural hematoma)
- □ Symptoms/exam findings concerning for shunt failure (eg, HA, vomiting, vision changes, papilledema, cranial nerve dysfunction, gait imbalance, incontinence, cognitive changes)

- Normal pressure hydrocephalus (NPH) [89,91]:
  - For diagnosis/work-up of suspected NPH
  - Follow-up of known/treated NPH if concern for shunt failure or complications

## Headache [83,92–107]

Headaches (HA) can be primary (no structural abnormality) or secondary (eg, structural abnormality, underlying disease, substances, or other causes).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI.** Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Primary headache disorders (migraine with or without aura, tension-type, new daily persistent headache, and others including facial pains/other headache disorders) and ONE of the following:
  - New neurological symptoms or signs associated with the patient's primary headache (including but not limited to altered mental status, behavior change not attributed to psychiatric disorder, cranial nerve palsies, papilledema, vertigo, transient vision loss, binocular diplopia, pupil asymmetry)
  - Chronic primary headache disorders (eg, tension-type, stabbing, new daily persistent headache) with headaches for ≥ 3 months AND one of the following:
    - Progressive increase in frequency lasting over weeks to months
    - Progressive increase in severity/pain intensity
    - Pattern change (ie, headache now consistently side-locked and was not previously side-locked)
  - Once for trigeminal autonomic cephalalgia's (cluster headache, paroxysmal hemicrania, short-lasting unilateral neuralgiform headache attacks/SUNCT, hemicrania continua) as part of diagnostic workup to exclude secondary causes
  - Migraine and ONE of the following
    - Prolonged or persistent aura (lasting > 1 hour or does not completely resolve)
    - Chronic migraine (≥ 3 months) with progressive increase in frequency lasting over weeks to months,
    - Chronic migraine (≥ 3 months) with progressive increase in severity/pain intensity
    - Pattern change (ie, headache now consistently side-locked and was not previously side-locked)

        - Once for initial workup/diagnosis of hemiplegic or confusional migraine
    - Cyclical vomiting syndrome or abdominal migraine AND abnormal neurologic signs or symptoms [108]: Once for initial evaluation/workup
    - Other headaches/facial pains:
        - Occipital Neuralgia: Once, as part of initial workup [109]
        - Trigeminal neuralgia: Once, as part of initial workup [110–112]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** or **Brain CT.**

- Suspected secondary headache disorder (ie, concern for structural abnormality, inflammatory disorder, or infectious etiology) and any ONE of the following:
    - New onset headache (< 3 months) and any ONE of the following:
        - New neurological symptoms or signs (including but not limited to altered mental status, behavior change not attributed to psychiatric disorder, abnormal neurological exam, papilledema, vertigo, transient vision loss, homonymous hemianopia, binocular diplopia, pupil asymmetry)
        - Pregnancy or peripartum
        - Age ≥ 50 years and no prior workup
        - Immunocompromise
        - See **Trauma** for patients with new onset headache after trauma
        - See **Known Malignancy** for patients with known cancer history
    - Suspected intracranial hypertension (symptoms/signs can include papilledema, pulsatile tinnitus, 6$^{th}$ nerve palsy, HA worse on waking or in supine position, transient vision loss) (see **intracranial hypertension**)
    - Headache with fever and other systemic symptoms (ie, neck stiffness, decreased consciousness, or neurological deficit) when there is a documented concern for a possible infectious etiology
    - Suspected intracranial hypotension/orthostatic headache (see **CSF Abnormalities**)
    - See **Genetic Conditions** for additional indications
- Pediatrics (< 18 years of age)
    - Concern for physical abuse

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain CT.**

- Thunderclap HA (worst headache of a person's life) with ALL of the following:
    - Symptom onset started < 6 hours [113]

- Abrupt/acute onset with severe pain reaching maximum intensity rapidly (within 1 hour)
- Lasting > 5 minutes

- New headache (within 24 hours of symptom onset) associated with exercise, sex/orgasm, Valsalva maneuver (pressure increase caused by breath holding with closed airway), or Valsalva type activities (eg, cough, sneezing) and no prior imaging [92,95,102]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain CT** and/or **Brain CTA**.

- Thunderclap HA (worst headache of a person's life) with ALL of the following:
  - Symptom onset > 6 hours ago but less than 72 hours [113]
  - Brain CT not done within 6 hours of symptom onset
  - Suspected subarachnoid hemorrhage (SAH)
  - Abrupt/acute onset with severe pain reaching maximum intensity rapidly (within 1 hour)
  - Lasting > 5 minutes

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** and/or **Brain MRA** (or **Brain CTA).**

- Thunderclap HA (worst headache of a person's life) with ALL of the following:
  - Symptom onset > 72 hours but less than 3-4 weeks
  - Negative brain CT
  - Abrupt/acute onset with severe pain reaching maximum intensity rapidly (within 1 hour)
  - Lasting > 5 minutes
- New headache associated with exercise, sex/orgasm, Valsalva maneuver (pressure increase caused by breath holding with closed airway), or Valsalva type activities (eg, cough, sneezing) AND negative brain CT [92,95,102]
- See **reversible cerebral vasoconstriction syndrome (RCVS)** for those indications

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** and **Brain MRA**. Brain CT and Brain CTA is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Trigeminal neuralgia and ONE of the following:
  - Concern for microvascular compression
  - Planning for microvascular decompression surgery

# Infection

IMAGING MODALITY: When any ONE of the following criteria are met, the preferred study is **Brain MRI** or **Brain CT**.

- Intracranial abscess, encephalitis or cerebritis and ONE of the following:
  - Suspected with signs and symptoms of acute altered mental status, headache, fever, neurological deficits, vomiting, seizures and/or papilledema
  - Known: For clinical decline or lack of improvement after 1-2 weeks of treatment [114]
- Meningitis with positive signs and symptoms (eg, fever, headache, mental status changes, stiff neck, nuchal rigidity, Kernig's sign (pain elicited by passive knee extension), or Brudzinski's sign (hip/knee flexion elicited by passive neck flexion)) OR with positive lab findings (such as elevated white blood cells and/or abnormal CSF studies) [114–116]

  NOTE: Brain CT/MRI should be performed before lumbar puncture in patients with an immunocompromised state, history of central nervous system disease, new seizure within 1 week of presentation, papilledema, abnormal consciousness, or focal neurological deficit to exclude increased intracranial pressure that could result in brain herniation
- Endocarditis with suspected septic emboli [117]

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated, cannot be performed.

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes
- Suspected metastatic cancer (ie, findings consistent with metastatic cancer on non-brain imaging) and signs or symptoms of brain metastases
- Lesion (including bone tumor/abnormality or soft tissue mass) on prior imaging [118]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRS** or **Brain MRI** (including MR Perfusion sequences). When a prior MRI was done without perfusion sequences, either MRS or repeat Brain MRI with perfusion is indicated.

- For further evaluation of a brain lesion to distinguish a brain tumor from other non-tumor diagnoses (eg, abscess or other infectious or inflammatory process) when Brain MRI is indeterminate [119–123]

## *Known Malignancy*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated, cannot be performed, or there is a specific concern for an acute complication (such as hemorrhage, tumor-related edema, or midline shift).

- Any malignancy with signs or symptoms of brain metastases (such as headache, sensory deficits, memory problems), at any stage in treatment (initial, restaging, surveillance).

  NOTE: There does not need to be a neurologic deficit on exam for a patient with known malignancy.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Any malignancy with brain metastases or leptomeningeal metastases seen on other imaging
- For brain metastases (any malignancy) treated with surgery and/or radiation:
  - Surgical or radiation planning (when not performed in last 2 weeks)
  - Within 48 hours postoperatively (indicated in addition to pretreatment study)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated, cannot be performed, or is noted specifically below

- B-Cell Lymphomas [124,125]
  - Burkitt Lymphoma
  - HIV-Related B-Cell Lymphomas: (Brain CT is an alternative to Brain MRI)
  - Lymphoblastic Lymphoma
  - Post-Transplant Lymphoproliferative Disorders
  - Primary CNS Lymphoma
- Bone tumors [126]
  - Chordoma (Brain CT is indicated in addition to Brain MRI)
- Breast cancer: with suspicious CNS signs/symptoms, and as clinically indicated in patient with stage IV disease [127]

- Central Nervous System (CNS) Cancers (Adult or Pediatric) at one or more of the following intervals [119]:
  - Initial evaluation
  - Surgical or radiation planning (when not performed in last 2 weeks)
  - Within 48 hours postoperatively
- Choroid plexus tumors (benign choroid plexus papilloma, intermediate atypical choroid plexus papilloma, malignant choroid plexus carcinoma) [128,129]
- Gestational trophoblastic neoplasia or hydatidiform mole: When lung metastasis is present [130]
- Head and Neck Cancer: for high-risk histology (eg, mucosal melanoma, high-grade neuroendocrine carcinoma, or adenocarcinoma), or concern for skull base invasion from primary tumor [131]
- Histiocytic neoplasms [132]
  - Langerhans cell histiocytosis
  - Rosai-Dorfman Disease and Erdheim-Chester Disease (with Orbit MRI)
- Kidney cancer: as clinically indicated [133]
- Melanoma: Cutaneous [134]
  - Clinically positive lymph nodes (ie, palpable or detected by imaging and biopsy-proven)
  - Stage IIIB, IIIC, or IV disease
- Merkel Cell Carcinoma: with concern for direct extension of tumor to intracranial structures, or as clinically indicated [135]
- Multiple myeloma: with concern for CNS disease (eg, confusion, headache, weakness, cranial nerve palsies) [136]
- Neuroblastoma: as clinically indicated (with Orbit MRI; Brain CT is an alternative to Brain MRI) [137]
- Neuroendocrine tumors [138]:
  - Adrenocortical Carcinoma
  - Extrapulmonary poorly differentiated neuroendocrine tumors (neuroendocrine carcinoma [NEC], large cell carcinoma, small cell carcinoma, mixed neuroendocrine-non-neuroendocrine neoplasm [MiNEN]) (Brain CT is an alternative to Brain MRI)
  - Well-Differentiated Grade 1-2 Neuroendocrine Tumor of the Lung or Thymus
- Non-Small Cell Lung Cancer [139]
- Retinoblastoma (Brain CT is indicated in addition to Brain MRI)
- Small Cell Bladder Cancer (including mixed histology with any small cell component or neuroendocrine features) [140]

- Small Cell Lung Cancer
- Small Cell Neuroendocrine Carcinoma of the Cervix (NECC) [141]
- Soft Tissue Sarcoma [142]
  - Alveolar Soft Part Sarcoma (ASPS)
  - Angiosarcoma
  - Left sided cardiac sarcoma
  - Malignant Phyllodes Tumor of Breast
- Squamous Cell Skin Cancer: for primary tumors on the head with apparent bone involvement [143]
- T-Cell Lymphoma (Brain CT is an alternative to Brain MRI) [144]

  NOTE: Includes Anaplastic Large Cell Lymphoma (which may be breast implant-associated)
- Testicular Cancer [145]
  - Nonseminoma: as clinically indicated (eg, beta-hCG > 5000, extensive lung metastasis, predominance of choriocarcinoma, neurologic symptoms, non-pulmonary visceral metastases, or AFP > 10,000)
  - Pure seminoma: as clinically indicated (eg, beta-hCG > 5000, non-pulmonary visceral metastases, extensive lung metastasis, or neurologic signs/symptoms)
- Thyroid cancer [146]
  - Papillary, follicular, and oncocytic thyroid cancer: for distant metastatic disease or prior to starting systemic therapy (Brain CT is an alternative to Brain MRI)
  - Anaplastic thyroid carcinoma (Brain CT is an alternative to Brain MRI)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain FDG-PET, Brain MRS** or **Brain MRI** (including MR Perfusion sequences). When a prior MRI was done without perfusion sequences, either Brain FDG-PET, MRS, or repeat Brain MRI with perfusion is indicated.

- For prediction of tumor grade (to differentiate low grade vs. high grade glioma) when Brain MRI is indeterminate [119–123]
- To guide stereotactic or open biopsy, surgery, or other intervention when Brain MRI is indeterminate [119–123]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Functional Brain MRI**.

- Prior to surgery or radiation when mapping of functional (ie, language, sensory, motor) cortical centers is needed after Brain MRI is indeterminate [61,147–150]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CTA (which includes CT perfusion)** or **CT Perfusion (if Brain CTA is not planned)**.

- For the assessment of microvascular permeability in individuals with intracranial neoplasms [121,151]

## Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. 'Active treatment' includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), CAR T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: During active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg, chemotherapy, targeted therapy, or immunotherapy) is typically every 2-3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated, cannot be performed, or there is a specific concern for an acute complication (such as hemorrhage, tumor-related edema, or midline shift).

- Any malignancy with signs or symptoms of brain metastases (such as headache, sensory deficits, memory problems), at any stage in treatment (initial, restaging, surveillance).

  NOTE: There does not need to be a neurologic deficit on exam for a patient with known malignancy.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Any malignancy with brain metastases or leptomeningeal metastases seen on other imaging
- For brain metastases treated with surgery and/or radiation:
  - Surgical or radiation planning (when not performed in last 2 weeks)
  - Within 48 hours postoperatively (indicated in addition to pretreatment study)
  - 3-5 weeks postoperatively for radiation planning
  - 3-6 weeks after radiation

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated, cannot be performed, or is noted specifically below

- B-Cell Lymphomas [124,125]
  - Burkitt Lymphoma
  - HIV-Related B-Cell Lymphomas (Brain CT is also appropriate)
  - Lymphoblastic Lymphoma
  - Post-Transplant Lymphoproliferative Disorders: if CNS involvement suspected due to neurologic signs/symptoms, or as clinically indicated
  - Primary CNS Lymphoma
- Bone tumors [126]
  - Chordoma (Brain CT is indicated in addition to Brain MRI)
- Breast cancer: with suspicious CNS signs/symptoms, and as clinically indicated in patient with stage IV disease [127]
- Central Nervous System (CNS) Cancers (Adult or Pediatric): at one or more of the following intervals [119]:
  - Surgical or radiation planning (when not performed in last 2 weeks)
  - Within 48 hours postoperatively
  - 3-5 weeks postoperatively for radiation planning
  - 3-6 weeks after radiation
  - During systemic therapy
  - For known or suspected recurrence
- Choroid plexus tumors (benign choroid plexus papilloma, intermediate atypical choroid plexus papilloma, malignant choroid plexus carcinoma) [128,129]
- Gestational trophoblastic neoplasia or hydatidiform mole: When lung metastasis is present [130]
- Head and Neck Cancer: for high-risk histology (eg, mucosal melanoma, high-grade neuroendocrine carcinoma, or adenocarcinoma), CNS signs/symptoms, or concern for skull base invasion by primary tumor [131]
- Histiocytic neoplasms [132]
  - Langerhans cell histiocytosis
  - Rosai-Dorfman Disease and Erdheim-Chester Disease (with Orbit MRI)
- Kidney cancer: as clinically indicated [133]
- Melanoma: Cutaneous [134]
  - Stage IIB, IIC, or IIIA: as clinically indicated after surgery and prior to initiation of adjuvant therapy

- Stage IIIB, IIIC, or IV

- Merkel Cell Carcinoma: for neurologic signs or symptoms, concern for direct extension of tumor to intracranial structures, or otherwise as clinically indicated [135]
- Multiple myeloma: with concern for CNS disease (eg, confusion, headache, weakness, cranial nerve palsies) [136]
- Neuroblastoma: with neurologic sign/symptoms or as clinically indicated (with Orbit MRI; Brain CT is an alternative to Brain MRI) [137]
- Neuroendocrine tumors [138]:
  - Adrenocortical Carcinoma
  - Extrapulmonary poorly differentiated neuroendocrine tumors (neuroendocrine carcinoma [NEC], large cell carcinoma, small cell carcinoma, mixed neuroendocrine-non-neuroendocrine neoplasm [MiNEN]) (Brain CT is an alternative to Brain MRI)
  - Well-Differentiated Grade 1-2 Neuroendocrine Tumor in the Lung or Thymus
- Non-Small Cell Lung Cancer [139]
- Retinoblastoma: as clinically indicated
- Small Cell Bladder Cancer (including mixed histology with any small cell component or neuroendocrine features) [140]
- Small Cell Lung Cancer
- Small Cell Neuroendocrine Carcinoma of the Cervix (NECC) [141]
- Soft Tissue Sarcoma [142]
  - Alveolar Soft Part Sarcoma (ASPS)
  - Angiosarcoma
  - Left sided cardiac sarcoma
  - Malignant Phyllodes Tumor of Breast
- Squamous Cell Skin Cancer: for primary tumors on the head with bone involvement [143]
- T-Cell Lymphoma (Brain CT is an alternative to Brain MRI) [144]

  NOTE: Includes Anaplastic Large Cell Lymphoma (which may be breast implant-associated)
- Testicular Cancer [145]
  - Nonseminoma: as clinically indicated (eg, beta-hCG > 5000, extensive lung metastasis, predominance of choriocarcinoma, neurologic symptoms, non-pulmonary visceral metastases, or AFP > 10,000)
  - Pure seminoma: as clinically indicated (eg, beta-hCG > 5000, non-pulmonary visceral metastases, extensive lung metastasis, or neurologic signs/symptoms)
- Thyroid cancer [146]

- Papillary, follicular, and oncocytic thyroid cancer: for persistent or recurrent locoregional disease, distant metastatic disease, prior to starting systemic therapy, or with CNS signs/symptoms (Brain CT is an alternative to Brain MRI)
- Anaplastic thyroid carcinoma (Brain CT is an alternative to Brain MRI)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain FDG-PET, Brain MRS** or **Brain MRI** (including MR Perfusion sequences). When a prior MRI was done without perfusion sequences, either Brain FDG-PET, MRS, or repeat Brain MRI with perfusion is indicated.

- For prediction of tumor grade (to differentiate low grade vs. high grade glioma) when Brain MRI is indeterminate [119–123]
- To guide stereotactic or open biopsy, surgery, or other intervention when Brain MRI is indeterminate [119–123]
- To help differentiate pseudoprogression, radiation-induced necrosis, or progression when Brain MRI is indeterminate [119–123]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Functional Brain MRI**.

- Prior to surgery or radiation when mapping of functional (ie, language, sensory, motor) cortical centers is needed after Brain MRI is indeterminate [61,147–150]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CTA (which includes CT perfusion) or CT Perfusion (if Brain CTA is not planned)**.

- For the assessment of microvascular permeability in individuals with intracranial neoplasms [121,151]

## Surveillance

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

Refer to the **Cancer Surveillance Table** for cancer-specific indications. Additionally, the below indications apply to all malignancies.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Follow-up and surveillance of treated brain metastases from any type of primary cancer [119]
  - Every 2-3 months for 1-2 years then
  - Every 4-6 months indefinitely

    NOTE: Imaging to evaluate emergent signs/symptoms is appropriate at any time.
- Follow-up and surveillance of treated leptomeningeal metastases from any type of primary cancer [119]
  - Every 2-3 months for 2 years then
  - Every 6 months for 3 additional years then
  - Annually indefinitely after year 5

    NOTE: Imaging to evaluate emergent signs/symptoms is appropriate at any time.

## Movement Disorders

Parkinsonian syndromes are a group of movement disorders characterized by motor symptoms of tremor, rigidity, postural instability, and bradykinesia with additional clinical presentation depending on the etiologies. Parkinson's disease (idiopathic Parkinsonism) is characterized by progressive degeneration of the dopaminergic neurons in the substantia nigra/striatum. Atypical Parkinsonian disorders include progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD), and dementia with Lewy bodies. [152,153]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Once during evaluation of atypical Parkinsonian (to exclude a secondary cause) [152,154]:
  - Atypical features include but are not limited to rapid disease progression, early gait instability, absence or paucity of tremor, irregular jerky tremor, unresponsive to dopaminergic medication, abnormal eye movements, and apraxia [153]
- Chorea with suspicion for Huntington disease (HD) [152]
- Suspected Creutzfeldt-Jakob disease [152]
- Suspected Amyotrophic Lateral Sclerosis (ALS) [152]
- Hemifacial spasm (CN VII) [110,112]:
  - For initial workup/diagnosis to exclude secondary structural etiologies

NOTE: For Differential diagnosis of degenerative from nondegenerative parkinsonism or from essential tremor the indicated study is DAT-SPECT (see Evolent Clinical Guideline 2052 for Radiopharmaceutical Tumor Localization)

NOTE: MRI Imaging is not indicated in essential tremor, Tourette's syndrome, or isolated focal dystonia (such as blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia) [154,155]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** and **Brain MRA**. Brain CT and Brain CTA are appropriate only when the preferred studies are contraindicated or cannot be performed

- Evaluate for microvascular compression in Hemifacial spasm and/or for consideration of microvascular decompression surgery

## Neuroendocrine Dysfunction

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**.

- Suspected pituitary adenomas/hormone dysfunction (ie, hormone deficiency [hypopituitarism] or hormone excess [hyperpituitarism]) [138,156–170]
    - Central adrenal insufficiency: morning 8 am cortisol < 4 ug/dL and plasma ACTH < 10 pg/mL [171]
    - Growth hormone (GH) deficiency: Lab tests include random GH, IGF-1, IGFBP-3, and/or peak GH level on growth hormone stimulation tests (GHST). Screening IGF-1 > 0 (ie, mean standard deviation score (SDS)/z-score set at 0) at any age makes GH deficiency unlikely [166–168,172–174]
        - Children (suspected based on growth deceleration, small for gestational age without catch up growth by 2 years of age, delayed bone age, or poor growth/short stature) and any ONE of the following:
            - Newborn/neonates:
                - Random GH level < 7 ng/mL (μg/L) during hypoglycemic episode, or in infants with recurrent hypoglycemia, midline defects, and microphallus
                - Random GH level < 5 ng/mL (μg/L) and additional pituitary hormone deficiencies
            - Infant:
                - Short stature, low height velocity, low IGF-1, low IGFBP-3, and multiple pituitary hormone deficiencies
            - Children/pediatric:
                - Short stature, low height velocity, and multiple (three or more) pituitary hormone deficiencies
                - Peak GH level < 3 ng/mL (μg/L)
                - Peak GH level < 10 ng/mL (μg/L) on two GHSTs (growth hormone stimulation tests)
        - Adults and ONE of the following:

- Panhypopituitarism (three or more pituitary hormone deficiencies) and low IGF-1 (SD ≤ -2 the set mean of zero)
- Peak GH level < 5 ng/mL (μg/L) after insulin tolerance test (ITT)

- Central hypothyroidism: Low thyroxine (FT4) with normal thyroid stimulating hormone (TSH) [161]
- Central diabetes insipidus/Vasopressin deficiency with polyuria (high serum osmolarity (> 295 mOsmol/L) and urine osmolarity > 600 mOsmol/L (urine osmolarity/plasma osmolality ratio should be 2 or greater)) [161]
- Panhypopituitarism: deficiency of most or all pituitary hormones (ie, GH, prolactin, adrenocorticotropin hormone [ACTH], follicle stimulating hormone [FSH], luteinizing hormone [LH], TSH, oxytocin, vasopressin/antidiuretic hormone [ADH])
- Secondary/central hypogonadotropic hypogonadism:
  - Males [159,161,169,170]:
    - Testosterone < 150 ng/dL
    - Testosterone 150 – 400 ng/dL with low or normal LH and FSH and elevated prolactin
  - Women [160,161]:
    - Estradiol < 200 pmol/L with normal LH/FSH and amenorrhea for 3 months or longer
- Hyperprolactinemia [156,165]:
  - Prolactin: 20-200 ng/mL for men and 25-200 ng/mL for women
    - Repeated assay confirms elevated prolactin and ALL of the following:
      - Normal TSH, FT4, BUN, Cr, and LFTs

        NOTE: (primary hypothyroidism, renal insufficiency, and liver failure elevate prolactin)
      - Not pregnant
      - Not on antipsychotics OR prolactin > 10 x upper limits of normal (ULN) on anti-psychotic medications
  - Prolactin: > 200 ng/mL, once to establish diagnosis
- Microprolactinomas (<10 mm)
  - Untreated:
    - 1 year after diagnosis, optional, to ensure stability
    - If suspected growth (based on changing pituitary dysfunction labs, rising prolactin, or new clinical symptoms)
  - Surgical planning when microadenomas are near optic chiasm
  - On medical therapy:

- 1 year after diagnosis, optional, to ensure stability
- For suspected growth (based on changing pituitary dysfunction labs, rising prolactin or new clinical symptoms)
- To assess for residual adenoma when cessation of dopamine agonists is being considered

- Macroprolactinomas (≥ 10 mm)
  - Assess response to surgery:
    - New baseline 3-6 months after surgery
    - Concern for post-op complications and < 6 months since surgery
    - Partial resection AND only partial response to dopamine agonists: every 6-12 months
    - Partial resection AND good response to dopamine agonists: for rising prolactin, new pituitary hormone dysfunction, or new symptoms (eg, vision changes, headaches)
    - Complete resection: for rising prolactin, new pituitary hormone dysfunction, or new symptoms (eg, vision changes, headaches)
  - Assess response to medical therapy:
    - 3-6 months after starting treatment
      - Treatment responsive (shrinkage on MRI and normalized prolactin levels, typically within 6 months of starting treatment):
        - For rising prolactin, new pituitary hormone dysfunction, or new symptoms (eg, vision changes, headaches)
      - Treatment-resistant:
        - 3-6 months after starting treatment AND at 1 year
        - After 1 year: for rising prolactin, new pituitary hormone dysfunction, or new symptoms (eg, vision changes, headaches)
      - Treatment-resistant and close proximity to the optic chiasm (abutting the chiasm):
        - Annually for the first 3 years
        - Then for rising prolactin, new pituitary hormone dysfunction, or new vision changes (ie, vision loss, visual field loss, optic atrophy)
      - New baseline if considering stopping dopamine agonists (absence of residual adenoma means less chance of recurrence)
- Central hyperthyroidism: TSH normal or elevated AND high free thyroxine (FT4). Free or total T3 often elevated [165]
- Cushing's Disease [161,162,165]:
  - Elevated cortisol (hypercortisolism established on initial screening tests) AND ACTH > 20 pg/mL

- If ACTH < 20 pg/mL, then (see Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging)

- Acromegaly [156,158]:
  - Elevated IGF-1
  - Borderline elevated/equivocal IGF-1 AND GH > 1 µg/L on 2-hour oral glucose tolerance test
- Central precocious puberty [163,164,175]:
  - Physical signs (tanner staging) of breast development in girls ≤ 8 years and testicular enlargement in boys ≤ 9 years and ONE of the following:
    - Bone age > 2 SD above chronological age
    - Biochemical evidence:
      - Ultrasensitive basal LH ≥ 0.25 IU/L for girls with Tanner B2 (palpable breast bud under areola) and for boys, or basal LH ≥ 0.3 IU/L for girls with Tanner B3 (palpable breast tissue outside areola)
      - Stimulated testing with gonadotropin releasing hormone (GnRH), GnRH-stimulated LH ≥ 5 IU/L
        - Girls < 6 years of age and boys < 8 years of age without CNS symptoms (eg, headaches, seizures, and/or visual field deficits), or any age with CNS symptoms (eg, headaches, seizures, and/or visual field deficits)

- Known pituitary microadenomas (< 10 mm) [156,165]:
  - Non-functional (non-hormone secreting) and ONE of the following:
    - 12 months after initial diagnosis to ensure stability
    - New symptoms or new pituitary hormone dysfunction
  - Functional (hormone secreting) and ONE of the following:
    - Assess response to treatment, typically 3-6 months after starting therapy
    - Rising/changing hormone levels or new symptoms
    - 12 months after initiation of drug holiday
- Known pituitary macroadenomas (> 10 mm) [156,157]:
  - Non-functional (non-hormone secreting) and ONE of the following:
    - Unresected: every 6 months
    - Resected (partial and/or complete): new baseline at 3-6 months post-op, then if change in pituitary hormone levels and/or new symptoms
    - Mass effect symptoms: visual field defects (typically bitemporal hemianopsia or junctional scotoma), vision loss, headache, or symptoms of hormone dysfunction/syndromes
  - Functional (hormone secreting) and ONE of the following:

- Assess response to treatment, typically 3-6 months after starting therapy
- Rising/changing hormone levels or new symptoms
- 12 months after initiation of drug holiday
- Resected (partial and/or complete): new baseline at 3-6 months post-op, then if change in pituitary hormone levels and/or new symptoms
- Mass effect symptoms: visual field defects (typically bitemporal hemianopsia or junctional scotoma), vision loss, headache, or symptoms of hormone dysfunction/syndromes

- Hypophysitis [34,176]:
  - Suspected disease
  - Evaluate treatment response and imaging will change management

## *Other Structural Abnormalities (Pituitary Incidentalomas)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated, cannot be performed or on a case-by-case basis to evaluate for hemorrhage or calcifications, or for surgical planning to evaluate bony anatomy.

- Pineal cyst and ONE of the following [177]:
  - Known pineal cyst with prior ventriculostomy for hydrocephalus: follow-up imaging at 3 months, 12 months, and 36 months post-operatively
  - Symptoms of increased intracranial pressure (ICP) or hydrocephalus (eg, headaches, gaze paresis, papilledema, Parinaud syndrome, nausea/vomiting)
  - Incidental known cysts in children (< 18 years): once 1-2 years after initial diagnosis to evaluate for stability
  - Atypical (multiloculated, enhancing, presence of solid component) cyst: follow-up at 1 year, 3 years, and then 5 years after diagnosis
- Rathke cleft cyst [178–180]:
  - Symptomatic patients (eg, headache, visual changes, pituitary hormone dysfunction):
  - Surgical planning
  - Surveillance:
    - Cyst < 5 mm: follow-up imaging at 2-3 years, if stable, then repeat imaging as clinically indicated (eg, visual changes, pituitary hormone dysfunction)
    - Cyst > 5 mm and > 5 mm from optic chiasm: follow-up imaging at 1 year
      - Stable, then repeat in 2-3 years, and then as clinically indicated (eg, visual changes, pituitary hormone dysfunction)
      - Unstable/growth, then repeat imaging every 1-2 years until stable, and then 2-3 years if stable, and then as clinically indicated (eg, visual changes, pituitary hormone dysfunction)

        - Cyst > 5 mm and < 5 mm from optic chiasm: follow-up imaging at 6-12 months
            - Stable, then repeat in 2-3 years, and then as clinically indicated (eg, visual changes, pituitary hormone dysfunction)
            - Unstable/growth, then repeat imaging every 1-2 years until stable, then then 2-3 years if stable, and then as clinically indicated (eg, visual changes, pituitary hormone dysfunction)
- Arachnoid cyst [181,182]:
    - Symptomatic patients (eg, headache, seizures, altered mental status, imbalance, cranial nerve deficits) with symptoms vary based on location, size, and mass effect.
    - Resected: at 3-6 months post-operatively, then yearly for 2-5 years
    - Unresected: at 6-12 months after initial diagnosis, then annual follow-up, then as clinically indicated (based on neurological signs/symptoms)
- Midline dermoid cysts/sinuses [183,184]:
    - Concern for intracranial extension
    - Pre-operative planning
- Pituitary apoplexy [185]:
    - Suspected: Pituitary hormone dysfunction and/or symptoms (eg, acute onset headache, vision loss, visual field deficits, oculomotor palsies)
    - Known: Post-surgery or several months after diagnosis (to evaluate for underlying tumor/adenoma or determine permanence of a defect)
- Craniopharyngioma [138,186–188]:
    - Suspected, to confirm diagnosis, after clinical and laboratory workup
    - Surgical planning
    - Weekly during radiation treatment, if needed to adjust treatment field
    - Surveillance after treatment (surgery/radiation):
        - At 3 months post-operatively, then every 3 months for 1 year, and then every 6-12 months for 2 years
    - New pituitary hormone dysfunction or new symptoms (eg, headache, vision changes)

## Seizure Disorder [189,190]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- New onset of an unprovoked seizure [190]

  NOTE: An unprovoked seizure is a seizure that occurs without any identifiable cause or trigger such as trauma, high fever, infection, drug and alcohol withdrawal, a reaction to medication, significant electrolyte imbalance, or low blood sugar (hypoglycemia)

- Newly identified change in seizure activity/pattern [190]
- Known seizure disorder with no prior brain imaging [190]

  NOTE: MRI is indicated if not previously performed when prior imaging was with CT rather than MRI
- Medically refractory epilepsy AND documented compliance with medications [190,191]
- Syncope with documented clinical concern for new unprovoked seizure disorder as the cause [192]
- Initial work-up for new afebrile seizure in children with no history of epilepsy except for benign epilepsy syndromes (see note below) [193]
- Abnormal EEG suggestive of structural/focal abnormality [190]
- Complex febrile seizures (defined as seizures that last > 15 minutes and recur more than once in 24 hours) in children accompanied by ANY of the following [189,194]:
  - Abnormal neurologic exam findings
  - Autism, cerebral palsy or developmental delay
  - Focal seizure onset (defined as those with onset limited to one hemisphere of the brain, and include focal aware seizures (retained awareness) and focal impaired awareness seizures (formerly known as complex partial seizures))
  - Postictal Todd's paralysis (when a seizure is followed by a brief period of temporary paralysis)
  - Abnormal EEG
- Assessment of suitability for surgical management [189,190]
- If needed prior to discontinuation of antiepileptic drugs (AEDs) or resuming driving

NOTE**:** Advanced imaging is not indicated for simple pediatric febrile seizures which include all of the following [189]: Children 6 months – 5 years old, fever > 100.4ºF, generalized (non-focal), lasts < 15 minutes, and does not recur within 24 hours.

Advanced imaging is also not indicated for pediatric benign epilepsy syndromes/idiopathic focal or generalized epilepsy with typical features such as: Childhood absence epilepsy (JAE), Benign epilepsy with centrotemporal spikes (BECTS) also known as Benign Rolandic Epilepsy (BRE), Juvenile absence epilepsy (JAE), Juvenile myoclonic epilepsy (JME), and benign epilepsy of childhood with centrotemporal spikes (BECCT). [189,195]

IMAGING MODALITY: When the following criteria are met, the indicated study is **functional Brain MRI**.

- Pre-operative evaluation for epilepsy surgery [61,196,197]

## Trauma [198]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain CT**. Brain MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Acute head trauma (< 7 days prior) **with** loss of consciousness or post-traumatic amnesia and ONE of the following:
  - Age > 60 years
  - Physical evidence of trauma above the clavicle
  - Post-traumatic seizure
  - Drug or alcohol intoxication
  - Deficits in short-term memory
  - New headache
  - Vomiting
  - Focal neurologic exam abnormality
  - GCS < 15
  - Coagulopathy or bleeding diathesis (disease condition or medication related)
- Acute head trauma (< 7 days) **with no** loss of consciousness or post-traumatic amnesia and ONE of the following:
  - Age ≥ 65 years
  - Physical signs of a basilar skull fracture
  - A dangerous mechanism of injury (eg, ejection from a motor vehicle, a pedestrian struck by a vehicle, or a fall from a height of > 3 feet or 5 stairs)
  - New severe headache
  - Vomiting
  - Focal neurologic exam abnormality
  - GCS < 15
  - Coagulopathy or bleeding diathesis (disease condition or medication related)
- Short-term follow-up imaging for acute head trauma and ONE of the following [199,200]
  - New or progressive neurologic exam findings
  - Positive/abnormal finding(s) on initial imaging (ie, hemorrhage)
- Sub-acute head trauma with gradual onset of neurological signs/symptoms AND concern for subdural hematoma/hemorrhage
- Head trauma (within 3 months of trauma) with suspected CSF leak
- Pediatric (< 16 years of age) head trauma when none of the above apply [201,202]

- < 2 years of age with ONE of the following:
  - Loss of consciousness for 5 seconds or longer
  - Abnormal behavior per parent
  - Signs of any palpable skull fracture
  - Severe mechanism of injury (falling from heigh > 3 feet, high-speed MVA, struck by high-impact object)
  - Altered mental status
  - GCS < 15
  - Abnormal neurological exam
- ≥ 2 years of age with one of the following:
  - Loss of consciousness
  - Vomiting
  - Severe headache
  - Signs of basilar skull fracture
  - Severe mechanism of injury (falling from height > 3 feet, high-speed MVA, bicycle crashes without helmet, struck by high-impact object)
  - Altered mental status
  - GCS < 15
  - Abnormal neurological exam
- Suspected child abuse, any age

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI.** Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Post-concussive syndrome when symptom (eg, headache, dizziness, difficulty concentrating/performing mental tasks, memory changes) duration is either disabling or lasts beyond 30 days [198,199,203,204]
- Persistent neurological exam abnormalities not explained by CT [199,200]
- Subacute (< 3 months) or chronic (> 3 months) head trauma with unexplained cognitive or neurologic abnormalities

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CTA** or **Brain MRA**.

- Evaluation of suspected vascular injury based on abnormality seen on prior imaging (CT/MRI) or with the clinical risk factors listed below:
  - Neurologic abnormality that is unexplained by a diagnosed injury

- Epistaxis from a suspected arterial source
- Asymptomatic patients with any of the following risk factors:
  - Severe head trauma (GCS 3–8) or penetrating injury
  - Petrous bone, skull base, Lefort II or III fractures
  - Diffuse axonal injury (seen on MRI)
  - Cervical spine fracture with fracture of C1 to C3 or fracture through the foramen transversarium
  - Cervical spine fracture with subluxation or rotational component

# Vascular Disease [40,41]

## *Aneurysm*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain CTA** or **Brain MRA**.

- Asymptomatic aneurysm screening based on risk:
  - Two or more first-degree family members (parent, brother, sister, or child) with a known intracranial aneurysm (ruptured or unruptured) [40,205,206]:
    - For initial screening
    - Every 5 years if negative [205]
  - One first-degree family member with a known ruptured intracranial aneurysm:
    - At age 40 and again at age 55 if initial screen was negative [205,207]

    NOTE: Screening for patients with one family member with an unruptured intracranial aneurysm (no family history of ruptured aneurysms) is NOT indicated [207]
  - One time screen for patients with coarctation of the aorta [40,205–210]

  NOTE: See **Genetic Conditions** for additional indications.
- Symptomatic aneurysm or intracranial pseudoaneurysm, suspected or known [205,206,211]:
  - New neurological symptoms or exam findings suggestive of ruptured intracranial aneurysm (eg, rapid/abrupt onset of severe/maximum intensity headache, new abnormal neurological exam findings, binocular diplopia, visual field defects)
- Follow-up of asymptomatic known aneurysms or intracranial pseudoaneurysm (saccular or fusiform) [211]:
  - Untreated: at 6-12 months, and then every 1-2 years if stable [40,206]
    - If growth of 0.5 mm over 36-month interval, then more frequent imaging is indicated [206]
  - Treated (surgical clipping or endovascular techniques): at 6-12 months after treatment, and then every 1-2 years [40,206]
  - Treatment planning (surgery, endovascular treatments)

- Traumatic intracranial pseudoaneurysm suspected but initial angiography negative, one follow-up to avoid missed diagnosis (1 week – 12 months post-injury) [211]

## *Hemorrhage*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CT** or **Brain MRI**.

- Evaluation of suspected acute subarachnoid or intraparenchymal hemorrhage [41,212,213]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** (or **Brain CT**) and/or **Brain MRA** (or **Brain CTA**).

- Follow-up of known intraparenchymal or subarachnoid hemorrhage or hematoma if needed to reassess rate of expansion, mass effect, edema, or guide management [41,212]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI**.

- Follow-up of known cerebral intraparenchymal hemorrhage to evaluate for low flow vascular malformation as the underlying cause [41,212]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CTA** or **Brain MRA**.

- Follow-up of known cerebral intraparenchymal hemorrhage to evaluate for high flow vascular malformation as the underlying cause

## *Malformation [41,214]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated, cannot be performed, or in emergency situations when there is concern for an acute hemorrhage.

- Suspected cerebral cavernous malformations (CCM) and other low flow vascular malformations (eg, cavernomas, dural venous anomalies (DVA) and capillary telangiectasias) or high flow vascular malformations [40,41]
- Screening in asymptomatic patients that carry a known familial mutation (ie, pathogenic variant in 1 of the 3 known genes: KRIT1[CCM1], CCM2, PDCD10 [CCM3]) [215]
- Known low flow CCM [215]:
  - New neurological symptoms or neurological exam abnormalities
  - Follow up surveillance imaging can be considered on a case-by-case basis to document stability in patients with a prior bleed or enlargement on prior imaging studies [215,216]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** and/or **Brain MRA** or **Brain CTA**.

- Suspected high flow vascular malformations (AVM, AVF, and dural AV fistulas [dAVF])
- Suspected hemorrhage/stroke from malformation
- Known untreated high flow malformation:
  - New neurological symptoms or neurological exam abnormalities
  - Follow up surveillance imaging can be considered on a case-by-case basis to document stability in patients with a prior bleed or enlargement on prior imaging studies
- Treatment planning for planned invasive intervention (low or high flow malformations)
- Treated malformations (resection, embolization, radiosurgery): post-operatively, then annually for 5 years to evaluate for regrowth/recurrence, and then as clinically indicated (ie, new neurological signs/symptoms) [215]

### *Stroke [41,212]*

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain CT** (or **Brain MRI**) and **Brain and Neck CTA** (or **Brain MRA** and **Neck MRA**).

- Suspected stroke or transient ischemic attack and ONE of the following:
  - Acute/new, possibly fluctuating, abnormal neurological symptoms
  - Exam findings such as sensory abnormalities, motor weakness, speech difficulties, visual loss, lack of coordination, or mental status changes [40,41,212]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**.

NOTE: If Brain CT has recently been performed, there needs to be a clinical progression of symptoms.

- Suspected stroke AND initial CT brain negative AND requested within 48 hours of onset of symptoms [217]
- Concern for ongoing ischemia [212]
- History of stroke with no prior imaging and ONE of the following [212,217]:
  - Once, to confirm diagnosis
  - Once, to guide secondary prevention management
- Screening for silent strokes, in patients with suspicion for unrecognized cerebrovascular disease with focal neurological symptoms and/or cognitive decline, and imaging will change management [218,219]

  NOTE: See **Genetic Conditions** section for additional indications (including for HbSS

sickle cell disease or HbSβ0 thalassemia)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRA** or **Brain CTA**.

- To evaluate the extracranial vertebrobasilar system, atherosclerotic burden, dissection, Moyamoya, and other vasculopathies that would alter management and/or guide management of risk factors

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain CTA (which includes CT perfusion)** or **CT Perfusion (if Brain CTA is not planned)**.

- For early detection of acute cerebral ischemia and infarct to determine the appropriateness of an intervention or procedure [220]
- Concern for hemorrhagic transformation in a patient with recent acute ischemic stroke [220]
- Differentiating stroke mimics (eg, seizure/epilepsy, migraine with aura, brain tumors, metabolic abnormalities, infectious encephalopathy) from acute stroke (post MRI or MRI is contraindicated) and will guide treatment [220,221]

## *Systemic Vascular Disease*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies can include any combination of the following: **Brain and Neck CTA, Brain CTA, Neck CTA,** or both **Brain MRA** and **Neck MRA.**

- For patients with fibromuscular dysplasia (FMD) [222,223]:
  - One-time evaluation (see **Combination Studies** section for additional studies)
  - New neurological signs or symptoms
- Spontaneous coronary arteries dissection (SCAD) [224]:
  - One-time evaluation (see **Combination Studies** section for additional studies)
- Subclavian steal syndrome when ultrasound is positive or indeterminate OR for planning interventions [225,226]

## *Other [227]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies can include any combination of the following: **Brain and Neck CTA**, **(**or **Brain CTA** and/or **Neck CTA)**, **Brain MRA**, and/or **Neck MRA**.

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or imbalance [228]
- Known asymptomatic severe (>70%) carotid stenosis for treatment planning [212,229]

- Follow-up of known carotid or vertebral artery dissection or extracranial (cervical or vertebral) pseudoaneurysm (also called dissecting pseudoaneurysm or false aneurysm) and ONE of the following [212,230–233]:
    - Traumatic dissection:
        - At 7 days, and 3 - 6 months post dissection
    - Non-traumatic dissection:
        - Once, 3 - 6 months post dissection
    - When documentation is provided that the results will be used to guide anticoagulation treatment (anticoagulant or antiplatelet therapy is continued until complete or stagnant healing has occurred)

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain CT** (or **Brain MRI**) and **Brain and Neck CTA, (**or **Brain CTA** and/or **Neck CTA)**, **Brain MRA,** and/or **Neck MRA**.

- Suspected carotid or vertebral artery dissection (spontaneous or secondary to trauma) [41,198,212,230,231,234]
- Follow-up of known carotid or vertebral artery dissection or extracranial (cervical or vertebral) pseudoaneurysm (also called dissecting pseudoaneurysm or false aneurysm) [212,230–233]:
    - If recurrent neck pain, headache, or new neurologic exam findings that suggest progression and/or intracranial complications

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain MRI** (includes internal auditory canal views when needed), **Brain and Neck CTA** (or **Brain CTA** and/or **Neck CTA)**, **Brain MRA,** and/or **Neck MRA**.

- Pulsatile tinnitus to identify suspected intracranial and/or arterial vascular etiologies (eg, dissection, fistula, glomus tumors/paragangliomas, dAVF, AVM, aberrant ICA, dehiscent jugular foramen, persistent stapedial artery) [7,9,10]

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain MRI** and **Brain MRA** or **Brain CTA**.

- Differentiate primary/idiopathic intracranial hypertension (previously pseudotumor cerebri syndrome) from secondary (eg, venous sinus thrombosis, mass, hydrocephalus, medications, other medical conditions) causes of elevated intracranial pressure [235–237]:
    - Suspected idiopathic intracranial hypertension (IIH) and ONE Of the following:
        - Documented papilledema (by ophthalmology, neurology, or neuro-ophthalmology)
        - Sixth nerve palsy thought to be from elevated intracranial pressure, but otherwise

normal neurological exam

- Opening pressure ≥ 250 mm CSF in adults or ≥ 280 mm CSF in pediatrics (<18 years of age or less, or ≥ 250 mm CSF if pediatric patient is not obese AND not sedated) with otherwise normal CSF studies

- Recurrent/relapsed idiopathic intracranial hypertension and ALL of the following:
  - Precipitating factors for high intracranial pressure (ICP) such as weight gain or medications
  - Symptoms suggestive of high intracranial pressure (eg, binocular diplopia, transient vision loss, positional headache, pulsatile tinnitus, neck/back/shoulder pain) or recurrent papilledema
- Focal neurologic exam abnormalities

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain CTA.**

- Suspected cerebral vasospasm after subarachnoid hemorrhage [40]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** (or **Brain CT**)**,** and/or **Brain MRA** (or **Brain CTA**)**.**

- Suspected reversible cerebral vasoconstriction syndrome (RCVS), persistent disease (lack of resolution after 3 months), or recurrence (ie, new neurological signs and/or symptoms) [83,102,107,238]
- Suspected central venous thrombosis to confirm diagnosis [212,239]
- Known central venous sinus thrombosis [212,239]:
  - Signs/symptoms suggestive of progression/propagation of thrombosis
  - Considering endovascular therapy
  - 3 - 6 months after diagnosis to evaluate for recanalization

  NOTE: Follow-up CTA or MRA to guide duration of anti-coagulation can be considered on a case-by-case basis. [239]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CTA** or **Neck MRA.**

- Carotid stenosis and any ONE of the following:
  - Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (eg, carotid stenosis ≥ 70%, technically limited study) [212,229]
  - Symptomatic patients and ONE of the following:
    - ≥ 50% stenosis on ultrasound
    - Equivocal ultrasound findings due to significant calcification, arterial tortuosity, or other findings

- Treatment/revascularization procedure planning
- Suspected restenosis following treatment and abnormal or indeterminate ultrasound

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** and/or **Brain MRA.** Brain CT and/or Brain CTA are appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected Moyamoya vasculopathy [41,240]
- Known Moyamoya with new or changing neurological signs and/or symptoms [41,240]

  NOTE: Moyamoya disease (MMD) is a chronic non-inflammatory steno-occlusive disease. Moyamoya syndrome is MMD associated with other vasculopathy comorbidities and/or systemic diseases such as autoimmune diseases (systemic lupus erythematosus [SLE], polyarteritis nodosa [PAN], Sjogren's, antiphospholipid antibody syndrome [APS]), sickle cell, Down syndrome, NF1, brain tumors, meningitis

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** (may be referred to as Vessel Wall, VW-MRI)

- For diagnosis and/or treatment response of arteriopathies (eg, non-occlusive vasculopathies, vasculitis, atherosclerotic plaque phenotyping/risk stratification, stroke etiology, reversible cerebral vasoconstriction syndrome [RCVS], Moyamoya) [107,241]

# Visual System Disorders

## *Anisocoria*

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain CT** and **Brain and Neck CTA** (or **Brain CTA** and/or **Neck CTA**).

- Acute/new Horner's syndrome (unilateral miosis, ptosis, and/or anhidrosis) that is associated with trauma and/or pain [242,243]

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain CT (**or **Brain MRI)** and **Brain and Neck CTA (**or **Brain CTA** and/or **Neck CTA)**.

- Acute/new Horner's syndrome (unilateral miosis, ptosis, and/or anhidrosis) not associated with trauma with localizing neurological symptoms and/or exam findings [242,243]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain and Neck CTA (**or **Brain CTA** and/or **Neck CTA)**.

- Non-acute Horner's syndrome (unilateral miosis, ptosis, and/or anhidrosis) WITHOUT localizing neurological symptoms/signs AND not previously worked up [242,243]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI** and/or **Neck MRA**.

- Non-acute Horner's syndrome (unilateral miosis, ptosis, and/or anhidrosis) WITH localizing neurological symptoms/signs AND not previously worked up [242,243]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Brain MRI (**or **Brain CT)** and **Brain MRA (**or **Brain CTA)**

- Acute third/oculomotor nerve palsy (ptosis, limited extraocular movements, with or without pupil involvement) [110,208,227,244]

NOTE: Neuroimaging is not indicated for ocular/benign etiologies for anisocoria including physiologic anisocoria, benign unilateral mydriasis, or structural ocular abnormality.

## *Abnormal Eye Movements*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected cranial nerve 3(III), 4(IV), and/or 6(VI)$^{th}$ nerve palsy based on symptoms and exam findings (binocular diplopia, abnormal eye movements/disconjugate gaze, with or without ptosis and pupillary dysfunction if 3$^{rd}$ nerve palsy) [110]

  NOTE: See **Combination Studies** section for brain and orbit MRI (often both are needed to evaluate entire course of the oculomotor nerves). Imaging is not indicated for subjective non-specific blurred vision or monocular diplopia with a normal neurological exam.

- Ophthalmoplegia with suspicion for underlying systemic disease (eg, infection, infiltrative, inflammatory, demyelinating disease) [245,246]
- Supranuclear gaze palsies (eg, skew deviation, internuclear ophthalmoplegia (INO), horizontal and vertical gaze palsies, Parinaud dorsal midbrain syndrome) [247]
- Opsoclonus-myoclonus-ataxia syndrome [248]:
  - At diagnosis
  - Repeat imaging if needed as part of workup for neuroblastoma, or for new neurological signs/symptoms
- Children with acquired/late-onset nystagmus (after 6 months of age) [249]
- Workup for pathologic nystagmus (eg, gaze evoked, rebound, see-saw, pendular, downbeat, upbeat, periodic alternating), opsoclonus, ocular flutter, oculopalatal tremor, ocular bobbing and reverse ocular bobbing, oculomasticatory myorhythmia, and internuclear ophthalmoplegia [250]

  NOTE: Imaging is not indicated for physiologic nystagmus (eg, endpoint/gaze nystagmus, caloric nystagmus, optokinetic nystagmus, vestibular-ocular reflex).

## *Optic Neuropathy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI**. Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Abnormal eye findings on ophthalmologic or neurologic examination that suggest CNS pathology and ONE of the following [245,246]:
  - Optic nerve edema/papillitis or papilledema
  - Optic nerve pallor or atrophy, that has not been previously worked up
- Vision loss and/or visual field defects not explained/caused by an ocular abnormality on complete ophthalmologic exam and testing (ie, not due to etiologies such as dry eye, cataracts, glaucoma, retinopathy, macular degeneration, corneal disorders) [245,246]:
  - For bilateral (symmetric or asymmetric) vision loss and/or post-chiasmal etiology suspected
  - Children with non-traumatic acute vision loss without papilledema [249]
- Suspected optic neuritis with symptoms (eg, decreased vision, decreased color vision, pain with eye movement) and/or abnormal exam findings (eg, visual field loss, vision loss, color vision changes, optic nerve abnormalities) [246]
- Leukocoria evaluation in a child [249]
- Optic nerve hypoplasia: Once, for initial workup [251]
- Optic pathway gliomas (OPG) [252–255]:
  - Baseline screening imaging (brain and orbit) in asymptomatic children with NF1 when a reliable visual assessment cannot be performed (eg, young age, ADHD/behavioral issues, developmental issues)
  - Suspected OPG in patient with NF1 AND symptomatic (ie, vision changes and/or abnormal ophthalmologic exam or testing including optic nerve evaluation, color vision, visual acuity, pupillary testing, ganglion and nerve fiber layer testing/optic coherence tomography, and visual field assessment)
  - Known NF1 related OPG surveillance:
    - Every 3 months for the first year, every 6 months for the next 2 years (years 2-3), annually for 2 years (years 3-5), and then as clinically indicated (ie, concern for progression based on symptoms and/or ophthalmology exam and testing)
  - For monitoring response to systemic treatment as clinically indicated
  - For surgery or radiation treatment planning

  NOTE: See **Known Malignancy** section for high grade gliomas
- Orbital and/or periorbital plexiform neurofibroma (exam findings can include blepharoptosis, proptosis, eyelid edema, strabismus) [255]:
  - Suspected plexiform neurofibroma
  - Known and signs or symptoms concerning for growth/progression (eg, decrease in

vision, visual field changes, strabismus, proptosis)

NOTE: See **Genetic Conditions** section for additional indications associated with NF1

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Brain MRI** and **Brain MRA.**

- Baseline imaging for morning glory disc diagnosed on ophthalmologic exam [256]

### *Vision Loss*

IMAGING MODALITY: When the following criteria are met, the indicated studies can include any combination of the following: **Brain CT** (or **Brain MRI)** and **Brain and Neck CTA (**or **Brain MRA** and **Neck MRA)**.

- Transient monocular vision loss lasting seconds to minutes with suspicion for TIA/cerebrovascular accident (CVA) [41,212]
- Work-up for new (within 1 month) retinal artery occlusion (ie, ophthalmic artery occlusion, central retinal artery occlusion, branch retinal artery occlusion, cilioretinal artery occlusion) confirmed by an ophthalmologist and ONE of the following [257,258]:
  - Age < 50 years
  - Age > 50 AND negative/normal laboratory evaluation including CBC/platelets, ESR and CRP (ie, temporal arteritis ruled out)

## Other

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Brain MRI** (includes internal auditory canal views when needed). Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Bone Marrow Transplant (BMT) [259]:
  - For initial workup of BMT
- Cranial nerve palsies [110]:

  NOTE: If probable location of a lesion is unclear from history and exam, imaging of the entire course of the relevant cranial nerve may require multiple imaging modalities but should start with most likely causative location (See Evolent Clinical Guideline 2072 for Head and Neck Imaging for indications).
  - New or worsening cranial nerve V palsy (eg, unilateral weakness or paralysis of masticator muscles, sensory abnormalities of the face/head, trigeminal neuralgia pain) [110]
  - New or worsening cranial nerve VII palsy associated with trauma, concern for structural abnormality (eg, facial nerve or CPA schwannoma, other mass, neoplasm, met), or underlying systemic illness (eg, inflammatory/infiltrative disease, demyelination) [110,260]
    - Imaging for idiopathic facial nerve palsy (ie, Bell's palsy) is indicated if atypical

features (gradual onset, failure to improve with time/incomplete recovery after 3 months, repeat recurrences, bilateral, presence of other neurological abnormalities) are present [260–262]

- New or worsening cranial nerve IX palsy (symptoms/findings such as tonsillar/oropharyngeal/otic pain, impaired taste posterior 1/3 of tongue and palate, loss of gag reflex, dysphagia)
- New or worsening cranial nerve X palsy (symptoms/findings such as palatal and/or vocal cord paralysis)
- New or worsening cranial nerve XI palsy (symptoms/findings of unilateral isolated weakness or paralysis of the sternocleidomastoid and trapezius muscles)
- New or worsening cranial nerve XII palsy (symptoms/findings such as dysarthria, tongue deviation or tongue weakness)

- Pediatric low-grade gliomas (pLGG), a heterogenous group of WHO grade 1 and 2 tumors [263]:
  - Suspected based on neurological symptoms, focal neurological exam abnormalities, and/or endocrine dysfunction
  - Known:
    - During systemic treatment; typically every 3 - 6 months until end of therapy
    - Surgery or radiation planning
  - Post-operatively to evaluate for residual tumor
  - Surveillance (see **Cancer Surveillance Table**)
- Diagnosis of central sleep apnea on polysomnogram and ONE of the following:
  - Pediatrics (< 18 years) AND prolonged central sleep apnea event (20 seconds or longer) or elevated central apnea-hypopnea index (CAHI with 5 or more events per hour), to exclude a structural abnormality [264]
  - Adults (≥ 18 years) with absence of heart failure and concern for a central neurological cause (eg, structural abnormality or stroke) when the following have been excluded (chronic opioid use, high altitude, renal failure, neuromuscular disease or treatment induced central sleep apnea) [265]
- Workup for new gait abnormalities with suspected central cause and any ONE of the following [266–268]:
  - Spastic hemiparetic gait (eg, spasticity/increased tone, unilateral circumduction on paretic side)
  - Spastic paraparetic/diplegic gait (eg, spastic/stiff, bilateral circumduction)
  - Cerebellar gait (eg, wide-based, wobbly, worse with turning, uneven surfaces, and tandem walking not significantly compensated by visual input)
  - Apraxic/frontal gait (eg, wide-based but short steps or shuffling and difficulty initiating)
  - Extrapyramidal/Parkinsonian gait (eg, stooped posture, rigidity, narrow-based slow

gait with short steps or shuffling, propensity to lean forward, freezing on turning or approaching obstacles)

- Choreatic/dysmetric gait (eg, sudden involuntary movements of knee and hip, irregular, variable step length and direction)
- Vestibular gait (eg, wide, insecure, or veering to one side)

- Syncope and ALL of the following [192,269,270]:
  - Neurologic deficit on exam (including ataxia or cognitive impairment)
  - Complete loss of consciousness
  - Cardiac, trauma, epilepsy, and/or psychogenic (eg, psychogenic non-epileptic seizures, pseudosyncope) causes have been excluded (eg, orthostatics, labs, ECG, echo, and/or EEG)

  NOTE: Neuroimaging in uncomplicated syncope (meaning normal neurological exam and not related to trauma) is not indicated.

- Presyncope (dizziness and vertigo without LOC) and ALL of the following:
  - Complete lab evaluation including electrolytes, glucose, troponins and no clear etiology
  - Full cardiac workup including ECG and echocardiogram, with or without holter or other event monitor device, has been completed and is normal

- Vertigo (sensation that the person or their surroundings are spinning/false sense of motion) and any ONE of the following [271,272]:
  - Acute persistent vertigo with concern for central/CNS abnormality (eg, abnormal neurological exam findings, dysarthria, dysphagia, or HINTS test suggestive of central etiology)

    NOTE: HINTS results indicating central etiology are normal head impulse test, direction changing nystagmus, or abnormal skew.
  - Chronic recurrent vertigo with unilateral hearing loss, unilateral tinnitus, or abnormal neurological exam findings
  - Chronic imbalance/disequilibrium with cerebellar ataxia (findings such as uncoordinated voluntary movements, wide-based unsteady gait, slurred speech) and/or sensory or proprioceptive ataxia (loss of coordination because of loss of position sense)
  - Unilateral/asymmetric hearing loss or tinnitus
  - Concern for stroke with known risk factors for cerebrovascular disease (eg, hypertension, smoking, obesity, hypercholesterolemia) and abnormal neurological exam findings or symptoms
  - Concern for central vertigo based on test results (eg, videonystagmography (VNG) or electronystagmography (ENG)) that suggest a likely CNS etiology [273]

  NOTE: Dizziness is a broad term that includes disequilibrium (imbalance with gait instability), presyncope (nearly fainting/blacking out), or non-specific lightheadedness.

Imaging for dizziness not described as vertigo can be considered on a case-by-case basis after workup (eg, labs, orthostatic measurements, Dix-Hallpike, supine roll test, HINTS, ECG, CXR, TTE, and/or EEG) for other causes has been completed.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck MRA** or **Neck CTA**.

- Pulsatile neck mass (eg, suspected atypical lymphovascular malformation, arteriovenous fistula, pseudoaneurysm, paraganglioma, or other mass) based on exam and/or ultrasound [(274)]

## Preoperative or Postoperative Assessment

IMAGING MODALITY**:** When any ONE of the below criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications
    - A clinical reason is provided how imaging may change management

  NOTE**:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Imaging

Unless otherwise specified within the guideline:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.

## Genetic Conditions

NOTES: When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Brain MRS**

- Mitochondrial disease [275,276]:
  - Once during work-up on a case-by-case basis

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Brain MRI** or **Brain CT**

- Achondroplasia [277]:
  - Once (to evaluate the corticomedullary junction; typically done in infancy)

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Brain MRA.** Brain CTA is appropriate only when the preferred study is contraindicated or cannot be performed.

- ADPKD (Autosomal Dominant Polycystic Kidney Disease) [278]:
  - Every 10 years (including at diagnosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Brain MRI.** Brain CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Beckwith-Wiedemann syndrome [279]:
  - At diagnosis if significant developmental delay is present
- Capillary Malformation-Arteriovenous Malformation Syndrome (eg, Sturge Weber Syndrome) [280]:
  - Once at diagnosis
  - Repeat imaging only if symptomatic
- FAP (Familial Adenomatous Polyposis) [281]:
  - As clinically indicated
- Heritable Retinoblastoma (RB1) [282,283]:
  - Every 6 months

- HFE-Related Hemochromatosis [284,285]:
  - As clinically indicated
- PTEN [286]:
  - As clinically indicated
- Tuberous Sclerosis [287]:
  - Annually
- X-linked Adrenoleukodystrophy [288]:
  - Every 6 months until age 12
  - Annually after age 12

IMAGING MODALITY: When any of the following criteria are met the indicated studies can include any combination of the following: **Brain MRI** or **Brain MRS**

- Canavan Disease [289]:
  - At diagnosis

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain MRI** or **Brain MRA**

- Fabrys Disease [290]:
  - Every 2 years (including at diagnosis) starting at age 18 OR
  - More frequently if symptomatic
- Microcephalic Osteodysplastic Primordial Dwarfism Type II [291]:
  - At diagnosis (or at birth) then annually

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Breast/Whole Body MRI** and **Chest CT** (or low-dose CT)

- Li Fraumeni (TP53) [292,293]:
  - Annually

    NOTE: Can also include Abdomen MRI annually starting at age 50 when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant. This may start 10 years younger than the earliest pancreatic cancer diagnosis in the family.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Neck/Chest/Abdomen/Pelvis MRA** or **CTA**

- Loeys-Dietz [294]:
  - Every two years (including at diagnosis) OR
  - More frequently if abnormalities are found
- Vascular Ehlers-Danlos syndrome (vEDS) [295]:
  - Every 18 months (including at diagnosis) OR
  - As clinically indicated to follow known vascular abnormalities

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Whole Body MRI** or ANY combination of the following: **Brain/Cervical/Thoracic/Lumbar Spine MRI**

- LZTR1-related Schwannomatosis [296]:
  - Every 2 years starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [293,297,298]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRI** or **CT**

- Multiple Endocrine Neoplasia type 1 (MEN1) [138,299]:
  - Annually starting at age 8

NOTE: Brain MRI is included in the above every 3 years starting at age 5 rather than age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine/Whole Body MRI**

- SMARCA4 and SMARCB1 (Includes SMARCB1-associated Schwannomatosis and

Rhabdoid Tumor Predisposition Syndrome) [296,300]:

- At diagnosis
- Monthly from age 0-6 months
- Every 2 months from age 7-18 months
- Every 3 months from age 19 months – 5 years
- Annually after age 5

IMAGING MODALITY: When any of the following criteria are met the indicated studies can include any combination of the following: **Brain MRI** and **MRA** OR **Brain CT** and **CTA**

- Sickle Cell Disease [218,301]:
  - When needed to screen for silent stroke
  - Abnormal Transcranial Doppler Velocity > 200 cm/s
  - New neurologic or cognitive concerns (including TIA, no formal testing required)
  - When cessation or changing frequency of transfusions is under consideration

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine MRI** AND **Abdomen MRI** or **CT**

- Von Hippel-Lindau (VHL) [302]:
  - Annually (including at diagnosis) starting at age 11
  - IAC MRI with or without Brain MRI is additionally indicated at the onset of hearing loss, tinnitus or vertigo

    NOTE: If it has been > 9 months since the last brain MRI, then brain MRI with IAC is more appropriate in order to bundle IAC evaluation with needed annual screening. If there has been a brain MRI without IAC within the last 9 months then MRI IAC is more appropriate.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Whole Body MRI**

- Constitutional Mismatch Repair Deficiency (CMMRD) syndrome [303]:
  - Annually starting at age 6
  - Brain MRI alone is indicated at diagnosis then every 6 months (regardless of age)
- POT1 Tumor Predisposition Syndrome [304]:
  - Annually starting at age 18

IMAGING MODALITY: When any of the following criteria is met, the indicated studies is **Brain MRI.** When any ONE of the below criteria are met for spine imaging, **Cervical Spine MRI, Thoracic Spine MRI,** and/or **Lumbar Spine MRI** are additionally indicated**.** CT is indicated only when the preferred study is contraindicated or cannot be performed.

- NF2-Related Schwannomatosis [305]:
  - Brain MRI annually beginning at age 10
  - Signs and symptoms concerning for spinal tumor (any level)
  - Cervical Spine MRI prior to cranial surgery
  - Lumbar Spine MRI prior to regional anesthesia

# Combination Studies

## *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

## *Brain/Neck/Chest MRA*

- Horner's syndrome, not previously worked up, for suspected vascular source (eg, dissection, aneurysm, arteritis) [242,306]

## *Brain and Neck CTA with Chest CTA*

- Horner's syndrome, not previously worked up, for suspected vascular source (eg dissection, aneurysm, arteritis) [242,306]

## *Brain/Neck/Chest/Abdomen/Pelvis CTA (or MRA)*

- For patients with fibromuscular dysplasia (FMD) [222,307]:
  - One-time evaluation
  - New symptoms or abnormal exam findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD) [224]:
  - One-time evaluation
- Takayasu's Arteritis [43,44,308,309]:
  - At diagnosis (including for suspected disease) [43,309]
  - New symptoms or abnormal exam findings [43,44,47,308]
  - Every 6-12 months for the first 2 years while on therapy
  - Annually after the first 2 years

## *Brain MRI and Sinus/Chest/Abdomen and Pelvis CT*

- Prior to bone marrow transplant or stem cell transplant

### *Brain (with or without IAC)/Maxillofacial/Face/Orbit/Temporal Bone/Neck/Chest/Abdomen and Pelvis Imaging*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies are **Neck CT/MRI** and/or **Chest CT**. When there is a concern for involvement of a specific area Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT may be indicated (individually or in any combination of studies).

- Suspected granulomatosis with polyangiitis (GPA) (formerly Wegener's Granulomatosis) with any ONE of the following:
  - Clinical signs and symptoms
    - Nasal involvement (bloody discharge, ulcers, crusting, congestion, blockage, septal defect/perforation)
    - Cartilaginous involvement (inflammation of ear/nose cartilage, hoarse voice, stridor, endobronchial involvement, saddle nose deformity)
    - Conductive or sensorineural hearing loss
  - Labs and biopsy findings:
    - Positive cytoplasmic antineutrophil cytoplasmic antibodies (cANCA) or antiprotease 3 (anti-PR3) antibodies
    - Biopsy showing small or medium vessel vasculitis
    - Biopsy showing granuloma, extravascular granulomatous inflammation, or giant cells
    - Biopsy showing pauci-immune glomerulonephritis
  - Imaging findings
    - Inflammation, consolidation, or effusion of nasal/paranasal sinuses, or mastoiditis on imaging

IMAGING MODALITY: When any ONE of the following criteria are met, one or more of the following studies are indicated: Neck CT/MRI, Chest CT, Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT.

- Known GPA when imaging results of a specific area is needed to guide decisions about initial therapy or response to therapy

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 70450 | Computed tomography, head or brain; without contrast material |

| Code | Description |
|---|---|
| 70460 | Computed tomography, head or brain; with contrast material(s) |
| 70470 | Computed tomography, head or brain; without contrast material, followed by contrast material(s) and further sections |
| 70471 | Computed tomographic angiography (CTA), head and neck, with contrast material(s), including noncontrast images, when performed, and image postprocessing |
| 70473 | Computed tomographic (CT) cerebral perfusion analysis with contrast material(s), including image postprocessing performed without concurrent CT or CT angiography of the same anatomy |
| 70496 | Computed tomographic angiography, head, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 70498 | Computed tomographic angiography, neck, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 70544 | Magnetic resonance angiography, head; without contrast material(s) |
| 70545 | Magnetic resonance angiography, head; with contrast material(s) |
| 70546 | Magnetic resonance angiography, head; without contrast material(s), followed by contrast material(s) and further sequences |
| 70547 | Magnetic resonance angiography, neck; without contrast material(s) |
| 70548 | Magnetic resonance angiography, neck; with contrast material(s) |
| 70549 | Magnetic resonance angiography, neck; without contrast material(s), followed by contrast material(s) and further sequences |
| 70551 | Magnetic resonance (eg, proton) imaging, brain (including brain stem); without contrast material |
| 70552 | Magnetic resonance (eg, proton) imaging, brain (including brain stem); with contrast material(s) |
| 70553 | Magnetic resonance (eg, proton) imaging, brain (including brain stem); without contrast material, followed by contrast material(s) and further sequences |
| 70554 | Magnetic resonance imaging, brain, functional MRI; including test selection and administration of repetitive body part movement and/or visual stimulation, not requiring physician or psychologist administration |

| Code | Description |
|---|---|
| 70555 | Magnetic resonance imaging, brain, functional MRI; requiring physician or psychologist administration of entire neurofunctional testing |
| 76390 | Magnetic resonance spectroscopy |
| 78608 | Brain imaging, positron emission tomography (PET); metabolic evaluation |
| 78609 | Brain imaging, positron emission tomography (PET); perfusion evaluation |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |
| +70472 | Computed tomographic (CT) cerebral perfusion analysis with contrast material(s), including image postprocessing performed with concurrent CT or CT angiography of the same anatomy (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester).
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine.

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** (310,311) | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** (312) | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** (138) | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** (313) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** (314) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Appendiceal Neoplasms and Cancers** [315] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** [124,125] | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (316) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (317) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for up to 5 years |
| **Bladder Cancer** (140) | **Non-Muscle Invasive (NMIBC)**<br>● Low-intermediate Risk NMIBC treated without cystectomy<br>○ Routine surveillance imaging is not indicated<br>● High Risk* NMIBC treated without cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ Once 12 months after diagnosis then<br>■ Every 1-2 years 9 additional years<br>■ No routine surveillance imaging after 10 years<br>● NMICBC after cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ 3 months after surgery then<br>■ 1 year after surgery then<br>■ Annually for 4 additional years<br>■ No routine surveillance imaging after 5 years<br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation** |

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| | **AND NMIBC after partial cystectomy or chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then<br>■ Annually for 3 additional years<br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** (126) | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors<br>○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then |

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| | ■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone**<br>● CT or MRI of primary tumor site as clinically indicated<br>● Chest CT<br>○ Every 6-12 months for 4 years then<br>○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 4 months for year 3 then<br>○ Every 6 months year 4 and 5 then<br>○ Annually after year 5, as clinically indicated |
| **Breast** (127) | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>● Stage I-III disease:<br>○ Routine surveillance imaging not indicated (followed with mammography)<br>**NOTE: See Restaging section for recurrence**<br>● Stage IV disease not currently on therapy |

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| | ○ Chest CT and Abdomen and Pelvis CT<br>■ Every 3-6 months |
| **Castleman's Disease** [318] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>● Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** [141] | **Stage I disease treated with non-fertility sparing**<br>● Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>● Pelvis MRI<br>○ Once 6 months after completion of treatment then<br>○ Annually for 2-3 additional years<br>**Stage II-IV**<br>● Pelvis MRI<br>○ Once 3-6 months after completion of treatment<br>○ Routine surveillance imaging not indicated thereafter<br>● Chest CT and Abdomen and Pelvis CT<br>○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>● Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** [319] | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** [320] | Routine surveillance imaging is not indicated |

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| **Central Nervous System (CNS) Tumors** [119,128,321–323] | **Choroid plexus tumors and carcinoma**<br>• Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>• Malignant choroid plexus carcinoma<br>  ○ Brain MRI<br>  ■ Every 3-4 months for 2 years then<br>  ■ Every 6 months for years 3-5 then<br>  ■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>• Circumscribed glioma (not otherwise listed) post gross total resection<br>  ○ Brain MRI<br>  ■ Every 3-6 months for 5 years then<br>  ■ Annually after 5 years<br>• Oligodendroglioma and astrocytoma grade 2<br>  ○ After chemotherapy and radiation<br>  ■ Brain MRI: Every 6-9 months<br>  ○ After chemotherapy OR radiation<br>  ■ Brain MRI: Every 3-4 months<br>  ○ After surgery only<br>  ■ Brain MRI: Every 3-4 months<br>NOTE: Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>• Pediatric Diffuse High-Grade Glioma<br>  ○ Brain MRI<br>  ■ 2-6 weeks after radiation then<br>  ■ Every 2-3 months for 1 year then |

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| | ■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then<br>□ As clinically indicated after 5 years<br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>NOTE: High-grade glioma includes ALL histologies if grade 3 and 4<br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated |

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| | • MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br>**Primary CNS Lymphoma**<br>• MRI Brain +/- MRI C/T/L Spine<br>  ○ Every 3 months for 2 years, then<br>  ○ Every 6 months for 3 years, then<br>  ○ Annually, indefinitely<br>**Primary Spinal Cord Tumors**<br>• Low grade tumors (grade 1-2)<br>  ○ MRI C/T/L Spine +/- MRI Brain<br>  ○ Every 3-6 months for 5 years then<br>  ○ Every 6-12 months indefinitely<br>• High grade tumors (grade 3-4)<br>  ○ MRI C/T/L Spine +/- MRI Brain<br>  ○ Once 2-6 weeks after treatment then<br>  ○ Every 2-4 months for 3 years then<br>  ○ Every 3-6 months for 2 years, then<br>  ○ Every 6-12 months indefinitely<br>NOTE: Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br>**Meningiomas**<br>• Grade 1 and 2 or unresected tumors:<br>  ○ MRI Brain (include spine if spinal involvement)<br>  ■ At 1, 3 and 6 months then<br>  ■ Every 6-12 months for 5 years then<br>  ■ Annually, as clinically indicated<br>• Grade 3<br>  ○ MRI Brain (include spine if spinal involvement)<br>  ■ Every 2-4 months for 3 years then |

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| | ■ Every 3-6 months<br>NOTE: SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** (324) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** (325) | Routine surveillance imaging is not indicated |
| **Dermatofibrosarcoma Protuberans (DFSP)** (326) | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** (327) | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | **After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |
| **Gastric** (328) | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |
| **Gastrointestinal Stroma Tumor (GIST)** (329) | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>NOTE: More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** (130) | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT |

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| | ○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** (330) | Routine surveillance imaging is not indicated |
| **Head and Neck** (131) | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change).<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** (331) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |
| **Histiocytic Neoplasms** (132) | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** (332,333) | Chest CT and Abdomen and Pelvis CT (+/- Neck CT) |

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| | • Every 3-6 months for 2 years as clinically indicated<br>  ○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** (334) | Routine surveillance imaging is not indicated |
| **Kidney Cancer** (133) | See **Active Surveillance** section for indications related to that management strategy.<br>**After prior ablation of primary tumor**<br>• Abdomen CT/MRI<br>  ○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>  ○ Annually<br>• Chest CT<br>  ○ Annually for 5 years then<br>  ○ As clinically indicated after 5 years<br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>• Chest CT and Abdomen CT/MRI<br>  ○ Every 3 months during year 1 then<br>  ○ Every 6 months during year 2 then<br>  ○ Every 9 months during years 3-4 then<br>  ○ Annually during year 5 then<br>  ○ As clinically indicated after year 5<br>**Stage I after partial or radical nephrectomy***<br>• Abdomen MRI/CT<br>  ○ Once within 3-12 months of surgery then<br>  ○ Annually up to 5 years then<br>  ○ As clinically indicated after year 5<br>• Chest CT<br>  ○ Annually for 5 years then<br>  ○ As clinically indicated after year 5<br>**Stage II after partial or radical nephrectomy*** |

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| | ● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br>**Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Baseline within 3-6 months then<br>○ Every 3-6 months for 3 years then<br>○ Annually for 2 additional years<br>○ As clinically indicated beyond 5 years<br>**Stage IV, relapsed, or surgically unresectable disease***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 1.5-4 months<br>● Brain MRI (preferred) or brain CT<br>○ Annually, or as clinically indicated<br>● Entire spine MRI<br>○ As clinically indicated<br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (134) | **Stage 0/in situ, Stage I, Stage IIA**<br>● No routine imaging needed<br>**Stage IIB-IV**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years<br>● Brain MRI if stage IIIB or higher |

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| | ○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years<br>NOTE: More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |
| **Melanoma: Uveal** [335] | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months for years 6-10 then<br>○ As clinically indicated after year 10<br>NOTE: Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [135] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** [336] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** [337] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |

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| **Multiple Myeloma** [136] | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually for 5 years<br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** [138] | **Well-differentiated NET, Grade 1-2**<br>● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |

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| **Neuroblastoma** [137] | **All risk groups**<br>● CT or MRI of primary site<br>○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** [139] | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |

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| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** (338) | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years then<br>● As clinically indicated after 5 years<br>NOTE: These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br>**Benign Teratoma**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years then<br>○ As clinically indicated after 5 years<br>**Small cell carcinoma of ovary**<br>● Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>○ Every 3-6 months for 2 years then<br>○ Annually |
| **Pancreatic Adenocarcinoma** (339) | Chest CT and Abdomen and Pelvis CT<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months for 2 years then<br>● As clinically indicated after 5 years |
| **Penile Cancer** (340) | **pN0 and pN1**<br>● Abdomen and Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually during years 3-4<br>**pN2 and pN3**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3 months for 1 then |

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| | ○ Every 6 months during years 2-4 |
| **Prostate Cancer** (341) | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** (342) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** (283,343,344) | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** (345) | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |

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| **Small Cell Lung Cancer (SCLC)** [346] | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (eg, neck, spine)<br>NOTE: Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** [142,347] | **<u>General surveillance guidelines for other sarcomas, based on site:</u>**<br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**<u>Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)</u>**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT |

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| | • **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>• **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>• **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>• **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>• **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**Specific sarcoma surveillance guidelines (above general guidance does not apply):**<br>**Desmoid tumor (aggressive fibromatosis)**<br>• Site-specific MRI (preferred) or CT<br>  ○ Every 3-6 months for 3 years then<br>  ○ Every 6-12 months<br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br>**Borderline Phyllodes Tumor**<br>• Chest or Breast MRI<br>  ○ Every 6 months for 2 years then<br>  ○ Annually for 3 additional years<br>**Malignant Phyllodes Tumor**<br>• Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>  ○ Every 3-6 months for 3 years then<br>  ○ Every 6 months for 2 additional years then<br>  ○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** [143] | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for |

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| | following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** [144]<br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** [145] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** (145) | See **Active Surveillance** section for indications related to that management strategy.<br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (348) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br>**Thymic Carcinoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT or Chest MRI<br>  ○ Every 3-6 months for 2 years then<br>  ○ Annually for an additional 3 years<br>  ○ As clinically indicated after year 5 |
| **Thyroid Cancer** (146) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>• Neck CT/MRI +/- Chest CT<br>  ○ Once 6-12 post thyroidectomy<br>  ○ Routine surveillance imaging thereafter not indicated<br>**Medullary Carcinoma**<br>• Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>  ○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>  ○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br>**Anaplastic Carcinoma**<br>• Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>  ○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (349) | **Endometrial Cancer treated with non-fertility sparing**<br>• Routine surveillance imaging thereafter not indicated<br>**Endometrial Cancer treated with fertility sparing**<br>• Pelvis MRI<br>  ○ Once 6-9 months after treatment<br>  ○ Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (350) | Chest CT and Abdomen and Pelvis CT/MRI<br>• End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>• Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** (351) | Pelvis MRI (Indicated in addition to PET/CT)<br>• End of treatment restaging once 3-6 months after completion of treatment<br>• Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** (352) | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** (353) | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>• Every 3 months for 2 years<br>• Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate 3D renderings that display the nuances of tissue beyond the capability of an x-ray, computed tomographic and magnetic resonance imaging have become integral diagnostic tools.

Computed Tomography (CT) is based on the differential absorption of x-rays by various tissues and uses X-rays to create cross-sectional images of the body. The X-ray source and detectors rotate around the patient, and a computer reconstructs the data into detailed images. [354] Its strengths are rapid image acquisition and high sensitivity and specificity for many conditions. It is excellent for evaluating trauma, acute emergencies, and staging cancers, and can assess multiple organ systems simultaneously.

Magnetic resonance imaging (MRI) is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. It uses strong magnetic fields and radiofrequency pulses to manipulate hydrogen atoms in the body. The resulting signals are detected and converted into images by a computer. [354] MRI provides superior soft tissue contrast, especially for brain, joints, liver, and certain abdominal organs, making it the modality of choice for most brain disorders. MRI also does not use ionizing radiation, making it safer for repeated imaging and for children and pregnant patients. [355]

## Choosing Between CT and MRI

Because CT is fast, widely available, and good for general organ assessment, it is preferred for [355]:

- Evaluation of skull deformity
- Evaluation of acute emergencies (severe headache, intracranial hemorrhage, acute TIA/stroke, traumatic injury)
- Assessment of intracranial aneurysms, vascular malformations, vessel stenosis, and artery dissection
- Evaluation of acute cerebral ischemia and infarct to determine course of treatment
- Postoperative complications

Because MRI provides superior soft tissue detail, it is preferred for [355]:

- Evaluation of autoimmune/inflammatory disorders, neurodegenerative disorders (eg, Alzheimer's disease, Parkinson's disease) and infection
- Diagnosis of and follow up on Chiari malformation
- Evaluation of and follow up on CSF flow disorder and hydrocephalus
- Evaluation of congenital and developmental brain abnormalities
- Evaluation of intracranial cysts and neuroendocrine dysfunction
- Follow-up on brain tumors/lesions and local screening/staging/surveillance for non-CNS cancers
- Pre and post-procedural vascular mapping

## Angiography Role in Imaging

Angiography is usually reserved for imaging of vascular lesions for detailed visualization of blood vessels to evaluate certain vascular pathologies. Most common brain disorders that CTA/MRA are appropriate imaging modalities include the following but not limited to subarachnoid hemorrhage, cerebral vasospasm, cerebral aneurysm, high-flow vascular malformation (AVM/AVF), transient ischemic attack, recent ischemic infarct, intraparenchymal hemorrhage, asymptomatic carotid stenosis, asymptomatic cervical bruit, and cervical vascular dissection or injury [40,212]

## The Use of Contrast Agents

Contrast agents are used in advanced imaging to enhance visibility of specific organs and structures. The chemical nature of the contrast agent chosen can highlight differences in specific tissue density, composition, perfusion, or vascularity. [355] CT contrast agents are typically iodinated compounds used to highlight differences in tissue density, while MRI contrast agents are usually gadolinium-based, capitalizing on its paramagnetic properties to highlight differences in tissue composition. [354] Contrast agents are employed when diagnosis requires enhanced visualization of blood vessels, organ perfusion, or tissue differentiation, but can present a risk to patients with impaired kidney function. [354] While contrast agents are highly useful in identifying vascular pathologies and mapping vascular anatomy for procedural planning or monitoring vascular conditions, it should be kept in mind that in cases of trauma, acute bleeding, and other emergent situations, contrast agents are not typically necessary. [354,355]

# ANALYSIS OF EVIDENCE

## CT and MRI

Due to its speed, ready availability, and lower cost, CT is preferred for rapid assessment in acute settings and excellent for bony detail (bone abnormalities diagnosis) and surgical planning. MRI is preferred for sensitivity, specificity, safety (no radiation) in most chronic or complex neurological indications, and superior for defining the extent of soft tissue masses and their relationship to adjacent structures.

The American College of Radiology (ACR) Appropriateness Criteria recommends MRI with internal auditory canal (IAC) view for soft tissue, nerve, central causes (sensorineural loss, vertigo with neurological symptoms), and CT temporal bone is preferred for bony detail (conductive hearing loss, surgical planning, trauma) for most hearing disorders. [1] MRI with IAC view is also the suitable imaging modality for tinnitus (pulsatile and nonpulsatile), complicated otitis media/otitis externa, and schwannoma. [7]

CT is not recommended for multiple sclerosis (MS) diagnosis, but MRI is preferred due to superior sensitivity and specificity. The 2024 McDonald criteria expand MRI's role, now including the optic nerve as a fifth anatomical location for dissemination in space (DIS). MRI protocols must cover brain, spinal cord, and optic nerve, using sequences such as T2-FLAIR, T2-weighted, susceptibility-sensitive, and post-gadolinium T1-weighted imaging. MRI can distinguish MS from mimics (eg, NMOSD, MOGAD) based on lesion location, morphology, and

enhancement patterns. [21,29] Specific lesion characteristics such as NMOSD, which has posterior optic nerve involvement, chiasm lesions, longitudinally extensive spinal cord lesions (≥ 3 vertebral segments), periependymal brainstem/diencephalic lesions, MS having anterior optic nerve involvement, short spinal cord lesions, Dawson fingers, juxtacortical lesions, and MOGAD having optic nerve head swelling, anterior optic nerve involvement, ADEM-like brain patterns in children. [32] MRI is preferred for Takayasu arteritis and as an alternative for giant cell arteritis (when ultrasound is inconclusive or unavailable) due to its ability to assess multiple vessels without radiation and its sensitivity to parenchymal and vascular changes, especially in atypical presentations or when diagnosis is unclear. MRI can also help distinguish GCA-related ischemic optic neuropathy from other causes (eg, multiple sclerosis, optic neuritis). [43,45] Vessel wall MRI is used in direct visualization of vessel wall pathology (thickening, enhancement), especially in vasculitis, intracranial atherosclerotic disease (ICAD), dissections, Moyamoya disease, and RCVS. [241]

CT without IV contrast is usually appropriate for rapid assessment, acute settings, low motion sensitivity, detection of acute hemorrhage, stroke, mass, acute lesions, hydrocephalus, and is preferred for initial evaluation in acute AMS. MRI without or with IV contrast is higher sensitivity for ischemia, infection, subtle SAH, mass lesions and is preferred for characterization of lesions, infection, inflammation, structural changes (atrophy) and central for most dementia syndromes. [48,49,55] fMRI is used for preoperative mapping of eloquent brain areas (memory, motor, language) in tumor and epilepsy surgery. [62]

MRI is the gold standard for evaluating structural CNS in developmental disorders, differentiating megalencephaly from secondary macrocephaly, detecting malformations (polymicrogyria, hemimegalencephaly, cortical dysplasia), white matter anomalies, vascular malformations, and tumors. CT, on the other hand, is used for craniofacial hyperostosis, osseous anatomy, trauma, and rapid assessment. In infants < 6 months of age, ultrasound is excellent for open fontanelles diagnosis. [66,68] MRI showed 86–89% sensitivity for cerebral palsy, white matter injury, cortical/deep gray matter lesions, and brain maldevelopments. Routine MRI is not recommended for autism spectrum disorder without additional findings and should be considered case-by-case, guided by clinical evaluation and risk/benefit assessment. [72] MRI is emphasized as the ideal modality for investigating CSF flow disorders in children, with phase-contrast sequences being crucial for functional assessment. MRI is also used in post-surgical follow-up (ventriculoperitoneal shunt, third ventriculostomy), while CT is used mainly for shunt malfunction diagnosis. [75] MRI is recommended for the diagnosis of Chiari malformation type 1, hydrosyringomyelia, accurate measurement of tonsillar descent and syrinx characterization. [78] MRI of the brain with contrast and MRI of the whole spine are recommended for all patients with suspected spontaneous intracranial hypotension and CT is used if MRI is unavailable or contraindicated; less sensitive but may show supportive findings. Myelography is indicated if MRI is inconclusive or to localize the site of CSF leak for targeted treatment. [82]

The ACR Appropriateness Criteria recommends CT without IV contrast in thunderclap headache diagnosis while MRI with and without IV contrast is the appropriate imaging modality for trigeminal autonomic cephalalgias/cluster headache and intracranial hypotension features. Both CT/MRI are appropriate for intracranial hypertension features, headache in pregnancy/peripartum or with red flags (eg, increasing severity, fever, neuro deficit, cancer, immunocompromise, age > 50, trauma). Imaging is not appropriate for primary migraine/tension-type headache and headache without red flags or abnormal neurological exam. [83]

Brain MRI (or CT if MRI is contraindicated) is the preferred imaging modality for intracranial infection (eg, meningitis, encephalitis, endocarditis, abscess, cerebritis, and progressive multifocal leukoencephalopathy) with positive signs and symptoms. [30,114,115,117]

Brain MRI without IV contrast is usually appropriate for most movement disorders and neurodegenerative disease indications and is preferred for initial assessment and diagnostic differentiation. CT may be appropriate for excluding mimics (structural/vascular/infectious) but not as the primary diagnosis. In all cranial neuropathies, MRI is the primary imaging modality due to its superior soft tissue contrast, ability to directly visualize nerves, and lack of ionizing radiation. High-resolution, thin-section, contrast-enhanced MRI is especially valuable for detecting lesions along the nerve course. CT, especially with contrast, is complementary, mainly for evaluating bony structures, skull base foramina, and trauma. It is less sensitive than MRI for soft tissue and nerve pathology. [110,152] In isolated dystonia, routine imaging is not indicated if clinical presentation and history are typical and conventional MRI is normal. [155]

In patients with neuroendocrine dysfunction, MRI with and without IV contrast is preferred imaging modality. Specifically, in hypo-functioning pituitary gland, MRI provides superior soft-tissue contrast, high-resolution visualization of the pituitary and parasellar regions, and can characterize both intrinsic and extrinsic lesions. CT with IV contrast may be used if MRI is contraindicated but is less sensitive. In hyperfunctioning pituitary adenoma, MRI is the gold standard for detecting hormone-secreting adenomas, especially microadenomas. CT, on the other hand, may help identify large tumors but is less sensitive for microadenomas detection. In pituitary apoplexy, MRI is optimal for detecting hemorrhage, tumor enlargement, and differentiating between hemorrhagic and non-hemorrhagic lesions. CT may be used in acute settings for rapid assessment, especially to exclude other causes of acute neurological symptoms. In surveillance post-pituitary or sellar mass resection, MRI is most useful for postoperative assessment, detecting recurrence, and differentiating between residual tumor and postoperative changes. CT may be used for osseous detail or if MRI is contraindicated. In diabetes insipidus, MRI is best for evaluating the hypothalamic-neurohypophyseal axis and detecting abnormalities leading to antidiuretic hormone deficiency. In precocious puberty, MRI is best for evaluating central causes, especially in younger children or those with neurological symptoms. [157] According to the Pituitary Society international Consensus Statement, MRI is recommended at 3–6 months in patients with macroprolactinomas after starting dopamine agonist therapy to assess shrinkage and may be repeated after 1 year in patients with microprolactinomas or when considering withdrawal of dopamine agonists. [156] In patients with central adrenal insufficiency, CT and MRI are the primary imaging modalities but not as a routine diagnostic tool. MRI is preferred for detailed tissue characterization, especially in children or pregnancy and CT for acute hemorrhage, infection, or mass. [171] In patients diagnosed with growth hormone deficiency, MRI is recommended to detect anatomical defects (eg, pituitary adenomas, hypoplastic pituitary, stalk abnormalities, ectopic posterior pituitary), brain tumors, or other CNS disorders. MRI is especially useful in newborns with midline defects, microphallus, and hypoglycemia. [167] In female patients with hypogonadism, MRI is indicated for central hypogonadism, parasellar mass, congenital hypogonadotrophic hypogonadism, unexplained amenorrhoea, or hyperprolactinaemia. [160] In male patients with hypogonadism, MRI is indicated for severe secondary hypogonadism, panhypopituitarism, persistent hyperprolactinemia, and symptoms of pituitary tumor (eg, visual field defects, new headaches). [169] High-resolution gadolinium-enhanced MRI is used to detect corticotropin-secreting pituitary adenomas (microadenomas < 6 mm, macroadenomas ≥10 mm). [162] Endocrine Society Clinical Practice Guideline recommends MRI in patients with acromegaly to ascertain tumor size, location, invasiveness and is used pre- and post-operatively (at ≥ 12

weeks after surgery for residual tumor/adjacent structures). [158] In patients with intracranial cysts, MRI is the preferred imaging modality in most cases to diagnosis, monitor, and guide management, except in colloid cysts where both CT and MRI can be used to assess risk of hydrocephalus and plan surgical resection. [177,179,182]

The ACR Appropriateness Criteria considers MRI with or without contrast is usually appropriate for new-onset seizures, medically refractory focal epilepsy, surgical planning, and known seizure disorder with change in semiology or history of tumor. CT is only reserved for acute/emergent cases. fMRI is used for functional mapping (language, memory, motor), prediction of postsurgical deficits, and may be appropriate for surgical planning, especially for language/memory lateralization. For complex febrile seizures and generalized seizures in children, MRI without IV contrast is usually appropriate, with ultrasound preferred in unstable neonates and CT without IV contrast may be appropriate for hemorrhage. Imaging is not indicated in simple febrile seizures. [189–191]

The ACR Appropriateness Criteria recommends CT without IV contrast as the first line imaging modality for all levels of severity levels in acute head trauma. MRI is not the first-line imaging modality for acute trauma but may be used for persistent neurologic deficits unexplained by CT, especially in subacute/chronic phases due to its sensitivity for subtle findings (eg, diffuse axonal injury, small contusions, microbleeds). [198]

In patients with acute ischemic stroke, MRI and CT without IV contrast are the appropriate modalities with MRI preferred for its sensitivity for ischemia and CT essential for rapid triage to exclude hemorrhage before thrombolytics. In patients with transient ischemic attack, CT without IV contrast is preferred for rapid assessment, hemorrhage and mimics exclusion, and ischemic changes assessment. MRI without IV contrast is most sensitive for acute infarct, useful for prognosis and repeat presentations. In recent ischemic infarct, CT and MRI without IV contrast, brain and neck CTA with IV contrast, and MRA with or without IV contrast are recommended as imaging modalities. [212]

For arteriopathy and Moyamoya, MRA/MRI without IV contrast are usually appropriate modalities. For vasculitis, MRA/MRI without IV contrast, CTA with IV contrast, MRI with IV contrast are usually appropriate modalities. For hemorrhage, MRA without IV contrast, CTA with IV contrast, arteriography, MRI with and without IV contrast are usually appropriate. Non-contrast and perfusion CT are often used in initial assessments for hemorrhage, infarct, and perfusion abnormalities. [40] According to American Heart Association, non-contrast CT is the first-line imaging for diagnosis of aneurysmal subarachnoid hemorrhage in acute severe headache or neurological deficit. [205] MRI/MRA is used for non-acute follow-up, cognitive outcome, and hydrocephalus assessment. For parenchymal assessment, vessel wall imaging, infarct detection, and meningeal enhancement, MRI with and without contrast are the recommended imaging modalities. [40]

For traumatic visual defect (suspect orbital injury), CT without IV contrast is considered appropriate for detecting fractures, foreign bodies, hematomas. MRI is useful for optic nerve injury (more sensitive for nerve edema/avulsion) but contraindicated if metallic foreign body is present. For optic neuritis, ophthalmoplegia or diplopia, and nonischemic visual loss with chiasm or post-chiasm symptoms, MRI with and without IV contrast is the appropriate initial imaging modality. [246] MRI with IV contrast is the gold standard for evaluating CNS neoplasms (pediatric low-grade gliomas (pLGG), including various locations (optic pathway, cerebellum, cortex, brainstem, spinal cord), and syndromes (NF1, TSC, etc.)). Postoperative MRI is recommended within 24–72 hours to assess residual tumor. [263] For acute central retinal artery occlusion,

urgent brain MRI with diffusion-weighted imaging (DWI-MRI) is preferred for all patients with acute visual loss. [257]

For acute persistent vertigo with abnormal neurologic examination or when HINTS examination is consistent with central vertigo, brain MRI without IV contrast is the appropriate imaging modality for its superior sensitivity to parenchymal changes, infarcts, and soft tissue resolution, especially in the posterior fossa and cerebellum. For chronic recurrent vertigo with unilateral hearing loss or tinnitus (most likely due to Menière disease), MRI with IAC view with and without IV contrast, and CT without IV contrast are the preferred imaging modalities. MRI (with specialized protocols) can detect endolymphatic hydrops and exclude other causes (eg, vestibular schwannoma) rather than confirm Menière disease. CT is preferred for diagnosing superior semicircular canal dehiscence and other bony abnormalities. For chronic disequilibrium with signs of cerebellar ataxia, MRI with and without IV contrast is the recommended modality. [271]

## CTA and MRA

The ACR Appropriateness Criteria considers arteriography and CTA/MRA are central for vasculopathy. For arteriopathy and Moyamoya, brain MRA without IV contrast and MRI without IV contrast are usually appropriate modality. [40,41] In recent ischemic infarct, brain CT and MRI without IV contrast, brain and neck CTA with IV contrast, and MRA (with/without IV contrast) are recommended as imaging modalities. Brain and neck CTA with IV contrast is useful for rapid vascular assessment. Brain and neck MRA with/without IV contrast is useful if less urgent, or contraindications to CT/CTA. [212] For vasculitis, brain MRA without IV contrast, MRI without IV contrast, CTA with IV contrast, MRI with and without IV contrast are usually appropriate. For hemorrhage, brain MRA without IV contrast, CTA with IV contrast, arteriography, MRI with and without IV contrast are usually appropriate. For aneurysm, AVM/AVF, vasospasm, and vasculitis, arteriography is the gold standard while brain CTA/MRA are the noninvasive imaging modality for screening and surveillance. Screening is recommended for high-risk groups (women, smokers, hypertensives, ≥ 2 relatives with unruptured intracranial aneurysms/subarachnoid hemorrhage, autosomal dominant polycystic kidney disease). [207] In small asymptomatic aneurysms, initial follow-up at 6–12 months, then every 1–2 years is recommended if stable. Long-term annual imaging after intervention should be considered to monitor for recurrence or new aneurysms. [206] In head trauma with intracranial arterial injury, brain CTA with IV contrast is the recommended modality. [198] In cervical vascular dissection or injury, brain and neck CTA with IV contrast, MRA with and without IV contrast are recommended modalities as initial assessment and surveillance. [212] In initial diagnosis of asymptomatic cervical bruit and surveillance for carotid stenosis, CTA neck with IV contrast, MRA neck without and with IV contrast are usually the appropriate imaging modalities. [212]

In patients with acute onset Horner syndrome, brain CT without IV contrast and brain and neck CTA with IV contrast are the recommended imaging modalities according to the ACR Appropriateness Criteria. [243]

For chronic recurrent vertigo with other brainstem neurologic deficits (most likely due to vertebrobasilar insufficiency), brain and neck MRA without and with IV contrast and brain and neck CTA with IV contrast are the appropriate imaging modalities. MRI is sensitive for posterior fossa infarcts diagnosis. MRA/CTA are preferred for vascular assessment (eg, stenosis, dissection). CTA also has higher sensitivity for vertebral artery dissection than MRA. [271]

## CTV and MRV

In patients with venous thrombosis, brain MRV with or without IV contrast and CTV with IV contrast are the appropriate imaging modalities according to the ACR appropriateness criteria. [41,212] MRV with/without IV contrast is essential for direct venous imaging and CTV with IV contrast is rapid, accurate for clot detection. [212] For head trauma with intracranial venous injury, brain CTV with IV contrast is the recommended modality. [198]

# POLICY HISTORY

| Date | Summary |
|---|---|
| July 2026 | • This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2070 for Brain Imaging:<br>○ ECG 2008 for Brain CT<br>○ ECG 2009 for Brain CTA<br>○ ECG 2010 for MRS<br>○ ECG 2011 for Brain MRA<br>○ ECG 2012 for Brain MRI<br>○ ECG 2013 for Brain PET Scan<br>○ ECG 2015 for Cerebral Perfusion CT<br>○ ECG 2028 for Functional MRI Brain<br>○ ECG 2040 for Neck CTA<br>○ ECG 2041 for Neck MRA<br>○ ECG 2068 for Brain and Neck CTA<br>• This guideline also merges the procedure codes from the above Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Sharma A, Kirsch CFE, Aulino JM, et al. ACR Appropriateness Criteria® Hearing Loss and/or Vertigo. *Journal of the American College of Radiology*. 2018;15(11):S321-S331. doi:10.1016/j.jacr.2018.09.020
2. Basura GJ, Adams ME, Monfared A, et al. Clinical Practice Guideline: Ménière's Disease. *Otolaryngology - Head and Neck Surgery (United States)*. 2020;162(2_suppl):S1-S55. doi:10.1177/0194599820909438
3. Chandrasekhar SS, Tsai Do BS, Schwartz SR, et al. Clinical Practice Guideline: Sudden Hearing Loss (Update). *Otolaryngology - Head and Neck Surgery (United States)*. 2019;161(1_suppl):S1-S45. doi:10.1177/0194599819859885
4. Tsai Do BS, Bush ML, Weinreich HM, et al. Clinical Practice Guideline: Age-Related Hearing Loss. *Otolaryngology - Head and Neck Surgery (United States)*. 2024;170(S2):S1-S54. doi:10.1002/ohn.750
5. Swarup A, Karakkandy V, Chappity P, et al. Comparing accuracy of cochlear measurements on magnetic resonance imaging and computed tomography: A step towards radiation-free cochlear implantation. *J Otol*. 2023;18(4):208-213. doi:10.1016/j.joto.2023.08.001
6. Widmann G, Dejaco D, Luger A, Schmutzhard J. Pre- and post-operative imaging of cochlear implants: a pictorial review. *Insights Imaging*. 2020;11(1). doi:10.1186/s13244-020-00902-6
7. Jain V, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Tinnitus: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S574-S591. doi:10.1016/j.jacr.2023.08.017
8. Cao AC, Hwa TP, Cavarocchi C, et al. Diagnostic Yield and Utility of Radiographic Imaging in the Evaluation of Pulsatile Tinnitus: A Systematic Review. *Otology & Neurotology Open*. 2023;3(2):e030. doi:10.1097/ONO.0000000000000030
9. Pegge SAH, Steens SCA, Kunst HPM, Meijer FJA. Pulsatile Tinnitus: Differential Diagnosis and Radiological Work-Up. *Curr Radiol Rep*. 2017;5(1):5. doi:10.1007/s40134-017-0199-7
10. Duvvuri M, Ali H, Amans MR. Non-invasive imaging modalities for diagnosing pulsatile tinnitus: a comprehensive review and recommended imaging algorithm. *J Neurointerv Surg*. Published online November 2, 2024:jnis-2023-020949. doi:10.1136/jnis-2023-020949
11. Agarwal M, Juliano AF, Hagiwara M, et al. ACR Appropriateness Criteria® Inflammatory Ear Disease. *Journal of the American College of Radiology*. 2025;22(5):S300-S318. doi:10.1016/j.jacr.2025.02.026
12. Rosenfeld RM, Schwartz SR, Cannon CR, et al. Clinical practice guideline: acute otitis externa. *Otolaryngol Head Neck Surg*. 2014;150(1 Suppl):S1-S24. doi:10.1177/0194599813517083
13. Hirvonen J, Lingam RK, Connor S. ESR Essentials: acute infections of the head and neck—practice recommendations by the European Society of Head and Neck Radiology. *Eur Radiol*. 2026;36:334-343. doi:10.1007/s00330-025-11818-4

14. Patel KM, Almutairi A, Mafee MF. Acute otomastoiditis and its complications: Role of imaging. *Oper Tech Otolayngol Head Neck Surg*. 2014;25(1):21-28. doi:10.1016/j.otot.2013.11.004

15. Baba A, Kurokawa R, Kurokawa M, et al. Advanced imaging of head and neck infections. *Journal of Neuroimaging*. 2023;33(4):477-492. doi:10.1111/jon.13099

16. Bertolaso C, Cammisa I, Orsini N, et al. Diagnosing acute mastoiditis in a pediatric emergency department: a retrospective review. *Acta Biomedica*. 2023;94(2). doi:10.23750/abm.v94i2.13839

17. Xun M, Liu X, Sha Y, Zhang X, Liu JP. The diagnostic utility of diffusion-weighted magnetic resonance imaging and high-resolution computed tomography for cholesteatoma: A meta-analysis. *Laryngoscope Investig Otolaryngol*. 2023;8(3):627-635. doi:10.1002/lio2.1032

18. Borsetto D, Sethi M, Clarkson K, et al. Evidence-based surveillance protocol for vestibular schwannomas: a long-term analysis of tumor growth using conditional probability. *J Neurosurg*. 2022;137(4):1026-1033. doi:10.3171/2022.1.JNS211544

19. Dunn IF, Bi WL, Mukundan S, et al. Congress of Neurological Surgeons Systematic Review and Evidence-Based Guidelines on the Role of Imaging in the Diagnosis and Management of Patients with Vestibular Schwannomas. *Clin Neurosurg*. 2018;82(2):E32-E34. doi:10.1093/neuros/nyx510

20. Goldbrunner R, Weller M, Regis J, et al. EANO guideline on the diagnosis and treatment of vestibular schwannoma. *Neuro Oncol*. 2020;22(1):31-45. doi:10.1093/neuonc/noz153

21. Barkhof F, Reich DS, Oh J, et al. 2024 MAGNIMS-CMSC-NAIMS consensus recommendations on the use of MRI for the diagnosis of multiple sclerosis. *www.thelancet.com/neurology*. 2025;24. www.thelancet.com/neurology

22. Baskaran AB, Grebenciucova E, Shoemaker T, Graham EL. Multiple Sclerosis. *Journal of Clinical Neurology (Korea)*. 2023;19(3):217-229. doi:10.3988/jcn.2022.0208

23. Traboulsee A, Simon JH, Stone L, et al. Revised recommendations of the consortium of MS centers task force for a standardized MRI protocol and clinical guidelines for the diagnosis and follow-up of multiple sclerosis. *American Journal of Neuroradiology*. 2016;37(3):394-401. doi:10.3174/ajnr.A4539

24. Wattjes MP, Ciccarelli O, Reich DS, et al. 2021 MAGNIMS–CMSC–NAIMS consensus recommendations on the use of MRI in patients with multiple sclerosis. *Lancet Neurol*. 2021;20(8):653-670. doi:10.1016/S1474-4422(21)00095-8

25. Thompson AJ, Banwell BL, Barkhof F, et al. Diagnosis of multiple sclerosis: 2017 revisions of the McDonald criteria. *Lancet Neurol*. 2018;17(2):162-173. doi:10.1016/S1474-4422(17)30470-2

26. Kalnins A, Lewis LM, Soderlund KA, et al. ACR Appropriateness Criteria® Demyelinating Diseases. *Journal of the American College of Radiology*. Published online 2026. doi:10.1016/j.jacr.2026.02.003

27. Scarpazza C, Signori A, Cosottini M, Sormani MP, Gerevini S, Capra R. Should frequent MRI monitoring be performed in natalizumab-treated MS patients? A contribution to a

recent debate. *Multiple Sclerosis Journal*. 2020;26(10):1227-1236. doi:10.1177/1352458519854162

28. Kümpfel T, Giglhuber K, Aktas O, et al. Update on the diagnosis and treatment of neuromyelitis optica spectrum disorders (NMOSD) – revised recommendations of the Neuromyelitis Optica Study Group (NEMOS). Part II: Attack therapy and long-term management. *J Neurol*. 2024;271(1):141-176. doi:10.1007/s00415-023-11910-z
29. Montalban X, Lebrun-Frénay C, Oh J, et al. Diagnosis of multiple sclerosis: 2024 revisions of the McDonald criteria. *www.thelancet.com/neurology*. 2025;24.
30. Kartau M, Sipilä JO, Auvinen E, Palomäki M, Verkkoniemi-Ahola A. Progressive Multifocal Leukoencephalopathy: Current Insights. *Degener Neurol Neuromuscul Dis*. 2019;Volume 9:109-121. doi:10.2147/DNND.S203405
31. Banwell B, Bennett JL, Marignier R, et al. Diagnosis of myelin oligodendrocyte glycoprotein antibody-associated disease: International MOGAD Panel proposed criteria. *Lancet Neurol*. 2023;22(3):268-282. doi:10.1016/S1474-4422(22)00431-8
32. Jarius S, Aktas O, Ayzenberg I, et al. Update on the diagnosis and treatment of neuromyelits optica spectrum disorders (NMOSD) – revised recommendations of the Neuromyelitis Optica Study Group (NEMOS). Part I: Diagnosis and differential diagnosis. *J Neurol*. 2023;270(7):3341-3368. doi:10.1007/s00415-023-11634-0
33. Wingerchuk DM, Banwell B, Bennett JL, et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. *Neurology*. 2015;85(2):177-189. doi:10.1212/WNL.0000000000001729
34. Shadmani G, Simkins TJ, Assadsangabi R, et al. Autoimmune diseases of the brain, imaging and clinical review. *Neuroradiology Journal*. 2022;35(2):152-169. doi:10.1177/19714009211042879
35. Graus F, Titulaer MJ, Balu R, et al. A clinical approach to diagnosis of autoimmune encephalitis. *Lancet Neurol*. 2016;15(4):391-404. doi:10.1016/S1474-4422(15)00401-9
36. Orozco E, Valencia-Sanchez C, Britton J, et al. Autoimmune Encephalitis Criteria in Clinical Practice. *Neurol Clin Pract*. 2023;13(3). doi:10.1212/CPJ.0000000000200151
37. Voortman M, Drent M, Baughman RP. Management of neurosarcoidosis: a clinical challenge. *Curr Opin Neurol*. 2019;32(3):475-483. doi:10.1097/WCO.0000000000000684
38. Bradshaw MJ, Pawate S, Koth LL, Cho TA, Gelfand JM. Neurosarcoidosis. *Neurol Neuroimmunol Neuroinflamm*. 2021;8(6):e1084. doi:10.1212/NXI.0000000000001084
39. Cleary JO, Sivarasan N, Burd C, Connor SEJ. Pictorial Review: Head and neck manifestations of granulomatosis with polyangiitis. *Br J Radiol*. 2021;(94).
40. Ledbetter LN, Burns J, Shih RY, et al. ACR Appropriateness Criteria® Cerebrovascular Diseases-Aneurysm, Vascular Malformation, and Subarachnoid Hemorrhage. *Journal of the American College of Radiology*. 2021;18(11):S283-S304. doi:10.1016/j.jacr.2021.08.012
41. Robertson RL, Palasis S, Rivkin MJ, et al. ACR Appropriateness Criteria® Cerebrovascular Disease-Child. *Journal of the American College of Radiology*. 2020;17(5):S36-S54. doi:10.1016/j.jacr.2020.01.036

42. Agarwal S, Sebastian LJD, Gaikwad S, et al. The role of susceptibility-weighted imaging & contrast-enhanced MRI in the diagnosis of primary CNS vasculitis: a large case series. *Sci Rep*. 2024;14(1):4718. doi:10.1038/s41598-024-55222-2

43. Dejaco C, Ramiro S, Bond M, et al. EULAR recommendations for the use of imaging in large vessel vasculitis in clinical practice: 2023 update. *Ann Rheum Dis*. 2024;83(6):741-751. doi:10.1136/ard-2023-224543

44. Maz M, Chung SA, Abril A, et al. 2021 American College of Rheumatology/Vasculitis Foundation Guideline for the Management of Giant Cell Arteritis and Takayasu Arteritis. *Arthritis & Rheumatology*. 2021;73(8):1349-1365. doi:10.1002/art.41774

45. D'Souza NM, Morgan ML, Almarzouqi SJ, Lee AG. Magnetic resonance imaging findings in giant cell arteritis. *Eye (Basingstoke)*. 2016;30(5):758-762. doi:10.1038/eye.2016.19

46. Prieto-Peña D, Castañeda S, Martínez-Rodríguez I, Atienza-Mateo B, Blanco R, González-Gay MA. Imaging tests in the early diagnosis of giant cell arteritis. *J Clin Med*. 2021;10(16). doi:10.3390/jcm10163704

47. Ni R, Kohler MJ. What is new in imaging to assist in the diagnosis of giant cell arteritis and Takayasu's arteritis since the EULAR and ACR/VF recommendations? *Front Med (Lausanne)*. 2024;11. doi:10.3389/fmed.2024.1495644

48. Soares BP, Shih RY, Utukuri PS, et al. ACR Appropriateness Criteria® Altered Mental Status, Coma, Delirium, and Psychosis: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S372-S383. doi:10.1016/j.jacr.2024.08.018

49. Soderlund KA, Austin MJ, Ben-Haim S, et al. ACR Appropriateness Criteria® Dementia: 2024 Update. *Journal of the American College of Radiology*. 2025;22(5):S202-S233. doi:10.1016/j.jacr.2025.02.031

50. McKhann GM, Knopman DS, Chertkow H, et al. The diagnosis of dementia due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's and Dementia*. 2011;7(3):263-269. doi:10.1016/j.jalz.2011.03.005

51. Albert MS, DeKosky ST, Dickson D, et al. The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's and Dementia*. 2011;7(3):270-279. doi:10.1016/j.jalz.2011.03.008

52. Petersen RC. Mild Cognitive Impairment. Published online 2016.

53. Arvanitakis Z, Shah RC, Bennett DA. Diagnosis and Management of Dementia: Review. *JAMA - Journal of the American Medical Association*. 2019;322(16):1589-1599. doi:10.1001/jama.2019.4782

54. Frisoni GB, Hansson O, Nichols E, et al. New landscape of the diagnosis of Alzheimer's disease. *The Lancet*. 2025;406(10510):1389-1407. doi:10.1016/S0140-6736(25)01294-2

55. Atri A, Dickerson BC, Clevenger C, et al. Alzheimer's Association clinical practice guideline for the Diagnostic Evaluation, Testing, Counseling, and Disclosure of Suspected Alzheimer's Disease and Related Disorders (DETeCD-ADRD): Executive summary of recommendations for primary care. *Alzheimer's and Dementia*. Published online June 1, 2024. doi:10.1002/alz.14333

56. Hoops S, Nazem BS, Siderowf BAD, et al. Validity of the MoCA and MMSE in the detection of MCI and dementia in Parkinson disease. Published online 2009.

57. Pas M Te, Rikkert MO, Bouwman A, Kessels R, Buise M. Screening for Mild Cognitive Impairment in the Preoperative Setting: A Narrative Review. *Healthcare (Switzerland)*. 2022;10(6). doi:10.3390/healthcare10061112

58. Atri A, Dickerson BC, Clevenger C, et al. The Alzheimer's Association clinical practice guideline for the diagnostic evaluation, testing, counseling, and disclosure of suspected Alzheimer's disease and related disorders (DETeCD-ADRD): Validated clinical assessment instruments. *Alzheimer's and Dementia*. 2025;21(1). doi:10.1002/alz.14335

59. Cordell CB, Borson S, Boustani M, et al. Alzheimer's Association recommendations for operationalizing the detection of cognitive impairment during the Medicare Annual Wellness Visit in a primary care setting. *Alzheimer's and Dementia*. 2013;9(2):141-150. doi:10.1016/j.jalz.2012.09.011

60. Chan CCH, Fage BA, Burton JK, et al. Mini-cog for the diagnosis of alzheimer's disease dementia and other dementias within a secondary care setting. *Cochrane Database of Systematic Reviews*. 2019;2019(9). doi:10.1002/14651858.CD011414.pub2

61. American College of Radiology; American Society of Neuroradiology; Society for Pediatric Radiology. *ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF FUNCTIONAL MAGNETIC IMAGING (FMRI) OF THE BRAIN*.; 2022. https://gravitas.acr.org/PPTS/DownloadPreviewDocument?DocId=138

62. Karambelkar A, Gandhi A, Trunz L, et al. National medicare trends in the utilization of fMRI. *Neuroscience Informatics*. 2022;2(1):100031. doi:10.1016/j.neuri.2021.100031

63. Wu W, Ji Y, Wang Z, et al. The FDA-approved anti-amyloid-β monoclonal antibodies for the treatment of Alzheimer's disease: a systematic review and meta-analysis of randomized controlled trials. *Eur J Med Res*. 2023;28(1):544. doi:10.1186/s40001-023-01512-w

64. Cummings J, Apostolova L, Rabinovici GD, et al. Lecanemab: Appropriate Use Recommendations. *Journal of Prevention of Alzheimer's Disease*. 2023;10(3):362-377. doi:10.14283/jpad.2023.30

65. Rossi A, Argyropoulou M, Zlatareva D, et al. European recommendations on practices in pediatric neuroradiology: consensus document from the European Society of Neuroradiology (ESNR), European Society of Paediatric Radiology (ESPR) and European Union of Medical Specialists Division of Neuroradiology (UEMS). *Pediatr Radiol*. 2023;53(1):159-168. doi:10.1007/s00247-022-05479-4

66. Orrù E, Calloni SF, Tekes A, Huisman TAGM, Soares BP. The child with macrocephaly: Differential diagnosis and neuroimaging findings. *American Journal of Roentgenology*. 2018;210(4):848-859. doi:10.2214/AJR.17.18693

67. Sampson MA, Berg AD, Huber JN, Olgun G. Necessity of Intracranial Imaging in Infants and Children With Macrocephaly. *Pediatr Neurol*. 2019;93:21-26. doi:10.1016/j.pediatrneurol.2018.10.018

68. Accogli A, Geraldo AF, Piccolo G, et al. Diagnostic Approach to Macrocephaly in Children. *Front Pediatr*. 2022;9. doi:10.3389/fped.2021.794069

69. Ashwal S, Michelson D, Plawner L, Dobyns WB. Practice Parameter: Evaluation of the child with microcephaly (an evidence-based review). Published online 2009. www.neurology.org

70. Novak I, Morgan C, Adde L, et al. Early, Accurate Diagnosis and Early Intervention in Cerebral Palsy. *JAMA Pediatr*. 2017;171(9):897-907. doi:10.1001/jamapediatrics.2017.1689

71. Veronese A, Osredkar D, Lovrečić L, Troha Gergeli A. Diagnostic Approach to Children with Unexplained Global Developmental Delay in Pediatric Neurology Outpatient Clinic. *Neuropediatrics*. 2024;56(2):125-132. doi:10.1055/a-2430-0494

72. Byrne D, Fisher A, Baker L, Twomey E, Gorman KM. Yield of brain MRI in children with autism spectrum disorder. *Eur J Pediatr*. 2023;182(8):3603-3609. doi:10.1007/s00431-023-05011-2

73. Tieder JS, Bonkowsky JL, Etzel RA, et al. Brief Resolved Unexplained Events (Formerly Apparent Life-Threatening Events) and Evaluation of Lower-Risk Infants: Executive Summary. *Pediatrics*. 2016;137(5):e20160591. doi:10.1542/peds.2016-0591

74. Lawrence Merritt J, Quinonez RA, Bonkowsky JL, et al. A framework for evaluation of the higher-risk infant after a brief resolved unexplained event. *Pediatrics*. 2019;144(2). doi:10.1542/peds.2018-4101

75. Mohammad SA, Osman NM, Ahmed KA. The value of CSF flow studies in the management of CSF disorders in children: a pictorial review. *Insights Imaging*. 2019;10(1):3. doi:10.1186/s13244-019-0686-x

76. Korbecki A, Zimny A, Podgórski P, Sąsiadek M, Bladowska J. Imaging of cerebrospinal fluid flow: Fundamentals, techniques, and clinical applications of phase-contrast magnetic resonance imaging. *Pol J Radiol*. 2019;84:240-250. doi:10.5114/pjr.2019.86881

77. Costa F, Benali SA, Dantas F, et al. Chiari Malformation: Diagnosis, Classifications, Natural History, and Conservative Management. World Federation of Neurosurgical Societies Spine Committee Recommendations. *Spine (Phila Pa 1976)*. 2025;50(11):767-778. doi:10.1097/BRS.0000000000005289

78. Hatgaonkar AM, Mahajan SM, Hatgoankar KA, Bandre GR. MRI Imaging Insights in Chiari Malformation Type 1 and Variations With Hydrosyringomyelia. *Cureus*. 2024;16(3):e55676. doi:10.7759/cureus.55676

79. Whitson WJ, Lane JR, Bauer DF, Durham SR. A prospective natural history study of nonoperatively managed Chiari I malformation: does follow-up MRI surveillance alter surgical decision making? *J Neurosurg Pediatr*. 2015;16(2):159-166. doi:10.3171/2014.12.PEDS14301

80. Massimi L, Peretta P, Erbetta A, et al. Diagnosis and treatment of Chiari malformation type 1 in children: the International Consensus Document. *Neurol Sci*. 2022;43(2):1311-1326. doi:10.1007/s10072-021-05317-9

81. Govindappa SKG, Adiga CP, Kumar S, Goolahally LN, Kumar S. Spontaneous Intracranial Hypotension: A Review of Neuroimaging and Current Concepts. *Indian Journal of Radiology and Imaging*. 2023;34(1):128-138. doi:10.1055/s-0043-1774301

82. Cheema S, Anderson J, Angus-Leppan H, et al. Multidisciplinary consensus guideline for the diagnosis and management of spontaneous intracranial hypotension. *J Neurol Neurosurg Psychiatry*. 2023;94(10):835-843. doi:10.1136/jnnp-2023-331166

83. Utukuri PS, Shih RY, Ajam AA, et al. ACR Appropriateness Criteria® Headache: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S70-S93. doi:10.1016/j.jacr.2023.02.018

84. Hiremath SB, Gautam AA, Sasindran V, Therakathu J, Benjamin G. Cerebrospinal fluid rhinorrhea and otorrhea: A multimodality imaging approach. *Diagn Interv Imaging*. 2019;100(1):3-15. doi:10.1016/j.diii.2018.05.003

85. Timpone VM, Parsons MS, Boulter DJ, et al. ACR Appropriateness Criteria® Imaging of Suspected Intracranial Hypotension. *J Am Coll Radiol*. 2024;21(11S):S396-S412. doi:10.1016/j.jacr.2024.08.020

86. Hersh DS, Martin JE, Bristol RE, et al. Hydrocephalus surveillance following CSF diversion: a modified Delphi study. *J Neurosurg Pediatr*. 2022;30(2):177-187. doi:10.3171/2022.5.PEDS22116

87. Khalatbari H, Parisi MT. Management of Hydrocephalus in Children: Anatomic Imaging Appearances of CSF Shunts and Their Complications. *American Journal of Roentgenology*. 2021;216(1):187-199. doi:10.2214/AJR.20.22888

88. Yamada S. Neuroimaging of Adult Hydrocephalus. *Neurosurg Clin N Am*. 2025;36(2):183-197. doi:10.1016/j.nec.2024.11.007

89. Virhammar J, Fasth O, Vedung F. When and how are complications suspected after shunt surgery in patients with normal pressure hydrocephalus? *Acta Neurochir (Wien)*. 2025;167(1). doi:10.1007/s00701-024-06415-1

90. Deopujari C, Mohanty C, Agrawal H, Jain S, Chawla P. A comparison of Adult and Pediatric Hydrocephalus. *Neurol India*. 2021;69(8):S381-S391. doi:10.4103/0028-3886.332283

91. Nakajima M, Yamada S, Miyajima M, et al. Guidelines for management of idiopathic normal pressure hydrocephalus (Third edition): Endorsed by the Japanese society of normal pressure hydrocephalus. *Neurol Med Chir (Tokyo)*. 2021;61(2):63-97. doi:10.2176/nmc.st.2020-0292

92. International Headache Society. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211. doi:10.1177/0333102417738202

93. Evans RW, Burch RC, Frishberg BM, et al. Neuroimaging for Migraine: The American Headache Society Systematic Review and Evidence-Based Guideline. *Headache: The Journal of Head and Face Pain*. 2020;60(2):318-336. doi:10.1111/head.13720

94. Togha M, Karimitafti MJ, Ghorbani Z, et al. Characteristics and comorbidities of headache in patients over 50 years of age: a cross-sectional study. *BMC Geriatr*. 2022;22(1):313. doi:10.1186/s12877-022-03027-1

95. González-Quintanilla V, Madera J, Pascual J. Update on headaches associated with physical exertion. *Cephalalgia*. 2023;43(3):3331024221146989. doi:10.1177/03331024221146989

96. Hamilton KT. Secondary Headaches During Pregnancy and the Postpartum Period. *Pract Neurol*. Published online May 2020:62-66. https://practicalneurology.com/diseases-diagnoses/headache-pain/secondary-headaches-during-pregnancy-and-the-postpartum-period/31660/

97. Hayes LL, Palasis S, Bartel TB, et al. ACR Appropriateness Criteria® Headache–Child. *Journal of the American College of Radiology*. 2018;15(5):S78-S90. doi:10.1016/j.jacr.2018.03.017

98. Trofimova A, Vey BL, Mullins ME, Wolf DS, Kadom N. Imaging of Children With Nontraumatic Headaches. *American Journal of Roentgenology*. 2018;210(1):8-17. doi:10.2214/AJR.17.18561

99. Raucci U, Borrelli O, Di Nardo G, et al. Cyclic Vomiting Syndrome in Children. *Front Neurol*. 2020;11:583425. doi:10.3389/fneur.2020.583425

100. Viera AJ, Antono B. Acute Headache in Adults: A Diagnostic Approach. *Am Fam Physician*. 2022;106(3):260-268.

101. Raucci U, Parisi P, Ferro V, et al. Children under 6 years with acute headache in Pediatric Emergency Departments. A 2-year retrospective exploratory multicenter Italian study. *Cephalalgia*. 2023;43(6):3331024231164361. doi:10.1177/03331024231164361

102. Ferrante E, Tassorelli C, Rossi P, Lisotto C, Nappi G. Focus on the management of thunderclap headache: from nosography to treatment. *J Headache Pain*. 2011;12(2):251-258. doi:10.1007/s10194-011-0302-z

103. Venkatesan T, Levinthal DJ, Tarbell SE, et al. Guidelines on management of cyclic vomiting syndrome in adults by the American Neurogastroenterology and Motility Society and the Cyclic Vomiting Syndrome Association. *Neurogastroenterology & Motility*. 2019;31(S2):e13604. doi:10.1111/nmo.13604

104. Do TP, Remmers A, Schytz HW, et al. Red and orange flags for secondary headaches in clinical practice: SNNOOP10 list. *Neurology*. 2019;92(3):134-144. doi:10.1212/WNL.0000000000006697

105. Lawton MT, Vates GE. Subarachnoid Hemorrhage. Solomon CG, ed. *New England Journal of Medicine*. 2017;377(3):257-266. doi:10.1056/NEJMcp1605827

106. Kane SF, Butler E, Sindelar BD. Nontraumatic Subarachnoid Hemorrhage and Ruptured Intracranial Aneurysm: Recognition and Evaluation. 2023;108(4). www.aafp.org/afp.

107. Chen CY, Fuh JL. Evaluating thunderclap headache. *Curr Opin Neurol*. 2021;34(3):356-362. doi:10.1097/WCO.0000000000000917

108. Levinthal DJ, Staller K, Venkatesan T. AGA Clinical Practice Update on Diagnosis and Management of Cyclic Vomiting Syndrome: Commentary. *Gastroenterology*. 2024;167(4):804-811.e1. doi:10.1053/j.gastro.2024.05.031

109. Choi I, Jeon SR. Neuralgias of the Head: Occipital Neuralgia. *J Korean Med Sci*. 2016;31(4):479-488. doi:10.3346/jkms.2016.31.4.479

110. Rath TJ, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Cranial Neuropathy: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S266-S303. doi:10.1016/j.jacr.2022.09.021

111. Liang C, Yang L, Reichardt W, Zhang B, Li R. Different MRI-based methods for the diagnosis of neurovascular compression in trigeminal neuralgia or hemifacial spasm: A network meta-analysis. *Journal of Clinical Neuroscience*. 2023;108:19-24. doi:10.1016/j.jocn.2022.12.016

112. Cruccu G, Finnerup NB, Jensen TS, et al. Trigeminal neuralgia: New classification and diagnostic grading for practice and research. *Neurology*. 2016;87(2):220-228. doi:10.1212/WNL.0000000000002840

113. Marcolini E, Hine J. Approach to the Diagnosis and Management of Subarachnoid Hemorrhage. *Western Journal of Emergency Medicine*. 2019;20(2):203-211. doi:10.5811/westjem.2019.1.37352

114. Duong MT, Rudie JD, Mohan S. Neuroimaging Patterns of Intracranial Infections: Meningitis, Cerebritis, and Their Complications. *Neuroimaging Clin N Am*. 2023;33(1):11-41. doi:10.1016/j.nic.2022.07.001

115. Perillo T, Capasso R, Pinto A. Neuroimaging of the Most Common Meningitis and Encephalitis of Adults: A Narrative Review. *Diagnostics*. 2024;14(11). doi:10.3390/diagnostics14111064

116. Costerus JM, Lemmens CMC, van de Beek D, Brouwer MC. Cranial imaging and lumbar puncture in patients with suspected central nervous system infection. *Clinical Infectious Diseases*. 2020;70(12):2469-2475. doi:10.1093/cid/ciz694

117. Ahn Y, Joo L, Suh CH, et al. Impact of Brain MRI on the Diagnosis of Infective Endocarditis and Treatment Decisions: Systematic Review and Meta-Analysis. *American Journal of Roentgenology*. 2022;218(6):958-968. doi:10.2214/AJR.21.26896

118. Ahlawat S, Lenchik L, Baker JC, et al. ACR Appropriateness Criteria® Suspected Primary Bone Tumors: 2024 Update. *Journal of the American College of Radiology*. 2025;22(5):S440-S454. doi:10.1016/j.jacr.2025.02.020

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120. Ivanidze J, Shih RY, Utukuri PS, et al. ACR Appropriateness Criteria® Brain Tumors. *Journal of the American College of Radiology*. 2025;22(5):S108-S135. doi:10.1016/j.jacr.2025.02.036

121. Eilaghi A, Yeung T, d'Esterre C, et al. Quantitative Perfusion and Permeability Biomarkers in Brain Cancer from Tomographic CT and MR Images. *Biomark Cancer*. 2016;8s2:BIC.S31801. doi:10.4137/bic.s31801

122. Weinberg BD, Kuruva M, Shim H, Mullins ME. Clinical Applications of Magnetic Resonance Spectroscopy in Brain Tumors. *Radiol Clin North Am*. 2021;59(3):349-362. doi:10.1016/j.rcl.2021.01.004

123. Galijasevic M, Steiger R, Mangesius S, et al. Magnetic Resonance Spectroscopy in Diagnosis and Follow-Up of Gliomas: State-of-the-Art. *Cancers (Basel)*. 2022;14(13):3197. doi:10.3390/cancers14133197

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128. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

129. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

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147. Kumar VA, Heiba IM, Prabhu SS, et al. The role of resting-state functional MRI for clinical preoperative language mapping. *Cancer Imaging*. 2020;20(1):47. doi:10.1186/s40644-020-00327-w

148. Vysotski S, Madura C, Swan B, et al. Preoperative FMRI associated with decreased mortality and morbidity in brain tumor patients. *Interdisciplinary Neurosurgery*. 2018;13:40-45. doi:10.1016/j.inat.2018.02.001

149. Silva MA, See AP, Essayed WI, Golby AJ, Tie Y. Challenges and techniques for presurgical brain mapping with functional MRI. *Neuroimage Clin*. 2018;17:794-803. doi:10.1016/j.nicl.2017.12.008

150. Lakhani DA, Sabsevitz DS, Chaichana KL, Quiñones-Hinojosa A, Middlebrooks EH. Current State of Functional MRI in the Presurgical Planning of Brain Tumors. *Radiol Imaging Cancer*. 2023;5(6). doi:10.1148/rycan.230078

151. Jain R. Perfusion CT Imaging of Brain Tumors: An Overview. *American Journal of Neuroradiology*. 2011;32(9):1570-1577. doi:10.3174/ajnr.A2263

152. Harvey HB, Watson LC, Subramaniam RM, et al. ACR Appropriateness Criteria® Movement Disorders and Neurodegenerative Diseases. *Journal of the American College of Radiology*. 2020;17(5):S175-S187. doi:10.1016/j.jacr.2020.01.042

153. McFarland NR. Diagnostic Approach to Atypical Parkinsonian Syndromes. *CONTINUUM: Lifelong Learning in Neurology*. 2016;22(4):1117-1142. doi:10.1212/CON.0000000000000348

154. Peralta C, Strafella AP, van Eimeren T, et al. Pragmatic Approach on Neuroimaging Techniques for the Differential Diagnosis of Parkinsonisms. *Mov Disord Clin Pract*. 2022;9(1):6-19. doi:10.1002/mdc3.13354

155. Simonyan K. Neuroimaging Applications in Dystonia. *Int Rev Neurobiol*. 2018;143:1-30. doi:10.1016/bs.irn.2018.09.007

156. Petersenn S, Fleseriu M, Casanueva FF, et al. Diagnosis and management of prolactin-secreting pituitary adenomas: a Pituitary Society international Consensus Statement. *Nat Rev Endocrinol*. 2023;19(12):722-740. doi:10.1038/s41574-023-00886-5

157. Burns J, Policeni B, Bykowski J, et al. ACR Appropriateness Criteria® Neuroendocrine Imaging. *Journal of the American College of Radiology*. 2019;16(5):S161-S173. doi:10.1016/j.jacr.2019.02.017

158. Katznelson L, Laws ER, Melmed S, et al. Acromegaly: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab*. 2014;99(11):3933-3951. doi:10.1210/jc.2014-2700

159. Crawford M, Kennedy L. Testosterone replacement therapy: role of pituitary and thyroid in diagnosis and treatment. *Transl Androl Urol*. 2016;5(6):850-858. doi:10.21037/tau.2016.09.01

160. Jayasena CN, Devine K, Barber K, et al. Society for endocrinology guideline for understanding, diagnosing and treating female hypogonadism. *Clin Endocrinol (Oxf)*. 2024;101(5):409-442. doi:10.1111/cen.15097

161. Fleseriu M, Hashim IA, Karavitaki N, et al. Hormonal Replacement in Hypopituitarism in Adults: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab*. 2016;101(11):3888-3921. doi:10.1210/jc.2016-2118

162. Reincke M, Fleseriu M. Cushing Syndrome: A Review. *JAMA*. 2023;330(2):170-181. doi:10.1001/jama.2023.11305

163. Klein DA, Emerick JE, Sylvester JE, Vogt KS. Disorders of Puberty: An Approach to Diagnosis and Management. *Am Fam Physician*. 2017;96(9):590-599.

164. Zhang M, Sun J, Wang Y, et al. The value of luteinizing hormone basal values and sex hormone-binding globulin for early diagnosis of rapidly progressive central precocious puberty. *Front Endocrinol (Lausanne)*. 2023;14:1273170. doi:10.3389/fendo.2023.1273170

165. Tritos NA, Miller KK. Diagnosis and Management of Pituitary Adenomas: A Review. *JAMA*. 2023;329(16):1386-1398. doi:10.1001/jama.2023.5444

166. Fatani TH. Diagnostic Value of IGF-1 in Growth Hormone-Deficient Children: Is a Second Growth Hormone Stimulation Test Necessary? *J Endocr Soc*. 2023;7(4):bvad018. doi:10.1210/jendso/bvad018

167. Collett-Solberg PF, Ambler G, Backeljauw PF, et al. Diagnosis, Genetics, and Therapy of Short Stature in Children: A Growth Hormone Research Society International Perspective. *Horm Res Paediatr*. 2019;92(1):1-14. doi:10.1159/000502231

168. Melmed S. Pathogenesis and Diagnosis of Growth Hormone Deficiency in Adults. *N Engl J Med*. 2019;380(26):2551-2562. doi:10.1056/NEJMra1817346

169. Bhasin S, Brito JP, Cunningham GR, et al. Testosterone Therapy in Men With Hypogonadism: An Endocrine Society Clinical Practice Guideline. *J Clin Endocrinol Metab*. 2018;103(5):1715-1744. doi:10.1210/jc.2018-00229

170. Mulhall JP, Trost LW, Brannigan RE, et al. Evaluation and Management of Testosterone Deficiency: AUA Guideline. *J Urol*. 2018;200(2):423-432. doi:10.1016/j.juro.2018.03.115

171. Charoensri S, Auchus RJ. A Contemporary Approach to the Diagnosis and Management of Adrenal Insufficiency. *Endocrinology and Metabolism*. 2024;39(1):73-82. doi:10.3803/EnM.2024.1894

172. Binder G, Reinehr T, Ibáñez L, et al. GHD Diagnostics in Europe and the US: An Audit of National Guidelines and Practice. *Horm Res Paediatr*. 2020;92(3):150-156. doi:10.1159/000503783

173. Yuen KCJ, Johannsson G, Ho KKY, Miller BS, Bergada I, Rogol AD. Diagnosis and testing for growth hormone deficiency across the ages: a global view of the accuracy, caveats, and cut-offs for diagnosis. *Endocr Connect*. 2023;12(7). doi:10.1530/EC-22-0504

174. Ibba A, Loche S. Diagnosis of GH Deficiency Without GH Stimulation Tests. *Front Endocrinol (Lausanne)*. 2022;13. doi:10.3389/fendo.2022.853290

175. Latronico AC, Roberts SA, Alonzo M, et al. Central precocious puberty: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab*. Published online June 13, 2026. doi:10.1210/clinem/dgag168

176. Bellastella G, Maiorino MI, Bizzarro A, et al. Revisitation of autoimmune hypophysitis: knowledge and uncertainties on pathophysiological and clinical aspects. *Pituitary*. 2016;19(6):625-642. doi:10.1007/s11102-016-0736-z

177. Jenkinson MD, Mills S, Mallucci CL, Santarius T. Management of pineal and colloid cysts. *Pract Neurol*. 2021;21(4):292-299. doi:10.1136/practneurol-2020-002838

178. Petersson M, Berinder K, Eden Engström B, et al. Natural history and surgical outcome of Rathke's cleft cysts—A study from the Swedish Pituitary Registry. *Clin Endocrinol (Oxf)*. 2022;96(1):54-61. doi:10.1111/cen.14622

179. Kinoshita Y, Taguchi A, Yamasaki F, Tominaga A, Arita K, Horie N. Natural course of Rathke's cleft cysts and risk factors for progression. *J Neurosurg*. 2023;138(5):1426-1432. doi:10.3171/2022.7.JNS22716

180. Fleseriu M, Gurnell M, McCormack A, et al. Pituitary incidentaloma: a Pituitary Society international consensus guideline statement. *Nat Rev Endocrinol*. 2025;21(10):638-655. doi:10.1038/s41574-025-01134-8

181. Jafrani R, Raskin JS, Kaufman A, Lam S. Intracranial arachnoid cysts: Pediatric neurosurgery update. *Surg Neurol Int*. 2019;10:15. doi:10.4103/sni.sni_320_18

182. Wang JY, Hadi H, Arshad M, Whitney E. A Comprehensive Review of Arachnoid Cysts. *Cureus*. 2025;17(5):e83894. doi:10.7759/cureus.83894

183. Buncke MJ, Lilly GL, Hamilton BE, MacArthur CJ. When is pre-operative imaging required for craniofacial dermoid cysts/sinuses? A review. *Int J Pediatr Otorhinolaryngol*. 2022;155:111090. doi:10.1016/j.ijporl.2022.111090

184. Choi JS, Bae YC, Lee JW, Kang G Bin. Dermoid cysts: Epidemiology and diagnostic approach based on clinical experiences. *Arch Plast Surg*. 2018;45(06):512-516. doi:10.5999/aps.2018.00017

185. Briet C, Salenave S, Bonneville JF, Laws ER, Chanson P. Pituitary Apoplexy. *Endocr Rev*. 2015;36(6):622-645. doi:10.1210/er.2015-1042

186. Jensterle M, Jazbinsek S, Bosnjak R, et al. Advances in the management of craniopharyngioma in children and adults. *Radiol Oncol*. 2019;53(4):388-396. doi:10.2478/raon-2019-0036

187. Amayiri N, Spitaels A, Zaghloul M, et al. SIOP PODC–adapted treatment guidelines for craniopharyngioma in low- and middle-income settings. *Pediatr Blood Cancer*. 2023;70(11). doi:10.1002/pbc.28493

188. Lara-Velazquez M, Mehkri Y, Panther E, et al. Current Advances in the Management of Adult Craniopharyngiomas. *Current Oncology*. 2022;29(3):1645-1671. doi:10.3390/curroncol29030138

189. Trofimova A, Milla SS, Ryan ME, et al. ACR Appropriateness Criteria® Seizures-Child. *Journal of the American College of Radiology*. 2021;18(5):S199-S211. doi:10.1016/j.jacr.2021.02.020

190. Lee RK, Burns J, Ajam AA, et al. ACR Appropriateness Criteria® Seizures and Epilepsy. *Journal of the American College of Radiology*. 2020;17(5):S293-S304. doi:10.1016/j.jacr.2020.01.037

191. Cankurtaran CZ, Templer J, Bandt SK, et al. Multimodal Presurgical Evaluation of Medically Refractory Focal Epilepsy in Adults: An Update for Radiologists. *American Journal of Roentgenology*. 2022;219(3):488-500. doi:10.2214/AJR.22.27588

192. Brignole M, Moya A, de Lange FJ, et al. 2018 ESC Guidelines for the diagnosis and management of syncope. *Eur Heart J*. 2018;39(21):1883-1948. doi:10.1093/eurheartj/ehy037

193. Hirtz D, Ashwal S, Berg A, et al. Practice parameter: Evaluating a first nonfebrile seizure in children. *Neurology*. 2023;55(5):616-623. doi:10.1212/WNL.55.5.616

194. Hourani R, Nasreddine W, Dirani M, et al. When Should a Brain MRI Be Performed in Children with New-Onset Seizures? Results of a Large Prospective Trial. *American Journal of Neuroradiology*. 2021;42(9):1695-1701. doi:10.3174/ajnr.A7193

195. Gaillard WD, Chiron C, Helen Cross J, et al. Guidelines for imaging infants and children with recent-onset epilepsy. *Epilepsia*. 2009;50(9):2147-2153. doi:10.1111/j.1528-1167.2009.02075.x

196. Benjamin CFA, Dhingra I, Li AX, et al. Presurgical language fMRI: Technical practices in epilepsy surgical planning. *Hum Brain Mapp*. 2018;39(10):4032-4042. doi:10.1002/hbm.24229

197. Yoganathan K, Malek N, Torzillo E, Paranathala M, Greene J. Neurological update: structural and functional imaging in epilepsy surgery. *J Neurol*. 2023;270(5):2798-2808. doi:10.1007/s00415-023-11619-z

198. Shih RY, Burns J, Ajam AA, et al. ACR Appropriateness Criteria® Head Trauma: 2021 Update. *J Am Coll Radiol*. 2021;18(5S):S13-S36. doi:10.1016/j.jacr.2021.01.006

199. Geiger P, Gmeiner R, Schön V, Petr O, Thomé C, Pinggera D. Timing of Magnetic Resonance Imaging (MRI) in Moderate and Severe TBI: A Systematic Review. *J Clin Med*. 2025;14(12). doi:10.3390/jcm14124078

200. Silverberg ND, Lee K, Mikolić A, et al. Action Collaborative on Traumatic Brain Injury Care: Adapted Clinical Practice Guideline. *Ann Fam Med*. 2025;23(6):552-569. doi:10.1370/afm.250352

201. Ryan ME, Pruthi S, Desai NK, et al. ACR Appropriateness Criteria® Head Trauma-Child. *Journal of the American College of Radiology*. 2020;17(5):S125-S137. doi:10.1016/j.jacr.2020.01.026

202. Wootton-Gorges SL, Soares BP, Alazraki AL, et al. ACR Appropriateness Criteria® Suspected Physical Abuse—Child. *Journal of the American College of Radiology*. 2017;14(5):S338-S349. doi:10.1016/j.jacr.2017.01.036

203. Leddy J, Baker JG, Haider MN, Hinds A, Willer B. A physiological approach to prolonged recovery from sport-related concussion. *J Athl Train*. 2017;52(3):299-308. doi:10.4085/1062-6050-51.11.08

204. Eierud C, Craddock RC, Fletcher S, et al. Neuroimaging after mild traumatic brain injury: Review and meta-analysis. *Neuroimage Clin*. 2014;4:283-294. doi:10.1016/j.nicl.2013.12.009

205. Hoh BL, Ko NU, Amin-Hanjani S, et al. 2023 Guideline for the Management of Patients With Aneurysmal Subarachnoid Hemorrhage: A Guideline From the American Heart Association/American Stroke Association. *Stroke*. 2023;54(7):e314-e370. doi:10.1161/STR.0000000000000436

206. Ogilvy CS. Unruptured Intracranial Aneurysms. *New England Journal of Medicine*. 2025;392(23):2357-2366. doi:10.1056/NEJMcp2409371

207. Rinkel GJ, Ruigrok YM. Preventive screening for intracranial aneurysms. *International Journal of Stroke*. 2022;17(1):30-36. doi:10.1177/17474930211024584

208. Thompson BG, Brown RD, Amin-Hanjani S, et al. Guidelines for the Management of Patients With Unruptured Intracranial Aneurysms. *Stroke*. 2015;46(8):2368-2400. doi:10.1161/STR.0000000000000070

209. Vallabhajosyula S, Yang LT, Thomas SC, et al. Prevalence and Outcomes of Bicuspid Aortic Valve in Patients With Aneurysmal Sub-Arachnoid Hemorrhage: A Prospective Neurology Registry Report. *J Am Heart Assoc*. 2022;11(8). doi:10.1161/JAHA.121.022339

210. Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC Guideline for the Management of Adults With Congenital Heart Disease. *J Am Coll Cardiol*. 2019;73(12):e81-e192. doi:10.1016/j.jacc.2018.08.1029

211. Zheng Y, Lu Z, Shen J, Xu F. Intracranial Pseudoaneurysms: Evaluation and Management. *Front Neurol*. 2020;11. doi:10.3389/fneur.2020.00582

212. Pannell JS, Corey AS, Shih RY, et al. ACR Appropriateness Criteria® Cerebrovascular Diseases-Stroke and Stroke-Related Conditions. *Journal of the American College of Radiology*. 2024;21(6):S21-S64. doi:10.1016/j.jacr.2024.02.015

213. Greenberg SM, Ziai WC, Cordonnier C, et al. 2022 Guideline for the Management of Patients With Spontaneous Intracerebral Hemorrhage: A Guideline From the American Heart Association/American Stroke Association. *Stroke*. 2022;53(7):E282-E361. doi:10.1161/STR.0000000000000407

214. Derdeyn CP, Zipfel GJ, Albuquerque FC, et al. Management of Brain Arteriovenous Malformations: A Scientific Statement for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke*. 2017;48(8):e200-e224. doi:10.1161/STR.0000000000000134

215. Akers AL, Albanese J, Alcazar-Felix RJ, et al. Guidelines for the Diagnosis and Clinical Management of Cavernous Malformations of the Brain and Spinal Cord: Consensus

Recommendations Based on a Systematic Literature Review by the Alliance to Cure Cavernous Malformation Clinical Advisory Board Experts Panel. *Neurosurgery*. Published online 2025. doi:10.1227/neu.0000000000003459

216. Flemming KD, Smith E, Marchuk D, Derry WB. Familial Cerebral Cavernous Malformations. *GeneReviews®*. Published online July 27, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1293/

217. Kleindorfer DO, Towfighi A, Chaturvedi S, et al. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association. *Stroke*. 2021;52(7):e364-e467. doi:10.1161/STR.0000000000000375

218. DeBaun MR, Jordan LC, King AA, et al. American Society of Hematology 2020 guidelines for sickle cell disease: prevention, diagnosis, and treatment of cerebrovascular disease in children and adults. *Blood Adv*. 2020;4(8):1554-1588. doi:10.1182/bloodadvances.2019001142

219. Smith EE, Saposnik G, Biessels GJ, et al. Prevention of Stroke in Patients with Silent Cerebrovascular Disease: A Scientific Statement for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke*. 2017;48(2):e44-e71. doi:10.1161/STR.0000000000000116

220. American College of Radiology. *ACR-ASNR-SPR Practice Parameter For The Performance of Computed Tomography (CT) Perfusion in Neuroradiologic Imaging*.; 2022. https://gravitas.acr.org/PPTS/GetDocumentView?docId=170

221. Khalili N, Wang R, Garg T, et al. Clinical application of brain perfusion imaging in detecting stroke mimics: A review. *Journal of Neuroimaging*. 2023;33(1):44-57. doi:10.1111/jon.13061

222. Gornik HL, Persu A, Adlam D, et al. First International Consensus on the diagnosis and management of fibromuscular dysplasia. *Vascular Medicine*. 2019;24(2):164-189. doi:10.1177/1358863X18821816

223. Kesav P, Manesh Raj D, John S, Raj DM, John S. Cerebrovascular Fibromuscular Dysplasia – A Practical Review. *Vasc Health Risk Manag*. 2023;19:543-556. doi:10.2147/VHRM.S388257

224. Hayes SN, Tweet MS, Adlam D, et al. Spontaneous Coronary Artery Dissection. *J Am Coll Cardiol*. 2020;76(8):961-984. doi:10.1016/j.jacc.2020.05.084

225. Mazzolai L, Teixido-Tura G, Lanzi S, et al. 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases. *Eur Heart J*. 2024;45(36):3538-3700. doi:10.1093/eurheartj/ehae179

226. Rafailidis V, Li X, Chryssogonidis I, et al. Multimodality Imaging and Endovascular Treatment Options of Subclavian Steal Syndrome. *Can Assoc Radiol J*. 2018;69(4):493-507. doi:10.1016/j.carj.2018.08.003

227. Lo CP, Huang CF, Hsu CC, et al. Neuroimaging of isolated and non-isolated third nerve palsies. *British Journal of Radiology*. 2012;85(1012):460-467. doi:10.1259/bjr/38090653

228. Lima Neto A, Bittar R, Gattas G, et al. Pathophysiology and Diagnosis of Vertebrobasilar Insufficiency: A Review of the Literature. *Int Arch Otorhinolaryngol*. 2017;21(03):302-307. doi:10.1055/s-0036-1593448

229. AbuRahma AF, Avgerinos ED, Chang RW, et al. Society for Vascular Surgery clinical practice guidelines for management of extracranial cerebrovascular disease. *J Vasc Surg*. 2022;75(1):4S-22S. doi:10.1016/j.jvs.2021.04.073

230. Patel SD, Haynes R, Staff I, Tunguturi A, Elmoursi S, Nouh A. Recanalization of cervicocephalic artery dissection. *Brain Circ*. 2020;6(3):175-180. doi:10.4103/bc.bc_19_20

231. Larsson SC, King A, Madigan J, Levi C, Norris JW, Markus HS. Prognosis of carotid dissecting aneurysms: Results from CADISS and a systematic review. *Neurology*. 2017;88(7):646-652. doi:10.1212/WNL.0000000000003617

232. Filo J, Ramirez-Velandia F, Lawlor D, et al. Evaluating the safety and efficacy of medical management in extracranial pseudoaneurysms: A comparative study. *J Neurosurg*. 2025;142(3):626-636. doi:10.3171/2024.6.JNS24732

233. Seven NA, Casanegra AI, Lanzino G, Keser Z. Extracranial Internal Carotid and Vertebral Dissecting Pseudoaneurysms: Clinical Features and Long-Term Outcomes. *Stroke: Vascular and Interventional Neurology*. 2023;3(3). doi:10.1161/svin.122.000703

234. American College of Radiology. *ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY ANGIOGRAPHY (CTA) OF THE HEAD AND NECK*.; 2020. https://gravitas.acr.org/PPTS/GetDocumentView?docId=72

235. Friedman DI, Liu GT, Digre KB. Revised diagnostic criteria for the pseudotumor cerebri syndrome in adults and children. *Neurology*. 2013;(81):1159-1165. https://www.neurology.org

236. Beier D, Korsbæk JJ, Bsteh G, et al. Magnetic Resonance Imaging Signs of Idiopathic Intracranial Hypertension. *JAMA Netw Open*. 2024;7(7). doi:10.1001/jamanetworkopen.2024.20138

237. Korsbæk JJ, Jensen RH, Høgedal L, Molander LD, Hagen SM, Beier D. Diagnosis of idiopathic intracranial hypertension: A proposal for evidence-based diagnostic criteria. *Cephalalgia*. 2023;43(3). doi:10.1177/03331024231152795

238. Burton TM, Bushnell CD. Reversible Cerebral Vasoconstriction Syndrome. *Stroke*. 2019;50(8):2253-2258. doi:10.1161/STROKEAHA.119.024416

239. Saposnik G, Bushnell C, Coutinho JM, et al. Diagnosis and Management of Cerebral Venous Thrombosis: A Scientific Statement from the American Heart Association. *Stroke*. 2024;55(3):E77-E90. doi:10.1161/STR.0000000000000456

240. Gonzalez NR, Amin-Hanjani S, Bang OY, et al. Adult Moyamoya Disease and Syndrome: Current Perspectives and Future Directions: A Scientific Statement From the American Heart Association/American Stroke Association. *Stroke*. 2023;54(10):e465-e479. doi:10.1161/STR.0000000000000443

241. Edjlali M, Qiao Y, Boulouis G, et al. Vessel wall MR imaging for the detection of intracranial inflammatory vasculopathies. *Cardiovasc Diagn Ther*. 2020;10(4):1108-1119. doi:10.21037/cdt-20-324

242. Maamouri R, Ferchichi M, Houmane Y, Gharbi Z, Cheour M. Neuro-Ophthalmological Manifestations of Horner's Syndrome: Current Perspectives. *Eye Brain*. 2023;Volume 15:91-100. doi:10.2147/EB.S389630

243. Dubey P, Shekhrajka N, Juliano AF, et al. ACR Appropriateness Criteria® Horner Syndrome. *Journal of the American College of Radiology*. 2025;22(11):S550-S577. doi:10.1016/j.jacr.2025.08.041

244. Tamhankar MA, Volpe NJ. Management of acute cranial nerve 3, 4 and 6 palsies: Role of neuroimaging. *Curr Opin Ophthalmol*. 2015;26(6):464-468. doi:10.1097/ICU.0000000000000200

245. Prasad S. Diagnostic Neuroimaging in Neuro-ophthalmic Disorders. *Continuum (Minneap Minn)*. 2014;20(4):1023-1062. www.ContinuumJournal.com

246. Kennedy TA, Corey AS, Policeni B, et al. ACR Appropriateness Criteria® Orbits, Vision and Visual Loss. *Journal of the American College of Radiology*. 2018;15(5):S116-S131. doi:10.1016/j.jacr.2018.03.023

247. Eggenberger ER, Eggenberger E. Supranuclear Eye Movement Abnormalities Definition of Terms. *Continuum (Minneap Minn)*. 2014;20(4):981-992. www.ContinuumJournal.com

248. Rossor T, Yeh EA, Khakoo Y, et al. Diagnosis and Management of Opsoclonus-Myoclonus-Ataxia Syndrome in Children. *Neurol Neuroimmunol Neuroinflamm*. 2022;9(3). doi:10.1212/NXI.0000000000001153

249. Maheshwari M, Ho ML, Bosemani T, et al. ACR Appropriateness Criteria® Orbital Imaging and Vision Loss-Child. *Journal of the American College of Radiology*. 2024;21(6):S219-S236. doi:10.1016/j.jacr.2024.02.023

250. Gurnani B, Kaur K, Chaudhary S, et al. Nystagmus in Clinical Practice: From Diagnosis to Treatment—A Comprehensive Review. *Clinical Ophthalmology*. 2025;19:1617-1657. doi:10.2147/OPTH.S523224

251. Kaur S, Jain S, Sodhi HBS, Rastogi A, Kamlesh. Optic nerve hypoplasia. *Oman J Ophthalmol*. 2013;6(2):77-82. doi:10.4103/0974-620X.116622

252. Campen CJ, Gutmann DH. Optic Pathway Gliomas in Neurofibromatosis Type 1. *J Child Neurol*. 2018;33(1):73-81. doi:10.1177/0883073817739509

253. de Blank PMK, Fisher MJ, Liu GT, et al. Optic Pathway Gliomas in Neurofibromatosis Type 1: An Update: Surveillance, Treatment Indications, and Biomarkers of Vision. *J Neuroophthalmol*. 2017;37:S23-S32. doi:10.1097/WNO.0000000000000550

254. Cassina M, Frizziero L, Opocher E, et al. Optic pathway glioma in type 1 neurofibromatosis: Review of its pathogenesis, diagnostic assessment, and treatment recommendations. *Cancers (Basel)*. 2019;11(11). doi:10.3390/cancers11111790

255. Carton C, Evans DG, Blanco I, et al. ERN GENTURIS tumour surveillance guidelines for individuals with neurofibromatosis type 1. *EClinicalMedicine*. 2023;56. doi:10.1016/j.eclinm.2022.101818

256. Radder N, Radder S. Morning Glory Disc Anomaly With Ipsilateral Carotid Vasculopathy: MRI Characteristics and Clinical Implications. *Cureus*. Published online October 6, 2025. doi:10.7759/cureus.93932

257. Biousse V, Nahab F, Newman NJ. Management of Acute Retinal Ischemia: Follow the Guidelines! *Ophthalmology*. 2018;125(10):1597-1607. doi:10.1016/j.ophtha.2018.03.054

258. MacGrory B, Schrag M, Biousse V, et al. Management of Central Retinal Artery Occlusion: A Scientific Statement from the American Heart Association. *Stroke*. 2021;52(6):E282-E294. doi:10.1161/STR.0000000000000366

259. Gerull S, Medinger M, Heim D, Passweg J, Stern M. Evaluation of the Pretransplantation Workup before Allogeneic Transplantation. *Biology of Blood and Marrow Transplantation*. 2014;20(11):1852-1856. doi:10.1016/j.bbmt.2014.06.029

260. Yao L, Wang B, Lu F, He X, Lu G, Zhang S. Facial nerve in skullbase tumors: imaging and clinical relevance. *Eur J Med Res*. 2023;28(1):121. doi:10.1186/s40001-023-01078-7

261. Baugh RF, Basura GJ, Ishii LE, et al. Clinical practice guideline: Bell's palsy. *Otolaryngol Head Neck Surg*. 2013;149(3 Suppl):S1-27. doi:10.1177/0194599813505967

262. Al-Noury K, Lotfy A. Normal and pathological findings for the facial nerve on magnetic resonance imaging. *Clin Radiol*. 2011;66(8):701-707. doi:10.1016/j.crad.2011.02.012

263. Roka K, Scheinemann K, Avula S, et al. European standard clinical practice recommendations for primary pediatric low-grade gliomas. *EJC Paediatric Oncology*. 2024;4. doi:10.1016/j.ejcped.2024.100169

264. Stowe RC, Miranda-Schaeubinger M, Andronikou S, Tapia IE. Polysomnographic predictors of abnormal brainstem imaging in children. *Journal of Clinical Sleep Medicine*. 2021;17(7):1411-1421. doi:10.5664/jcsm.9210

265. Regn DD, Davis AH, Smith WD, Blasser CJ, Ford CM. Central Sleep Apnea in Adults: Diagnosis and Treatment. *Federal Practitioner*. 2023;40(3):78-86. doi:10.12788/fp.0367

266. Pirker W, Katzenschlager R. Gait disorders in adults and the elderly. *Wien Klin Wochenschr*. 2017;129(3-4):81-95. doi:10.1007/s00508-016-1096-4

267. Marshall FJ. Approach to the elderly patient with gait disturbance. *Neurol Clin Pract*. 2012;2(2):103-111. doi:10.1212/CPJ.0b013e31825a7823

268. Tetreault L, Kalsi-Ryan S, Benjamin Davies, et al. Degenerative Cervical Myelopathy: A Practical Approach to Diagnosis. *Global Spine J*. 2022;12(8):1881-1893. doi:10.1177/21925682211072847

269. Shen WK, Sheldon RS, Benditt DG, et al. 2017 ACC/AHA/HRS Guideline for the Evaluation and Management of Patients With Syncope. *J Am Coll Cardiol*. 2017;70(5):e39-e110. doi:10.1016/j.jacc.2017.03.003

270. Kligerman SJ, Bykowski J, Hurwitz Koweek LM, et al. ACR Appropriateness Criteria® Syncope. *Journal of the American College of Radiology*. 2021;18(5):S229-S238. doi:10.1016/j.jacr.2021.02.021

271. Wang LL, Thompson TA, Shih RY, et al. ACR Appropriateness Criteria® Dizziness and Ataxia: 2023 Update. *Journal of the American College of Radiology*. 2024;21(6):S100-S125. doi:10.1016/j.jacr.2024.02.018

272. Tarnutzer AA, Kerkeni H, Diener S, et al. Diagnosis and treatment of vertigo and dizziness. *HNO*. 2025;73(S3):357-369. doi:10.1007/s00106-025-01599-z

273. Zuniga SA, Adams ME. Efficient Use of Vestibular Testing. *Otolaryngol Clin North Am*. 2021;54(5):875-891. doi:10.1016/j.otc.2021.05.011

274. Aulino JM, Kirsch CFE, Burns J, et al. ACR Appropriateness Criteria® Neck Mass-Adenopathy. *Journal of the American College of Radiology*. 2019;16(5):S150-S160. doi:10.1016/j.jacr.2019.02.025

275. Chinnery PF. Primary Mitochondrial Disorders Overview. *GeneReviews*®. Published online July 29, 2021. https://www.ncbi.nlm.nih.gov/books/NBK1224/

276. Lunsing RJ, Strating K, de Koning TJ, Sijens PE. Diagnostic value of MRS-quantified brain tissue lactate level in identifying children with mitochondrial disorders. *Eur Radiol*. 2017;27(3):976-984. doi:10.1007/s00330-016-4454-8

277. Legare JM. Achondroplasia. *GeneReviews*®. Published online November 20, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1152/

278. Harris P, Torres V. Polycystic Kidney Disease, Autosomal Dominant. *GeneReviews*®. Published online September 29, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1246/

279. Shuman C, Kalish JM, Weksberg R. Beckwith-Wiedemann Syndrome. *GeneReviews*®. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1394/

280. Bayrak-Toydemir P, Stevenson DA. Capillary Malformation-Arteriovenous Malformation Syndrome. *GeneReviews*®. Published online September 12, 2019. https://www.ncbi.nlm.nih.gov/books/NBK52764/

281. Yen T, Stanich PP, Axell L, Patel SG. APC-Associated Polyposis Conditions. *GeneReviews*®. Published online May 12, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1345/

282. Lohmann DR, Gallie BL. Retinoblastoma. *GeneReviews*®. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1452/

283. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

284. Mariani R, Bertola F, Piperno A. HAMP- and HJV-Related Hemochromatosis. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1170/

285. Barton JC, Parker CJ. HFE-Related Hemochromatosis. *GeneReviews*®. Published online April 11, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1440/

286. Yehia L, Eng C. PTEN Hamartoma Tumor Syndrome. *GeneReviews*®. Published online August 7, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1488/

287. Northrup H, Koenig MK, Pearson DA, Au KS. Tuberous Sclerosis Complex. *GeneReviews*®. Published online August 1, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1220/

288. Raymond G V, Moser AB, Fatemi A. X-Linked Adrenoleukodystrophy. *GeneReviews*®. Published online April 6, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1315/

289. Nagy A, Bley AE, Eichler F. Canavan Disease. *GeneReviews*®. Published online December 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1234/

290. Mehta A, Hughes DA. Fabry Disease. *GeneReviews*®. Published online April 11, 2024. https://www.ncbi.nlm.nih.gov/sites/books/NBK1292/

291. Duker A, Jackson A, Bober MB. Microcephalic Osteodysplastic Primordial Dwarfism Type II. *GeneReviews*®. Published online November 20, 2025. https://www.ncbi.nlm.nih.gov/books/NBK575926/

292. Schneider K, Zelley K, Nichols KE, Schwartz Levine A, Garber J. Li-Fraumeni Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1311/

293. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate Version 3.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

294. Loeys BL, Dietz HC. Loeys-Dietz Syndrome. *GeneReviews*®. Published online September 12, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1133/

295. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews*®. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

296. Dhamija R, Plotkin S, Gomes A, Babovic-Vuksanovic D. LZTR1- and SMARCB1-Related Schwannomatosis. *GeneReviews*®. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK487394/

297. Friedman J. Neurofibromatosis 1. *GeneReviews*®. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

298. Miller DT, Freedenberg D, Schorry E, et al. Health Supervision for Children With Neurofibromatosis Type 1. *Pediatrics*. 2019;143(5):e20190660. doi:10.1542/peds.2019-0660

299. Giusti F, Marini F, Brandi ML. Multiple Endocrine Neoplasia Type 1. *GeneReviews*®. Published online March 10, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1538/

300. Nemes K, Bens S, Bourdeaut F, et al. Rhabdoid Tumor Predisposition Syndrome. *GeneReviews*®. Published online May 12, 2022. https://www.ncbi.nlm.nih.gov/books/NBK469816/

301. Bender M, Carlberg K. Sickle Cell Disease. *GeneReviews*®. Published online February 13, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1377/

302. van Leeuwaarde RS van, Ahmad S, van Nesselrooij B, Zandee W, Giles RH. Von Hippel-Lindau Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1463/

303. Tabori U, Hansford JR, Achatz MI, et al. Clinical Management and Tumor Surveillance Recommendations of Inherited Mismatch Repair Deficiency in Childhood. *Clinical Cancer Research*. 2017;23(11):e32-e37. doi:10.1158/1078-0432.CCR-17-0574

304. Accardo ML, Osborne J, Else T. POT1 Tumor Predisposition. *GeneReviews*®. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK563529/

305. Evans DG. NF2-Related Schwannomatosis. *GeneReviews®*. Published online April 20, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1201/

306. Davagnanam I, Fraser CL, Miszkiel K, Daniel CS, Plant GT. Adult Horner's syndrome: a combined clinical, pharmacological, and imaging algorithm. *Eye*. 2013;27(3):291-298. doi:10.1038/eye.2012.281

307. Kesav P, Manesh Raj D, John S. Cerebrovascular Fibromuscular Dysplasia – A Practical Review. *Vasc Health Risk Manag*. 2023;Volume 19:543-556. doi:10.2147/VHRM.S388257

308. Johnson A, Emery D, Clifford A. Intracranial involvement in takayasu's arteritis. *Diagnostics*. 2021;11(11). doi:10.3390/diagnostics11111997

309. Samaan M, Abramyan A, Sundararajan S, et al. Cerebrovascular implications of takayasu arteritis: a review. *Neuroradiology*. 2025;67(1):125-136. doi:10.1007/s00234-024-03472-2

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322. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

323. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

324. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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343. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

344. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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354. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

355. Vachha BA, Moonis G, Wintermark M, Massoud TF, eds. *What Radiology Residents Need to Know: Neuroradiology*. Springer; 2024.

# Evolent Clinical Guideline 2071 for Chest Imaging

| **Guideline Number:**<br>Evolent_CG_2071 | **Applicable Codes** | |
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| **Original Date:**<br>January 2027 | **Last Revised Date:**<br>June 2026 | **Implementation Date:**<br>January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Imaging of the chest generates images of the organs and structures within the chest (thorax). Computed Tomography (CT) uses ionizing radiation to generate images of organs and structures. Magnetic Resonance Imaging (MRI) generates images of organs and structures without the use of ionizing radiation. Computed tomography angiography (CTA) generates images of vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Magnetic resonance angiography (MRA) generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without ionizing radiation.

**NOTE:** Authorizations for CTA and MRA covers both arterial and venous imaging. The term *angiography* refers to both arteriography and venography.

## Special Note

When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

## Autoimmune Disease

### *Sarcoidosis* [1]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**.

- For suspected sarcoidosis after initial workup including chest x-ray (CXR)
- For known sarcoidosis when any ONE of the following are present:
  - Progression of symptoms (including normal CXR with unexplained dyspnea or cough)
  - Progression on CXR

### *Granulomatosis with Polyangiitis (GPA) (Formerly Wegener's Granulomatosis)* [2,3]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT.** (See **Combination Studies** for other indicated studies)

- Advanced imaging for GPA is indicated with any ONE of the following:
  - Suspected GPA based on clinical findings (eg, biopsy results, lab testing including antineutrophil cytoplasmic antibodies (ANCA))
  - Known GPA when imaging results of a specific anatomic area are needed to guide systemic therapy

## Congenital Abnormalities

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest MRI**.

- Congenital non-cardiac non-vascular thoracic malformation on other imaging (eg, CXR, echocardiogram, gastrointestinal study or CT) [4,5]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** or **Chest MRI**.

- Congenital heart disease with pulmonary hypertension [6]
- Chest wall malformations (eg, pectus excavatum, pectus carinatum, scoliosis) in patients with cardiorespiratory symptoms for whom treatment is being considered [7]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT**.

- Thoracic malformation on CXR [8]

## Chronic Cough [9,10]

IMAGING MODALITY: When ALL the following criteria are met, the indicated study is **Chest CT**.

- Symptoms > 8 weeks
- CXR completed
- Any ONE of the following**:**

- Clinical concern for bronchiectasis
- After evaluation for other causes and failed treatment for those diagnosed with any ONE of the following:
  - Asthma
  - Gastroesophageal Reflux Disease
  - Discontinuation of Angiotensin-Converting Enzyme (ACE) inhibitors
  - Postnasal drip

## Diffuse Lung Disease (DLD)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** (typically with a high-resolution protocol (HRCT)).

- For evaluation of suspected DLD (including diffuse parenchymal and interstitial lung diseases) in patients who do NOT have a Systematic Autoimmune Rheumatic Diseases (SARD)* when ALL the following criteria are met:
  - After initial CXR excludes a more acute disease (eg, pneumonia)
  - In any ONE of the following situations [11]:
    - Based on restrictive pattern pulmonary function test
    - For biopsy guidance when DLD is suspected [12]
    - With signs or symptoms unresponsive to treatment, such as:
      - Shortness of breath
      - Persistent dyspnea
      - Persistent cough
- In patients with a known SARD when the following criteria is met:
  - Once with documentation of concern for DLD [13]

    **NOTE:** Additional requests can be considered on a case-by-case basis as clinically indicated.
- For reassessment of known DLD in any ONE of the following situations:
  - Annually
  - For clinical progression of disease

***NOTE:** The following diseases are considered SARDs: Rheumatoid Arthritis, Systematic Sclerosis, Idiopathic Inflammatory Myositis (including polymyositis, dermatomyositis, antisynthetase syndrome, immune-mediated necrotizing myopathy), Mixed Connective Tissue Disease, and Sjögren's Disease. [13]

# Esophageal Disorders

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT**.

- Dysphagia evaluation after appropriate prior work up including endoscopy (EGD) and/or fluoroscopic studies (eg, modified barium swallow or biphasic esophogram) is indeterminate or abnormal [14]

# Infection

## *Fever of Unknown Origin*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT.**

- For fever of unknown origin (temperature of ≥ 101 degrees for a minimum of 3 weeks) after all of the following has been completed and a source is not identified: complete blood count with differential, three sets of blood cultures, CXR, complete metabolic panel, urinalysis, Erythrocyte Sedimentation Rate (ESR), Antinuclear Antibody (ANA), Rheumatoid Arthritis (RA), serologic testing (Epstein-Barr Virus (EBV), Human Immunodeficiency Virus (HIV) and hepatitis), tuberculin test and Abdomen and Pelvis CT or Abdomen MRI and Pelvis MRI [15]

## *Pneumonia and Related Complications*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**.

- Recent pneumonia and suspected parapneumonic effusion or empyema after recent CXR [16]
- For evaluation of non-resolving pneumonia (or inflammatory disease) documented by at least two imaging studies in any ONE of the following situations:
  - Unimproved with 4 weeks of antibiotic treatment
  - Unresolved at 8 weeks [17]

## *Tuberculosis (TB)* [18]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT**.

- Known or suspected tuberculosis and initial CXR completed

# Lung Cancer Screening in High-Risk Patients

IMAGING MODALITY: When the following criteria are met, the indicated study is **Low Dose CT (LDCT)** (CPT Code 71271).

Annual screening is indicated when ALL the following criteria are met:

- There is at least a 20 pack-year personal history of cigarette smoking [19,20]

  **NOTE:** Secondhand smoke exposure and other forms of smoking (eg, pipe, cigar, marijuana, vaping) do not factor into current recommendations for LDCT Screening.

- Individual is between 50 - 80 years of age [19,20]

  **NOTE:** Can be considered on a case-by-case basis for individuals > 80 if there is documentation that the individual is a candidate for and willing to undergo curative treatment upon diagnosis.

- Individual is asymptomatic (ie, no acute lung-related symptoms)
- Any ONE of the following criteria is met:
  - No previous LDCT
  - Last LDCT ≥ 12 months before intended date of current request (regardless of findings)
    - Last LDCT was within the last 12 months and another LDCT is now indicated based on any ONE of the scenarios outlined in Lung-RADS (see **Table 1**)

# Lung Nodules

**NOTE:** Lung Imaging Reporting and Data Systems (Lung-RADS) specifies appropriate follow-up of lung nodules seen on LDCT (see **Table 1**). The Fleischner guideline (see **Table 2**) specifies appropriate follow-up of incidental lung nodules seen on studies other than a LDCT (including CXR or Chest CT). If there are multiple nodules, the largest and most concerning nodule is used when interpreting both tables.

## *Follow-up of Lung Nodule seen on Screening LDCT*

IMAGING MODALITY: When the following criteria are met, the indicated study is **LDCT**.

- Follow-up of pulmonary nodule identified on screening LDCT at the interval specified by Lung-RADS (see **Table 1**) [21]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT**.

- For any Lung RADS 4B finding identified on LDCT either immediate Chest CT or immediate Positron Emission Tomography (PET)/CT are appropriate.

## *Lung Nodules with No History of Malignancy* [22,23]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**.

- Incidental pulmonary nodule on x-ray:
  - Immediate follow up with Chest CT if the nodule is indeterminate as per the radiology report (ie, not typical of granulomatous disease)
- Incidental pulmonary nodules on non-chest CT (eg, a Neck, Shoulder, or Abdomen CT):
  - Nodules > 8 millimeters (mm) or those with very suspicious features need a dedicated Chest CT as early as possible
  - Nodules ≤ 8 mm should follow the Fleischner table (see **Table 2**) to determine when

a dedicated Chest CT is needed.

- Follow-up of pulmonary nodules detected on a non-screening (regular) Chest CT is as per Fleischner table (see **Table 2**) when ALL the following criteria are met:
  - Individual is ≥ 35 years old
    - If age is < 35 years old, non-malignant causes are more likely, and infection should be excluded. Once infection is excluded if the nodule is unable to followed with CXR and explanation given as to how management would change, can be considered on a case-by-case basis.
  - No personal history of cancer
    - If there is a prior history of cancer, follow-up imaging can be done as soon as 3 months.
  - Not immunocompromised
    - If the patient is immunocompromised, follow-up imaging can be done as soon as 1 month if there is suspicion of fulminant infection.

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT.**

- Further evaluation of one of the following identified on another imaging study, or one follow-up study to ensure stability after one of the findings below are seen. Additional follow-up studies indicated only if there is a change in the finding on repeat imaging:
  - Lymphadenopathy
  - Lung mass not described as a nodule (generally > 3 centimeters (cm))
  - Pleural thickening, nodule, or mass
- For further evaluation of any ONE of the following:
  - Weight loss of ≥ 5% over 12 months AND signs and symptoms consistent with a source in the chest (eg, a smoker with a cough) after initial CXR [24]
  - Weight loss of ≥ 5% over 12 months when initial evaluation with CXR, age-appropriate cancer screening (eg, colonoscopy and mammography), labs (including Complete Blood Count (CBC), Comprehensive Metabolic Panel (CMP), HbA1C, Thyroid Stimulating Hormone (TSH), stool hemoccult, ESR/C-Reactive Protein (CRP), HIV, Hepatitis C) fail to identify a cause AND there is documented further decline in weight [24]
  - Documentation of concern for malignancy (ie, lymphoma) and any ONE of the following B symptoms (See **Combination Studies** for other indicated studies):
    - Fevers > 101°F
    - Drenching night sweats

        - Unexplained weight loss of > 10% body weight
    - Hydatidiform mole when CXR shows metastases [25]
    - Gestational trophoblastic neoplasia [25]
    - Suspected paraneoplastic syndrome (including dermatomyositis) when appropriate workup has been done and there is a suspicion of malignancy [24]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest MRI**.

- Other Chest Masses [26]
    - For further evaluation of chest mass when prior imaging suggests MRI as the next step rather than CT

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** or **Chest MRI**.

- Evaluation for suspected thymoma screening in Myasthenia Gravis patients [27,28]
- For further evaluation of mediastinal masses on prior imaging [29]
- For further evaluation of chest wall mass after prior indeterminate imaging [26,30]

## *Known Malignancy*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**

IMAGING MODALITY: When any ONE of the following criteria is met, the indicated study is **Chest CT.**

- For initial staging of malignancies when either biopsy proven or suspected based on prior imaging
- For evaluation of any hematologic malignancy prior to planned bone marrow transplant or stem cell transplant [31,32]

IMAGING MODALITY: For initial staging of ANY one of the following cancers, the indicated study is **Chest CT**, which may be in addition to PET when medical necessity criteria for PET have separately been met.

- Any ONE of the following types of sarcoma: Alveolar Soft Parts Sarcoma, Angiosarcoma, Clear Cell Sarcoma, Epithelioid Sarcoma, Rhabdomyosarcoma, Ewing Sarcoma, Leiomyosarcoma, Liposarcoma, Osteosarcoma [33,34]
- Hodgkin Lymphoma (Pediatric and Adult) [35,36]
- Non-Small Cell Lung Cancer for pre-surgical evaluation or evaluation of recurrence or progression [37]

- Paraganglioma or pheochromocytoma [38]
- Pediatric Aggressive Mature B-Cell Lymphomas [39]
- Pleural mesothelioma [40]
- Post-Transplant Lymphoproliferative Disorder [41]
- Thymoma or Thymic Carcinoma [42]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA**.

**NOTE:** This is indicated in addition to non-vascular imaging (CT or MRI) of the same body parts.

- When needed for clarification of vascular involvement from tumor

## Active Surveillance

Active surveillance refers to a strategy of clinical and imaging surveillance of selected early-stage cancers rather than immediate treatment.

IMAGING MODALITY: When the following criteria is met, the indicated study is **Chest CT.**

- Stage I kidney cancer on active surveillance at the following intervals [43]:
  - Once at baseline then
  - As clinically indicated

IMAGING MODALITY: When the following criteria is met, the indicated study **Chest CT**.

- Pancreatic well-differentiated neuroendocrine tumor ≤ 2 cm on active surveillance [38]
  - As clinically indicated but not more than annually

## Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. ‘Active treatment’ includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), Chimeric Antigen Receptor (CAR) T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: During active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg, chemotherapy, targeted therapy, or immunotherapy) is typically every 2 - 3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria is met, the indicated study is **Chest CT.**

- For restaging of malignancies [38]
- For evaluation of any hematologic malignancy prior to planned bone marrow transplant or stem cell transplant [31,32]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**, which may be in addition to PET when medical necessity criteria for PET have separately been met.

- For restaging of any ONE of the following malignancies:
  - The following types of sarcoma: Alveolar Soft Parts Sarcoma, Angiosarcoma, Clear Cell Sarcoma, Epithelioid Sarcoma, Rhabdomyosarcoma, Ewing Sarcoma, Leiomyosarcoma, Liposarcoma, Osteosarcoma [33,34]
  - Hodgkin Lymphoma (Pediatric and Adult) [35,36]
  - Non-Small Cell Lung Cancer for pre-surgical evaluation or evaluation of recurrence or progression [37]
  - Pediatric Aggressive Mature B-Cell Lymphomas [39]
  - Pleural mesothelioma [40]
  - Post-Transplant Lymphoproliferative Disorder [41]
  - Thymoma or Thymic Carcinoma [42]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA**.

**NOTE:** This is indicated in addition to non-vascular imaging (CT or MRI) of the same body parts.

- When needed for clarification of vascular involvement from tumor

## Surveillance

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

Refer to the **Cancer Surveillance Table** for specific indications. For cancers where there is not specific guidance about stage IV disease, see below.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT**.

- Patients in remission or on a treatment break with a type of stage IV cancer that is not addressed by the **Cancer Surveillance Table**: indicated every 3 - 6 months

## Other

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**.

- Pneumothorax on CXR when imaging findings will change management
- Hemoptysis after x-ray completed [44]
- Large type IV hiatal hernia or diaphragmatic hernia (eg, Bochdalek, Morgagni or congenital) (See **Combination Studies** for other indicated studies) [45,46]
- See **Combination Studies** for vocal cord immobility, phrenic nerve paralysis, dysphagia, and possible airway pathology

## Pain

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**. Chest MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Non-traumatic chest wall pain with normal CXR and or rib x-ray with any ONE of the following [19]:
  - Suspicion of malignancy
  - Signs and symptoms of infection (eg, fever, elevated inflammatory markers, known infection at other sites)
- Pain with history of chest radiation or chest surgery

## Pulmonary Embolism [47–52]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CTA**. Chest CT, Chest MRI, and Chest MRA are not appropriate for this indication.

- Suspected pulmonary embolism (PE) in any ONE of the following situations:
  - High probability of PE based on any ONE of the following (D-dimer not required):
    - Presence of shock or hypotension
    - High probability of PE based on any ONE of the following validated clinical scoring systems (see **Clinical Assessment of Pulmonary Embolism**):
      - Wells score (original version) ≥ 7
      - Geneva score (original version) ≥ 11
      - Geneva score (simplified version) ≥ 5
  - Elevated D-dimer (regardless of risk assessment score)

- Follow-up of known pulmonary embolism with symptoms (eg, dyspnea, fatigue, lightheadedness and/or edema) that recur or with symptoms that are persistent at 3 months following initial diagnosis

  **NOTE**: Follow-up imaging in asymptomatic patients to determine if an embolus has resolved or to determine cessation of anticoagulation is not indicated, as imaging findings may persist and are not used to determine the duration of therapy.

## Transplants

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT.** If requested, other chest imaging studies can be considered on a case-by-case basis at the discretion of the ordering provider.

- Prior to solid organ transplantation
  - For operative planning for lung donor
  - When needed for initial placement on the transplant list
  - Repeat imaging as often as every 3 months to maintain transplant eligibility (or earlier if an organ becomes available)

  **NOTE:** See **Known Malignancy** for indications prior to bone marrow transplant and stem cell transplant.
- Routine surveillance of prior lung transplantation or concern for complication at any time following lung or heart transplantation (CXR not required) [53]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CT, Chest CTA, Chest MRI,** and **Chest MRA**.

- Pre-operative planning for solid organ transplantation

## Trauma

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** or **Chest MRI.**

- Suspected chest wall injuries (including musculotendinous, costochondral cartilage, sternoclavicular joint, and manubriosternal joint injuries) with prior non-diagnostic or indeterminate imaging (eg, as x-ray or ultrasound) when imaging will potentially alter management

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT**

- Recent blunt trauma and suspected pleural effusion with recent CXR [16]

### *Brachial Plexopathy* [54–57]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest MRI** (depending on the location of the injury/plexopathy).

**NOTE:** If multiple studies are requested, only ONE of the following studies is indicated to image the brachial plexus: Neck MRI, Shoulder MRI, or Chest MRI.

- Traumatic Brachial Plexopathy: if mechanism of injury is highly suspicious for brachial plexopathy (eg, birth trauma, mid-clavicular fracture, shoulder dislocation, contact injury to the neck (burner or stinger syndrome) or penetrating injury) [58]
- Non-traumatic Brachial Plexopathy (including neurogenic thoracic outlet syndrome): when Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive of brachial plexopathy

## Vascular Disease

### *Aortic Disease*

#### Asymptomatic Thoracic Aortic Aneurysm [59–62]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** or **Chest MRI**. Chest CTA and Chest MRA are appropriate only for complex vascular anatomy or suspected complications, but they are also reasonable when the threshold for operative repair (5 cm) is reached.

- Asymptomatic suspected thoracic aortic aneurysm (TAA) if prior imaging (eg, transthoracic echocardiogram (TTE) or chest x-ray) suggested TAA (eg, showing a dilated thoracic aorta) or was otherwise inconclusive or insufficient
- Asymptomatic suspected TAA based on personal or family history (ie, screening)
    - Screening in individuals with a personal history of bicuspid aortic valve when prior TTE was inconclusive or insufficient
    - Screening in individuals at elevated risk due to family history when TTE is inconclusive or insufficient with any ONE of the following [60]:
        - First degree relatives of individuals with a known bicuspid aortic valve
        - First and/or second-degree relatives with known thoracic aortic aneurysm (defined as 1.5 times (> 50%) larger than the predicted aorta size based on age, sex, body size)
        - First-degree relatives of individuals with a known aortic dissection
        - First or second-degree relatives of individuals with a heritable thoracic aorta disease

      **NOTE:** See **Genetic Conditions** for additional screening indications
- Asymptomatic known TAA if the study is ordered at an appropriate TAA surveillance interval:
    - At the time of diagnosis, as noted above

- Initially every 6 - 12 months, and then every 12 - 24 months if stable and aortic diameter < 4.5 cm
- Every 12 months when aortic diameter is 4.5 - 4.9 cm
- Every 6 months when aortic diameter is ≥ 5.0 cm, or for preoperative planning
- If there is a change in clinical status or cardiac exam, more frequent imaging is indicated

### Symptomatic Thoracic Aortic Aneurysm

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CTA**. Chest MRA is appropriate only when the preferred study is contraindicated or cannot be performed. If requested, other chest imaging studies can be considered on a case-by-case basis based on the urgency of the presenting complaint.

- Known or suspected symptomatic TAA
  - Signs and symptoms may include:
    - Abrupt onset of severe sharp or stabbing pain in the chest, back or abdomen (could indicate aneurysm rupture)
    - Asymmetric blood pressure between limbs
    - Acute chest or back pain and at high risk for aortic aneurysm and/or aortic syndrome (risk factors include hypertension, atherosclerosis, prior cardiac or aortic surgery, underlying aneurysm, and/or connective tissue disorder (eg, Marfan syndrome, vascular form of Ehlers-Danlos syndrome, Loeys-Dietz syndrome)

### Acute Aortic Syndromes (AAS) [60,61]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CTA**. Chest MRA is appropriate only when the preferred study is contraindicated or cannot be performed. If requested, other chest imaging studies can be considered on a case-by-case basis based on the urgency of the presenting complaint.

- For initial diagnosis of suspected AAS or for follow up of these conditions as clinically indicated at clinically reasonable intervals. These conditions may include:
  - Aortic dissection
  - Ruptured aortic aneurysm
  - Intramural hematoma
  - Penetrating atherosclerotic ulcer
  - Vascular cause of dysphagia from esophageal compression or airway compression
  - Compromised branch artery flow (ie, asymmetric blood pressure between limbs), esophageal compression
- For suspected AAS (eg, aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer) with any ONE of the following:

- Prior imaging (eg, echocardiogram) is suggestive of AAS
- High risk patient for AAS and any ONE sign/symptom concerning for AAS*:
  - High risk conditions for AAS:
    - Marfan's syndrome or other connective tissue disease, family history of aortic disease, known aortic valve disease, recent aortic manipulation and/or known thoracic aortic aneurysm
- Non-high-risk patient and two or more signs/symptoms concerning for AAS

***NOTE**: Signs or symptoms concerning AAS include the following: Chest, back or abdominal pain described as abrupt onset, severe in intensity and/or ripping or tearing in quality, pulse deficit or systolic blood pressure differential, focal neurologic deficit with pain, new heart murmur with pain, and hypotension or shock.

- For follow-up of known aortic syndromes (eg, aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer) as clinically indicated.

## Arterial Thromboembolism

IMAGING MODALITY: When the following criteria is met, the indicated study is **Chest CTA**. Chest MRA is appropriate only when the preferred study is contraindicated or cannot be performed. Echocardiogram and advanced vascular imaging of the abdomen and pelvis and extremities may also be indicated to identify the source of the emboli. (See **Combination Studies** for other indicated studies)

- Clinical concern for upper or lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [63–65]

## Preoperative Vascular Indications

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA**. (See **Combination Studies** for other indicated studies)

- Ablation for atrial fibrillation [66]
- Thoracic Endovascular Aneurysm Repair (TEVAR) [60]
- Transcatheter Aortic Valve Replacement (TAVR) [67]

## Postoperative Vascular Indications

### *Postoperative Follow-up of Aortic Repair [60,61]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT** or **Chest MRI**. Chest CTA or Chest MRA are appropriate for complex vascular anatomy or suspected complications. (See **Combination Studies** for other indicated studies)

- Follow up after thoracic aorta open repair at the following intervals:
  - At one-year post-repair
  - Every 5 years thereafter

        - More frequent imaging (as clinically indicated) may be needed if there are complications or abnormal findings on surveillance imaging
- Follow-up thoracic endovascular aortic repair (TEVAR) at the following intervals [60,61]
    - Baseline study at 1 month post-TEVAR
    - Annually thereafter until year 5
        - More frequent imaging (as clinically indicated) may be needed if there are complications or abnormal findings on surveillance imaging
        - After 5 post-operative years without complications, advanced imaging is indicated every 5 years

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA**.

- Evaluation of post-operative complications (eg, pseudoaneurysms) following interventional vascular procedures (eg, surgical bypass grafts, vascular stents, and Inferior Vena Cava (IVC) filters) [68]

## *Other Vascular Disease*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Chest CTA** or **Chest MRA**. Chest CT is indicated only when CTA/MRA are contraindicated or cannot be performed

- Superior Vena Cava (SVC) syndrome [69]

**NOTE:** SVC syndrome is a clinical diagnosis and may be suspected when there are signs of venous congestion in the upper body (eg, shortness of breath, distended neck veins and facial/upper extremity edema)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CT, Chest MRI, Chest CTA,** or **Chest MRA**.

- Suspected pulmonary hypertension when other testing (echocardiogram or right heart catheterization) is suggestive of the diagnosis [70]
- Suspected or known thoracic outlet syndrome [71,72]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA**. Chest CT or Chest MRI are not appropriate for this indication.

- Subclavian steal syndrome after indeterminate or abnormal ultrasound [60]
- For patients with fibromuscular dysplasia (FMD) (See **Combination Studies** for other indicated studies) [73,74]:
    - Baseline vascular study indicated from brain to pelvis
- For assessment in patients with spontaneous coronary artery dissection (SCAD) (See

**Combination Studies** for other indicated studies) [75]

- One-time evaluation

- Takayasu's Arteritis (See **Combination Studies** for other indicated studies) [76]:
  - At initial diagnosis
  - Every 6 months for the first 2 years while on therapy
  - Annually after the first 2 years
- Non-Central Horner's Syndrome (Secondary/preganglionic or tertiary/post-ganglionic) to evaluate for a vascular source (eg, dissection, aneurysm, arteritis) (See **Combination Studies** for other indicated studies) [77,78]

### *Congenital Vascular Disease [79–81]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Chest CTA**. Chest MRA is appropriate only when the preferred study is contraindicated or cannot be performed or for pediatrics or for repeat imaging. Chest CT and Chest MRI are not appropriate for these indications. (See **Combination Studies** for other indicated studies)

- Suspected thoracic malformation with suggestive prior imaging (eg, CXR, echocardiogram, gastrointestinal study, Chest CT)
- Congenital heart disease with pulmonary hypertension and/or extra-cardiac vascular anomalies (eg, Tetralogy of Fallot, transposition of the great vessels, truncus arteriosus)
- Suspected coarctation of the aorta with suggestive prior testing (eg, disparity in the pulsations and blood pressures in the legs versus the arms)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Chest CTA, Chest MRI,** or **Chest MRA**.

- Pulmonary sequestration

## Preoperative or Postoperative Assessment

**IMAGING MODALITY:** When any ONE of the following criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative evaluation:
  - Prior to the following procedures:
    - Prior to transplant (see **Transplants**)
    - Prior to Ablation for atrial fibrillation, [66] Thoracic Endovascular aneurysm repair (TEVAR), [60] or Transcatheter Aortic Valve Replacement (TAVR), (see **Preoperative Vascular Indications**) [67] or to electromagnetic navigation

bronchoscopy (this is a non-diagnostic CT) [82]

- When not addressed in specific indications:
  - Imaging of the area requested is needed to develop a surgical plan

- Postoperative evaluation:
  - After catheter ablation in patients with atrial fibrillation if complications are suspected [66]
  - For suspected vascular complications (see **Postoperative Vascular Indications**)
- When not addressed in specific indications and any ONE of the following criteria are met:
  - Known or suspected complications
  - A clinical reason is provided how imaging may change management

**NOTE:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Indeterminate Imaging

Unless otherwise specified within the guideline:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance is indicated unless specified as highly suspicious or a change was found on last follow-up exam.)

## Genetic Conditions

**NOTE:** When medical necessity is met for an individual study **AND** conscious sedation is required (eg, for young pediatric patients or patients with significant developmental delay), the entire combination is indicated)

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Chest CT.**

- Alpha-1 Anti-Trypsin Deficiency (AATD) [83]:
  - At diagnosis
- BHDS (Birt-Hogg-Dube) [84]:
  - At diagnosis **OR** with signs or symptoms concerning for pneumothorax

- Cystic Fibrosis [85]:
  - Every 2 years and as needed to assess for bronchiectasis
- Tuberous Sclerosis [86]:
  - Every 5 years **OR** more frequently for follow-up of known findings or symptoms

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Chest MRI.**

- ADPKD (Autosomal Dominant Polycystic Kidney Disease) **AND** family history of thoracic aortic dissection:
  - Every 2 years (including at diagnosis) [87]

  **NOTE:** Either cardiac MRI or Chest MRI is indicated for surveillance, not both

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Chest MRI** or **Chest CT.**

- BAP1-TPDS (BAP-1 tumor predisposition syndrome) [88]:
  - With clinical concern for malignant mesothelioma

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Neck/Chest/Abdomen/Pelvis MRA** or **CTA.**

- Loeys-Dietz [89]:
  - Every two years (including at diagnosis) **OR**
  - More frequently if abnormalities are found
- Vascular Ehlers-Danlos syndrome (vEDS) [90,91]:
  - Every 18 months (including at diagnosis) **OR**
  - As clinically indicated to follow known vascular abnormalities

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRA** or **CTA.**

- Marfan Syndrome [92]:
  - Every 3 years (including at diagnosis)
  - More frequently (annually) if EITHER history of dissection, dilation of aorta beyond aortic root OR aortic root/ascending aorta are not adequately visualized on TTE (ie, advanced imaging is needed to monitor the thoracic aorta)
- Williams Syndrome [93]:
  - Abdominal vascular exam or imaging findings (eg, diminished pulses, bruits or signs

of diffuse thoracic aortic stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Chest/Abdomen/Pelvis MRI** or **CT.**

- Multiple Endocrine Neoplasia type 1 (MEN1) [38,94]:
  - Annually starting at age 8

    **NOTE:** Brain MRI is included in the above every 3 years starting at age 5 rather than age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **Whole Body MRI.** Neck/Chest/Abdomen/Pelvis CT is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Hereditary PGL/PCC Syndromes (including SDHx mutations) [95]:
  - Every 2 years (including at diagnosis) starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Chest CTA** or **Chest MRA.**

- Turner Syndrome [61]:
  - Screening with no known vascular abnormality at the following intervals:
    - At diagnosis
    - Every 5 years
    - Prior to pregnancy/pregnancy planning
  - Annually if any one of the following are present:
    - Coarctation of the aorta
    - Aortic dilation
    - Bicuspid aortic valve
    - Hypertension

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Breast/Whole Body MRI** and **Chest CT** (or low-dose CT).

- Li Fraumeni (TP53) [96,97]:
  - Annually

    **NOTE:** Can also include Abdomen MRI annually starting at age 50 when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family

as the identified variant. This may start 10 years younger than the earliest pancreatic cancer diagnosis in the family.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated below.

- Neurofibromatosis 1 (NF1) [98]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

# Combination Studies

## *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

## *Chest/Abdomen and Pelvis CT*

- As numerous disease processes, including but not limited to malignancy, may affect the Chest, Abdomen and Pelvis, this combination is indicated when the guideline criteria for BOTH Chest CT and Abdomen and Pelvis CT have been met
- Documentation of concern for malignancy (ie, lymphoma) and any ONE of the following B symptoms:
  - Fevers > 101° F
  - Drenching night sweats
  - Unexplained weight loss of > 10% body weight

## *Chest/Abdomen CTA*

- Evaluation of extensive vascular disease involving the chest and abdominal cavities when pelvic imaging is not needed
- Significant post-traumatic or post-procedural vascular complications when pelvic imaging is not needed

## *Chest/Abdomen CT*

- Large type IV hiatal hernia or diaphragmatic hernia (eg, Bochdalek, Morgagni or

Congenital) [45,46]

## *Chest/Abdomen and Pelvis CTA (or MRA)*

**NOTE:** MRA is indicated if CTA is contraindicated or cannot be performed

- Evaluation prior to endovascular aneurysm repair (EVAR) when thoracic involvement is present
- Evaluation prior to Transcatheter Aortic Valve Replacement (TAVR) [67]
- Acute aortic dissection [99]
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest, abdomen and pelvis

## *Chest/Abdominal Aorta CTA with Lower Extremity Runoff*

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [63,64]

## *Chest/Abdomen/Lower Extremity MRA*

**NOTE:** MRA is indicated when CTA is contraindicated or cannot be performed.

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [63–65]

## *Chest/Upper Extremity CTA (or MRA)*

**NOTE:** MRA is indicated when CTA is contraindicated or cannot be performed.

- Clinical concern for upper extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting upper extremity arterial thromboembolism [100]

## *Neck/Chest CT*

- Vocal cord immobility on endoscopic exam [101]
- Phrenic nerve paralysis on diaphragm fluoroscopy (fluoroscopic sniff test)
- Evaluation of dysphagia after appropriate prior work up including endoscopy (EGD) and/or fluoroscopic studies (such as modified barium swallow, biphasic Esophogram) is indeterminate or abnormal [14,102]
- Evaluation of possible airway pathology with any ONE of the following:
    - Indeterminate or abnormal prior imaging (eg, x-ray, ultrasound, fluoroscopy)
    - Clinical evidence suggesting airway obstruction (eg, stridor, stertor, dyspnea on exertion)

- For evaluation of known or suspected laryngeal, subglottic, or tracheal stenosis [102]

## *Heart MRI (or CT) and Chest MRA (or CTA)*

- When medical necessity criteria indications are met for each Chest MRA (or CTA) and Heart MRI (see Evolent Clinical Guideline 7297 for Heart Magnetic Resonance Imaging) or Heart CT (see Evolent Clinical Guideline 7296 for Heart Computed Tomography), such as for certain congenital malformations when evaluation of cardiac and extra-cardiac structures are needed.

## *Brain/Neck/Chest MRA*

- Horner's syndrome, not previously worked up, for suspected vascular source (e.g. dissection, aneurysm, arteritis) [78,103]

## *Brain and Neck CTA with Chest CTA*

- Horner's syndrome, not previously worked up, for suspected vascular source (e.g. dissection, aneurysm, arteritis) [78,103]

## *Brain/Neck/Chest/Abdomen/Pelvis CTA (or MRA)*

- For patients with fibromuscular dysplasia (FMD) [73,74]:
  - One-time evaluation
  - New symptoms or abnormal exam findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD) [75]
  - One-time evaluation
- Takayasu's Arteritis [104–107]:
  - At diagnosis (including for suspected disease) [104,107]
  - New symptoms or abnormal exam findings [104–106,108]
  - Every 6-12 months for the first 2 years while on therapy
  - Annually after the first 2 years

## *Brain MRI and Sinus/Chest/Abdomen and Pelvis CT*

- Prior to bone marrow transplant or stem cell transplant

## *Brain (with or without IAC)/Maxillofacial/Face/Orbit/Temporal Bone/Neck/Chest/Abdomen and Pelvis Imaging*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies are Neck CT/MRI and/or Chest CT. When there is a concern for involvement of a specific area Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT may be indicated (individually or in any combination of studies).

- Suspected Granulomatosis with Polyangiitis (GPA) (Formerly Wegener's

Granulomatosis) with any ONE of the following:

- Clinical signs and symptoms
  - Nasal involvement (bloody discharge, ulcers, crusting, congestion, blockage, septal defect/perforation)
  - Cartilaginous involvement (inflammation of ear/nose cartilage, hoarse voice, stridor, endobronchial involvement, saddle nose deformity)
  - Conductive or sensorineural hearing loss
- Labs and biopsy findings:
  - Positive cytoplasmic antineutrophil cytoplasmic antibodies (cANCA) or antiprotease 3 (anti-PR3) antibodies
  - Biopsy showing small or medium vessel vasculitis
  - Biopsy showing granuloma, extravascular granulomatous inflammation, or giant cells
  - Biopsy showing pauci-immune glomerulonephritis
- Imaging findings
  - Inflammation, consolidation, or effusion of nasal/paranasal sinuses, or mastoiditis on imaging

IMAGING MODALITY: When any ONE of the following criteria are met, one or more of the following studies are indicated: Neck CT/MRI, Chest CT, Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT.

- Known GPA when imaging results of a specific area is needed to guide decisions about initial therapy or response to therapy

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 71250 | Computed tomography, thorax, diagnostic; without contrast material |
| 71260 | Computed tomography, thorax, diagnostic; with contrast material(s) |
| 71270 | Computed tomography, thorax, diagnostic; without contrast material, followed by contrast material(s) and further sections |
| 71271 | Computed tomography, thorax, low dose for lung cancer screening, without contrast material(s) |

| Code | Description |
|---|---|
| 71275 | Computed tomographic angiography, chest (noncoronary), with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 71550 | Magnetic resonance (eg, proton) imaging, chest (eg, for evaluation of hilar and mediastinal lymphadenopathy); without contrast material(s) |
| 71551 | Magnetic resonance (eg, proton) imaging, chest (eg, for evaluation of hilar and mediastinal lymphadenopathy); with contrast material(s) |
| 71552 | Magnetic resonance (eg, proton) imaging, chest (eg, for evaluation of hilar and mediastinal lymphadenopathy); without contrast material(s), followed by contrast material(s) and further sequences |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging.

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH NOT suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test DOES suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

## Clinical Assessment of Pulmonary Embolism

### *Original Wells Score for Prediction of Pulmonary Embolism* [48]

| Clinical Criteria | Score |
|---|---|
| Clinical Symptoms of DVT (deep vein thrombosis) | 3 |
| Other diagnosis (less likely than pulmonary embolism) | 3 |
| Heart rate > 100 bpm | 1.5 |
| Surgery in previous 4 weeks or Immobilization (≥ 3 days) | 1.5 |
| Previous DVT/PE (pulmonary embolism) | 1.5 |
| Hemoptysis | 1 |

| Clinical Criteria | Score |
|---|---|
| Malignancy | 1 |
| **Clinical Probability** | |
| Low probability of pulmonary embolus | 0 – 1 |
| Intermediate probability | 2 – 6 |
| High probability | ≥ 7 |

### *Original and Simplified Geneva Score for Prediction of Pulmonary Embolism* *(48,50)*

| Clinical Criteria | Original Version | Simplified Version |
|---|---|---|
| Age ≥ 65 years | 1 | 1 |
| Previous DVT (deep vein thrombosis) or PE (pulmonary embolism) | 3 | 1 |
| Recent surgery or fracture (within 1 month) | 2 | 1 |
| Active malignant condition | 2 | 1 |
| Unilateral lower limb pain | 3 | 1 |
| Hemoptysis | 2 | 1 |
| Heart rate 75-94 bpm | 3 | 1 |
| Heart rate ≥ 95 bpm | 5 | 2 |
| Unilateral edema of lower limb and pain on deep palpation | 4 | 1 |
| **Clinical Probability** | | |
| Low probability of Pulmonary Embolus (PE) | 0 – 3 | 0 – 1 |
| Intermediate probability | 4 – 10 | 2 – 4 |
| High probability | ≥ 11 | ≥ 5 |

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (eg, non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine

# Table 1: Lung-RADS Assessment Categories [21]

*This table is reproduced without alteration or edit in accordance with provisions in a Creative Commons License. The full document and license information can be found here: **Lung RADS | American College of Radiology (acr.org)**

American College of Radiology™

**Lung-RADS® v2022**

Release Date: November 2022

| Lung-RADS | Category Descriptor | Findings | Management |
|---|---|---|---|
| 0 | **Incomplete**<br>Estimated Population Prevalence: ~1% | Prior chest CT examination being located for comparison (see note 9) | Comparison to prior chest CT; |
| | | Part or all oflungs cannot be evaluated | Additional lung cancer screening CT imaging needed; |
| | | Findings suggestive of an inflammatory or infectious process (see note 10) | 1-3 month LDCT |
| 1 | **Negative**<br>Estimated Population Prevalence: 39% | **No lung nodules OR** | 12-month screening LDCT |
| | | **Nodule with benign features:**<br>• Complete, central, popcorn, or concentric ring calcifications **OR**<br>• Fat-containing | |
| 2 | **Benign** - Based on imaging features or indolent behavior<br>Estimated Population Prevalence: 45% | **Juxtapleural nodule:**<br>• < 10 mm (524 $mm^3$) mean diameter at baseline or new **AND**<br>• Solid; smooth margins; and oval, lentiform, or triangular shape | |
| | | **Solid nodule:**<br>• < 6 mm (< 113 $mm^3$) at baseline **OR**<br>• New < 4 mm (< 34 $mm^3$) | |
| | | **Part solid nodule:**<br>• < 6 mm total mean diameter (< 113 $mm^3$) at baseline | |
| | | **Non solid nodule (GGN):**<br>• < 30 mm (< 14,137 $mm^3$) at baseline, new, or growing **OR**<br>• ≥ 30 mm (≥ 14,137 $mm^3$) stable or slowly growing (see note 7) | |
| | | **Airway nodule,** subsegmental - at baseline, new, or stable (see note 11) | |
| | | Category 3 lesion that is stable or decreased in size at 6-month follow-up CT **OR** Category 4B lesion proven to be benign in etiology following appropriate diagnostic workup | |
| 3 | **Probably Benign** - Based on imaging features or behavior<br>Estimated Population Prevalence: 9% | **Solid nodule:**<br>• ≥ 6 to < 8 mm (≥ 113 to < 268 $mm^3$) at baseline **OR**<br>• New 4 mm to < 6 mm (34 to < 113 $mm^3$) | 6-month LDCT |
| | | **Part solid nodule:**<br>• ≥ 6 mm total mean diameter (≥ 113 $mm^3$) with solid component < 6 mm (< 113 $mm^3$) at baseline **OR**<br>• New < 6 mm total mean diameter (< 113 $mm^3$) | |
| | | **Non solid nodule (GGN):**<br>• ≥ 30 mm (≥ 14,137 $mm^3$) at baseline or new | |
| | | **Atypical pulmonary cyst:** (see note 12)<br>• Growing cystic component (mean diameter) of a thick-walled cyst | |
| | | Category 4A lesion that is stable or decreased in size at 3-month follow-up CT (excluding airway nodules) | |
| 4A | **Suspicious**<br>Estimated Population Prevalence: 4% | **Solid nodule:**<br>• ≥ 8 to < 15 mm (≥ 268 to < 1,767 $mm^3$) at baseline **OR**<br>• Growing < 8 mm (< 268 $mm^3$) **OR**<br>• New 6 to < 8 mm (113 to < 268 $mm^3$) | 3-month LDCT;<br>PET/CT may be considered if there is a ≥ 8 mm (≥ 268 $mm^3$) solid nodule or solid component |
| | | **Part solid nodule:**<br>• ≥ 6 mm total mean diameter (≥ 113 $mm^3$) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 $mm^3$) at baseline **OR**<br>• New or growing < 4 mm (< 34 $mm^3$) solid component | |
| | | **Airway nodule,** segmental or more proximal - at baseline (see note 11) | |
| | | **Atypical pulmonary cyst:** (see note 12)<br>• Thick-walled cyst **OR**<br>• Multilocular cyst at baseline **OR**<br>• Thin- or thick-walled cyst that becomes multilocular | |
| 4B | **Very Suspicious**<br>Estimated Population Prevalence: 2% | **Airway nodule,** segmental or more proximal - stable or growing (see note 11) | Referral for further clinical evaluation |
| | | **Solid nodule:**<br>• ≥ 15 mm (≥ 1767 $mm^3$) at baseline **OR**<br>• New or growing ≥ 8 mm (≥ 268 $mm^3$) | Diagnostic chest CT with or without contrast;<br>PET/CT may be considered if there is a ≥ 8 mm (≥ 268 $mm^3$) solid nodule or solid component;<br>tissue sampling;<br>and/or referral for further clinical evaluation<br>Management depends on clinical evaluation, patient preference, and the probability of malignancy (see note 13) |
| | | **Part solid nodule:**<br>• Solid component ≥ 8 mm (≥ 268 $mm^3$) at baseline **OR**<br>• New or growing ≥ 4 mm (≥ 34 $mm^3$) solid component | |
| | | **Atypical pulmonary cyst:** (see note 12)<br>• Thick-walled cyst with growing wall thickness/nodularity **OR**<br>• Growing multilocular cyst (mean diameter) **OR**<br>• Multilocular cyst with increased loculation or new/increased opacity (nodular, ground glass, or consolidation) | |
| | | **Slow growing solid or part solid nodule** that demonstrates growth over multiple screening exams (see note 8) | |
| 4X | Estimated Population Prevalence: < 1% | Category 3 or 4 nodules with additional features or imaging findings that increase suspicion for lung cancer (see note 14) | |
| S | **Significant or Potentially Significant**<br>Estimated Population Prevalence: 10% | **Modifier:** May add to category 0-4 for clinically significant or potentially clinically significant findings unrelated to lung cancer (see note 15) | As appropriate to the specific finding |

# Table 2: 2017 Fleischner Society Guidelines for Management of Incidental Detected Pulmonary Nodules [22]

## *Fleischner Table*

*This table is reproduced without alteration or editing.

**Fleischner Society 2017 Guidelines for Management of Incidentally Detected Pulmonary Nodules in Adults**

**A: Solid Nodules***

| Nodule Type | Size: <6 mm (<100 mm³) | Size: 6–8 mm (100–250 mm³) | Size: >8 mm (>250 mm³) | Comments |
|---|---|---|---|---|
| Single | | | | |
| Low risk† | No routine follow-up | CT at 6–12 months, then consider CT at 18–24 months | Consider CT at 3 months, PET/CT, or tissue sampling | Nodules <6 mm do not require routine follow-up in low-risk patients (recommendation 1A). |
| High risk† | Optional CT at 12 months | CT at 6–12 months, then CT at 18–24 months | Consider CT at 3 months, PET/CT, or tissue sampling | Certain patients at high risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up (recommendation 1A). |
| Multiple | | | | |
| Low risk† | No routine follow-up | CT at 3–6 months, then consider CT at 18–24 months | CT at 3–6 months, then consider CT at 18–24 months | Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A). |
| High risk† | Optional CT at 12 months | CT at 3–6 months, then at 18–24 months | CT at 3–6 months, then at 18–24 months | Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A). |

**B: Subsolid Nodules***

| Nodule Type | Size: <6 mm (<100 mm³) | Size: ≥6 mm (>100 mm³) | Comments |
|---|---|---|---|
| Single | | | |
| Ground glass | No routine follow-up | CT at 6–12 months to confirm persistence, then CT every 2 years until 5 years | In certain suspicious nodules < 6 mm, consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection. (Recommendations 3A and 4A). |
| Part solid | No routine follow-up | CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years. | In practice, part-solid nodules cannot be defined as such until ≥6 mm, and nodules <6 mm do not usually require follow-up. Persistent part-solid nodules with solid components ≥6 mm should be considered highly suspicious (recommendations 4A-4C) |
| Multiple | CT at 3–6 months. If stable, consider CT at 2 and 4 years. | CT at 3–6 months. Subsequent management based on the most suspicious nodule(s). | Multiple <6 mm pure ground-glass nodules are usually benign, but consider follow-up in selected patients at high risk at 2 and 4 years (recommendation 5A). |

Note.—These recommendations do not apply to lung cancer screening, patients with immunosuppression, or patients with known primary cancer.

* Dimensions are average of long and short axes, rounded to the nearest millimeter.

† Consider all relevant risk factors (see Risk Factors).

There are multiple factors that may place an individual in the high-risk category such as smoking history and nodule characteristics. The designation of high risk may be assigned by the treating provider.

### Cancer Risk Factors [22]

- Low Risk Factors

- Young age
- Less smoking
- Smaller nodule size
- Regular margins
- Location other than the upper lobe

- High Risk Factors
  - Older age
  - Heavy smoking
  - Larger nodule size
  - Irregular or spiculated margins
  - Upper lobe location

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** (109,110) | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** (111) | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** (38) | Chest CT and Abdomen +/- Pelvis CT/MRI<br>• Every 3-12 months for 5 years then<br>• As clinically indicated after 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Ampullary Adenocarcinoma** [112] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** [113] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** [114] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** [39,41] | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>  ○ Every 6 months for 2 years then<br>  ○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>• Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>  ○ Every 6 months for 1 year then<br>  ○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>• Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>  ○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (115) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (116) | Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 2 years then<br>• Every 6-12 months for up to 5 years |
| **Bladder Cancer** (117) | **Non-Muscle Invasive (NMIBC)**<br>• Low-intermediate Risk NMIBC treated without cystectomy<br>  ○ Routine surveillance imaging is not indicated<br>• High Risk* NMIBC treated without cystectomy<br>  ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>  ■ Once 12 months after diagnosis then<br>  ■ Every 1-2 years 9 additional years<br>  ■ No routine surveillance imaging after 10 years<br>• NMICBC after cystectomy<br>  ○ Abdomen and Pelvis CT/MRI (may be |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | referred to as CT/MRI Intravenous Pyelogram)<br>■ 3 months after surgery then<br>■ 1 year after surgery then<br>■ Annually for 4 additional years<br>■ No routine surveillance imaging after 5 years<br><br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br><br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then<br>■ Annually for 3 additional years<br><br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** [118] | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then<br>■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone**<br>● CT or MRI of primary tumor site as clinically indicated<br>● Chest CT<br>○ Every 6-12 months for 4 years then<br>○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 4 months for year 3 then<br>○ Every 6 months year 4 and 5 then<br>○ Annually after year 5, as clinically indicated |
| **Breast** [119] | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>● Stage I-III disease:<br>○ Routine surveillance imaging not indicated (followed with mammography)<br>**NOTE: See Restaging section for recurrence**<br>● Stage IV disease not currently on therapy<br>○ Chest CT and Abdomen and Pelvis CT<br>■ Every 3-6 months |
| **Castleman's Disease** [120] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>● Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** [121] | **Stage I disease treated with non-fertility sparing**<br>● Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>● Pelvis MRI<br>○ Once 6 months after completion of treatment then<br>○ Annually for 2-3 additional years<br>**Stage II-IV**<br>● Pelvis MRI<br>○ Once 3-6 months after completion of treatment<br>○ Routine surveillance imaging not indicated thereafter<br>● Chest CT and Abdomen and Pelvis CT<br>○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>  ○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** (122) | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** (123) | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** (124–128) | **Choroid plexus tumors and carcinoma**<br>• Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>• Malignant choroid plexus carcinoma<br>  ○ Brain MRI<br>  ■ Every 3-4 months for 2 years then<br>  ■ Every 6 months for years 3-5 then<br>  ■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>• Circumscribed glioma (not otherwise listed) post gross total resection<br>  ○ Brain MRI<br>  ■ Every 3-6 months for 5 years then<br>  ■ Annually after 5 years<br>• Oligodendroglioma and astrocytoma grade 2<br>  ○ After chemotherapy and radiation<br>  ■ Brain MRI: Every 6-9 months<br>  ○ After chemotherapy OR radiation<br>  ■ Brain MRI: Every 3-4 months<br>  ○ After surgery only<br>  ■ Brain MRI: Every 3-4 months |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | NOTE: Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br><br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma<br>○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then<br>□ As clinically indicated after 5 years<br><br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>**NOTE:** High-grade glioma includes ALL histologies if grade 3 and 4 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br><br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated<br>● MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br><br>**Primary CNS Lymphoma**<br>● MRI Brain +/- MRI C/T/L Spine<br>○ Every 3 months for 2 years, then<br>○ Every 6 months for 3 years, then<br>○ Annually, indefinitely<br><br>**Primary Spinal Cord Tumors**<br>● Low grade tumors (grade 1-2)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months indefinitely<br>● High grade tumors (grade 3-4)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Once 2-6 weeks after treatment then<br>○ Every 2-4 months for 3 years then<br>○ Every 3-6 months for 2 years, then<br>○ Every 6-12 months indefinitely |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **NOTE:** Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br><br>**Meningiomas**<br>● Grade 1 and 2 or unresected tumors:<br>○ MRI Brain (include spine if spinal involvement)<br>■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>**NOTE:** SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** (129) | **Stage I**<br>● Routine surveillance imaging is not indicated<br><br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br><br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous** | Routine surveillance imaging is not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** [130] | |
| **Dermatofibrosarcoma Protuberans (DFSP)** [131] | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** [132] | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |
| **Gastric** [133] | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Gastrointestinal Stroma Tumor (GIST)** [134] | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>**NOTE:** More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [135] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [136] | Routine surveillance imaging is not indicated |
| **Head and Neck** [137] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change).<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** [138] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Histiocytic Neoplasms** (139) | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** (35,36) | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** (140) | Routine surveillance imaging is not indicated |
| **Kidney Cancer** (43) | See **Active Surveillance** section for indications related to that management strategy.<br>**After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ As clinically indicated after 5 years<br><br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then<br>○ Annually during year 5 then<br>○ As clinically indicated after year 5<br><br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br><br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br><br>**Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Baseline within 3-6 months then<br>○ Every 3-6 months for 3 years then<br>○ Annually for 2 additional years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ As clinically indicated beyond 5 years<br><br>**Stage IV, relapsed, or surgically unresectable disease***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 1.5-4 months<br>● Brain MRI (preferred) or brain CT<br>○ Annually, or as clinically indicated<br>● Entire spine MRI<br>○ As clinically indicated<br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (141) | **Stage 0/in situ, Stage I, Stage IIA**<br>● No routine imaging needed<br><br>**Stage IIB-IV**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years<br>● Brain MRI if stage IIIB or higher<br>○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years<br>**NOTE:** More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |
| **Melanoma: Uveal** (142) | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Annually for 5 years<br><br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 10 years then<br>○ As clinically indicated after year 10<br><br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months for years 6-10 then<br>○ As clinically indicated after year 10<br><br>**NOTE:** Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** (143) | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** (144) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** (40) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Multiple Myeloma** (145) | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually for 5 years<br><br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** (38) | **Well-differentiated NET, Grade 1-2** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br><br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br><br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br><br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |
| **Neuroblastoma** [146] | **All risk groups**<br>● CT or MRI of primary site<br>○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br><br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** [37] | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |
| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** [147] | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years then<br>● As clinically indicated after 5 years<br>**NOTE:** These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors) |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Benign Teratoma**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years then<br>○ As clinically indicated after 5 years<br>**Small cell carcinoma of ovary**<br>● Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>○ Every 3-6 months for 2 years then<br>○ Annually |
| **Pancreatic Adenocarcinoma** (148) | Chest CT and Abdomen and Pelvis CT<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months for 2 years then<br>● As clinically indicated after 5 years |
| **Penile Cancer** (149) | **pN0 and pN1**<br>● Abdomen and Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually during years 3-4<br>**pN2 and pN3**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3 months for 1 then<br>○ Every 6 months during years 2-4 |
| **Prostate Cancer** (150) | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** (151) | **Stage I**<br>● Routine surveillance imaging is not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** (152–154) | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** (155) | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |
| **Small Cell Lung Cancer (SCLC)** (156) | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (eg, neck, spine)<br>NOTE: Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** (33,34) | **General surveillance guidelines for other sarcomas, based on site:** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT<br>● **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>● **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>● **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>● **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>● **Round Cell/Myxoid Liposarcoma:** Whole Body |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br><br>**Specific sarcoma surveillance guidelines (above general guidance does not apply):**<br><br>**Desmoid tumor (aggressive fibromatosis)**<br>● Site-specific MRI (preferred) or CT<br>○ Every 3-6 months for 3 years then<br>○ Every 6-12 months<br><br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br><br>**Borderline Phyllodes Tumor**<br>● Chest or Breast MRI<br>○ Every 6 months for 2 years then<br>○ Annually for 3 additional years<br><br>**Malignant Phyllodes Tumor**<br>● Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** (157) | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** (158)<br><br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Testicular Cancer – Pure Seminoma** [159] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br><br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br><br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br><br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3<br><br>**Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** [159] | See **Active Surveillance** section for indications related to that management strategy.<br><br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br><br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br><br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** [42] | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br><br>**Thymic Carcinoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** [160] | **Follicular, Papillary, or Oncocytic Carcinoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Neck CT/MRI +/- Chest CT<br>  ○ Once 6-12 post thyroidectomy<br>  ○ Routine surveillance imaging thereafter not indicated<br><br>**Medullary Carcinoma**<br>• Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>  ○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>  ○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br><br>**Anaplastic Carcinoma**<br>• Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>  ○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (161) | **Endometrial Cancer treated with non-fertility sparing**<br>• Routine surveillance imaging thereafter not indicated<br><br>**Endometrial Cancer treated with fertility sparing**<br>• Pelvis MRI<br>  ○ Once 6-9 months after treatment<br>  ○ Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence.<br><br>• **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>  ○ Every 3-6 months for 3 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** [162] | Chest CT and Abdomen and Pelvis CT/MRI<br>● End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>● Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** [163] | Pelvis MRI (Indicated in addition to PET/CT)<br>● End of treatment restaging once 3-6 months after completion of treatment<br>● Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** [164] | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** [165] | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>● Every 3 months for 2 years<br>● Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Advances in cross-sectional imaging have established computed tomography (CT) and magnetic resonance imaging (MRI) as important diagnostic tools for evaluation of thoracic anatomy and pathology beyond conventional radiography. [166] Compared with chest radiography, CT and MRI provide cross-sectional visualization that allows improved depiction of intrathoracic structures, including the lungs, mediastinum, pleura, chest wall, and thoracic

vasculature. [167] Imaging studies are generally performed to address specific clinical questions rather than for routine or screening purposes in asymptomatic individuals. [168]

CT imaging is based on differential attenuation of x-rays by tissues and produces tomographic, cross-sectional images through computerized reconstruction of acquired data. [166] Modern multidetector CT scanners allow rapid acquisition of volumetric datasets with thin-section reconstruction and multiplanar reformatting, enabling detailed evaluation of thoracic anatomy. [166]

CT of the chest provides high spatial resolution and is well suited for evaluation of lung parenchyma, pleura, mediastinal structures, chest wall, and osseous anatomy. [167] CT permits detailed assessment of aerated lung, which is limited on MRI because of low signal intensity and susceptibility to motion artifacts. [167] Due to rapid image acquisition, CT is less affected by respiratory motion compared with MRI and is widely available in both outpatient and acute care settings. [167]

Intravenous iodinated contrast may be used with CT to enhance visualization of mediastinal structures, vascular anatomy, and selected thoracic lesions when characterization of enhancement is clinically relevant. [166]

CT angiography (CTA) combines thin-section CT acquisition with timed administration of intravenous iodinated contrast to evaluate thoracic vascular structures. [166] CTA allows detailed visualization of the pulmonary arteries, thoracic aorta, and other intrathoracic vessels using multiplanar reformations and three-dimensional reconstructions. [166]

MRI is based on the magnetic properties of hydrogen nuclei and generates images through tissue-specific differences in relaxation properties without the use of ionizing radiation. [166] Image contrast can be manipulated through pulse sequences, and gadolinium-based contrast agents may be administered to improve soft tissue and vascular visualization. [166]

MRI provides excellent soft tissue contrast and may be useful for evaluation of mediastinal masses, chest wall lesions, and selected cardiac or pericardial abnormalities extending into the thorax. [167] MRI may be considered in circumstances where soft tissue characterization is desired or when avoidance of ionizing radiation is an important consideration. [167]

MRI has important limitations for evaluation of lung parenchyma due to low signal from aerated lung and susceptibility to respiratory and cardiac motion artifacts. [167] MRI examinations generally require longer acquisition times and have lower spatial resolution for small pulmonary structures compared with CT. [167] As a result, MRI is not routinely used as a primary imaging modality for diffuse lung disease or many acute thoracic conditions. [168]

Magnetic resonance angiography (MRA) of the chest uses MRI techniques, with or without gadolinium-based contrast agents, to evaluate thoracic vascular structures. [166] Contrast-enhanced MRA improves visualization of blood vessels by exploiting the paramagnetic properties of gadolinium to enhance signal within well-perfused vascular structures. [166] MRA may be used for selected evaluation of thoracic vascular anatomy when detailed soft tissue contrast is desired and avoidance of ionizing radiation is an important consideration. [167]

MRA has limitations related to longer acquisition times, lower spatial resolution for small vessels compared with CT angiography, and susceptibility to respiratory and cardiac motion artifacts, which restrict its routine use in thoracic imaging (Eisenberg 2020). [167] MRA is not used for routine chest imaging in the absence of specific clinical indications. [168]

### Selection of CT Versus MRI for Chest Imaging

Selection of CT versus MRI for chest imaging depends on the structures being evaluated and the diagnostic information sought. [167] In general:

- CT is generally preferred for evaluation of lung parenchyma, pleura, and many acute thoracic processes because of its spatial resolution and speed. [167]
- MRI may be used selectively for soft tissue characterization, mediastinal or chest wall assessment, and situations where radiation exposure is a significant concern. [167]

Imaging modality selection should balance diagnostic performance with patient safety and clinical necessity.

### Use of Contrast Agents

Iodinated contrast agents are commonly used with CT to enhance vascular structures and improve delineation of mediastinal anatomy. [166] Gadolinium-based contrast agents are used in MRI to improve visualization of soft tissue and vascular structures but require consideration of renal function and patient-specific risk factors. [166]

CT involves exposure to ionizing radiation, which is associated with cumulative radiation dose and potential long-term risk, particularly in younger patients and those undergoing repeated examinations.[166] MRI does not involve ionizing radiation but may be contraindicated in patients with certain implanted devices or metallic foreign bodies and may be limited by patient tolerance and scan duration. [166] Contrast-related risks, including contrast-induced nephropathy and nephrogenic systemic fibrosis, should be considered when selecting imaging modality and contrast use. [166]

# ANALYSIS OF EVIDENCE

## *CT and MRI for the Chest*

Due to its speed, broad availability, and ability to evaluate aerated lung parenchyma, CT is the primary advanced imaging modality for most thoracic conditions. It is routinely used for evaluation of chronic cough following chest radiography, diffuse lung disease (typically using high-resolution protocols), infectious complications, indeterminate pulmonary nodules, and a wide range of other thoracic indications. [166] CT's established performance characteristics and standardized protocols support its role as the initial and definitive imaging study in these contexts. [9,11,12,16,22,102]

MRI plays a more limited and selective role in thoracic imaging. Its primary value lies in situations where soft-tissue characterization is required, such as evaluation of mediastinal or chest wall lesions, or when CT cannot be performed due to contraindications. MRI is not routinely used for evaluation of lung parenchyma but serves as a problem-solving modality when characterization beyond CT is necessary. This pattern is consistent with published guidance on nonvascular thoracic MRI. [23,26,29,30,168]

For diffuse lung disease, CT is explicitly favored, most often using high-resolution CT techniques. HRCT provides the spatial resolution necessary for evaluation of interstitial and parenchymal abnormalities and is supported by both ACR Appropriateness Criteria and ACR

STR performance parameters. MRI does not provide comparable diagnostic performance for these indications. [11,12]

In patients with suspected interstitial lung disease related to systemic autoimmune rheumatic disease, CT remains the preferred modality for screening and monitoring. In this context, CT may be pursued even in the absence of acute findings on chest radiography, reflecting disease-specific guidance supporting cross-sectional evaluation rather than reliance on plain films alone. [13]

For esophageal or airway-adjacent symptoms with indeterminate prior evaluation—such as dysphagia following endoscopy or fluoroscopy, or suspected tracheobronchial disease—CT provides comprehensive anatomic assessment and supports further diagnostic clarification when initial testing is inconclusive. [14,102]

## *CT and MRI for Additional Thoracic Indications*

### Infection, Nodules, Screening, Chest Wall, and Mediastinum

CT is indicated for escalation in cases of thoracic infection when initial evaluation fails to identify a source or when complications are suspected. This includes evaluation of fever of unknown origin after prior imaging and assessment of non-resolving pneumonia or suspected post-infectious complications. [15] CT is used in these settings to define extent of disease and identify complications not visible on radiography. [17]

For pleural disease, including suspected parapneumonic effusion or empyema following chest radiography and evaluation of unexplained pleural effusions, CT is the preferred modality when radiographs are insufficient. Cross-sectional imaging allows for assessment of pleural anatomy, loculation, and adjacent structures. [16]

In suspected pulmonary tuberculosis, CT is used following initial chest radiography to further characterize parenchymal and mediastinal findings and to clarify indeterminate radiographic abnormalities. This approach aligns with established imaging recommendations for TB evaluation. [18]

For lung cancer screening, low-dose CT is the recommended modality for annual screening in high-risk populations. Identified nodules are managed using standardized Lung-RADS criteria, which guide imaging follow-up and downstream evaluation. [21]

Incidentally detected pulmonary nodules identified outside the screening setting are managed according to the 2017 Fleischner Society guidelines. These recommendations rely on standard chest CT for both initial characterization and interval surveillance, with MRI not playing a role in routine nodule follow-up. [22]

For chest wall and mediastinal lesions, MRI is an appropriate adjunct modality when further soft-tissue characterization is required or when prior imaging suggests MRI as the next diagnostic step. MRI provides improved anatomic detail and tissue contrast in these settings and is used selectively rather than as an initial imaging study. [23,26,29]

For other symptom-driven thoracic indications, such as hemoptysis or suspected tracheal stenosis and tracheobronchial disease, CT is used following baseline assessment to provide targeted evaluation based on clinical suspicion and guideline-supported escalation pathways. [44,102,167]

### *CTA and MRA*

CT angiography and MR angiography are addressed separately from nonangiographic CT and MRI. These studies are defined as dedicated vascular examinations, encompassing both arterial and venous imaging, and are reserved for indications where vascular assessment is required.

For suspected pulmonary embolism, CT pulmonary angiography is the indicated imaging study in patients with high clinical probability, as defined by validated scoring systems. Nonangiographic chest CT, chest MRI, and chest MRA are not appropriate substitutes for this indication. This approach is supported by multiple professional society guidelines and imaging appropriateness criteria. [47–49,51,52]

In thoracic aortic disease, imaging modality selection is guided by clinical presentation. CT or MRI may be used for surveillance of asymptomatic aneurysms, while CTA is preferred for evaluation of symptomatic aneurysms and acute aortic syndromes. MRA serves as an alternative when CTA cannot be performed. These pathways are supported by major cardiovascular guidelines and ACR Appropriateness Criteria. [60,61,99]

For other vascular thoracic indications—including superior vena cava syndrome, suspected pulmonary hypertension, and thoracic outlet syndrome—either CTA or MRA may be appropriate depending on the clinical scenario, with modality selection guided by diagnostic requirements and patient-specific factors. [69,70,72]

### *In Summary*

Across thoracic imaging indications, consistent modality patterns are observed. CT, including low-dose CT where specified, is the primary modality for evaluation of lung parenchyma and most nonvascular thoracic conditions due to its availability, speed, and diagnostic performance. MRI is used selectively for soft-tissue characterization or when CT cannot be performed. CTA and MRA are reserved for vascular indications, with CTA commonly preferred in acute settings and MRA serving as an alternative when appropriate. [21,22,47,61]

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2071 for Chest Imaging:<br>○ ECG 2018 Chest for Computed Tomography (CT)<br>○ ECG 2019 for Chest Magnetic Resonance Imaging (MRI)<br>○ ECG 2020 for Chest Computed Tomography Angiography (CTA)<br>○ ECG 2021 for Chest Magnetic Resonance Angiography (MRA) |

| Date | Summary |
|---|---|
| | ○ ECG 2030 Low Dose Computed Tomography (CT) for Lung Cancer Screening<br>● This guideline also merges the procedure codes from the above Evolent Guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# REFERENCES


1. Bokhari SRA, Zulfiqar H, Mansur A. Sarcoidosis. *StatPearls*. Published online June 25, 2025. https://www.ncbi.nlm.nih.gov/books/NBK430687/
2. Guzman-Soto MI, Kimura Y, Romero-Sanchez G, et al. From Head to Toe: Granulomatosis with Polyangiitis. *RadioGraphics*. 2021;41(7):1973-1991. doi:10.1148/rg.2021210132
3. Robson JC, Grayson PC, Ponte C, et al. 2022 American College of Rheumatology/European Alliance of Associations for Rheumatology classification criteria for granulomatosis with polyangiitis. *Ann Rheum Dis*. 2022;81(3):315-320. doi:10.1136/annrheumdis-2021-221795
4. Sodhi KS, Ciet P, Vasanawala S, Biederer J. Practical protocol for lung magnetic resonance imaging and common clinical indications. doi:10.1007/s00247-021-05090-z/Published
5. Cancemi G, Distefano G, Vitaliti G, et al. Congenital Lung Malformations: A Pictorial Review of Imaging Findings and a Practical Guide for Diagnosis. Published online 2024. doi:10.3390/children
6. Jone PN, Ivy DD, Hauck A, et al. Pulmonary Hypertension in Congenital Heart Disease: A Scientific Statement From the American Heart Association. *Circ Heart Fail*. 2023;16(7). doi:10.1161/HHF.0000000000000080
7. Mak SM, Bhaludin BN, Naaseri S, Chiara F Di, Jordan S, Padley S. Imaging of congenital chest wall deformities. *British Journal of Radiology*. 2016;89(1061). doi:10.1259/bjr.20150595
8. Cancemi G, Distefano G, Vitaliti G, et al. Congenital Lung Malformations: A Pictorial Review of Imaging Findings and a Practical Guide for Diagnosis. Published online 2024. doi:10.3390/children
9. Turner RD, Bothamley GH. Chronic cough and a normal chest X-ray - a simple systematic approach to exclude common causes before referral to secondary care: a retrospective cohort study. *NPJ Prim Care Respir Med*. 2016;26(1):15081. doi:10.1038/npjpcrm.2015.81
10. Rouadi PW, Idriss SA, Bousquet J, et al. WAO - ARIA consensus on chronic cough: Executive summary. *World Allergy Organization Journal*. 2025;18(3). doi:10.1016/j.waojou.2025.101034
11. Hobbs SB, Chung JH, Walker CM, et al. ACR Appropriateness Criteria® Diffuse Lung Disease. *Journal of the American College of Radiology*. 2021;18(11):S320-S329. doi:10.1016/j.jacr.2021.08.008
12. ACR-STR. *PRACTICE PARAMETER FOR THE PERFORMANCE OF HIGH-RESOLUTION COMPUTED TOMOGRAPHY (HRCT) OF THE LUNGS IN ADULTS*.; 2020. Accessed January 8, 2025. https://www.acr.org/-/media/ACR/Files/Practice-Parameters/HRCT-Lungs.pdf
13. Johnson SR, Bernstein EJ, Bolster MB, et al. 2023 American College of Rheumatology (ACR)/American College of Chest Physicians (CHEST) Guideline for the Screening and

Monitoring of Interstitial Lung Disease in People with Systemic Autoimmune Rheumatic Diseases. *Arthritis and Rheumatology*. 2024;76(8):1201-1213. doi:10.1002/art.42860

14. Levy AD, Carucci LR, Bartel TB, et al. ACR Appropriateness Criteria® Dysphagia. *Journal of the American College of Radiology*. 2019;16(5):S104-S115. doi:10.1016/j.jacr.2019.02.007
15. Brown I, Finnigan NA. Fever of Unknown Origin. *StatPearls*. Published online August 14, 2023. https://www.ncbi.nlm.nih.gov/books/NBK532265/
16. Morris MF, Henry TS, Raptis CA, et al. ACR Appropriateness Criteria® Workup of Pleural Effusion or Pleural Disease. *Journal of the American College of Radiology*. 2024;21(6):S343-S352. doi:10.1016/j.jacr.2024.02.013
17. Little BP, Gilman MD, Humphrey KL, et al. Outcome of recommendations for radiographic follow-up of pneumonia on outpatient chest radiography. *American Journal of Roentgenology*. 2014;202(1):54-59. doi:10.2214/AJR.13.10888
18. Ravenel JG, Chung JH, Ackman JB, et al. ACR Appropriateness Criteria® Imaging of Possible Tuberculosis. *Journal of the American College of Radiology*. 2017;14(5):S160-S165. doi:10.1016/j.jacr.2017.02.022
19. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Lung Cancer Screening Version 1.2025 © National Comprehensive Cancer Network, Inc. 2025. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
20. Wolf AMD, Oeffinger KC, Shih TY, et al. Screening for lung cancer: 2023 guideline update from the American Cancer Society. *CA Cancer J Clin*. 2024;74(1):50-81. doi:10.3322/caac.21811
21. Christensen J, Prosper AE, Wu CC, et al. ACR Lung-RADS v2022: Assessment Categories and Management Recommendations. *Journal of the American College of Radiology*. 2024;21(3):473-488. doi:10.1016/j.jacr.2023.09.009
22. MacMahon H, Naidich DP, Goo JM, et al. Guidelines for management of incidental pulmonary nodules detected on CT images: From the Fleischner Society 2017. *Radiology*. 2017;284(1):228-243. doi:10.1148/radiol.2017161659
23. Bueno J, Lichtenberger JP, Rauch G, Carter BW. MR imaging of primary chest wall neoplasms. *Topics in Magnetic Resonance Imaging*. 2018;27(2):83-93. doi:10.1097/RMR.0000000000000164
24. Thomas K, Gould M, Naeger D. Overview of the initial evaluation, diagnosis, and staging of patients with suspected lung cancer. UpToDate - Wolters Kluwer. April 2025. https://www.uptodate.com/contents/overview-of-the-initial-evaluation-diagnosis-and-staging-of-patients-with-suspected-lung-cancer
25. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Gestational Trophoblastic Neoplasia Version 2.2026 © National Comprehensive Cancer Network, Inc. 2025. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

26. Mansour J, Raptis D, Bhalla S, et al. Diagnostic and Imaging Approaches to Chest Wall Lesions. *RadioGraphics*. 2022;42(2):359-378. doi:10.1148/rg.210095

27. Strange CD, Ahuja J, Shroff GS, Truong MT, Marom EM. Imaging Evaluation of Thymoma and Thymic Carcinoma. *Front Oncol*. 2022;11. doi:10.3389/fonc.2021.810419

28. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Thymomas and Thymic Carcinomas Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.

29. Ackman JB, Chung JH, Walker CM, et al. ACR Appropriateness Criteria® Imaging of Mediastinal Masses. *Journal of the American College of Radiology*. 2021;18(5):S37-S51. doi:10.1016/j.jacr.2021.01.007

30. Nguyen ET, Bayanati H, Bilawich AM, et al. Canadian Society of Thoracic Radiology/Canadian Association of Radiologists Clinical Practice Guidance for Non-Vascular Thoracic MRI. *Canadian Association of Radiologists Journal*. 2021;72(4):831-845. doi:10.1177/0846537121998961

31. Gerull S, Medinger M, Heim D, Passweg J, Stern M. Evaluation of the Pretransplantation Workup before Allogeneic Transplantation. *Biology of Blood and Marrow Transplantation*. 2014;20(11):1852-1856. doi:10.1016/j.bbmt.2014.06.029

32. Kaste SC, Kaufman RA, Sunkara A, et al. Routine Pre- and Post-Hematopoietic Stem Cell Transplant Computed Tomography of the Abdomen for Detecting Invasive Fungal Infection Has Limited Value. *Biology of Blood and Marrow Transplantation*. 2015;21(6):1132-1135. doi:10.1016/j.bbmt.2015.02.023

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44. Olsen KM, Manouchehr-pour S, Donnelly EF, et al. ACR Appropriateness Criteria® Hemoptysis. *Journal of the American College of Radiology*. 2020;17(5):S148-S159. doi:10.1016/j.jacr.2020.01.043
45. Laracca GG, Spota A, Perretta S. Optimal workup for a hiatal hernia. *Ann Laparosc Endosc Surg*. 2021;6. doi:10.21037/ALES.2020.03.02
46. American College of Radiolgoy. ACR Appropriateness Criteria® Hernia. *American College of Radiolgoy* . Published online 2022. https://acsearch.acr.org/docs/3158169/Narrative/
47. Kirsch J, Wu CC, Bolen MA, et al. ACR Appropriateness Criteria® Suspected Pulmonary Embolism: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S488-S501. doi:10.1016/j.jacr.2022.09.014
48. Konstantinides S V, Meyer G, Becattini C, et al. 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the

European Respiratory Society (ERS). *Eur Heart J*. 2020;41(4):543-603. doi:10.1093/eurheartj/ehz405

49. Moore AJE, Wachsmann J, Chamarthy MR, Panjikaran L, Tanabe Y, Rajiah P. Imaging of acute pulmonary embolism: an update. *Cardiovasc Diagn Ther*. 2018;8(3):225-243. doi:10.21037/cdt.2017.12.01

50. Tak T, Karturi S, Sharma U, Eckstein L, Poterucha JT, Sandoval Y. Acute Pulmonary Embolism: Contemporary Approach to Diagnosis, Risk-Stratification, and Management. *International Journal of Angiology*. 2019;28(02):100-111. doi:10.1055/s-0039-1692636

51. Rivera-Lebron B, McDaniel M, Ahrar K, et al. Diagnosis, Treatment and Follow Up of Acute Pulmonary Embolism: Consensus Practice from the PERT Consortium. *Clinical and Applied Thrombosis/Hemostasis*. 2019;25:1076029619853037. doi:10.1177/1076029619853037

52. de Jong CMM, Kroft LJM, van Mens TE, Huisman M V, Stöger JL, Klok FA. Modern imaging of acute pulmonary embolism. *Thromb Res*. 2024;238:105-116. doi:10.1016/j.thromres.2024.04.016

53. Kim SJ, Azour L, Hutchinson BD, et al. Imaging Course of Lung Transplantation: From Patient Selection to Postoperative Complications. *RadioGraphics*. 2021;41(4):1043-1063. doi:10.1148/rg.2021200173

54. Szaro P, McGrath A, Ciszek B, Geijer M. Magnetic resonance imaging of the brachial plexus. Part 1: Anatomical considerations, magnetic resonance techniques, and non-traumatic lesions. *Eur J Radiol Open*. 2022;9:100392. doi:10.1016/j.ejro.2021.100392

55. Szaro P, Geijer M, Ciszek B, McGrath A. Magnetic resonance imaging of the brachial plexus. Part 2: Traumatic injuries. *Eur J Radiol Open*. 2022;9:100397. doi:10.1016/j.ejro.2022.100397

56. Boulter DJ, Job J, Shah LM, et al. ACR Appropriateness Criteria® Plexopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S423-S441. doi:10.1016/j.jacr.2021.08.014

57. Weidert E, Williams K, Srinivasan R, Chaviano K. Traumatic Brachial Plexopathy. PM&R The Journal of Injury, Function, and Rehabilitaton. May 11, 2022. https://now.aapmr.org/traumatic-brachial-plexopathy/

58. Sinn C. Brachial Plexopathy: Differential Diagnosis and Treatment. PM&R Knowledge NOW®. June 8, 2022. https://now.aapmr.org/brachial-plexopathy-differential-diagnosis-and-treatment-2/

59. Borger MA, Fedak PWM, Stephens EH, et al. The American Association for Thoracic Surgery consensus guidelines on bicuspid aortic valve–related aortopathy: Full online-only version. *J Thorac Cardiovasc Surg*. 2018;156(2):e41-e74. doi:10.1016/j.jtcvs.2018.02.115

60. Mazzolai L, Teixido-Tura G, Lanzi S, et al. 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases. *Eur Heart J*. 2024;45(36):3538-3700. doi:10.1093/eurheartj/ehae179

61. Isselbacher EM, Preventza O, Hamilton Black J, et al. 2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart

Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. *Circulation*. 2022;146(24):e334-e482. doi:10.1161/CIR.0000000000001106

62. Mariscalco G, Debiec R, Elefteriades JA, Samani NJ, Murphy GJ. Systematic Review of Studies That Have Evaluated Screening Tests in Relatives of Patients Affected by Nonsyndromic Thoracic Aortic Disease. *J Am Heart Assoc*. 2018;7(15):e009302. doi:10.1161/JAHA.118.009302
63. Gornik HL, Aronow HD, Goodney PP, et al. 2024 ACC/AHA/AACVPR/APMA/ABC/SCAI/SVM/SVN/SVS/SIR/VESS Guideline for the Management of Lower Extremity Peripheral Artery Disease. *J Am Coll Cardiol*. 2024;83(24):2497-2604. doi:10.1016/j.jacc.2024.02.013
64. Browne WF, Sung J, Majdalany BS, et al. ACR Appropriateness Criteria® Sudden Onset of Cold, Painful Leg: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S565-S573. doi:10.1016/j.jacr.2023.08.012
65. Arnold J, Koyfman A, Long B. High risk and low prevalence diseases: Acute limb ischemia. *American Journal of Emergency Medicine*. 2023;74:152-158. doi:10.1016/j.ajem.2023.09.052
66. Calkins H, Hindricks G, Cappato R, et al. 2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of atrial fibrillation. *Heart Rhythm*. 2017;14(10):e275-e444. doi:10.1016/j.hrthm.2017.05.012
67. Hedgire SS, Saboo SS, Galizia MS, et al. ACR Appropriateness Criteria® Preprocedural Planning for Transcatheter Aortic Valve Replacement: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S501-S512. doi:10.1016/j.jacr.2023.08.009
68. Zierler RE, Jordan WD, Lal BK, et al. The Society for Vascular Surgery practice guidelines on follow-up after vascular surgery arterial procedures. *J Vasc Surg*. 2018;68(1):256-284. doi:10.1016/j.jvs.2018.04.018
69. Trivedi SB, Ray C, Chadalavada S, Makramalla A, Kord A. Superior Vena Cava Syndrome: An Update and Literature Review of Percutaneous Endovascular Treatments. *Semin Intervent Radiol*. 2022;39(4):446-453. doi:10.1055/s-0042-1757344
70. Sharma M, Burns AT, Yap K, Prior DL. The role of imaging in pulmonary hypertension. *Cardiovasc Diagn Ther*. 2021;11(3):859-880. doi:10.21037/cdt-20-295
71. Jones MR, Prabhakar A, Viswanath O, et al. Thoracic Outlet Syndrome: A Comprehensive Review of Pathophysiology, Diagnosis, and Treatment. *Pain Ther*. 2019;8(1):5-18. doi:10.1007/s40122-019-0124-2
72. Zurkiya O, Ganguli S, Kalva SP, et al. ACR Appropriateness Criteria® Thoracic Outlet Syndrome. *Journal of the American College of Radiology*. 2020;17(5):S323-S334. doi:10.1016/j.jacr.2020.01.029
73. Gornik HL, Persu A, Adlam D, et al. First International Consensus on the diagnosis and management of fibromuscular dysplasia. *Vascular Medicine*. 2019;24(2):164-189. doi:10.1177/1358863X18821816
74. Kesav P, Manesh Raj D, John S. Cerebrovascular Fibromuscular Dysplasia - A Practical Review. *Vasc Health Risk Manag*. 2023;19:543-556. doi:10.2147/VHRM.S388257

75. Hayes SN, Tweet MS, Adlam D, et al. Spontaneous Coronary Artery Dissection. *J Am Coll Cardiol*. 2020;76(8):961-984. doi:10.1016/j.jacc.2020.05.084

76. Joseph G, Goel R, Thomson VS, Joseph E, Danda D. Takayasu Arteritis: JACC Focus Seminar 3/4. *J Am Coll Cardiol*. Published online December 13, 2022. doi:10.1016/j.jacc.2022.09.051

77. Davagnanam I, Fraser CL, Miszkiel K, Daniel CS, Plant GT. Adult Horner's syndrome: a combined clinical, pharmacological, and imaging algorithm. *Eye (Lond)*. 2013;27(3):291-298. doi:10.1038/eye.2012.281

78. Maamouri R, Ferchichi M, Houmane Y, Gharbi Z, Cheour M. Neuro-Ophthalmological Manifestations of Horner's Syndrome: Current Perspectives. *Eye Brain*. 2023;Volume 15:91-100. doi:10.2147/EB.S389630

79. Baumgartner H, De Backer J, Babu-Narayan S V, et al. 2020 ESC Guidelines for the management of adult congenital heart disease. *Eur Heart J*. 2021;42(6):563-645. doi:10.1093/eurheartj/ehaa554

80. Stout KK, Daniels CJ, Aboulhosn JA, et al. 2018 AHA/ACC Guideline for the Management of Adults With Congenital Heart Disease. *J Am Coll Cardiol*. 2019;73(12):e81-e192. doi:10.1016/j.jacc.2018.08.1029

81. Krishnamurthy R, Suman G, Chan SS, et al. ACR Appropriateness Criteria® Congenital or Acquired Heart Disease. *Journal of the American College of Radiology*. 2023;20(11):S351-S381. doi:10.1016/j.jacr.2023.08.018

82. Tan Y, Shen S jun, Wang C yun, Zhou Q juan, Jing QF. Comparative efficacy and safety of electromagnetic navigation bronchoscopy localization and CT- guided percutaneous localization in thoracoscopic resection of pulmonary nodules: a systematic review and meta-analysis. Published online September 30, 2022. doi:10.21203/rs.3.rs-2069587/v1

83. Stoller JK, Hupertz V, Aboussouan LS. Alpha-1 Antitrypsin Deficiency. *GeneReviews*®. Published online June 1, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1519/

84. Sattler EC, Steinlein OK. Birt-Hogg-Dubé Syndrome. *GeneReviews*®. Published online December 5, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1522/

85. Savant A, Lyman B, Bojanowski C, Upadia J. Cystic Fibrosis. *GeneReviews*®. Published online August 8, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1250/

86. Northrup H, Koenig MK, Pearson DA, Au KS. Tuberous Sclerosis Complex. *GeneReviews*®. Published online August 1, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1220/

87. Harris P, Torres V. Polycystic Kidney Disease, Autosomal Dominant. *GeneReviews*®. Published online September 29, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1246/

88. Pilarski R, Byrne L, Carlo MI, Hanson H, Cebulla C, Abdel-Rahman M. BAP1 Tumor Predisposition Syndrome. *GeneReviews*®. Published online December 5, 2024. https://www.ncbi.nlm.nih.gov/books/NBK390611/

89. Loeys BL, Dietz HC. Loeys-Dietz Syndrome. *GeneReviews*®. Published online September 12, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1133/

90. Bowen JM, Hernandez M, Johnson DS, et al. Diagnosis and management of vascular Ehlers-Danlos syndrome: Experience of the UK national diagnostic service, Sheffield. *European Journal of Human Genetics*. 2023;31(7):749-760. doi:10.1038/s41431-023-01343-7

91. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews*®. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

92. Dietz H. FBN1-Related Marfan Syndrome. *GeneReviews*®. Published online February 17, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1335/

93. Morris CA. Williams Syndrome. *GeneReviews*®. Published online April 13, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1249/

94. Giusti F, Marini F, Brandi ML. Multiple Endocrine Neoplasia Type 1. *GeneReviews*®. Published online March 10, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1538/

95. Else T, Greenberg S, Fishbein L. Hereditary Paraganglioma-Pheochromocytoma Syndromes. *GeneReviews*®. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1548/

96. Schneider K, Zelley K, Nichols KE, Schwartz Levine A, Garber J. Li-Fraumeni Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1311/

97. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate Version 3.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

98. Friedman J. Neurofibromatosis 1. *GeneReviews*®. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

99. Kicska GA, Hurwitz Koweek LM, Ghoshhajra BB, et al. ACR Appropriateness Criteria® Suspected Acute Aortic Syndrome. *Journal of the American College of Radiology*. 2021;18(11):S474-S481. doi:10.1016/j.jacr.2021.09.004

100. Friedman DD, Ponkowski MJ, Shetty AS, et al. CT Angiography of the Upper Extremities: Review of Acute Arterial Entities. *Radiographics*. 2025;45(1). doi:10.1148/rg.240077

101. Dankbaar JW, Pameijer FA. Vocal cord paralysis: anatomy, imaging and pathology. *Insights Imaging*. 2014;5(6):743-751. doi:10.1007/s13244-014-0364-y

102. Little BP, Walker CM, Bang TJ, et al. ACR Appropriateness Criteria® Tracheobronchial Disease. *Journal of the American College of Radiology*. 2024;21(11):S518-S533. doi:10.1016/j.jacr.2024.08.015

103. Davagnanam I, Fraser CL, Miszkiel K, Daniel CS, Plant GT. Adult Horner's syndrome: a combined clinical, pharmacological, and imaging algorithm. *Eye*. 2013;27(3):291-298. doi:10.1038/eye.2012.281

104. Dejaco C, Ramiro S, Bond M, et al. EULAR recommendations for the use of imaging in large vessel vasculitis in clinical practice: 2023 update. *Ann Rheum Dis*. 2024;83(6):741-751. doi:10.1136/ard-2023-224543

105. Maz M, Chung SA, Abril A, et al. 2021 American College of Rheumatology/Vasculitis Foundation Guideline for the Management of Giant Cell Arteritis and Takayasu Arteritis. *Arthritis & Rheumatology*. 2021;73(8):1349-1365. doi:10.1002/art.41774

106. Johnson A, Emery D, Clifford A. Intracranial involvement in takayasu's arteritis. *Diagnostics*. 2021;11(11). doi:10.3390/diagnostics11111997

107. Samaan M, Abramyan A, Sundararajan S, et al. Cerebrovascular implications of takayasu arteritis: a review. *Neuroradiology*. 2025;67(1):125-136. doi:10.1007/s00234-024-03472-2

108. Ni R, Kohler MJ. What is new in imaging to assist in the diagnosis of giant cell arteritis and Takayasu's arteritis since the EULAR and ACR/VF recommendations? *Front Med (Lausanne)*. 2024;11. doi:10.3389/fmed.2024.1495644

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126. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

127. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

128. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

129. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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152. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

153. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

154. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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166. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

167. Eisenberg RL. *What Radiology Residents Need to Know: Chest Radiology*. Springer International Publishing; 2020. doi:10.1007/978-3-030-16826-1

168. Bang TJ, Chung JH, Walker CM, et al. ACR Appropriateness Criteria® Routine Chest Imaging. *Journal of the American College of Radiology*. 2023;20(5):S224-S233. doi:10.1016/j.jacr.2023.02.006

# Evolent Clinical Guideline 2072 for Head and Neck Imaging

## *Excluding Neck Vascular Imaging*

| **Guideline Number:** Evolent_CG_2072 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:** January 2027 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Imaging of the head and neck generates images of the temporal bone, face, and neck. Computed Tomography (CT) uses ionizing radiation to generate images of structures. Magnetic Resonance Imaging (MRI) generates images of structures without the use of ionizing radiation.

## Special Note

- See Evolent Clinical Guideline 2070 for Brain Imaging for clinical indications on Magnetic Resonance Angiography (MRA) and Computed Tomography Angiography (CTA) of the neck.
- When Face/Orbit/Neck MRI (also includes dedicated IAC imaging) is indicated, only one authorization is issued corresponding to the area of concern.
    - If imaging of the IAC is needed and brain imaging is not needed, this study is appropriate. If imaging of the brain is needed, MRI brain includes the IAC and is the more appropriate study (see Evolent Clinical Guideline 2070 for Brain Imaging)
- When Temporal/Orbit/Sella CT (also includes mastoid, IAC, and posterior fossa) is indicated, only one authorization is issued corresponding to the area of concern.
- When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

## Acoustic (Vestibulocochlear) Disorder

IMAGING MODALITY: When any ONE of the following criteria are met the indicated study is **Temporal/Orbit/Sella CT**.

- Hearing loss with and any ONE of the following [1–5]:
  - Acquired conductive hearing loss on audiogram with or without mass (cholesteatoma or neoplasm) on exam
  - Mixed conductive and sensorineural hearing loss on audiogram
  - Congenital hearing loss (unilateral or bilateral, conductive, or sensorineural)

    **NOTE:** Hearing loss can be mild initially and progress over time after birth.
  - Surgical planning (including evaluation for cochlear implant)
    - Evaluation of electrode placement following cochlear implant placement
  - Preoperative planning for bone conduction devices and middle ear implants for conductive and mixed hearing loss [6]
- Pulsatile tinnitus, unilateral or bilateral, and any ONE of the following [7,8]:
  - Known Paget Disease
  - Findings on exam consistent with vascular retrotympanic lesions (eg, glomus tumors/paraganglioma's, persistent stapedial artery, aberrant internal carotid artery (ICA), jugular foramen dehiscence)
  - Suspicion for one of the following: high-riding jugular bulb or diverticulum, sigmoid sinus wall abnormalities (eg, dehiscence or diverticulum), or otic capsule lesions (eg, otosclerosis/otospongiosis)
- Cholesteatoma with any ONE of the following [9]:
  - Suspected cholesteatoma based on abnormal exam
  - Surgical planning
  - Suspected recurrence (ie, evaluate for bony erosion)
- Suspected superior semicircular canal dehiscence and ALL the following [1,10,11]:
  - Bone conduction hyperacusis (hypersensitivity to self-generated sounds like voice), pulsatile tinnitus, sound-induced vertigo, or pressure induced vertigo
  - Any one of the following findings on exam/testing: nystagmus, abnormal bone conduction/hearing loss on audiometry, or enhanced Vestibular Evoked Myogenic Potentials (VEMP) responses
- Vertigo (sensation that the person or their surroundings are spinning/false sense of motion) and any ONE of the following [1,12–15]:
  - Episodic vertigo and ALL the following:

        - Normal neurologic exam
        - Documented concern for a bony abnormality (eg, trauma/suspected fractures, inflammatory/iatrogenic bony erosions)
    - Suspected atypical benign paroxysmal positional vertigo (BPPV) with concern for underlying structural abnormality indicated by any ONE of the following:
        - Abnormal neurologic exam
        - Vision changes
        - Severe headache
        - Downbeat nystagmus on Dix-Hallpike
        - Negative supine roll test (ie, no horizontal nystagmus, that changes direction depending on which side the head is rolled to, is elicited on testing)
        - Head Impulse Test, Nystagmus, Test of Skew (HINTS) test result that indicates a peripheral etiology (ie, abnormal head impulse test, direction fixed (horizontal or horizontal greater than torsional) nystagmus, AND absent skew)

    **NOTE:** Typical BPPV is an episodic positional vertigo that shows torsional upbeat nystagmus with Dix-Hallpike or horizontal direction changing nystagmus with supine roll test. Imaging for typical BPPV without neurological signs/symptoms is NOT recommended.

- Dizziness not described as vertigo can be considered on a case-by-case basis after workup for other causes is non-revealing with ALL the following:
    - Labs and orthostatic measurements completed
    - Downbeat nystagmus on Dix-Hallpike, negative supine roll test, and/or peripheral etiology on HINTS
    - Other tests (ie, electrocardiogram (ECG), chest x-ray (CXR), transthoracic echocardiogram (TTE), and/or electroencephalogram (EEG)) completed depending on suspected underlying etiology

    **NOTE:** Dizziness is a broad term that includes disequilibrium (imbalance with gait instability), presyncope (nearly fainting/blacking out), or non-specific lightheadedness.
- Preoperative planning for Eustachian tube procedures (eg, balloon dilation) [16]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT** or **Face/Orbit/Neck MRI**.

- Suspicious middle ear or skull base lesion that is indeterminate or abnormal on prior imaging and requires further evaluation [7,17,18]

IMAGING MODALITY: When any ONE of the following criteria are met and MRI is contraindicated or cannot be performed, the indicated study is **Temporal/Orbit/Sella CT**. (See Evolent Clinical Guideline 2070 for Brain Imaging for MRI/IAC indications)

- Acquired unilateral sensorineural hearing loss documented on audiogram [1]
- Suspected acoustic neuroma (vestibular schwannoma) or cerebellar pontine angle tumor based on clinical signs and symptoms (eg, unilateral non-pulsatile tinnitus, asymmetric hearing loss, chronic imbalance, vertigo, focal neurological exam abnormalities) [7]
- Unilateral or asymmetric non-pulsatile tinnitus with suspected retrocochlear lesion [7]

# Autoimmune

## *Allergic Rhinitis* [19,20]

IMAGING MODALITY: When any ONE of the following criteria are met, the preferred study is **Maxillofacial CT**.

**NOTE:** Advanced imaging is NOT indicated for uncomplicated allergic rhinitis or uncomplicated rhinosinusitis.

- Allergic rhinitis and any ONE of the following:
  - Suspicion of complications (eg, recurrent acute rhinosinusitis, chronic or complicated rhinosinusitis)
  - Structural abnormalities (eg, development of nasal polyps/polyposis, septal deviation, turbinate hypertrophy, nasal polyps) AND surgical correction is planned or being considered

IMAGING MODALITY: When the following criteria are met, the preferred study is **Face/Orbit/Neck MRI** or **Maxillofacial CT**.

- Allergic rhinitis AND suspected sinonasal neoplasm

## *Granulomatosis with Polyangiitis (GPA) (Formerly Wegener's Granulomatosis)* [21,22]

See **Combination Studies** for all indications.

## *Juvenile Idiopathic Arthritis (JIA) with Temporomandibular Joint* [23–25]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Temporomandibular Joint (TMJ) MRI.**

- Suspected TMJ involvement in patients with JIA
- Known JIA with TMJ involvement for monitoring disease progression and response to therapy
  - 3-6 months after starting systemic therapy, and then annually during active treatment
  - If progression is seen on initial follow-up MRI after starting treatment then follow-up in 3 months
  - Surgical planning

### *Refractory Reactive Airway Disease (Asthma)* [20,26]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT.**

- Severe or refractory asthma with coexisting chronic rhinosinusitis (CRS) and ALL the following:
  - Sinusitis persists despite medical therapy
  - Surgical intervention (eg, endoscopic sinus surgery or balloon sinuplasty) is being considered

## Cerebrospinal Fluid (CSF) Abnormalities [27]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI,** and/or **Maxillofacial CT**, and/or **Temporal/Orbit/Sella CT**.

**NOTE:** Temporal Bone CT for CSF otorrhea (or secondary CSF rhinorrhea via the eustachian tube). Face MRI or Maxillofacial CT for CSF rhinorrhea. Imaging modality depends on the suspected leak location and/or suspected etiology.

- Suspected CSF leak based on otorrhea, rhinorrhea, and/or otorhinorrhea with positive Βετα2 transferrin or Βετα-trace testing [28,29]
- Prior imaging (eg, CT, MRI, nuclear medicine imaging) suggestive of a bony defect or lesion contributing to suspected or known CSF leak [28,29]
- Preoperative planning for CSF leak repair

## Congenital Abnormalities

IMAGING MODALITY: When the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT.**

- Congenital microtia and aural atresia [30,31]
  - Preoperative planning
  - Evaluate for cholesteatoma

  **NOTE:** CT is NOT recommended in the newborn period. Surgery is typically done after 6-7 yrs of age.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT.**

- Choanal atresia [32]
  - Diagnostic workup
  - Surgical planning

IMAGING MODALITY: When the following criteria are met, the indicated study is **Maxillofacial CT** or **Face/Orbit/Neck MRI**. [33,34]

- Complicated or syndromic cleft palate and any ONE of the following:
  - Preoperative planning for treatment/surgery
  - Airway evaluation [35,36]

# Infection and Inflammation

## *Facial/Soft Tissue Infection*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Maxillofacial CT** or **Face/Orbit/Neck MRI**.

- Facial infection with suspected abscess [37]
- Osteomyelitis and any ONE of the following [38–41]:
  - Suspected osteomyelitis after abnormal or indeterminate x-ray [39,41]
  - Surgical planning

## *Neck Infection [9,37,42]*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI.**

- Superficial (skin and/or subcutaneous tissues) infection not responding to medication
- Suspected deep space infection (eg, sublingual, parapharyngeal, retropharyngeal, parotid, and masticator spaces) or suspected abscess [42]
- Suspected necrotizing fasciitis
- Clinical concern for airway compromise (eg, dyspnea, stridor, voice changes)

## *Otologic Infection and Complications [9]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT** or **MRI.** (See Evolent Clinical Guideline 2070 for Brain Imaging for MRI/IAC indications).

- Complicated otitis externa with concern for necrotizing otitis externa (NOE) (also known as malignant otitis externa) or skull base osteomyelitis (SBO) with any ONE of the following [10,43]:
  - Clinical suspicion based on symptoms (eg, otalgia, fever, headache, cranial nerve abnormalities, neurological symptoms, and/or seizures)
  - Assessment of treatment response
- Chronic otitis media (chronic infection and/or inflammation > 3 months) and ONE of the following [10]:
  - Surgical planning

- Suspected cholesteatoma

- Acute otitis media AND concern for extracranial or intracranial complications (eg, mastoiditis, abscess, empyema) and any ONE of the following [44,45]:
  - Failed antibiotic therapy
  - Worsening or new symptoms (eg, headache, vertigo, meningismus/neck rigidity, or fever)
  - Worsening or new signs (eg, postauricular edema, mastoid tenderness, cranial nerve deficits, stupor/altered mental status)

## *Rhinosinusitis [20,26,28,46–50]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT**.

- Recurrent acute rhinosinusitis (RARS) (4 or more episodes of acute bacterial rhinosinusitis (ABRS) per year without symptoms in between episodes) with any ONE of the following [26]:
  - Failure of medical management (2 courses of antibiotic treatment) AND suspected alternative diagnosis or suspected complications [48]
  - Treatment/surgical planning for anatomical variants (eg, infraorbital cells and concha bullosa) that could be corrected
  - Abnormal exam findings (eg, purulent mucus or edema in medial meatus or ethmoid region, nasal polyps) suspicious for development of chronic rhinosinusitis
  - Preoperative planning when surgery is planned
- Chronic rhinosinusitis (CRS) [26]
  - For diagnosis (defined as symptoms ≥ 12 weeks duration) and ALL the following:
    - At least 2 of the following symptoms:
      - Mucopurulent drainage
      - Nasal obstruction and/or congestion
      - Facial pain, pressure, or fullness
      - Decreased or absent sense of smell
    - Failed medical therapy (ie, nasal saline irrigation and intranasal corticosteroid)
  - Preoperative planning when surgery is planned and any ONE of the following:
    - Failed medical therapy (ie, nasal saline irrigation and intranasal corticosteroids)
    - Abnormal exam findings (eg, unilateral or bilateral nasal polyps, enlarged inferior turbinates with obstruction) [46,50]
- Persistent sinusitis (worsening course, severe presentation, or not responding to treatment) in pediatrics (age < 18 years) for preoperative planning [47]
- Odontogenic rhinosinusitis (sinusitis caused by an odontogenic infection) [49]

- Suspected paranasal sinus infection (typically unilateral maxillary sinusitis) from dental source (e.g. periapical abscess, foreign body) based on clinical symptoms (eg, unilateral symptoms, purulent and foul-smelling drainage, dental pain, and/or history of recent dental intervention)
- Surgical planning

  **NOTE:** Maxillofacial CT (may be referred to as Cone Beam CT) imaging of dental diagnoses (eg, tooth abscess, dental caries, wisdom teeth removal, dental implant planning) without an associated medical diagnosis is NOT indicated. [28]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Maxillofacial CT**.

**NOTE**: Imaging is NOT indicated for uncomplicated acute bacterial rhinosinusitis (ABRS) or acute viral rhinosinusitis (AVRS).

- Acute bacterial rhinosinusitis (ABRS) with symptoms (purulent rhinorrhea with obstruction/congestion and/or facial pain) > 10 days, or worsening within 10 days after initial improvement, and any ONE of the following [46]:
  - Suspected complications (ie, neurologic, ophthalmologic, or soft tissue involvement outside of the nasal cavity and paranasal sinuses) and any ONE of the following:
    - Orbital swelling, proptosis, restricted eye movements, decreased vision, and/or cranial nerve palsies suggesting orbital extension
    - Severe headache, facial swelling, meningitis symptoms, altered mental status, seizures, and/or focal neurologic abnormalities suggesting intracranial extension
    - Suspected cavernous sinus thrombosis
    - Suspected osteomyelitis [39–41]

  **NOTE:** Prior medical therapy is NOT required if there is a suspected complication of rhinosinusitis
  - Comorbidities with increased risk for complications (eg, selective IgA deficiency, CVID, SCID, HIV, chemotherapy or other immunosuppressive therapy, chronic diseases affecting mucociliary clearance (eg, cystic fibrosis, primary ciliary dyskinesia), or history of facial trauma and/or facial surgery)
  - Failed antibiotic therapy (failure to improve or worsening after 2 courses of antibiotic therapy) and suspected alternative diagnosis (eg, malignancy, non-infectious causes of facial pain, odontogenic sinusitis)
- Clinical suspicion for invasive fungal sinusitis [28]
- Suspected sinonasal mass and/or malignancy [46]

## *Salivary Gland Infection/Inflammation (Sialadenitis)* [51–53]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Maxillofacial CT** and/or **Neck CT.**

- Suspected mass/unilateral enlarged salivary gland with abnormal ultrasound (eg, diffuse enlargement, abscess, stricture, stone) [51]
- Acute or chronic sialadenitis with concern for complicated disease and **ONE** of the following:
  - Abscess
  - Fistula
  - Stenosis or stricture
  - Recurrent disease
- Suspected sialolithiasis (salivary gland stones)
- Suspected post-radiation sialadenitis
- Bilateral gland enlargement and/or chronic xerostomia with suspicion for systemic disease (eg, Sjögren's Syndrome, IgG4-RS, Human Immunodeficiency Virus (HIV), granulomatous diseases, malignancy, chronic recurrent juvenile parotitis)

# Jaw Abnormalities

## *Osteonecrosis of the Mandible/Maxilla* [54,55]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Maxillofacial CT**. Face/Orbit/Neck MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected osteonecrosis of the maxilla and/or mandible

## *Temporomandibular Disorders (TMD)* [56–58]

Temporomandibular disorders (TMD) is an umbrella diagnostic term that encompasses a group of musculoskeletal and neuromuscular conditions that involve the temporomandibular joint (TMJ), masticatory muscles, and associated structures that cause non-odontogenic orofacial pain, pain with chewing, jaw clicking or popping, or jaw locking. [58]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **TMJ MRI**.

- Persistent symptoms/suspected internal joint derangement after failed conservative care (eg, analgesics, anti-inflammatories, muscle relaxants, physical therapy, cognitive behavior therapy, or biofeedback) for 2 weeks or more
- Suspected malignant neoplasm
- Suspected arthritis (osteoarthritis, inflammatory, or septic)
- Preoperative planning for reconstruction/repositioning

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When any ONE of the following criteria is met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI**.

- Suspicious lesion(s) seen on physical exam and/or endoscopy in the mouth or throat (such as a mass or ulceration in the oral cavity or pharynx) [59]
- Suspicious lesion that is indeterminate or abnormal on prior imaging and requires further evaluation [60,61]
- Neck Mass or Lymphadenopathy (See **Neck Mass or Lymphadenopathy**)
- Odynophagia (See **Throat Pain (Odynophagia)**)
- Otalgia (See **Ear Pain (Otalgia)**)
- Vocal Cord Abnormalities (See **Vocal Cord Abnormalities**)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Maxillofacial CT, Neck CT,** or **Face/Orbit/Neck MRI.**

- Suspected salivary gland neoplasm (parotid, submandibular, and/or sublingual gland)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT** or **Face/Orbit/Neck MRI.**

- Suspected sinonasal/facial mass/neoplasm based on any **ONE** of the following:
  - Physical exam
  - Nasal endoscopy
  - Prior imaging (sinus X-Ray and/or dental imaging) abnormalities [28,62]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT** or **Face/Orbit/Neck MRI**.

- Suspected or known orbital or ocular neoplasm [17]

## *Known Malignancy*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI**.

- Acute Lymphoblastic Leukemia [63]
- Basal cell carcinoma: for primary tumors on the head and neck with concern for major nerve involvement [64]
- B cell lymphomas (follicular lymphoma, marginal zone lymphoma, primary mediastinal large B-cell lymphoma, mantle cell lymphoma, diffuse large B-cell lymphoma, Burkitt lymphoma, B-lymphoblastic lymphoma, and all other) [65]
- Castleman Disease [66]
- Cervical Paraganglioma [67]
- Cutaneous Lymphoma (includes primary cutaneous B-cell lymphoma, mycosis fungoides/Sézary syndrome, primary cutaneous CD30+ T-cell lymphoproliferative disorders, subcutaneous panniculitis-like T-cell lymphoma and primary cutaneous indolent T-cell lymphoproliferative disorders (LPD)): if PET/CT not done [68]
- Melanoma, Cutaneous: for primary tumors on the head or neck when PET is not used and with any ONE of the following [69]:
    - Stage II or higher
    - Clinically positive lymph nodes (ie, palpable or detected by imaging and biopsy-proven)
- Merkel Cell Carcinoma: for primary tumors on the head or neck when PET is not used [70]
- Occult primary [71]
- Rhabdomyosarcoma: for primary tumors on the head or neck (dedicated imaging of the orbits also indicated for orbital tumors) [72,73]
- Soft tissue sarcoma: for primary site of disease on the head or neck [72]
- Squamous cell carcinoma of the skin: for positive lymph nodes, distant metastatic disease, or as clinically indicated [74]
- T Cell Lymphoma [75]

  **NOTE:** Includes Anaplastic Large Cell Lymphoma (which may be breast implant-associated)
- Thyroid cancer [76]

IMAGING MODALITY: For initial staging of ANY one of the following cancers, **Neck CT** or **Face/Orbit/Neck MRI** is indicated, which may be in addition to PET when medical necessity criteria for PET have separately been met.

**NOTE: Temporal/Orbit/Sella CT** is also appropriate in addition to PET when medical necessity criteria are met for both studies.

- Head and Neck Cancer [77]
- Hodgkin Lymphoma (Pediatric and Adult) [78,79]

- Pediatric Aggressive Mature B-Cell Lymphomas (Burkitt lymphoma, diffuse large B-cell lymphoma (DLBCL), primary mediastinal large B-cell lymphoma (PMBCL), large B-cell lymphoma, high grade B-cell lymphoma, B-lymphoblastic lymphoma) [80]
- Post-Transplant Lymphoproliferative Disorders [65]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Temporal/Orbit/Sella CT.**

- Melanoma: Uveal [81]
- Retinoblastoma [82–86]
- Rhabdomyosarcoma: Indicated in addition to Neck CT for orbital tumors [72,73]
- Any other cancer with suspected ocular/orbital involvement

## Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. 'Active treatment' includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), CAR T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: During active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg chemotherapy, targeted therapy, or immunotherapy) is typically every 2 - 3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI**.

- Any cancer **NOT** listed below with suspected head or neck involvement
- Acute Lymphoblastic Leukemia [63]
- Basal cell carcinoma: for primary tumors on the head and neck with concern for major nerve involvement [64]
- B cell lymphomas (follicular lymphoma, marginal zone lymphoma, primary mediastinal large B-cell lymphoma, mantle cell lymphoma, diffuse large B-cell lymphoma, Burkitt lymphoma, B-lymphoblastic lymphoma, and all other) [65]
- Castleman Disease [66]
- Cervical Paraganglioma [87]
- Cutaneous Lymphoma (includes primary cutaneous B-cell lymphoma, mycosis fungoides/Sézary syndrome, primary cutaneous CD30+ T-cell lymphoproliferative disorders, subcutaneous panniculitis-like T-cell lymphoma and primary cutaneous

indolent T-cell lymphoproliferative disorders (LPD)): if PET/CT not done [68]

- Melanoma, Cutaneous: for primary tumors on the head or neck when PET is not used [69]
- Merkel Cell Carcinoma: for primary tumors on the head or neck when PET is not used [70]
- Occult primary [71]
- Rhabdomyosarcoma: for primary tumors on the head or neck (dedicated imaging of the orbits also indicated for orbital tumors) [73]
- Soft tissue sarcoma: for primary site of disease on the head or neck [72]
- Squamous cell carcinoma of the skin: for positive lymph nodes, distant metastatic disease, or as clinically indicated [74]
- T Cell Lymphoma [75]

  **NOTE:** Includes Anaplastic Large Cell Lymphoma (which may be breast implant-associated)
- Thyroid cancer [76]

IMAGING MODALITY: For restaging of ANY one of the following cancers, **Neck CT** or **Face/Orbit/Neck MRI** is indicated, which may be in addition to PET when medical necessity criteria for PET have separately been met.

**NOTE: Temporal/Orbit/Sella CT** is also appropriate in addition to PET when medical necessity criteria are met for both studies.

- Head and Neck Cancer [77]
- Hodgkin Lymphoma (Pediatric and Adult) [78,79]
- Pediatric Aggressive Mature B-Cell Lymphomas (Burkitt lymphoma, diffuse large B-cell lymphoma (DLBCL), primary mediastinal large B-cell lymphoma (PMBCL), large B-cell lymphoma, high grade B-cell lymphoma, B-lymphoblastic lymphoma) [80]
- Post-Transplant Lymphoproliferative Disorders [65]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Temporal/Orbit/Sella CT.**

- Melanoma: Uveal [81]
- Retinoblastoma [82–86]
- Rhabdomyosarcoma: Indicated in addition to neck CT for orbital tumors [72,73]
- Any other cancer with suspected ocular/orbital involvement

## Surveillance

Surveillance imaging refers to imaging done to detect recurrence in patients who have

completed definitive cancer treatment. Surveillance begins at completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

Refer to the **Cancer Surveillance Table** for cancer-specific indications. Additionally, the below indications apply to all malignancies.

## Nasal Abnormalities (21,22,88,89)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT.**

- Surgical planning for ONE of the following structural abnormalities:
  - Nasal septal deviation (88)
  - Saddle nose deformity (associated with GPA)

## Parathyroid Gland(s) (90–92)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT.**

- Known/biochemically diagnosed primary hyperparathyroidism (elevated PTH and normal/high calcium) and any ONE of the following:
  - Ultrasound and/or nuclear medicine sestamibi scans have been completed and are negative, indeterminate, or discordant
  - Suspected ectopic parathyroid gland
  - Preoperative planning
  - Biochemical persistent or recurrent disease after surgery or ablative therapy
- Biochemically diagnosed secondary or tertiary hyperparathyroidism for surgical planning (ie, identify all eutopic, possible ectopic, and/or supernumerary glands to guide surgical approach)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI**.

- Known/biochemically diagnosed primary hyperparathyroidism (elevated parathyroid hormone (PTH) and normal/high calcium) for preoperative planning and ALL the following:
  - CT indeterminate or unavailable
  - Suspected multi-gland or ectopic disease

## Sella Abnormalities [93,94]

IMAGING MODALITY: When any ONE of the following criteria are met and MRI is contraindicated or cannot be performed, the indicated study is **Temporal/Orbit/Sella CT.** (See Evolent Clinical Guideline 2070 for Brain Imaging for indications).

- Suspected bone-destructive lesions of the sella turcica and/or skull base
- Suspected pituitary mass with confirmed pituitary dysfunction (ie, abnormal prolactin, growth hormone, cortisol, testosterone, oxytocin, TSH, ACTH, LH, FSH, and/or ADH)
- To help differentiate (ie, calcification detection) type of a large pituitary mass seen on prior imaging
- Preoperative evaluation of sellar lesions, if needed, to evaluate for adjacent skull base invasion

## Thyroid Abnormalities [95]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI.**

**NOTE**: Ultrasound is the initial imaging study of a thyroid region mass. Biopsy is usually the next step in the evaluation of a possible thyroid malignancy and advanced imaging is not typically needed prior to biopsy. [96]

- To assess extent of enlarged thyroid tissue (Goiter) or nodule on ultrasound and any ONE of the following [95,96]:
  - Prior imaging suggests substernal, deep, or retropharyngeal extension [95]
  - Prior imaging, physical exam, and/or symptoms (dyspnea, orthopnea, dysphagia) suggest compression or involvement of the airway or esophagus [95]
  - Presence of pathologic cervical lymph nodes
  - Suspected infiltrative disease/malignancy [96]

# Trauma

## *Face*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT.**

- History of recent facial trauma and any ONE of the following [97–99]:
  - Visual or palpable nasal deformity
  - Edema and contusion over frontal bone
  - Facial paresthesia
  - Inability to open jaw (trismus)
  - Malocclusion (teeth not fitting together correctly)

- Loss of teeth
- Palpable bony defect (step off)
- Prior indeterminate or abnormal imaging
- Further evaluation of a known facial fracture for treatment planning/surgical repair
- Persistent clear nasal drainage (possible CSF leak)

- Isolated nasal trauma and any ONE of the following [97]:
  - Visible/palpable deformity of the external nose or disruption of the internal structures of the nasal cavity (such as septal deviation)
  - Surgical correction is planned or is being considered

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI.** [97]

- Indeterminate or abnormal prior imaging that needs further clarification (i.e. suspected complications including but not limited to unexplained nerve defects, suspected foreign bodies(ie, body (asphalt), herniations, CSF leak)
- Preoperative planning for planned surgical repair

## *Neck*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT**

- History of recent neck trauma with any **ONE** of the following [100,101]:
  - Stridor or stertor
  - Dyspnea
  - Neck crepitus, subcutaneous air
  - Hoarseness, dysphonia
  - Dysphagia, odynophagia (pain with swallowing)
  - Indeterminate or abnormal prior imaging
  - Preoperative planning for planned surgery

## *Temporal Bone* [100,102]

IMAGING MODALITY: When any ONE the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT**.

- Indeterminate or abnormal prior imaging (eg, X-ray, non-Temporal Bone CT)
- History of temporal bone trauma and suspected fracture with any **ONE** of the following:
  - Suspicious mechanism of injury (eg, penetrating or blunt trauma to the lateral skull)
  - Facial nerve paralysis

- Hearing loss
- Tinnitus
- Vertigo
- Otorrhea (ie, suspected CSF leak)

- Preoperative planning for management of known temporal bone fracture

### *Orbit*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Temporal/Orbit/Sella CT** or **Face/Orbit/Neck MRI**.

- Trauma with periorbital edema, periorbital ecchymosis, or hyphema and any ONE of the following [103–106]:
  - New, post-trauma, visual field defect and/or vision loss
  - Suspected orbital fracture (ie, periorbital edema and contusion)
  - Restricted eye movements/diplopia
  - Assessment of penetrating ocular injury
  - Evaluation for foreign body
  - Suspected traumatic optic neuropathy or avulsion injury

## Vascular

### *Epistaxis [107,108]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Maxillofacial CT** or **Face/Orbit/Neck MRI.**

- Epistaxis and **ONE** of the following:
  - Preoperative planning for planned surgical correction
  - Severe or recurrent without a clear cause on endoscopic exam to evaluate for secondary pathology
  - Suspected posterior bleeding/inaccessible site

## Visual System Disorders [103,109,110]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI**. Temporal/Orbit/Sella CT when the preferred study is contraindicated or cannot be performed.

- Non-acute Horner's syndrome that has not previously been worked up and a post-ganglionic cause is suspected (eg, abnormalities of the third order nerves, superior orbital fissure, orbital apex, skull base, or cavernous sinus) [111,112]
- Abnormal eye movements

- Suspected cranial nerve 3rd (III), 4th (IV), or 6th (VI) nerve palsy based on symptoms and exam findings (binocular diplopia, abnormal eye movements/dysconjugate gaze, with or without ptosis and pupillary dysfunction if 3rd nerve palsy). [18,103]
  - Ophthalmoplegia with concern for orbital pathology [103]
  - Adult onset strabismus for preoperative planning/surgical management of complex adult strabismus cases [113]
- Abnormal findings on ophthalmologic exam and ONE of the following [103,104]:
  - Optic nerve abnormalities (eg, optic nerve pallor, atrophy, edema/papillitis, papilledema)
  - Non-traumatic orbital asymmetry (eg, proptosis/exophthalmos, enophthalmos)
- Optic neuropathy (ie, decreased visual acuity/color vision/contrast and/or visual field defects with abnormal optic nerve abnormalities on exam) [103,104,114]:
  - Diagnostic workup (differentiate ischemic optic neuropathy from other causes, optic papillitis, papilledema//elevated intracranial pressure, compression, infiltration, and/or other causes) [103,104,114,115]
  - Initial evaluation for optic nerve hypoplasia [104]
  - Initial evaluation for morning glory disc on ophthalmologic examination (typically diagnosed by 5 years of age but may be diagnosed later depending on access to care/dilated eye exam with ophthalmology) [116]
- Vision loss and/or visual field defects not explained/caused by an ocular abnormality on ophthalmologic exam and testing (ie, not due to conditions such as dry eye, cataracts, glaucoma, retinopathy, macular degeneration, corneal disorders) and ONE of the following [103,117,118]:
  - Unilateral or asymmetric vision loss or visual field defect and pre-chiasmal etiology suspected
  - Children (< 18 years of age) with non-traumatic acute vision loss without papilledema [104]
- Optic neuritis: Inflammation of the optic nerve with a wide variety of causes (eg, infectious, demyelinating, autoimmune, infiltrative, neoplastic, demyelinating disease, compressive, post vaccination, idiopathic) [103,119–124]
  - Suspected optic neuritis to (eg, new pain with eye movements, vision loss, visual field changes (HVF), and/or other abnormal tests (VEP, OCT))
  - Progression or recurrence (eg, new pain with eye movements, vision loss, visual field changes (HVF) and/or other abnormal tests (VEP, OCT))
  - Severe optic neuritis with poor recovery
- Orbital and/or periorbital plexiform neurofibroma (exam findings can include blepharoptosis, proptosis, eyelid edema, strabismus) (see **Genetic Conditions**) [125]
  - Suspected plexiform neurofibroma
  - With signs or symptoms concerning for growth/progression (eg, decrease in vision,

visual field changes, strabismus, proptosis)

- Optic pathway gliomas (OPG) [125–129]:
  - Baseline screening imaging (brain and orbit) in children with NF1 when a reliable visual assessment cannot be performed (eg, young age, development issues, ADHD/behavioral issues)
  - Suspected OPG in patient with NF1 AND symptomatic (ie, vision changes and/or abnormal ophthalmologic exam or testing including optic nerve evaluation, color vision, visual acuity, pupillary testing, ganglion and nerve fiber layer testing/optic coherence tomography, and visual field assessment)
  - Known NF1 related OPG surveillance
    - Every 3 months for the first year, every 6 months for the next 2 years (years 2 - 3), annually for 2 years (years 3 - 5), and then as clinically indicated (ie, concern for progression based on symptoms and/or ophthalmology exam and testing)
    - For monitoring response to systemic treatment as clinically indicated
    - For surgery or radiation treatment planning

  **NOTE**: See **Known Malignancy** section for high grade gliomas

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Temporal/Orbit/Sella CT**. [95]

- Concern for orbital inflammatory syndromes after complete ophthalmologic exam with testing and laboratory studies [130,131]
- Thyroid eye disease (aka, Graves Ophthalmopathy) and ONE of the following [132–134]:
  - Atypical cases: unilateral presentation, asymmetric proptosis, or euthyroid disease (normal thyroid labs)
  - Suspected Dysthyroid Optic Neuropathy (DON) (seen in severe cases with crowding at the orbital apex from inflammation)
  - Evaluation of treatment response in moderate to severe active thyroid eye disease
  - Surgical planning (decompression or strabismus surgery)
- Infection [103,104]
  - Pre-septal, post-septal/orbital cellulitis, or abscess
  - Suspected acute or chronic orbital osteomyelitis [38]
- Midline developmental anomalies and/or congenital orbital anomalies (eg, anophthalmia, microphthalmia, coloboma/staphyloma, morning glory disc anomaly, macrophthalmos/buphthalmos, dermoid/epidermoid cyst, nasolacrimal duct cyst/dacryocystocele and mucocele, and hypertelorism) [135]
- Leukocoria in an infant or child (< 18 years of age) [104]
- Suspected orbital mass after complete ophthalmologic exam and testing [17,103,104]

# Other

## *Brachial Plexopathy* [136–139]

IMAGING MODALITY: When any ONE of the following criteria are met, **Neck MRI** is an indicated study (depending on the location of the injury/plexopathy).

**NOTE:** If multiple studies are requested, only ONE of the following studies is indicated to image the brachial plexus: Neck MRI, Shoulder MRI, or Chest MRI.

- Traumatic Brachial Plexopathy: if mechanism of injury is highly suspicious for brachial plexopathy (eg, birth trauma, mid-clavicular fracture, shoulder dislocation, contact injury to the neck (burner or stinger syndrome) or penetrating injury)
- Non-traumatic Brachial Plexopathy (including neurogenic thoracic outlet syndrome): when Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive of brachial plexopathy

## *Additional Cranial Nerve Palsies (not discussed elsewhere)* [18,140]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Face/Orbit/Neck MRI**. (See Evolent Clinical Guideline 2070 for Brain Imaging for Brain indications). Maxillofacial CT if the preferred study is contraindicated or cannot be performed.

**NOTE:** If probable location of a lesion is unclear from history and exam, imaging of the entire course of the relevant cranial nerve may require multiple imaging modalities but should start with the most likely causative location.

- New anosmia (CN I) (complete loss of smell), hyposmia (reduced sense of smell) or dysosmia (abnormal sense of smell) confirmed on smell tests (eg, SS, UPSIT, Q-SIT) and ONE of the following [18,141,142]:
  - Additional abnormal neurological exam findings
  - Unclear etiology after history (i.e. no preceding viral illness) and endoscopic exam (eg, no polyps, obstruction, or signs of chronic rhinosinusitis) with negative COVID 19 testing and a history of trauma
- New or worsening cranial nerve V palsy (eg, unilateral weakness or paralysis of masticator muscles, sensory abnormalities of the face/head, trigeminal neuralgia pain) [18]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI.** (See Evolent Clinical Guideline 2070 for Brain Imaging for Brain MRI/IAC indications). Maxillofacial CT and/or Temporal/Orbit/Sella CT are appropriate only when the preferred studies are contraindicated or cannot be performed.

**NOTE:** If probable location of a lesion is unclear from history and exam, imaging of the entire course of the relevant cranial nerve may require multiple imaging modalities but should start with the most likely causative location.

- New or worsening cranial nerve VII palsy associated with trauma, concern for underlying structural abnormality (eg, facial nerve or CPA schwannoma, other mass, neoplasm,

met), or underlying systemic illness (eg, inflammatory/infiltrative disease, demyelination) [9,143]

- Imaging for idiopathic facial nerve palsy (ie, Bell's palsy) is indicated for atypical features (ie, gradual onset, failure to improve with time/incomplete recovery after 3 months, repeat recurrences, bilateral, or presence of other neurological abnormalities)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** (See Evolent Clinical Guideline 2070 for Brain Imaging for Brain indications). Neck CT is appropriate only when the preferred study is contraindicated or cannot be performed. [18]

**NOTE:** If probable location of a lesion is unclear from history and exam, imaging of the entire course of the relevant cranial nerve may require multiple imaging modalities but should start with the most likely causative location.

- New cranial nerve IX palsy (eg, tonsillar/oropharyngeal/otic pain, impaired taste posterior 1/3 of tongue and palate, loss of gag reflex, or dysphagia) [18]
- New cranial nerve X palsy (eg, palatal and/or vocal cord paralysis) [18]
- New cranial nerve XI palsy (eg, unilateral isolated weakness or paralysis of the sternocleidomastoid and trapezius muscles)
- New cranial nerve XII palsy (eg, dysarthria, tongue deviation or tongue weakness)

## *Ear Pain (Otalgia)* *[10,140,144,145]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI.**

- Suspected referred ear pain and ALL the following:
  - Normal exam
  - Persistent pain
  - Symptoms suspicious for head and/or neck malignancy (ie, weight loss, dysphagia, odynophagia, dyspnea, adenopathy)
  - Older age (> 50 years)
- Suspected referred ear pain AND lower cranial neuropathies (Temporal Bone/IAC/Mastoid CT is an alternative for this indication)

## *Esophagus / Pharynx* *[42,146]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT.**

- Dysphagia AND prior endoscopic (eg, EGD) and fluoroscopic evaluation (eg, modified barium swallow, biphasic esophagram) that is indeterminate or abnormal
- Suspected deep mucosal or submucosal lesion not fully assessed by endoscopy (ie,

endoscopic blind spot/indeterminate exam)

## *Foreign Body (Aerodigestive Tract)* [147]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT.**

- Suspected foreign body in a symptomatic patient with negative laryngoscopy and negative or indeterminate x-ray (ie, radiolucent object)
- Known foreign body for surgical planning or for suspected iatrogenic injury following removal of a foreign body

## *Neck Mass or Lymphadenopathy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI** or **Neck CT**.

- Indeterminate or abnormal prior imaging (eg, ultrasound or non-neck CT/MRI) [60,61]
- Neck mass or lymphadenopathy present in an anatomic area that is not evaluated adequately by ultrasound (such as oral cavity, oropharynx, behind (deep to) the mandible or behind (deep to) the airway/pharynx)
- Neck mass/lesion with increased risk for malignancy as demonstrated by any ONE of the following [148]:
  - Fixation to adjacent tissues
  - Firm consistency
  - Size > 1.5 cm
  - Ulceration of overlying skin
  - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered to be from an infectious cause
  - Personal history of cancer
  - Failed antibiotic therapy for suspected infectious etiology [148]

## *Throat Pain (Odynophagia)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT**. [149]

- Suspected tendinitis of the longus colli muscle (eg, retropharyngeal tendinitis or acute calcific prevertebral tendinitis) and ALL of the following:
  - Acute onset of intense neck pain
  - Limited range of neck motion
  - Odynophagia
  - Normal laryngoscopy

- Suspected nontraumatic thyroid cartilage fracture and ALL the following:
  - Neck pain
  - Odynophagia
  - Normal laryngoscopy

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Face/Orbit/Neck MRI**.

- Odynophagia with concern for malignancy and ALL the following [150,151]:
  - Persistent pain (> 3 weeks)
  - Abnormal exam (neck lump) or abnormal flexible nasoendoscopy exam
  - Dysphagia on fluoroscopic studies (eg, modified barium swallow, biphasic esophagram)

    **NOTE:** Workup for dysphagia starts with fluoroscopic studies (eg, modified barium swallow, biphasic esophagram)

### *Vocal Cord Abnormalities [152]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Neck CT** or **Face/Orbit/Neck MRI**.

- Vocal cord lesion(s) that is suspicious for malignancy (eg, ulceration, increased vasculature, exophytic growth, leukoplakia)
- Vocal cord immobility on endoscopic exam
- See **Combination Studies** for additional indications including phrenic nerve paralysis, dysphagia, and airway pathology

## Preoperative or Postoperative Assessment

IMAGING MODALITY**:** When any ONE of the below criteria are met, the indicated imaging modality is the one that is stated in the specific section that it is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:

- Known or suspected complications
- A clinical reason is provided how imaging may change management

**NOTE:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Findings

Unless follow up is otherwise specified within the guideline:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

## Genetic Conditions

**NOTE:** When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **Whole Body MRI.** Neck/Chest/Abdomen/Pelvis CT is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Hereditary PGL/PCC Syndromes (including SDHx mutations) [153]:
  - Every 2 years (including at diagnosis) starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **IAC MRI** when brain imaging is not being performed.

- Von Hippel-Lindau (VHL) [154]:
  - Once at age 15 - 20 (asymptomatic) **OR**
  - At onset of hearing loss, tinnitus or vertigo

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Neck/Chest/Abdomen/Pelvis MRA** or **CTA**

- Loeys-Dietz [155]:
  - Every two years (including at diagnosis) **OR**

- More frequently if abnormalities are found

- Vascular Ehlers-Danlos syndrome (vEDS) [156]:
  - Every 18 months (including at diagnosis) **OR**
  - As clinically indicated to follow known vascular abnormalities

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [157]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)
- PGL/PCC [153]:
  - Hereditary PGL/PCC Syndromes (including SDHx mutations): Every 2 years (including at diagnosis) **AND** MRI is contraindicated or cannot be performed
- Von Hippel-Lindau (VHL) [154]:
  - Once at age 15 - 20 (asymptomatic) **OR** at onset of hearing loss, tinnitus, or vertigo

  **NOTE:** If performed with Brain MRI, separate authorization for IAC MRI is not needed

# Combination Studies

## *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

## *Neck/Chest CT*

- Vocal cord immobility on endoscopic exam [152]
- Phrenic nerve paralysis on diaphragm fluoroscopy (fluoroscopic sniff test)
- Evaluation of dysphagia after appropriate prior work up including endoscopy (EGD) and/or fluoroscopic studies (such as modified barium swallow, biphasic esophagram) is indeterminate or abnormal [146,158]
- Evaluation of possible airway pathology with any ONE of the following:
  - Indeterminate or abnormal prior imaging (eg, x-ray, ultrasound, fluoroscopy)

- Clinical evidence suggesting airway obstruction (eg, stridor, stertor, dyspnea on exertion)
- For evaluation of known or suspected laryngeal, subglottic, or tracheal stenosis [158]

## *Brain MRI and Sinus/Chest/Abdomen and Pelvis CT*

- Prior to bone marrow transplant or stem cell transplant

## *Brain (with or without IAC)/Maxillofacial/Face/Orbit/Temporal Bone/Neck/Chest/Abdomen and Pelvis Imaging*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies are Neck CT/MRI and/or Chest CT. When there is a concern for involvement of a specific area Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT may be indicated (individually or in any combination of studies).

- Suspected Granulomatosis with Polyangiitis (GPA) (Formerly Wegener's Granulomatosis) with any ONE of the following:
  - Clinical signs and symptoms
    - Nasal involvement (bloody discharge, ulcers, crusting, congestion, blockage, septal defect/perforation)
    - Cartilaginous involvement (inflammation of ear/nose cartilage, hoarse voice, stridor, endobronchial involvement, saddle nose deformity)
    - Conductive or sensorineural hearing loss
  - Labs and biopsy findings:
    - Positive cytoplasmic antineutrophil cytoplasmic antibodies (cANCA) or antiprotease 3 (anti-PR3) antibodies
    - Biopsy showing small or medium vessel vasculitis
    - Biopsy showing granuloma, extravascular granulomatous inflammation, or giant cells
    - Biopsy showing pauci-immune glomerulonephritis
  - Imaging findings
    - Inflammation, consolidation, or effusion of nasal/paranasal sinuses, or mastoiditis on imaging

IMAGING MODALITY: When any ONE of the following criteria are met, one or more of the following studies are indicated: Neck CT/MRI, Chest CT, Brain MRI (with or without IAC), Maxillofacial MRI, Face/Orbit CT (or MRI), Temporal Bone CT, and/or Abdomen and Pelvis CT.

- Known GPA when imaging results of a specific area is needed to guide decisions about initial therapy or response to therapy

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 70336 | Magnetic resonance (eg, proton) imaging, temporomandibular joint(s) |
| 70480 | Computed tomography, orbit, sella, or posterior fossa or outer, middle, or inner ear; without contrast material |
| 70481 | Computed tomography, orbit, sella, or posterior fossa or outer, middle, or inner ear; with contrast material(s) |
| 70482 | Computed tomography, orbit, sella, or posterior fossa or outer, middle, or inner ear; without contrast material, followed by contrast material(s) and further sections |
| 70486 | Computed tomography, maxillofacial area; without contrast material |
| 70487 | Computed tomography, maxillofacial area; with contrast material(s) |
| 70488 | Computed tomography, maxillofacial area; without contrast material, followed by contrast material(s) and further sections |
| 70490 | Computed tomography, soft tissue neck; without contrast material |
| 70491 | Computed tomography, soft tissue neck; with contrast material(s) |
| 70492 | Computed tomography, soft tissue neck; without contrast material followed by contrast material(s) and further sections |
| 70540 | Magnetic resonance (eg, proton) imaging, orbit, face, and/or neck; without contrast material(s) |
| 70542 | Magnetic resonance (eg, proton) imaging, orbit, face, and/or neck; with contrast material(s) |
| 70543 | Magnetic resonance (eg, proton) imaging, orbit, face, and/or neck; without contrast material(s), followed by contrast material(s) and further sequences |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |

| Code | Description |
|---|---|
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** [63,159] | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** [160] | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** [67] | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** [161] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** [162] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** [163] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** (65,80) | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (64) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (164) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for up to 5 years |
| **Bladder Cancer** (165) | **Non-Muscle Invasive (NMIBC)**<br>● Low-intermediate Risk NMIBC treated without cystectomy<br>○ Routine surveillance imaging is not indicated<br>● High Risk* NMIBC treated without cystectomy |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ Once 12 months after diagnosis then<br>■ Every 1-2 years 9 additional years<br>■ No routine surveillance imaging after 10 years<br>● NMICBC after cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ 3 months after surgery then<br>■ 1 year after surgery then<br>■ Annually for 4 additional years<br>■ No routine surveillance imaging after 5 years<br><br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br><br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Annually for 3 additional years<br><br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** (166) | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors<br>○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then<br>■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • CT or MRI of primary tumor site as clinically indicated<br>• Chest CT<br>  ○ Every 6-12 months for 4 years then<br>  ○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>• CT or MRI of primary tumor site and Chest CT<br>  ○ Every 3 months for 2 years then<br>  ○ Every 4 months for year 3 then<br>  ○ Every 6 months year 4 and 5 then<br>  ○ Annually after year 5, as clinically indicated |
| **Breast** (167) | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>• Stage I-III disease:<br>  ○ Routine surveillance imaging not indicated (followed with mammography)<br>  **NOTE: See Restaging section for recurrence**<br>• Stage IV disease not currently on therapy<br>  ○ Chest CT and Abdomen and Pelvis CT<br>  ■ Every 3-6 months |
| **Castleman's Disease** (66) | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>• Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** (87) | **Stage I disease treated with non-fertility sparing**<br>• Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>• Pelvis MRI<br>  ○ Once 6 months after completion of treatment then<br>  ○ Annually for 2-3 additional years<br>**Stage II-IV** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Pelvis MRI<br>  ○ Once 3-6 months after completion of treatment<br>  ○ Routine surveillance imaging not indicated thereafter<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>• Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>  ○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** (168) | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** (169) | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** (170–174) | **Choroid plexus tumors and carcinoma**<br>• Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>• Malignant choroid plexus carcinoma<br>  ○ Brain MRI<br>  ■ Every 3-4 months for 2 years then<br>  ■ Every 6 months for years 3-5 then<br>  ■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>• Circumscribed glioma (not otherwise listed) post gross total resection<br>  ○ Brain MRI<br>  ■ Every 3-6 months for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Annually after 5 years<br>● Oligodendroglioma and astrocytoma grade 2<br>○ After chemotherapy and radiation<br>■ Brain MRI: Every 6-9 months<br>○ After chemotherapy OR radiation<br>■ Brain MRI: Every 3-4 months<br>○ After surgery only<br>■ Brain MRI: Every 3-4 months<br>**NOTE:** Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma<br>○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ▫ As clinically indicated after 5 years<br><br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>**NOTE:** High-grade glioma includes ALL histologies if grade 3 and 4<br><br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br><br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated<br>● MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br><br>**Primary CNS Lymphoma**<br>● MRI Brain +/- MRI C/T/L Spine<br>○ Every 3 months for 2 years, then<br>○ Every 6 months for 3 years, then<br>○ Annually, indefinitely<br><br>**Primary Spinal Cord Tumors**<br>● Low grade tumors (grade 1-2)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Every 3-6 months for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months indefinitely<br>● High grade tumors (grade 3-4)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Once 2-6 weeks after treatment then<br>○ Every 2-4 months for 3 years then<br>○ Every 3-6 months for 2 years, then<br>○ Every 6-12 months indefinitely<br>NOTE: Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br>**Meningiomas**<br>● Grade 1 and 2 or unresected tumors:<br>○ MRI Brain (include spine if spinal involvement)<br>■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>**NOTE:** SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** (175) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** (68) | Routine surveillance imaging is not indicated |
| **Dermatofibrosarcoma Protuberans (DFSP)** (176) | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** (177) | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Gastric** [178] | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |
| **Gastrointestinal Stroma Tumor (GIST)** [179] | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>**NOTE:** More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [180] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [181] | Routine surveillance imaging is not indicated |
| **Head and Neck** [77] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change). |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** (182) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |
| **Histiocytic Neoplasms** (183) | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** (78,79) | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** (184) | Routine surveillance imaging is not indicated |
| **Kidney Cancer** (185) | See **Surveillance** section for indications related to that management strategy. |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after 5 years<br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then<br>○ Annually during year 5 then<br>○ As clinically indicated after year 5<br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery*** <br>● Chest CT and Abdomen and Pelvis CT/MRI <br>○ Baseline within 3-6 months then <br>○ Every 3-6 months for 3 years then <br>○ Annually for 2 additional years <br>○ As clinically indicated beyond 5 years <br>**Stage IV, relapsed, or surgically unresectable disease*** <br>● Chest CT and Abdomen and Pelvis CT/MRI <br>○ Every 1.5-4 months <br>● Brain MRI (preferred) or brain CT <br>○ Annually, or as clinically indicated <br>● Entire spine MRI <br>○ As clinically indicated <br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (69) | **Stage 0/in situ, Stage I, Stage IIA** <br>● No routine imaging needed <br>**Stage IIB-IV** <br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck <br>○ Every 3-12 months for 2 years then <br>○ Every 6-12 months for 3 additional years <br>● Brain MRI if stage IIIB or higher <br>○ Every 3-12 months for 2 years then <br>○ Every 6-12 months for 3 additional years <br>NOTE: More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Melanoma: Uveal** [81] | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months for years 6-10 then<br>○ As clinically indicated after year 10<br>NOTE: Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [70] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** [186] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** [187] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Multiple Myeloma** [188] | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Annually for 5 years<br><br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** [67] | **Well-differentiated NET, Grade 1-2**<br>● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br><br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br><br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br><br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |
| **Neuroblastoma** [85] | **All risk groups**<br>● CT or MRI of primary site |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | ○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br><br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** (189) | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br><br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |
| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** (190) | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer** |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | • Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 2 years then<br>• Every 6-12 months for 3 additional years then<br>• As clinically indicated after 5 years<br>**NOTE:** These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br>**Benign Teratoma**<br>• Abdomen and Pelvis CT/MRI<br>  ○ Every 3-6 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years then<br>  ○ As clinically indicated after 5 years<br>**Small cell carcinoma of ovary**<br>• Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>  ○ Every 3-6 months for 2 years then<br>  ○ Annually |
| **Pancreatic Adenocarcinoma** [191] | Chest CT and Abdomen and Pelvis CT<br>• Every 3-6 months for 3 years then<br>• Every 6-12 months for 2 years then<br>• As clinically indicated after 5 years |
| **Penile Cancer** [192] | **pN0 and pN1**<br>• Abdomen and Pelvis CT<br>  ○ Every 6 months for 2 years then<br>  ○ Annually during years 3-4<br>**pN2 and pN3**<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Every 3 months for 1 then<br>  ○ Every 6 months during years 2-4 |

| Cancer | Cancer Imaging After Definitive Treatment |
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| **Prostate Cancer** [193] | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** [194] | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** [82–84] | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** [195] | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |
| **Small Cell Lung Cancer (SCLC)** [196] | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (eg, |

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| | neck, spine)<br>**NOTE:** Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** [72,73] | **General surveillance guidelines for other sarcomas, based on site:**<br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT<br>● **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | or Brain CT<br>• **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>• **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>• **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>• **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**Specific sarcoma surveillance guidelines (above general guidance does not apply):**<br>**Desmoid tumor (aggressive fibromatosis)**<br>• Site-specific MRI (preferred) or CT<br>  ○ Every 3-6 months for 3 years then<br>  ○ Every 6-12 months<br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br>**Borderline Phyllodes Tumor**<br>• Chest or Breast MRI<br>  ○ Every 6 months for 2 years then<br>  ○ Annually for 3 additional years<br>**Malignant Phyllodes Tumor**<br>• Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>  ○ Every 3-6 months for 3 years then<br>  ○ Every 6 months for 2 additional years then<br>  ○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** [74] | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for following disease, based on risk of recurrence, or as |

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| | clinically indicated. |
| **T-cell Lymphomas** [75]<br><br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** [197] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br><br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br><br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br><br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3<br><br>**Bulky stage IIB, IIC, and III seminoma, received** |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | **chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** (197) | See **Surveillance** section for indications related to that management strategy.<br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (198) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br>**Thymic Carcinoma** |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | ● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** (76) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>● Neck CT/MRI +/- Chest CT<br>○ Once 6-12 post thyroidectomy<br>○ Routine surveillance imaging thereafter not indicated<br><br>**Medullary Carcinoma**<br>● Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br><br>**Anaplastic Carcinoma**<br>● Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (199) | **Endometrial Cancer treated with non-fertility sparing**<br>● Routine surveillance imaging thereafter not indicated<br><br>**Endometrial Cancer treated with fertility sparing**<br>● Pelvis MRI<br>○ Once 6-9 months after treatment<br>○ Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | recurrence.<br>• **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (200) | Chest CT and Abdomen and Pelvis CT/MRI<br>• End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>• Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** (201) | Pelvis MRI (Indicated in addition to PET/CT)<br>• End of treatment restaging once 3-6 months after completion of treatment<br>• Routine surveillance imaging thereafter not indicated<br>**NOTE:** The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** (202) | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** (203) | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>• Every 3 months for 2 years<br>• Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate high-resolution cross-sectional images, computed tomography (CT) and magnetic resonance imaging (MRI) have become integral diagnostic tools for head and neck imaging. [204,205]

Computed Tomography (CT) is based on the differential absorption of x-rays by tissues and uses x-rays to create cross-sectional images reconstructed by a computer. [204] Its strengths are rapid image acquisition and high spatial resolution, making it well suited for evaluation of osseous anatomy, trauma, and acute conditions. [204]

Magnetic resonance imaging (MRI) is based on the magnetic properties of hydrogen nuclei and generates images using strong magnetic fields and radiofrequency pulses. [204,205] MRI provides superior soft-tissue contrast without ionizing radiation, making it preferred for evaluation of neural structures and complex soft-tissue pathology. [204,205]

### Brain and Skull Base

MRI is preferred for evaluation of the brain and skull base because it provides superior soft-tissue contrast and multiplanar assessment of brain parenchyma, meninges, cranial nerves, and skull base structures. [205] MRI is also preferred for evaluation of cranial neuropathies because it allows assessment of the intracranial and skull base course of cranial nerves and related soft-tissue interfaces. [140,205]

CT plays a complementary role in brain and skull base imaging and is well suited for rapid assessment and evaluation of osseous anatomy, including suspected fractures, and when MRI is contraindicated or cannot be performed. [204,205]

Overall, modality selection for brain and skull base imaging reflects MRI preference for neural and soft-tissue evaluation and CT use for rapid assessment and bony detail. [204,205]

### Temporal Bone and Internal Auditory Canal (IAC)

Computed tomography (CT) is the primary imaging modality for evaluation of the temporal bone CT is preferred for evaluation of the temporal bone because it provides high spatial resolution of osseous structures of the external, middle, and inner ear. [204,205]

ACR Appropriateness guidance supports CT for structural evaluation of hearing loss and related otologic presentations when detailed bony assessment is required. [1]

MRI is preferred for evaluation of the internal auditory canal and retrocochlear pathology because it provides superior soft-tissue characterization of neural structures and the cerebellopontine angle. [1,205]

Overall, temporal bone imaging follows a complementary approach in which CT is preferred for bony anatomy and MRI is preferred for neural and soft-tissue evaluation of the IAC and related intracranial structures. [204,205]

### Orbits and Vision Pathways

MRI is preferred for evaluation of the orbits and vision pathways because it provides superior soft-tissue contrast for the optic nerves, orbital apex, cavernous sinus, and intracranial visual pathways. (103,205)

CT plays a complementary role in orbital imaging and is well suited for evaluation of the bony orbit and acute trauma. (97,204)

Choosing between CT and MRI depends on whether the clinical question requires osseous detail (CT) or detailed soft-tissue and neural pathway assessment (MRI). (204,205)

Overall, orbital and vision pathway imaging reflects MRI preference for soft-tissue and neural evaluation and CT use for bony anatomy and acute conditions. (204,205)

### Face and Sinonasal Region

CT is preferred for evaluation of the face and sinonasal region because it provides high spatial resolution of osseous anatomy and air-filled structures, including the paranasal sinuses. (46,204) CT is also preferred for evaluation of facial trauma because it provides detailed assessment of facial fractures and bony injury patterns. (97)

MRI plays a complementary role in sinonasal imaging and is preferred when detailed soft-tissue characterization is needed, including evaluation of suspected sinonasal neoplasm, perineural spread, or intracranial or orbital extension. (46,205)

Overall, face and sinonasal imaging follows a modality-specific approach in which CT is preferred for anatomy, inflammation, and trauma, and MRI is used for advanced soft-tissue assessment. (46,204,205)

### Jaw and Temporomandibular Joint

MRI is preferred for evaluation of temporomandibular joint soft-tissue pathology because it allows assessment of intra-articular structures and inflammatory change. (23,57)

CT plays a complementary role in jaw and TMJ imaging and is well suited for evaluation of osseous anatomy, including structural and bony abnormalities of the mandible and maxilla. (54,204)

Choosing between CT and MRI depends on whether the clinical question requires evaluation of soft-tissue internal derangement (MRI) or detailed bony anatomy and mineralized structures (CT). (54,204)

Overall, jaw and TMJ imaging reflects MRI preference for soft-tissue and intra-articular assessment and CT use for osseous evaluation and structural definition. (23,54,204)

### Neck (Soft Tissue and Aerodigestive Tract)

CT is widely used for evaluation of the soft tissues of the neck because it provides rapid cross-sectional assessment of complex cervical anatomy and deep tissue planes. (42,204)

CT is also used to evaluate aerodigestive tract pathology, including pharyngeal processes, when broad anatomic assessment is needed. [42]

MRI plays a complementary role in neck imaging and is preferred when detailed soft-tissue characterization is required, including evaluation of malignancy and perineural spread. [152,205]

Overall, neck soft-tissue and aerodigestive imaging reflects CT use for broad anatomic evaluation and MRI use for advanced soft-tissue characterization in selected scenarios. [42,146,152,204,205]

### Selection of CT Versus MRI

Across head and neck imaging, computed tomography (CT) and magnetic resonance imaging (MRI) serve complementary and well-defined roles based on differences in image acquisition, tissue characterization, and clinical utility. In general [204,205]:

- CT is generally preferred for evaluation of osseous anatomy, trauma, and acute pathology.
- MRI provides soft-tissue contrast without ionizing radiation and is generally preferred for neural and complex soft-tissue evaluation.

When applied by anatomic region [1,42,46,97,103,204,205]:

- MRI is generally preferred for brain, skull base, and vision pathways.
- CT is generally preferred for sinonasal disease, facial trauma, and bony anatomy; and both modalities are used selectively for the temporal bone, internal auditory canal, and neck soft tissues based on the clinical question.

Imaging modality selection should balance diagnostic performance with patient safety and clinical necessity.

# ANALYSIS OF EVIDENCE

### Brain and Skull Base

MRI is positioned as the primary advanced imaging modality for evaluation of the brain and skull base due to its superior soft-tissue contrast and multiplanar assessment of brain parenchyma, meninges, cranial nerves, and skull base structures. This modality preference is consistent across neuroradiology literature and guideline-supported imaging pathways that emphasize MRI for intracranial and neural pathology rather than CT. [205]

Within this framework, MRI is explicitly favored for evaluation of cranial neuropathies, as it allows assessment of the intracranial, cisternal, skull base, and foraminal segments of the cranial nerves and supports characterization of compressive, inflammatory, and infiltrative processes. Disease-specific imaging guidance anchors this preference and reinforces MRI's role as the definitive modality for neural pathway assessment. [140,205]

CT plays a complementary but secondary role in brain and skull base imaging and is primarily used when rapid assessment is required, when evaluation of osseous anatomy is the dominant concern, or when MRI cannot be performed. Foundational imaging literature supports CT for

bony detail and acute settings but does not position it as equivalent to MRI for evaluation of intracranial soft-tissue disease. [204]

### Temporal Bone and Internal Auditory Canal (IAC)

CT is the primary modality for evaluation of the temporal bone due to its high spatial resolution and ability to clearly depict the complex osseous anatomy of the external, middle, and inner ear. This modality positioning is consistently reflected in otologic imaging literature and ACR Appropriateness Criteria for hearing loss and vertigo. [1,204]

For internal auditory canal and retrocochlear pathology, MRI is favored due to its superior characterization of neural structures, cerebellopontine angle contents, and intracranial extension of disease. ACR Appropriateness Criteria explicitly direct imaging toward MRI when neural etiologies of hearing loss or tinnitus are suspected, reinforcing a modality shift based on the underlying anatomic structures of interest. [1]

This distinction between CT-dominant temporal bone imaging and MRI-dominant IAC evaluation reflects a consistent anatomic-based imaging approach, with modality selection driven by whether bony or neural pathology is suspected. [204,205]

### Orbits and Vision Pathways

MRI is the preferred modality for evaluation of the orbits and visual pathways, as it provides superior soft-tissue contrast for the optic nerves, orbital apex, cavernous sinus, and intracranial visual pathways. Appropriateness Criteria for vision disorders consistently support MRI when optic neuropathy, intracranial involvement, or post-chiasmal processes are suspected. [103,205]

CT serves a complementary role in orbital imaging and is primarily used for evaluation of the bony orbit, foreign bodies, and acute trauma. Its utility is anchored in its speed and ability to delineate osseous injury rather than detailed soft-tissue characterization. [97,204]

### Face and Sinonasal Region

CT is the primary imaging modality for evaluation of the face and sinonasal region due to its ability to depict osseous anatomy and air-filled structures with high spatial resolution. ACR Appropriateness Criteria for sinonasal disease consistently position CT as the initial and definitive imaging study for inflammatory disease, anatomic variation, and preoperative planning. [46]

CT is also favored in the setting of facial trauma, where precise delineation of fractures and bony injury patterns is required. Trauma-specific appropriateness guidance reinforces CT as the modality of choice in this context. [97]

MRI is used selectively in sinonasal imaging when soft-tissue characterization is necessary, including evaluation of suspected neoplasm, invasive disease, perineural spread, or intracranial or orbital extension beyond what CT can adequately assess. This problem-solving role is consistently described in neuroradiology texts and ACR guidance. [46,205]

### Jaw and Temporomandibular Joint

MRI is the preferred modality for evaluation of temporomandibular joint disorders when assessment of soft-tissue structures, including the articular disc, synovium, and inflammatory changes, is required. Specialty literature and disease-specific guidance support MRI for evaluation of internal derangement and inflammatory joint pathology. [23,57]

CT plays a complementary role in evaluation of the jaw and temporomandibular joint when detailed assessment of osseous pathology is required, including osteonecrosis, structural abnormalities, and mineralized changes. CT's role is supported in both foundational imaging literature and jaw-specific reviews. [54,204]

### Neck (Soft Tissues and Aerodigestive Tract)

CT is widely used for evaluation of the soft tissues of the neck due to its rapid acquisition and ability to assess complex cervical anatomy, deep neck spaces, and aerodigestive tract structures. Imaging literature and disease-specific guidance position CT as the preferred modality for infection, mass evaluation, and broad anatomic assessment. [42,204]

For aerodigestive tract complaints such as dysphagia or suspected pharyngeal pathology, CT provides comprehensive cross-sectional evaluation following indeterminate initial studies and supports escalation pathways described in ACR Appropriateness Criteria. [146]

MRI is used selectively in neck imaging when detailed soft-tissue characterization is required, particularly in suspected malignancy, perineural spread, or complex disease extension. Its role as a problem-solving modality aligns with neuroradiology literature and subspecialty imaging reviews. [152,205]

### In Summary

Across head and neck imaging indications, consistent modality patterns are observed. CT serves as the primary modality for evaluation of sinonasal disease, facial trauma, jaw pathology, and broad neck soft-tissue assessment due to its speed and osseous detail. MRI is preferred for evaluation of the brain, skull base, cranial nerves, vision pathways, and temporomandibular joint soft-tissue pathology, and functions as a selective problem-solving modality elsewhere. This region-based modality framework reflects established radiologic principles and guideline-supported imaging pathways. [1,46,204,205]

# POLICY HISTORY

| Date | Summary |
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| June 2026 | • This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2072 for Head and Neck Imaging<br>  ○ ECG 2039 for Neck CT<br>  ○ ECG 2047 for Sinus Maxillofacial CT |

| Date | Summary |
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| | ○ ECG 2048 for Sinus, Face, Orbit, Neck and Internal Auditory Canal MRI<br>○ ECG 2054 for Temporal Bone, Mastoid, Orbits, Sella, Internal Auditory Canal CT<br>○ ECG 2055 for Temporomandibular Joint (TMJ) MRI<br>● This guideline also merges the procedure codes from the above Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-covered service or drug. Evolent reserves the right to review and update this Clinical Guideline in its sole discretion. Notice of any changes shall be provided as required by applicable provider agreements and laws or regulations. Members should contact their Plan customer service representative for specific coverage information.*

*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Sharma A, Kirsch CFE, Aulino JM, et al. ACR Appropriateness Criteria® Hearing Loss and/or Vertigo. *Journal of the American College of Radiology*. 2018;15(11):S321-S331. doi:10.1016/j.jacr.2018.09.020
2. Widmann G, Dejaco D, Luger A, Schmutzhard J. Pre- and post-operative imaging of cochlear implants: a pictorial review. *Insights Imaging*. 2020;11(1). doi:10.1186/s13244-020-00902-6
3. Chandrasekhar SS, Tsai Do BS, Schwartz SR, et al. Clinical Practice Guideline: Sudden Hearing Loss (Update). *Otolaryngology - Head and Neck Surgery (United States)*. 2019;161(1_suppl):S1-S45. doi:10.1177/0194599819859885
4. Tsai Do BS, Bush ML, Weinreich HM, et al. Clinical Practice Guideline: Age-Related Hearing Loss. *Otolaryngology - Head and Neck Surgery (United States)*. 2024;170(S2):S1-S54. doi:10.1002/ohn.750
5. Basura GJ, Adams ME, Monfared A, et al. Clinical Practice Guideline: Ménière's Disease. *Otolaryngology - Head and Neck Surgery (United States)*. 2020;162(2_suppl):S1-S55. doi:10.1177/0194599820909438
6. Maier H, Lenarz T, Agha-Mir-Salim P, et al. Consensus Statement on Bone Conduction Devices and Active Middle Ear Implants in Conductive and Mixed Hearing Loss. *Otology and Neurotology*. 2022;43(5):513-529. doi:10.1097/MAO.0000000000003491
7. Jain V, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Tinnitus: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S574-S591. doi:10.1016/j.jacr.2023.08.017
8. Duvvuri M, Ali H, Amans MR. Non-invasive imaging modalities for diagnosing pulsatile tinnitus: a comprehensive review and recommended imaging algorithm. *J Neurointerv Surg*. Published online November 2, 2024:jnis-2023-020949. doi:10.1136/jnis-2023-020949
9. Baba A, Kurokawa R, Kurokawa M, et al. Advanced imaging of head and neck infections. *Journal of Neuroimaging*. 2023;33(4):477-492. doi:10.1111/jon.13099
10. Agarwal M, Juliano AF, Hagiwara M, et al. ACR Appropriateness Criteria® Inflammatory Ear Disease. *Journal of the American College of Radiology*. 2025;22(5):S300-S318. doi:10.1016/j.jacr.2025.02.026
11. Ward BK, Van De Berg R, Van Rompaey V, et al. Superior semicircular canal dehiscence syndrome: Diagnostic criteria consensus document of the committee for the classification of vestibular disorders of the Bárány Society. *J Vestib Res*. 2021;31(3):131-141. doi:10.3233/VES-200004
12. Bhattacharyya N, Gubbels SP, Schwartz SR, et al. Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo (Update). *Otolaryngology–Head and Neck Surgery*. 2017;156(S3). doi:10.1177/0194599816689667
13. Wang LL, Thompson TA, Shih RY, et al. ACR Appropriateness Criteria® Dizziness and Ataxia: 2023 Update. *Journal of the American College of Radiology*. 2024;21(6):S100-S125. doi:10.1016/j.jacr.2024.02.018

14. Newman-Toker DE, Kerber KA, Hsieh Y, et al. HINTS Outperforms ABCD2 to Screen for Stroke in Acute Continuous Vertigo and Dizziness. *Academic Emergency Medicine*. 2013;20(10):986-996. doi:10.1111/acem.12223

15. Kligerman SJ, Bykowski J, Hurwitz Koweek LM, et al. ACR Appropriateness Criteria® Syncope. *Journal of the American College of Radiology*. 2021;18(5):S229-S238. doi:10.1016/j.jacr.2021.02.021

16. Tucci DL, McCoul ED, Rosenfeld RM, et al. Clinical Consensus Statement: Balloon Dilation of the Eustachian Tube. *Otolaryngology - Head and Neck Surgery (United States)*. 2019;161(1):6-17. doi:10.1177/0194599819848423

17. Sakai M, Hiyama T, Kuno H, Kobayashi T, Nakajima T. Imaging of the skull base and orbital tumors. *Jpn J Radiol*. 2025;43(2):152-163. doi:10.1007/s11604-024-01662-9

18. Rath TJ, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Cranial Neuropathy: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S266-S303. doi:10.1016/j.jacr.2022.09.021

19. Seidman MD, Gurgel RK, Lin SY, et al. Clinical Practice Guideline: Allergic Rhinitis. *Otolaryngology–Head and Neck Surgery*. 2015;152(S1):S1-S43. doi:10.1177/0194599814561600

20. Payne SC, McKenna M, Buckley J, et al. Clinical Practice Guideline: Adult Sinusitis Update. *Otolaryngology–Head and Neck Surgery*. 2025;173(S1). doi:10.1002/ohn.1344

21. Patil V, Auradkar A, Muniraju M, Faseeh KM. Otolaryngologic manifestations in granulomatosis with Polyangitis: A systematic review of clinical presentations and renal correlation. *European Archives of Oto-Rhino-Laryngology*. Published online 2026. doi:10.1007/s00405-025-10002-0

22. Cleary JO, Sivarasan N, Burd C, Connor SEJ. Head and neck manifestations of granulomatosis with polyangiitis. *Br J Radiol*. 2021;94(1119). doi:10.1259/bjr.20200914

23. Bollhalder A, Patcas R, Eichenberger M, et al. Magnetic resonance imaging followup of temporomandibular joint inflammation, deformation, and mandibular growth in juvenile idiopathic arthritis patients receiving systemic treatment. *Journal of Rheumatology*. 2020;47(6):909-916. doi:10.3899/jrheum.190168

24. Schmidt C, Ertel T, Arbogast M, Hügle B, Von Kalle T, Neff A. The Diagnosis and Treatment of Rheumatoid and Juvenile Idiopathic Arthritis of the Temporomandibular Joint. *Dtsch Arztebl Int*. 2022;119(4):47-54. doi:10.3238/arztebl.m2021.0388

25. Inarejos Clemente EJ, Tolend M, Navallas M, Doria AS, Meyers AB. MRI of the temporomandibular joint in children with juvenile idiopathic arthritis: protocol and findings. *Pediatr Radiol*. 2023;53(8):1498-1512. doi:10.1007/s00247-023-05616-7

26. Shin JJ, Wilson M, McKenna M, et al. Clinical Practice Guideline: Surgical Management of Chronic Rhinosinusitis. *Otolaryngology–Head and Neck Surgery*. 2025;172(S2). doi:10.1002/ohn.1287

27. Shih RY, Burns J, Ajam AA, et al. ACR Appropriateness Criteria® Head Trauma: 2021 Update. *Journal of the American College of Radiology*. 2021;18(5):S13-S36. doi:10.1016/j.jacr.2021.01.006

28. Hagiwara M, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Sinonasal Disease: 2021 Update. *Journal of the American College of Radiology*. 2022;19(5):S175-S193. doi:10.1016/j.jacr.2022.02.011

29. Hiremath SB, Gautam AA, Sasindran V, Therakathu J, Benjamin G. Cerebrospinal fluid rhinorrhea and otorrhea: A multimodality imaging approach. *Diagn Interv Imaging*. 2019;100(1):3-15. doi:10.1016/j.diii.2018.05.003

30. Lee MY, Cho YS, Han GC, Oh JH. Current Treatments for Congenital Aural Atresia. *J Audiol Otol*. 2020;24(4):161-166. doi:10.7874/jao.2020.00325

31. Truong MT, Liu YCC, Kohn J, et al. Integrated microtia and aural atresia management. *Front Surg*. 2022;9. doi:10.3389/fsurg.2022.944223

32. Šebová I, Vyrvová I, Barkociová J. Nasal Cavity CT Imaging Contribution to the Diagnosis and Treatment of Choanal Atresia. *Medicina (B Aires)*. 2021;57(2):93. doi:10.3390/medicina57020093

33. Pitkanen V V., Geneid A, Saarikko AM, Hakli S, Alaluusua SA. Diagnosing and Managing Velopharyngeal Insufficiency in Patients With Cleft Palate After Primary Palatoplasty. *J Craniofac Surg*. 2025;36(3):1008-1016. doi:10.1097/SCS.0000000000009822

34. Kuijpers MAR, Chiu YT, Nada RM, Carels CEL, Fudalej PS. Three-dimensional imaging methods for quantitative analysis of facial soft tissues and skeletal morphology in patients with orofacial clefts: A systematic review. *PLoS One*. 2014;9(4). doi:10.1371/journal.pone.0093442

35. Chin AWT, Tse KS, Lee HC, Hon YW, Lo KL. Imaging features and techniques in assessment of cleft palate: A pictorial essay. *Hong Kong Journal of Radiology*. 2021;24(1):56-61. doi:10.12809/HKJR2117088

36. *Parameters of Care For Evaluation and Treatment of Individuals with Cleft Lip/Palate and/or Other Craniofacial Conditions*.; 2024.

37. Hirvonen J, Lingam RK, Connor S. ESR Essentials: acute infections of the head and neck—practice recommendations by the European Society of Head and Neck Radiology. *Eur Radiol*. 2026;36:334-343. doi:10.1007/s00330-025-11818-4

38. Hu AC, Ng WKY. Orbital Osteomyelitis in the Pediatric Patient. *Journal of Craniofacial Surgery*. 2021;32(1):206-209. doi:10.1097/SCS.0000000000006801

39. Santos P, Moreira C, Gião N, Coelho PV. Chronic Osteomyelitis of the Jaws: Management and Outcomes in a Tertiary Maxillofacial Surgery Unit. *Craniomaxillofac Trauma Reconstr*. 2025;18(4):43. doi:10.3390/cmtr18040043

40. Habib A, Sivaji N, Ashraf T. Maxillary Osteomyelitis: A Rare Entity. *Case Rep Otolaryngol*. 2016;2016:1-3. doi:10.1155/2016/9723806

41. Sadaksharam J, Murugesan M. Osteomyelitis of maxilla: A rare finding from a radiologist point of view. *Contemp Clin Dent*. 2019;10(2):394-396. doi:10.4103/ccd.ccd_566_18

42. Rahim I, Napolitano A, Burd C, Lingam RK. Imaging of pharyngeal pathology. *Br J Radiol*. 2023;96(1149). doi:10.1259/bjr.20230046

43. Rosenfeld RM, Schwartz SR, Cannon CR, et al. Clinical practice guideline: acute otitis externa. *Otolaryngol Head Neck Surg*. 2014;150(1 Suppl):S1-S24. doi:10.1177/0194599813517083

44. Bertolaso C, Cammisa I, Orsini N, et al. Diagnosing acute mastoiditis in a pediatric emergency department: a retrospective review. *Acta Biomedica*. 2023;94(2). doi:10.23750/abm.v94i2.13839

45. Patel KM, Almutairi A, Mafee MF. Acute otomastoiditis and its complications: Role of imaging. *Oper Tech Otolayngol Head Neck Surg*. 2014;25(1):21-28. doi:10.1016/j.otot.2013.11.004

46. Kirsch CFE, Bykowski J, Aulino JM, et al. ACR Appropriateness Criteria® Sinonasal Disease. *Journal of the American College of Radiology*. 2017;14(11):S550-S559. doi:10.1016/j.jacr.2017.08.041

47. Tekes A, Palasis S, Durand DJ, et al. ACR Appropriateness Criteria® Sinusitis-Child. *Journal of the American College of Radiology*. 2018;15(11):S403-S412. doi:10.1016/j.jacr.2018.09.029

48. Aring AM, Chan MM. Current Concepts in Adult Acute Rhinosinusitis. *Am Fam Physician*. 2016;94(2):97-105. www.aafp.org/afp

49. Psillas G, Papaioannou D, Petsali S, Dimas GG, Constantinidis J. Odontogenic maxillary sinusitis: A comprehensive review. *J Dent Sci*. 2021;16(1):474-481. doi:10.1016/j.jds.2020.08.001

50. Poto R, Pelaia C, Di Salvatore A, Saleh H, Scadding GW, Varricchi G. Imaging of chronic rhinosinusitis with nasal polyps in the era of biological therapies. *Curr Opin Allergy Clin Immunol*. 2024;24(4):243-250. doi:10.1097/ACI.0000000000000964

51. Abdel Razek AAK, Mukherji S. Imaging of sialadenitis. *Neuroradiol J*. 2017;30(3):205-215. doi:10.1177/1971400916682752

52. Kalia V, Kalra G, Kaur S, Kapoor R. CT Scan as an Essential Tool in Diagnosis of Non-radiopaque Sialoliths. *J Maxillofac Oral Surg*. 2015;14(S1):240-244. doi:10.1007/s12663-012-0461-8

53. Kim MJ, Milliren A, Gerold Jr DJ. Salivary Gland Disorders: Rapid Evidence Review. *Am Fam Physician*. 2024;109(6):550-559.

54. Wongratwanich P, Shimabukuro K, Konishi M, et al. Do various imaging modalities provide potential early detection and diagnosis of medication-related osteonecrosis of the jaw? A review. *Dentomaxillofacial Radiology*. 2021;50(6). doi:10.1259/dmfr.20200417

55. Ruggiero SL, Dodson TB, Aghaloo T, Carlson ER, Ward BB, Kademani D. American Association of Oral and Maxillofacial Surgeons' Position Paper on Medication-Related Osteonecrosis of the Jaws—2022 Update. *Journal of Oral and Maxillofacial Surgery*. 2022;80(5):920-943. doi:10.1016/j.joms.2022.02.008

56. Gauer RL, Semidey MJ. Diagnosis and treatment of temporomandibular disorders. *Am Fam Physician*. 2015;91(6):378-386. http://www.ncbi.nlm.nih.gov/pubmed/25822556

57. Gharavi SM, Qiao Y, Faghihimehr A, Vossen J. Imaging of the Temporomandibular Joint. *Diagnostics*. 2022;12(4). doi:10.3390/diagnostics12041006

58. Mallya SM, Ahmad M, Cohen JR, Kaspo G, Ramesh A. Recommendations for Imaging of the Temporomandibular Joint. Position Statement from the American Academy of Oral and Maxillofacial Radiology and the American Academy of Orofacial Pain. *J Oral Facial Pain Headache*. 2023;37(1):7-15. doi:10.11607/ofph.3268

59. Lahiri AK, Daultrey CR. Imaging evaluation of the benign and malignant lesions of the floor of the mouth: Pictorial review. *South African Journal of Radiology*. 2023;27(1). doi:10.4102/sajr.v27i1.2677

60. Aulino JM, Kirsch CFE, Burns J, et al. ACR Appropriateness Criteria® Neck Mass-Adenopathy. *Journal of the American College of Radiology*. 2019;16(5):S150-S160. doi:10.1016/j.jacr.2019.02.025

61. Garner HW, Wessell DE, Lenchik L, et al. ACR Appropriateness Criteria® Soft Tissue Masses: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S234-S245. doi:10.1016/j.jacr.2023.02.009

62. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical Practice Guideline (Update): Adult Sinusitis. *Otolaryngology–Head and Neck Surgery*. 2015;152(S2):S1-S39. doi:10.1177/0194599815572097

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82. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

83. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

84. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

85. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Neuroblastoma Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

86. Berry JL, Munier FL, Gallie BL, et al. Response criteria for intraocular retinoblastoma: RB-RECIST. *Pediatr Blood Cancer*. 2021;68(5). doi:10.1002/pbc.28964

87. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Cervical Cancer Version 2.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

88. Ashwinirani SR, Suragimath G, Telrandhe S, Suragimath DG. Deviated Nasal Septum: A Comprehensive Review. *Journal of Datta Meghe Institute of Medical Sciences University*. 2024;19(3):406-411. doi:10.4103/jdmimsu.jdmimsu_185_24

89. Mendiratta V, Baisakhiya N, Singh D, Datta G, Mittal A, Mendiratta P. Sinonasal Anatomical Variants: CT and Endoscopy Study and Its Correlation with Extent of Disease. *Indian Journal of Otolaryngology and Head and Neck Surgery*. 2015;68(3):352-358. doi:10.1007/s12070-015-0920-x

90. Petranović Ovčariček P, Giovanella L, Carrió Gasset I, et al. The EANM practice guidelines for parathyroid imaging. *Eur J Nucl Med Mol Imaging*. 2021;48(9):2801-2822. doi:10.1007/s00259-021-05334-y

91. Morris MA, Saboury B, Ahlman M, et al. Parathyroid Imaging: Past, Present, and Future. *Front Endocrinol (Lausanne)*. 2022;12. doi:10.3389/fendo.2021.760419

92. Zander D, Bunch PM, Policeni B, et al. ACR Appropriateness Criteria® Parathyroid Adenoma. *Journal of the American College of Radiology*. 2021;18(11):S406-S422. doi:10.1016/j.jacr.2021.08.013

93. Burns J, Policeni B, Bykowski J, et al. ACR Appropriateness Criteria® Neuroendocrine Imaging. *Journal of the American College of Radiology*. 2019;16(5):S161-S173. doi:10.1016/j.jacr.2019.02.017

94. Fleseriu M, Gurnell M, McCormack A, et al. Pituitary incidentaloma: a Pituitary Society international consensus guideline statement. *Nat Rev Endocrinol*. 2025;21(10):638-655. doi:10.1038/s41574-025-01134-8

95. Hoang JK, Oldan JD, Mandel SJ, et al. ACR Appropriateness Criteria® Thyroid Disease. *Journal of the American College of Radiology*. 2019;16(5):S300-S314. doi:10.1016/j.jacr.2019.02.004

96. Gharib H, Papini E, Garber JR, et al. American Association of Clinical Endocrinologists, American College of Endocrinology, and Associazione Medici Endocrinologi Medical Guidelines for Clinical Practice for the Diagnosis and Management of Thyroid Nodules - 2016 Update Appendix. *Endocrine Practice*. 2016;22:1-60. doi:10.4158/EP161208.GL

97. Parsons MS, Policeni B, Juliano AF, et al. ACR Appropriateness Criteria® Imaging of Facial Trauma Following Primary Survey. *Journal of the American College of Radiology*. 2022;19(5):S67-S86. doi:10.1016/j.jacr.2022.02.013

98. Lee JT, Camacho MA, Diercks DB, et al. ACR Appropriateness Criteria® Major Blunt Trauma: Update 2025. *Journal of the American College of Radiology*. Published online February 2026. doi:10.1016/j.jacr.2026.01.030

99. Wong GC, Song Y, Sampson RD, Wang L, Chung KC. Initial Imaging for Adults With Maxillofacial Trauma in a National Claims Database. *JAMA Netw Open*. 2026;9(2):e2558293. doi:10.1001/jamanetworkopen.2025.58293

100. Gallo A, Betts A, Ritter J. Imaging of Head and Neck Trauma. *Operative Techniques in Otolaryngology - Head and Neck Surgery*. 2020;31(4):275-282. doi:10.1016/j.otot.2020.10.003

101. Siletz A, Inaba K. Diagnostic approach to penetrating neck trauma: What you need to know. *Journal of Trauma and Acute Care Surgery*. 2024;97(2):175-182. doi:10.1097/TA.0000000000004292

102. Kurihara YY, Fujikawa A, Tachizawa N, Takaya M, Ikeda H, Starkey J. Temporal Bone Trauma: Typical CT and MRI Appearances and Important Points for Evaluation. *RadioGraphics*. 2020;40(4):1148-1162. doi:10.1148/rg.2020190023

103. Kennedy TA, Corey AS, Policeni B, et al. ACR Appropriateness Criteria® Orbits, Vision and Visual Loss. *Journal of the American College of Radiology*. 2018;15(5):S116-S131. doi:10.1016/j.jacr.2018.03.023

104. Maheshwari M, Ho ML, Bosemani T, et al. ACR Appropriateness Criteria® Orbital Imaging and Vision Loss-Child. *Journal of the American College of Radiology*. 2024;21(6):S219-S236. doi:10.1016/j.jacr.2024.02.023

105. Goyal P, Lee S, Gupta N, et al. Orbital apex disorders: Imaging findings and management. *Neuroradiol J*. 2018;31(2):104-125. doi:10.1177/1971400917740361

106. Wevers M, Strabbing EM, Engin O, Gardeniers M, Koudstaal MJ. CT parameters in pure orbital wall fractures and their relevance in the choice of treatment and patient outcome: a systematic review. *Int J Oral Maxillofac Surg*. 2022;51(6):782-789. doi:10.1016/j.ijom.2021.10.001

107. Tunkel DE, Anne S, Payne SC, et al. Clinical Practice Guideline: Nosebleed (Epistaxis). *Otolaryngology - Head and Neck Surgery (United States)*. 2020;162(1_suppl):S1-S38. doi:10.1177/0194599819890327

108. Péporté ARJ, Vassallo E, Preda L, Beale T, Hirvonen J. ESR Essentials: imaging in nasal obstruction and epistaxis—practice recommendations by the European Society of Head and Neck Radiology. *Eur Radiol*. Published online February 16, 2026. doi:10.1007/s00330-025-12305-6

109. Kanda T, Miyazaki A, Zeng F, et al. Magnetic resonance imaging of intraocular optic nerve disorders: review article. *Pol J Radiol*. 2020;85:e67-e81. doi:10.5114/pjr.2020.93364

110. Friedman ER, Juliano AF, Hagiwara M, et al. ACR Appropriateness Criteria® Vision Loss. *Journal of the American College of Radiology*. 2025;22(11):S738-S765. doi:10.1016/j.jacr.2025.08.030

111. Dubey P, Shekhrajka N, Juliano AF, et al. ACR Appropriateness Criteria® Horner Syndrome. *Journal of the American College of Radiology*. 2025;22(11):S550-S577. doi:10.1016/j.jacr.2025.08.041

112. Maamouri R, Ferchichi M, Houmane Y, Gharbi Z, Cheour M. Neuro-Ophthalmological Manifestations of Horner's Syndrome: Current Perspectives. *Eye Brain*. 2023;Volume 15:91-100. doi:10.2147/EB.S389630

113. Pineles SL. Acquired Diplopia in Adults: Heavy Eye Syndrome. *J Binocul Vis Ocul Motil*. 2022;72(4):223-225.

114. Salvetat ML, Pellegrini F, Spadea L, Salati C, Zeppieri M. Non-Arteritic Anterior Ischemic Optic Neuropathy (NA-AION): A Comprehensive Overview. *Vision*. 2023;7(4):72. doi:10.3390/vision7040072

115. Lee BE, Yoon RG. High-resolution MRI features of nonarteritic anterior ischemic optic neuropathy: a case series. *Int J Ophthalmol*. 2025;18(12):2319-2324. doi:10.18240/ijo.2025.12.13

116. Radder N, Radder S. Morning Glory Disc Anomaly With Ipsilateral Carotid Vasculopathy: MRI Characteristics and Clinical Implications. *Cureus*. Published online October 6, 2025. doi:10.7759/cureus.93932

117. Prasad S. Diagnostic Neuroimaging in Neuro-ophthalmic Disorders. *Continuum (Minneap Minn)*. 2014;20(4):1023-1062. www.ContinuumJournal.com

118. Patel SC, Smith SM, Kessler AT, Bhatt AA. Imaging of the Primary Visual Pathway based on Visual Deficits. *J Clin Imaging Sci*. 2021;11:19. doi:10.25259/JCIS_12_2021

119. Banwell B, Bennett JL, Marignier R, et al. Diagnosis of myelin oligodendrocyte glycoprotein antibody-associated disease: International MOGAD Panel proposed criteria. *Lancet Neurol*. 2023;22(3):268-282. doi:10.1016/S1474-4422(22)00431-8

120. Traboulsee A, Simon JH, Stone L, et al. Revised recommendations of the consortium of MS centers task force for a standardized MRI protocol and clinical guidelines for the diagnosis and follow-up of multiple sclerosis. *American Journal of Neuroradiology*. 2016;37(3):394-401. doi:10.3174/ajnr.A4539

121. Wingerchuk DM, Banwell B, Bennett JL, et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. *Neurology*. 2015;85(2):177-189. doi:10.1212/WNL.0000000000001729

122. Wattjes MP, Ciccarelli O, Reich DS, et al. 2021 MAGNIMS–CMSC–NAIMS consensus recommendations on the use of MRI in patients with multiple sclerosis. *Lancet Neurol*. 2021;20(8):653-670. doi:10.1016/S1474-4422(21)00095-8

123. Petzold A, Fraser CL, Abegg M, et al. Diagnosis and classification of optic neuritis. *Lancet Neurol*. 2022;21(12):1120-1134. doi:10.1016/S1474-4422(22)00200-9

124. Barkhof F, Reich DS, Oh J, et al. 2024 MAGNIMS-CMSC-NAIMS consensus recommendations on the use of MRI for the diagnosis of multiple sclerosis. *www.thelancet.com/neurology*. 2025;24. www.thelancet.com/neurology

125. Carton C, Evans DG, Blanco I, et al. ERN GENTURIS tumour surveillance guidelines for individuals with neurofibromatosis type 1. *EClinicalMedicine*. 2023;56. doi:10.1016/j.eclinm.2022.101818

126. Campen CJ, Gutmann DH. Optic Pathway Gliomas in Neurofibromatosis Type 1. *J Child Neurol*. 2018;33(1):73-81. doi:10.1177/0883073817739509

127. de Blank PMK, Fisher MJ, Liu GT, et al. Optic Pathway Gliomas in Neurofibromatosis Type 1: An Update: Surveillance, Treatment Indications, and Biomarkers of Vision. *J Neuroophthalmol*. 2017;37:S23-S32. doi:10.1097/WNO.0000000000000550

128. Cassina M, Frizziero L, Opocher E, et al. Optic pathway glioma in type 1 neurofibromatosis: Review of its pathogenesis, diagnostic assessment, and treatment recommendations. *Cancers (Basel)*. 2019;11(11). doi:10.3390/cancers11111790

129. Roka K, Scheinemann K, Avula S, et al. European standard clinical practice recommendations for primary pediatric low-grade gliomas. *EJC Paediatric Oncology*. 2024;4. doi:10.1016/j.ejcped.2024.100169

130. Mombaerts I, Bilyk JR, Rose GE, et al. Consensus on diagnostic criteria of idiopathic orbital inflammation using a modified delphi approach. *JAMA Ophthalmol*. 2017;135(7):769-776. doi:10.1001/jamaophthalmol.2017.1581

131. Yoon MK, Lu JE. An Evidence-Based Approach to Diagnosing Patients Presenting With Orbital Inflammatory Syndromes (An American Ophthalmological Society Thesis). *Am J Ophthalmol*. 2024;266:156-181. doi:10.1016/j.ajo.2024.05.010

132. Burch HB, Perros P, Bednarczuk T, et al. Management of Thyroid Eye Disease: A Consensus Statement by the American Thyroid Association and the European Thyroid Association. *Thyroid*. 2022;32(12):1439-1470. doi:10.1089/thy.2022.0251

133. Bartalena L, Gallo D, Kahaly GJ, Marinó M, Tanda ML. Comparison of the 2021 EUGOGO guidelines and the 2022 ATA/ETA consensus statement for the management of Graves' orbitopathy. *Eur Thyroid J*. 2025;14(6). doi:10.1530/ETJ-25-0318

134. Lei C, Jin J, Li R, et al. Management of Thyroid Eye Disease: A Comparison Between Three Recent Clinical Guidelines. *Ophthalmol Ther*. Published online March 1, 2026. doi:10.1007/s40123-026-01326-z

135. Bhat R, Al-Samarraie M, Nada A, Leiva-Salinas C, Whitehead M, Mahdi E. Spotlight on the pediatric eye: a pictorial review of orbital anatomy and congenital orbital pathologies. *Neuroradiol J*. 2021;34(1):21-32. doi:10.1177/1971400920949232

136. Boulter DJ, Job J, Shah LM, et al. ACR Appropriateness Criteria® Plexopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S423-S441. doi:10.1016/j.jacr.2021.08.014

137. Szaro P, McGrath A, Ciszek B, Geijer M. Magnetic resonance imaging of the brachial plexus. Part 1: Anatomical considerations, magnetic resonance techniques, and non-traumatic lesions. *Eur J Radiol Open*. 2022;9:100392. doi:10.1016/j.ejro.2021.100392

138. Szaro P, Geijer M, Ciszek B, McGrath A. Magnetic resonance imaging of the brachial plexus. Part 2: Traumatic injuries. *Eur J Radiol Open*. 2022;9:100397. doi:10.1016/j.ejro.2022.100397

139. Pacella G, Natella R, Bruno F, et al. Brachial Plexopathies: A Comprehensive Radiologic Method Integrating Ultrasound and MRI. *J Clin Med*. 2025;14(17). doi:10.3390/jcm14176311

140. Khaku A, Mcginn J, Patel V, Zacharia T, Goldenberg D. Guidelines for radiographic imaging of cranial neuropathies. *ENT-Ear, Nose & Throat Journal*. 2017;96(10-11). www.entjournal.comE23

141. Saltagi AK, Saltagi MZ, Nag AK, et al. Diagnosis of Anosmia and Hyposmia: A Systematic Review. *Allergy Rhinol (Providence)*. 2021;12:21526567211026570. doi:10.1177/21526567211026568

142. Savard DJ, Ursua FG, Gaddey HL. Smell and Taste Disorders in Primary Care. *Am Fam Physician*. 2023;108(3):240-248.

143. Al-Noury K, Lotfy A. Normal and pathological findings for the facial nerve on magnetic resonance imaging. *Clin Radiol*. 2011;66(8):701-707. doi:10.1016/j.crad.2011.02.012

144. Scott Earwood J, Sherrod Rogers T, Alan Rathjen N. Ear Pain: Diagnosing Common and Uncommon Causes. *Am Fam Physician*. 2018;97(1):20-27. https://pubmed.ncbi.nlm.nih.gov/29365233/

145. Norris CD, Koontz NA. Secondary Otalgia: Referred Pain Pathways and Pathologies. *AJNR Am J Neuroradiol*. 2020;41(12):2188-2198. doi:10.3174/ajnr.A6808

146. Levy AD, Carucci LR, Bartel TB, et al. ACR Appropriateness Criteria® Dysphagia. *Journal of the American College of Radiology*. 2019;16(5):S104-S115. doi:10.1016/j.jacr.2019.02.007

147. Pham ST, Sakai O, Andreu-Arasa VC. Imaging approach to ingested foreign bodies in the neck. *Neuroradiology*. 2024;66(6):867-881. doi:10.1007/s00234-024-03348-5

148. Pynnonen MA, Gillespie MB, Roman B, et al. Clinical Practice Guideline: Evaluation of the Neck Mass in Adults. *Otolaryngology–Head and Neck Surgery*. 2017;157(S2):S1-S30. doi:10.1177/0194599817722550

149. Polastri M, Di Marco L, Andreoli E. Odynophagia in individuals with neck pain: the importance of differential diagnosis in physiotherapy practice. *Journal of Yeungnam medical science*. 2023;40(Suppl):S129-S133. doi:10.12701/jyms.2023.00843

150. Wright O, Zhang TT, Gyimah DA, Davies-Husband C. Magnetic resonance imaging has a limited role in investigating odynophagia if examination is normal: A binary logistic regression analysis of 484 patients presenting to a tertiary head and neck clinic. *Clinical Otolaryngology*. 2022;47(6):650-655. doi:10.1111/coa.13967

151. Wilkinson JM, Codipilly C, Wilfahrt RP. Dysphagia: Evaluation and Collaborative Management. *Am Fam Physician*. 2021;103(2):97-106. www.aafp.org/afp

152. Dankbaar JW, Pameijer FA. Vocal cord paralysis: anatomy, imaging and pathology. *Insights Imaging*. 2014;5(6):743-751. doi:10.1007/s13244-014-0364-y

153. Else T, Greenberg S, Fishbein L. Hereditary Paraganglioma-Pheochromocytoma Syndromes. *GeneReviews®*. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1548/

154. van Leeuwaarde RS van, Ahmad S, van Nesselrooij B, Zandee W, Giles RH. Von Hippel-Lindau Syndrome. *GeneReviews®*. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1463/

155. Loeys BL, Dietz HC. Loeys-Dietz Syndrome. *GeneReviews®*. Published online September 12, 2024. https://www.ncbi.nlm.nih.gov/books/NBK1133/

156. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews®*. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

157. Friedman J. Neurofibromatosis 1. *GeneReviews®*. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

158. Little BP, Walker CM, Bang TJ, et al. ACR Appropriateness Criteria® Tracheobronchial Disease. *Journal of the American College of Radiology*. 2024;21(11):S518-S533. doi:10.1016/j.jacr.2024.08.015

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172. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005
173. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x
174. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226
175. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
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204. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

205. Vachha BA, Moonis G, Wintermark M, Massoud TF, eds. *What Radiology Residents Need to Know: Neuroradiology*. Springer; 2024.

# Evolent Clinical Guideline 2073 for Lower Extremity Imaging

## *Ankle, Foot, Hip, Knee, Lower Extremity*

| **Guideline Number:** Evolent_CG_2073 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** January 2027 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines, and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Computed Tomography (CT) uses ionizing radiation to generate images of the lower extremities. Magnetic Resonance Imaging (MRI) generates images of the lower extremities without the use of ionizing radiation. Computed tomography angiography (CTA) generates images of vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Magnetic resonance angiography (MRA) generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without ionizing radiation.

## Special Notes

- Plain X-rays must precede CT/MRI evaluation, unless otherwise indicated
- One authorization for CTA and/or MRA covers both arterial and venous imaging. The term *angiography* refers to both arteriography and venography. Additionally, CTA and MRA refers to angiography not arthrography.
- When a CT/MR Arthrogram is requested, meets medical necessity criteria for the appropriate joint, AND a clinical explanation is given for why an arthrogram is needed instead of MRI, the authorization issued is as a CT or MRI of that joint. A separate or additional authorization for the arthrogram is not needed.
    - If the above criteria are met, contraindication for MRI is not required for approval of CT Arthrogram.
- When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

## Foreign Body [1]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT**. Lower Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected or known foreign body of the lower extremity with prior imaging that is indeterminate or abnormal

# Fracture

## *Suspected Fracture*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Hip and Femur [2,3]
  - Suspected occult, stress, or insufficiency fracture with a negative or indeterminate initial X-ray (no follow-up X-ray required)
- Non-hip lower extremity
  - Suspected occult, stress, or insufficiency fracture [3] with any ONE of the following:
    - Negative or indeterminate X-rays taken ≥ 10 days after the injury or initial clinical assessment
    - Suspicion of any ONE of the following fracture types after initial X-ray (at any point in time):
      - Anterior tibial diaphysis
      - Patella
      - Medial malleolus
      - Navicular
      - Fifth metatarsal base
      - Proximal second metatarsal
      - Tibial hallux sesamoid
      - Talus
- Suspected pathologic fracture or impending fracture on prior imaging as documented in the notes OR with any ONE of the following findings on X-ray:
  - Periosteal reaction
  - Cortical breakthrough
  - Permeative/moth-eaten appearance

- Wide zone of transition
- Lytic lesion

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT** or **Lower Extremity MRI**.

- Suspected Lisfranc injury (complex fracture dislocation of the meta-tarsal joint(s) of the foot) AND prior normal or indeterminate X-ray [4]

**NOTE**: Advanced imaging of the foot (not ankle) is the appropriate study to evaluate a possible Lisfranc injury

### *Known Fracture* [5,6]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT**. Lower Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected nonunion or delayed union as demonstrated by a lack of bone healing on two or more X-rays ≥ 4 months apart [7]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Known traumatic fracture on prior imaging, with suspected associated ligament or tendon injury

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT** or **Lower Extremity MRI**.

- Known traumatic lower extremity fracture on prior imaging, without concern for an associated ligament or tendon injury [2,5]

## Infection of Bone, Joint, or Soft Tissue Abscess [8]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of infection (including osteomyelitis) of the lower extremity with abnormal or indeterminate findings on any ONE of the following:
  - X-ray for suspected bone/joint infection
  - Ultrasound for suspected soft tissue infection
- Negative prior imaging with a clinical suspicion of advanced infection (including osteomyelitis) based on any ONE of the following:

- Signs/symptoms of joint or bone infection (eg, pain, swelling, decreased range of motion, fever)
- Laboratory findings consistent with possible bone or joint infection such as:
  - Elevated erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP)
  - Elevated white blood cell count
  - Positive joint aspiration

- Lower extremity ulcer with suspected advanced infection (including osteomyelitis) with ALL of the following [9,10]:
  - Signs of advanced infection on exam (eg, redness, warmth, swelling, bone exposed or encountered when probing the wound, worsening breakdown or smell)
  - No improvement despite prior treatment and bone or deep soft tissue infection is now suspected
- Neuropathic foot with signs of advanced infection (eg, friable or discolored granulation tissue, foul odor, discharge, or delayed wound healing) [9]

# Inflammation

## *Crystalline Arthropathy* [11,12]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT** (typically a Dual-energy CT).

- For suspected or known crystal deposition arthropathy (eg, gout, calcium pyrophosphate deposition (CPPD)) after initial rheumatological work up (eg, serum uric acid, calcium, phosphorus, magnesium levels, joint aspiration) and initial X-rays, with any ONE of the following:
  - Inconclusive joint aspiration
  - Joint aspiration cannot be performed
  - Extra-articular crystal deposits (eg, in tendons, joint bursa) identified on prior imaging

## *Inflammatory (Autoimmune) Joint Disease* [12–14]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected inflammatory joint disease (eg, rheumatoid arthritis, psoriatic arthritis) with any ONE of the following:
  - Prior indeterminate or abnormal imaging
  - Prior normal imaging with lab test results (eg, rheumatoid factor (RF), CRP, antinuclear antibody (ANA), ESR) that suggest autoimmune disease
- For known inflammatory joint disease (eg, rheumatoid arthritis, psoriatic arthritis), with any ONE of the following:

- Recent indeterminate imaging
- To assess the response to ongoing active medical therapy where prior imaging and/or labs are currently insufficient or have been insufficient in the past
- To help determine the need to change ongoing active medical therapy based on new or worsening signs/symptoms (eg, joint swelling, tenderness, effusion, erythema, warmth, restricted motion, prolonged morning stiffness)

### *Inflammatory Myopathies* *(15,16)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected inflammatory myopathy (eg, polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis) with any ONE of the following:
  - Clinical suspicion based on presenting symptoms (eg, symmetric extremity weakness)
  - Clinical suspicion based on lab test results (eg, muscle enzyme testing)
  - Clinical suspicion based on prior electromyogram (EMG) results
  - Biopsy planning

    **NOTE:** Typically, one study is indicated; requests for additional sites are considered on a case-by-case basis.
- For known inflammatory myopathy (eg, polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis) with any ONE of the following:
  - Prior indeterminate imaging
  - To assess the response to ongoing active medical therapy in which prior imaging and/or labs are or have been insufficient
  - To help determine the need to continue or change ongoing active medical therapy in which prior imaging and/or labs are or have been insufficient

## Joint Prosthesis/Replacement (17,18)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity MRI** or Lower Extremity CT.

- Suspected joint prosthesis complication (eg, prosthesis loosening, dysfunction, pseudotumor formation, or osteolysis), after initial X-rays

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI** (may be referred to as Metal Artifact Reduction Sequence (MARS)). Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected metallosis (ie, increased serum levels of metal ions) with painful metal-on-

metal hip replacement or trunnionosis (mechanically assisted crevice corrosion (MACC)) [19] after initial X-rays, and any ONE of the following:

- Significantly elevated Cobalt levels (≥ 1.5 micrograms/liter (ppb)) [20]
- Significantly elevated Chromium levels (≥ 2.0 micrograms/liter (ppb)) [21]
- Indeterminate or abnormal joint aspiration (eg, findings of metallic debris and absence of infection)
- When the study is ordered by an orthopedic surgeon

# Loose Bodies or Synovial Chondromatosis [22,23]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Joint pain or mechanical symptoms suspected to be the result of loose bodies and/or chondromatosis after prior indeterminate or abnormal imaging

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI.** Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed, or when requested to evaluate mass calcification or bone involvement.

- Superficial lower extremity mass after non-diagnostic ultrasound [24]
- Deep lower extremity mass after non-diagnostic X-ray [24]

## *Known Malignancy [25,26]*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI** or **Lower Extremity CT.**

- For initial staging of a biopsy-proven primary extremity tumor
- Newly diagnosed malignancy with physical exam and/or prior imaging suggestive of nodal disease at any of the time points detailed above
- Newly diagnosed malignancy with concern for suspected lower extremity metastatic disease (includes bone metastases) after initial imaging (typically X-ray or bone scan) has been performed

### Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. 'Active treatment' includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), chimeric antigen receptor (CAR) T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: during active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg, chemotherapy, targeted therapy, or immunotherapy) is typically every 2-3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI** or **Lower Extremity CT.**

- For restaging of a primary lower extremity tumor at any of the time points detailed above
- For any malignancy with physical exam and/or prior imaging suggestive of nodal disease at any of the time points detailed above
- For any malignancy with concern for lower extremity metastatic disease (including bone metastases) at any of the time points detailed above after initial imaging (typically X-ray or bone scan) has been performed

### Surveillance

Refer to the **Cancer Surveillance Table** for specific indications.

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at the completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

## Osteochondral Lesions [5,6,27–29]

### *Defects, Fractures, Osteochondritis Dissecans*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of osteochondral lesion with prior X-ray that is indeterminate or

abnormal, based on any ONE of the following:

- Mechanism of injury (eg, prior twisting type joint injury, repeated joint microtrauma)
- Physical findings (eg, focal pain, decreased range of motion, or joint clicking/catching)

## Osteonecrosis [30]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- To further characterize a prior abnormal X-ray suggesting osteonecrosis
- Symptomatic and high-risk patients (eg, glucocorticosteroid use, renal transplant, glycogen storage disease, alcohol abuse, sickle cell anemia) after initial X-ray
- Known osteonecrosis of the hip (eg, avascular necrosis, Legg-Calve-Perthes Disease) to evaluate the contralateral joint after initial X-ray of the unaffected joint

## Other Structural Abnormalities

**NOTE**: See **Suspected Malignancy** for superficial and deep extremity masses

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected Baker's cyst after non-diagnostic ultrasound [31,32]
- Known Baker's cyst, for preoperative planning [31,32]

# Pain

**NOTE**: Prior completed X-ray showing no clear etiology of joint/extremity pain must precede Lower Extremity CT/MRI evaluation unless otherwise indicated. See **Special Notes** regarding CT Arthrogram.

### *Lower Extremity Pain [33,34]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

In the absence of a positive **joint-specific orthopedic sign** AND prior X-ray showing no clear etiology of the pain, advanced imaging is indicated with any ONE of the following:

- Persistent joint or musculotendinous lower extremity pain unresponsive to **Active Conservative Therapy (ACT)** which includes physical therapy, chiropractic treatments, and/or physician-supervised **Home Exercise Program (HEP)** of at least 4 weeks duration within the last 6 months
- With progression or worsening of symptoms during the course of ACT

- Pediatric patient that is either < 12 years old OR cannot comply with the prescribed therapy

**NOTE:** For Bilateral Hip CT/MRI requests: When the patient meets hip CT/MRI criteria for both right and left hip pain (X-ray completed and persistent pain unresponsive to active conservative therapy) without a positive orthopedic sign, then Pelvis CT/MRI (see Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging) is the indicated study.

## *Lower Extremity Orthopedic Signs*

**NOTE**: With a positive orthopedic sign from the list below, an initial X-ray is always preferred; however, it is not required unless otherwise specified.

Advanced imaging is indicated for any orthopedic exam test that clearly suggests joint instability, including, but not limited to, any positive orthopedic sign demonstrated by a positive result for any ONE of the following tests listed below:

### Ankle [5,29,35–37]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests:

| Suspected Injury | Test Name | Description |
|---|---|---|
| High Ankle | Anterior drawer test | Anterior translation of 1 cm or more of the foot while stabilizing the tibia compared to the healthy contralateral ankle |
| | Cotton Test | Translation of 3-5 mm and/or a palpable click with lateral translation of the tibia while stabilizing the foot |
| | Dorsiflexion external rotation stress test | Pain with external rotation stress with the foot in maximal dorsiflexion |
| | Posterior drawer test | Excessive posterior translation of the foot while stabilizing the tibia compared to the healthy contralateral ankle |
| | Squeeze Test | Pain with compression of the proximal fibula against the tibia |
| Achilles Tendon [38] | Palpable partial/complete tendon defect | Direct palpation of an Achilles tendon injury |
| | Thompson Test | Absence of plantar flexion of the foot with squeezing of the calf |

- Positive ankle stress X-rays (a specialized X-ray study that assesses the integrity of the ankle's ligaments and joints)

**Knee** [6,31]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests:

| Suspected Injury | Test Name | Description |
|---|---|---|
| Anterior cruciate ligament (ACL) [39] | Anterior drawer test | Increased anterior translation of the tibia with the foot stabilized and the knee flexed to 90 degrees |
| | Lachman's Test | Increased anterior translation of the tibia with the thigh stabilized and the knee flexed to 20-30 degrees |
| | Pivot shift test | Anterior tibial subluxation with internal rotation and valgus stress to the knee |
| Meniscus [40] | Apley's test | Pain/grinding during axial compression and rotation of the knee |
| | McMurray's Compression Test | Pain/clicking in the knee with internal and external rotation with extension |
| | Thessaly Test | Pain/clicking in the knee with internal and/or external rotation while standing only on that leg |
| Posterior cruciate ligament (PCL) [41] | Posterior Drawer Test | Increased posterior translation of the tibia with the foot stabilized and the knee flexed to 90 degrees |
| | Posterior tibial sag sign (Godfrey test or step-off test) | The tibia sags posteriorly relative to the femur when the knee is flexed compared to the other/contralateral knee |
| Medial collateral ligament (MCL) [42] | Positive valgus stress testing/laxity | Pain or laxity in the knee with medially directed (valgus) pressure |
| Lateral collateral ligament (LCL) [43] | Positive varus stress testing/laxity | Pain or laxity in the knee with laterally directed (varus) pressure |

| Suspected Injury | Test Name | Description |
|---|---|---|
| Patella dislocation [44] | Patellofemoral apprehension test | Pain with lateral pressure on the patella with contraction of the quadriceps and the knee flexed to 30 degrees |

- Suspected ACL rupture: acute knee injury with physical exam limited by pain and swelling after initial X-ray that does not show a clear etiology, with any ONE of the following [45]:
  - Extreme mechanism of injury (eg, twisting, blunt force)
  - Extreme pain or very swollen joint
  - Inability to stand (bear full weight)
  - Audible pop at time of injury
  - Large knee effusion on recent X-ray
- Acute mechanical locking of the knee with inability to fully extend the knee (not due to pain or guarding) [46]
- Suspected acute or recurrent patellar dislocation with X-ray findings compatible with a dislocation (eg, lipohemarthrosis, osteochondral fracture, patella alta, trochlear dysplasia) [47,48]

**Hip** [27]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests [49]:

| Suspected Injury | Test Name | Description |
|---|---|---|
| Femoroacetabular impingement (FAI) and/or labral tear | Anterior impingement sign / Flexion, Adduction, and Internal Rotation (FADIR) test | Hip or groin pain with hip flexion, adduction, and internal rotation |
| | Posterior impingement sign | Pain with hip extension and external rotation |
| Suspected Slipped Capital Femoral Epiphysis (SCFE) [50] | Drehmann sign | The hip remains externally rotated when flexed to 90 degrees and there is pain or inability to internally rotate the hip |

- Suspected Femoroacetabular impingement (FAI) (ie, abnormal bone structure in hip joint causing chronic pain) OR suspected labral tear (ie, specific injury to the cartilage rim

(labrum) of the hip socket) with any ONE of the following [51–53]:

- Symptoms of hip clicking, locking, catching, giving way or instability with a clinical suspicion of FAI/labral tear
- X-ray findings suggestive of FAI/labral tear (eg, cross over sign, pistol grip deformity, alpha angle over 50 degrees)
- Need to determine candidacy for hip preservation surgery for known FAI

**NOTE:** For Bilateral Hip CT/MRI requests: When the patient meets the criteria above for a suspected labral tear with a positive orthopedic sign, then bilateral hip CTs/MRIs are the indicated studies. When Bilateral hip CT/MR arthrograms are requested and otherwise meet guidelines, bilateral hip CTs/MRIs are the preferred studies.

## Painful Acquired or Congenital Flatfoot Deformity [29,54,55]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT** or Lower Extremity MRI.

- Evaluation of painful acquired flatfoot deformity (pes planus) or suspicion of congenital flatfoot deformity (eg, tarsal coalition) with ALL of the following:
  - After prior X-ray with no clear etiology for pain OR patient age ≤ 18 years
  - Failed prior 4-week trial of inactive conservative therapy including at least TWO of the following (active conservative therapy is NOT required):
    - Activity modification
    - Rest, ice, and/or heat
    - Splinting or orthotics
    - Pharmacotherapy (eg, nonsteroidal anti-inflammatory drugs [NSAIDs], steroids)

## Pediatric Specific Indications (≤ 18 Years Old)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CT**. Lower Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Osteoid osteoma, after prior X-ray is indeterminate or abnormal [56]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected Slipped Capital Femoral Epiphysis (SCFE) with negative or indeterminate frog leg lateral and AP X-rays of the hips, with any ONE of the following [50]:
  - Drehmann sign
  - Limited internal rotation of the hip
- Imaging of a single joint in suspected Chronic Recurrent Multifocal Osteomyelitis after

initial X-ray and laboratory evaluation (eg, CRP, ESR) [57,58]

**NOTE**: Whole Body MRI (See Evolent Clinical Guideline 2076 for Whole Body MRI and CT) is preferred when imaging of multiple joints is requested.

- Acute limp in a child ≤ 5 years old [59] with any ONE of the following:
  - Concern for infection not localized to the hip (initial imaging not required)
  - Concern for infection localized to the hip (consider initial imaging with ultrasound)

  **NOTE:** Requests for persistent pain with negative X-ray and no concern for infection can be considered on a case-by-case basis.

## Peripheral Nerve Entrapment [60,61]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected peripheral nerve entrapment (eg, Morton's neuroma, tarsal tunnel) with any ONE of the following:
  - Abnormal EMG or nerve conduction study
  - Abnormal X-ray or ultrasound
  - Failed prior 4-week inactive conservative treatment (active treatment with physical therapy is not required) including at least TWO of the following:
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Pharmacotherapy (eg, NSAIDs, steroids)

## Tendon Rupture

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of a specific tendon rupture, after prior X-ray, with mechanism of injury and/or physical findings consistent with possible tendon rupture [38,62,63]

## Vascular Disease

### *Aneurysm*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA** or Lower Extremity MRA.

- Clinical suspicion of aneurysm, with prior abnormal or indeterminate imaging [64]

## *Hemorrhage*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA**. Lower Extremity MRA is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical findings (eg, bruit, hemorrhage, hematoma, pulselessness) and/or prior imaging suggestive of lower extremity vascular injury [65,66]

## *Malformation* [67,68]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity MRA** and/or **Lower Extremity MRI**. Lower Extremity CTA and/or Lower Extremity CT is appropriate only when the preferred study is contraindicated, cannot be performed, or based on surgeon preference.

- For suspected lower extremity vascular malformation with prior indeterminate or abnormal ultrasound
- For known lower extremity vascular malformation with any ONE of the following:
  - Advanced imaging results will potentially change management
  - Preoperative planning
  - Follow-up after prior surgical treatment and/or embolization

## *Systemic Vascular Disease*

### Arterial Thromboembolism

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA**. Lower Extremity MRA is appropriate only when the preferred study is contraindicated or cannot be performed. Echocardiogram and advanced vascular imaging of the chest, abdomen, and/or pelvis may also be indicated to identify the source of the emboli.

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [69–71]

### Peripheral Vascular Disease

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lower Extremity CTA**. When both abdominal and lower extremity are needed, see Evolent Clinical Guideline 2069 for Abdomen and Pelvis Imaging. When CTA is contraindicated or cannot be performed, the indicated study is Lower Extremity MRA. When abdominal imaging is requested in addition to lower extremity MRA, Abdomen MRA is additionally indicated. A separate Pelvis MRA authorization is not required (in addition to the Abdomen MRA). Only one Lower Extremity MRA authorization is required (not two).

- Suspected or known atherosclerotic peripheral arterial disease when any ONE of the following non-invasive studies are abnormal or indeterminate [72–74]:
  - Ankle-brachial index (ABI) (< 0.9 is the cutoff for diagnosis of peripheral arterial disease and > 1.4 is considered inconclusive)

- Toe brachial index (< 0.7 is the cutoff for diagnosis of peripheral arterial disease)
- Segmental pressure test (a pressure gradient ≥ 20 mmHg is considered abnormal)
- Doppler ultrasound
- Treadmill test
- 6-minute walking test

- Suspected or known acute critical limb ischemia with any ONE of the following clinical signs of peripheral vascular disease [70]:
  - Ischemic rest pain
  - Tissue loss
  - Gangrene

  **NOTE**: Prior ultrasound is not needed
- Known predisposing conditions (eg, Buerger disease, cystic adventitial disease, arterial endofibrosis, fibromuscular dysplasia, segmental arterial mediolysis and/or genetic conditions such as Marfan syndrome, Loeys-Dietz syndrome, or vascular Ehler-Danlos Syndrome) and any ONE of the following [75]:
  - Prior imaging suggestive of non-atherosclerotic peripheral vascular disease of the lower extremity
  - Signs/symptoms of lower extremity vascular disease (eg, claudication, weak pulses)
- Lower extremity ulcers on exam from suspected or known peripheral vascular disease, with prior abnormal or indeterminate ultrasound [72,76]
- After prior stenting or surgery (arterial and/or venous) with any ONE of the following [69,77]:
  - Recurrent symptoms
  - Signs of recurrent disease on examination
  - Prior abnormal or indeterminate non-invasive testing or imaging (eg, ankle/brachial index, ultrasound)

### Vasculitis

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA** or **Lower Extremity MRA**.

- Clinical suspicion of vasculitis with prior abnormal or indeterminate imaging [75,78]

## *Other*

### Deep Venous Thrombosis (DVT)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA**. Lower Extremity MRA is appropriate only when the preferred study is contraindicated, cannot be performed, or when ordered for preprocedural planning.

- For suspected or known lower extremity DVT with ALL of the following [79,80]:
  - Prior ultrasound is abnormal or indeterminate
  - Advanced imaging study results will change management

### Hemodialysis Graft Dysfunction

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA** or Lower Extremity MRA.

- If prior ultrasound was not sufficient for required treatment decisions [81]

### Popliteal Artery Entrapment Syndrome

IMAGING MODALITY: When the following criteria is met, the indicated study is **Lower Extremity CTA** or Lower Extremity MRA.

- Suspected or known popliteal artery entrapment syndrome with ALL of the following [82]:
  - Prior ultrasound is abnormal or indeterminate
  - Advanced imaging study results will potentially change management

### Tumor Evaluation

IMAGING MODALITY: When the following criteria is met, the indicated studies are **Lower Extremity CTA** or **Lower Extremity MRA** (may be in combination with CT or MRI of tumor).

- When needed for clarification of vascular involvement from tumor after prior imaging

## Preoperative or Postoperative Assessment

IMAGING MODALITY**:** When any ONE of the following criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications
    - A clinical reason is provided how imaging may change management

NOTE**:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the

relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Findings

Further evaluation of indeterminate findings on prior imaging (unless follow-up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

## Genetic Conditions

**NOTES:** When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Lower Extremity MRA** or **Lower Extremity CTA**.

- Vascular Ehlers-Danlos Syndrome (vEDS) [83]:
  - With inconclusive ultrasound or ultrasound suggestive of vascular pathology OR
  - Acute extremity pain and concern for dissection/rupture

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Lower Extremity MRI**. Lower Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Gaucher Disease [84]:
  - Prior to treatment or dose change OR
  - For evaluation of bone pain

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [85–87]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)

- Annually
- With signs or symptoms concerning for growth or change

- Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

# Combination Studies

## *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

## *Abdomen/Lower Extremity MRA*

- For suspected or known peripheral vascular disease, please see section for **Peripheral Vascular Disease**.

## *Chest/Abdomen/Lower Extremity MRA*

**NOTE:** MRA is indicated when CTA is contraindicated or cannot be performed.

- Clinical concern for lower extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting lower extremity arterial thromboembolism [69–71]

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 72195 | Magnetic resonance (eg, proton) imaging, pelvis; without contrast material(s) |
| 72196 | Magnetic resonance (eg, proton) imaging, pelvis; with contrast material(s) |
| 72197 | Magnetic resonance (eg, proton) imaging, pelvis; without contrast material(s), followed by contrast material(s) and further sequences |
| 73700 | Computed tomography, lower extremity; without contrast material |
| 73701 | Computed tomography, lower extremity; with contrast material(s) |
| 73702 | Computed tomography, lower extremity; without contrast material, followed by contrast material(s) and further sections |

| Code | Description |
|---|---|
| 73706 | Computed tomographic angiography, lower extremity, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 73718 | Magnetic resonance (eg, proton) imaging, lower extremity other than joint; without contrast material(s) |
| 73719 | Magnetic resonance (eg, proton) imaging, lower extremity other than joint; with contrast material(s) |
| 73720 | Magnetic resonance (eg, proton) imaging, lower extremity other than joint; without contrast material(s), followed by contrast material(s) and further sequences |
| 73721 | Magnetic resonance (eg, proton) imaging, any joint of lower extremity; without contrast material |
| 73722 | Magnetic resonance (eg, proton) imaging, any joint of lower extremity; with contrast material(s) |
| 73723 | Magnetic resonance (eg, proton) imaging, any joint of lower extremity; without contrast material(s), followed by contrast material(s) and further sequences |
| 73725 | Magnetic resonance angiography, lower extremity, with or without contrast material(s) |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Conservative Therapy

Conservative therapy should include a multimodality approach consisting of a combination of active and inactive components. Completion of at least one active modality for 4 weeks in the past 6 months is required:

**Active Modalities**

- Physical therapy
- Physician-supervised **Home Exercise Program (HEP)**
- Chiropractic care

**Inactive Modalities**

- Medications (eg, NSAIDs, steroids, analgesics)
- Injections
- Medical Devices (eg, transcutaneous electrical nerve stimulation [TENS] unit, bracing)

## Home Exercise Program (HEP)

The following two elements are required for HEP to meet the criteria for completion of a trial of ACT:

- Information is provided on specific exercise prescription/plan AND
- Follow-up with patient regarding completion of HEP over at least a 4-week period OR documented inability to complete HEP due to increased pain with inability to physically perform the prescribed exercises.

**NOTE**: Patient inconvenience or noncompliance without explanation does not meet the "inability to complete HEP" criterium

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester).
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds weight limit/dimensions of MRI machine.

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** (88,89) | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** (90) | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** (91) | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** (92) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** (93) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** (94) | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br><br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br><br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** (95,96) | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>  ○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (97) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (98) | Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 2 years then<br>• Every 6-12 months for up to 5 years |
| **Bladder Cancer** (99) | **Non-Muscle Invasive (NMIBC)**<br>• Low-intermediate Risk NMIBC treated without cystectomy<br>  ○ Routine surveillance imaging is not indicated<br>• High Risk* NMIBC treated without cystectomy<br>  ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>  ■ Once 12 months after diagnosis then<br>  ■ Every 1-2 years 9 additional years<br>  ■ No routine surveillance imaging after 10 years<br>• NMICBC after cystectomy<br>  ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>  ■ 3 months after surgery then<br>  ■ 1 year after surgery then<br>  ■ Annually for 4 additional years<br>  ■ No routine surveillance imaging after 5 years<br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br><br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then<br>■ Annually for 3 additional years<br><br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** (100) | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors<br>○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone**<br>● CT or MRI of primary tumor site as clinically indicated<br>● Chest CT<br>○ Every 6-12 months for 4 years then<br>○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 4 months for year 3 then<br>○ Every 6 months year 4 and 5 then<br>○ Annually after year 5, as clinically indicated |
| **Breast** (101) | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>● Stage I-III disease:<br>○ Routine surveillance imaging not indicated (followed with mammography)<br>**NOTE: See Restaging section for recurrence**<br>● Stage IV disease not currently on therapy |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Chest CT and Abdomen and Pelvis CT<br>■ Every 3-6 months |
| **Castleman's Disease** [102] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>● Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** [103] | **Stage I disease treated with non-fertility sparing**<br>● Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>● Pelvis MRI<br>○ Once 6 months after completion of treatment then<br>○ Annually for 2-3 additional years<br>**Stage II-IV**<br>● Pelvis MRI<br>○ Once 3-6 months after completion of treatment<br>○ Routine surveillance imaging not indicated thereafter<br>● Chest CT and Abdomen and Pelvis CT<br>○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>● Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** [104] | Routine surveillance imaging is not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Chronic Myeloid Leukemia (CML)** [105] | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** [106–110] | **Choroid plexus tumors and carcinoma**<br>● Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>● Malignant choroid plexus carcinoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for years 3-5 then<br>■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>● Circumscribed glioma (not otherwise listed) post gross total resection<br>○ Brain MRI<br>■ Every 3-6 months for 5 years then<br>■ Annually after 5 years<br>● Oligodendroglioma and astrocytoma grade 2<br>○ After chemotherapy and radiation<br>■ Brain MRI: Every 6-9 months<br>○ After chemotherapy OR radiation<br>■ Brain MRI: Every 3-4 months<br>○ After surgery only<br>■ Brain MRI: Every 3-4 months<br>NOTE: Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then<br>□ As clinically indicated after 5 years<br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>NOTE: High-grade glioma includes ALL histologies if grade 3 and 4<br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br>**Medulloblastoma (adult)** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • MRI Brain<br>  ○ Every 2-3 months for 2 years then<br>  ○ Every 6-12 months for 10 years then<br>  ○ As clinically indicated<br>• MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br><br>**Primary CNS Lymphoma**<br>• MRI Brain +/- MRI C/T/L Spine<br>  ○ Every 3 months for 2 years, then<br>  ○ Every 6 months for 3 years, then<br>  ○ Annually, indefinitely<br><br>**Primary Spinal Cord Tumors**<br>• Low grade tumors (grade 1-2)<br>  ○ MRI C/T/L Spine +/- MRI Brain<br>  ○ Every 3-6 months for 5 years then<br>  ○ Every 6-12 months indefinitely<br>• High grade tumors (grade 3-4)<br>  ○ MRI C/T/L Spine +/- MRI Brain<br>  ○ Once 2-6 weeks after treatment then<br>  ○ Every 2-4 months for 3 years then<br>  ○ Every 3-6 months for 2 years, then<br>  ○ Every 6-12 months indefinitely<br>NOTE: Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br><br>**Meningiomas**<br>• Grade 1 and 2 or unresected tumors:<br>  ○ MRI Brain (include spine if spinal involvement) |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>NOTE: SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** (111) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** (112) | Routine surveillance imaging is not indicated |
| **Dermatofibrosarcoma Protuberans (DFSP)** (113) | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | recurrence |
| **Esophageal and Esophagogastric Junction Cancers** (114) | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |
| **Gastric** (115) | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |
| **Gastrointestinal Stroma Tumor (GIST)** (116) | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>NOTE: More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [117] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br><br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [118] | Routine surveillance imaging is not indicated |
| **Head and Neck** [119] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change).<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** [120] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |
| **Histiocytic Neoplasms** [121] | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br><br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br><br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** (122,123) | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** (124) | Routine surveillance imaging is not indicated |
| **Kidney Cancer** (125) | See **Active Surveillance** section for indications related to that management strategy.<br><br>**After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after 5 years<br><br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Annually during year 5 then<br>○ As clinically indicated after year 5<br><br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br><br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br><br>**Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Baseline within 3-6 months then<br>○ Every 3-6 months for 3 years then<br>○ Annually for 2 additional years<br>○ As clinically indicated beyond 5 years<br><br>**Stage IV, relapsed, or surgically unresectable disease***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 1.5-4 months<br>● Brain MRI (preferred) or brain CT<br>○ Annually, or as clinically indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Entire spine MRI<br>  ○ As clinically indicated<br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (126) | **Stage 0/in situ, Stage I, Stage IIA**<br>• No routine imaging needed<br>**Stage IIB-IV**<br>• Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>  ○ Every 3-12 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years<br>• Brain MRI if stage IIIB or higher<br>  ○ Every 3-12 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years<br>NOTE: More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |
| **Melanoma: Uveal** (127) | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>• Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>• Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Every 6-12 months for 10 years then<br>  ○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>• Chest CT and Abdomen +/- Pelvis MRI/CT<br>  ○ Every 3-6 months for 5 years then<br>  ○ Every 6-12 months for years 6-10 then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ As clinically indicated after year 10<br>NOTE: Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [128] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** [129] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** [130] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Multiple Myeloma** [131] | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually for 5 years<br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** [91] | **Well-differentiated NET, Grade 1-2**<br>● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br><br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br><br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |
| **Neuroblastoma** (132) | **All risk groups**<br>● CT or MRI of primary site<br>○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br><br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** (133) | **Stage I-II treated with surgery +/- chemotherapy** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • CT Chest<br>  ○ Every 6 months for 2-3 years then<br>• CT Chest or Low Dose CT (LDCT)<br>  ○ Annually<br><br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>• CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>  ○ Every 3-6 months for 3 years then<br>• CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>  ○ Annually<br>• Brain MRI (regardless of stage)<br>  ○ As clinically indicated |
| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** (134) | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer**<br>• Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 2 years then<br>• Every 6-12 months for 3 additional years then<br>• As clinically indicated after 5 years<br>NOTE: These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br><br>**Benign Teratoma**<br>• Abdomen and Pelvis CT/MRI<br>  ○ Every 3-6 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years then<br>  ○ As clinically indicated after 5 years<br><br>**Small cell carcinoma of ovary** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>  ○ Every 3-6 months for 2 years then<br>  ○ Annually |
| **Pancreatic Adenocarcinoma** [135] | Chest CT and Abdomen and Pelvis CT<br>• Every 3-6 months for 3 years then<br>• Every 6-12 months for 2 years then<br>• As clinically indicated after 5 years |
| **Penile Cancer** [136] | **pN0 and pN1**<br>• Abdomen and Pelvis CT<br>  ○ Every 6 months for 2 years then<br>  ○ Annually during years 3-4<br>**pN2 and pN3**<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Every 3 months for 1 then<br>  ○ Every 6 months during years 2-4 |
| **Prostate Cancer** [137] | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** [138] | **Stage I**<br>• Routine surveillance imaging is not indicated<br>**Stage II-III**<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Every 6-12 months for 5 years<br>**Stage IV**<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 3 years<br><br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br><br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** (139–141) | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** (142) | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |
| **Small Cell Lung Cancer (SCLC)** (143) | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (eg, neck, spine)<br><br>NOTE: Brain CT is indicated for patients who have a contraindication to MRI.<br><br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** (144,145) | **<u>General surveillance guidelines for other sarcomas, based on site:</u>**<br><br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br><br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**<u>Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)</u>**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT<br>● **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>● **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>● **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>● **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>● **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**<u>Specific sarcoma surveillance guidelines (above general guidance does not apply):</u>**<br>**Desmoid tumor (aggressive fibromatosis)**<br>● Site-specific MRI (preferred) or CT |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 3-6 months for 3 years then<br>○ Every 6-12 months<br><br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br><br>**Borderline Phyllodes Tumor**<br>● Chest or Breast MRI<br>○ Every 6 months for 2 years then<br>○ Annually for 3 additional years<br><br>**Malignant Phyllodes Tumor**<br>● Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** [146] | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** [147]<br><br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** [148] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br><br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br><br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3<br><br>**Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** (148) | See **Active Surveillance** section for indications related to that management strategy.<br><br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (149) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br>**Thymic Carcinoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** (150) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>● Neck CT/MRI +/- Chest CT<br>○ Once 6-12 post thyroidectomy<br>○ Routine surveillance imaging thereafter not indicated<br>**Medullary Carcinoma**<br>● Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>○ Once 2-3 months after surgery if baseline |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | calcitonin is ≥ 150 pg/mL<br>○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br>**Anaplastic Carcinoma**<br>● Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (151) | **Endometrial Cancer treated with non-fertility sparing**<br>● Routine surveillance imaging thereafter not indicated<br>**Endometrial Cancer treated with fertility sparing**<br>● Pelvis MRI<br>○ Once 6-9 months after treatment<br>○ Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence.<br>● **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (152) | Chest CT and Abdomen and Pelvis CT/MRI<br>● End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>● Routine surveillance imaging thereafter not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** [153] | Pelvis MRI (Indicated in addition to PET/CT)<br>● End of treatment restaging once 3-6 months after completion of treatment<br>● Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** [154] | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** [155] | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>● Every 3 months for 2 years<br>● Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate 3D renderings that display the nuances of tissue beyond the capability of an X-ray, CT and MRI have become integral diagnostic tools.

CT is based on the differential absorption of X-rays by various tissues and uses X-rays to create cross-sectional images of the body. The X-ray source and detectors rotate around the patient, and a computer reconstructs the data into detailed images. [156] It is well suited for lower extremity imaging in the setting of trauma and acute conditions, providing rapid, detailed assessment of osseus structures and the ability to evaluate complex injuries for surgical planning. [157]

MRI is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. It uses strong magnetic fields and radiofrequency pulses to manipulate hydrogen atoms in the body. The resulting signals are detected and converted into images by a computer. [156] MRI provides superior soft-tissue and bone marrow contrast, making it particularly useful for evaluating joints, ligaments, tendons,

muscles, and tumor extent in the lower extremities, and does not use ionizing radiation, making it safer for repeated imaging and for children and pregnant patients. [157]

**Choosing Between CT and MRI**

Because CT provides superior bony detail and fracture characterization, it is preferred for [157]:

- Complex or intra-articular fractures
- Fracture evaluation and characterization
- Preoperative osseous surgical planning
- Postoperative assessment of bone or hardware complications
- Bone integrity, cortical involvement, and mineralization
- Evaluation limited by MRI contraindication or hardware artifact

Because MRI provides superior marrow and soft-tissue contrast, it is preferred for [157]:

- Occult fractures and stress injuries
- Ligamentous and tendon injuries
- Muscle and soft-tissue injury
- Bone marrow abnormalities
- Tumor characterization and local extent
- Classification of vascular involvement by tumor (non-procedural)
- Postoperative soft-tissue complications

# ANALYSIS OF EVIDENCE

For patients with lower extremity joint pain or instability identified on clinical examination, MRI serves as the primary advanced imaging modality due to its excellent soft-tissue contrast and ability to evaluate intra-articular and periarticular structures. [6,27] It enables detailed assessment of osseous and soft-tissue structures, including ligamentous injuries of the knee (eg, ACL and collateral ligaments), meniscal pathology, tendon abnormalities such as the Achilles tendon, and intra-articular lesions such as FAI-related and labral pathology. [6,27,29] CT is primarily used for evaluation of osseous structures, particularly for fracture characterization and preoperative assessment of bony anatomy but is limited in soft-tissue evaluation due to inferior contrast resolution. [6,27] CT arthrography may aid in the evaluation of intra-articular pathology such as labral or cartilage abnormalities, although its role is secondary to MRI given the latter's superior soft-tissue characterization. [27]

In the setting of suspected lower extremity fractures, MRI is the preferred modality for detection of radiographically occult or stress-related fractures—particularly in the hip/femur—given its high

sensitivity for fracture lines and marrow edema. [2,3] CT complements MRI with greater specificity for confirming fractures, evaluating cortical detail, and defining fracture extent, particularly for surgical planning or when MRI is equivocal. [2,3] In the foot, specifically suspected Lisfranc injuries, CT and MRI are complementary, with CT demonstrating associated osseous injury and fracture extent, while MRI provides sensitive assessment of the Lisfranc ligament complex and associated ligamentous or occult osseous injury when radiographs are inconclusive. [4]

For evaluation of prosthesis-related complications, MRI and CT function as complementary modalities. MRI, particularly with metal artifact–reduction techniques, enables detailed assessment of soft tissue abnormalities, including synovitis, effusion, and adverse local tissue reactions. [17,18] CT provides detailed evaluation of hardware position, alignment, and surrounding osseous structures, and is useful for assessing osteolysis, fracture extent, and component stability, particularly for surgical planning. [17,18]

In osteonecrosis and osteochondral lesions, MRI is favored due to its high sensitivity for early disease and superior soft tissue and cartilage characterization, with sensitivity and specificity approaching (or nearing) 100% for osteonecrosis. [29,30] It enables detailed assessment of lesion size, location, bone marrow edema, cartilage integrity, and imaging features of lesion stability. [28,30] CT provides complementary value, offering superior delineation of osseous detail—particularly subchondral collapse, lesion size and location, and osseous healing—and plays an important role in staging and surgical planning, though it remains limited in cartilage evaluation without arthrography. [28,30]

In suspected infection, MRI is the preferred modality owing to its high sensitivity for bone marrow and soft tissue abnormalities and its ability to delineate abscesses, fistulas, and joint involvement. [8] CT serves an adjunctive role, aiding in the identification of osseous destruction, sequestra, soft tissue gas, and procedural planning. [8] For lower extremity ulcers, particularly diabetic or neuropathic foot, MRI is also preferred, to evaluate for underlying osteomyelitis and define the extent of disease for treatment planning. [10]

For suspected soft tissue masses or malignancy, MRI is preferred given its superior soft tissue contrast, multiplanar capability, and ability to provide intrinsic tumor characterization and local staging, including assessment of neurovascular involvement and differentiation of benign from malignant lesions. [24] CT is complementary, particularly for evaluating mineralization, osseous involvement, and complex anatomy, and may provide comparable staging when MRI is contraindicated. [24]

In inflammatory conditions, imaging selection varies by disease process: MRI is generally favored for inflammatory joint diseases and inflammatory myopathies, whereas CT (particularly dual-energy CT) is preferred for crystalline arthropathies. [11,12,15] MRI provides superior evaluation of synovitis, bone marrow edema, and muscle inflammation, detecting early structural changes not visible on radiographs. [12,15] In contrast, CT enables direct visualization and characterization of crystal deposition and is more sensitive for detecting osseous erosions and mineralization, with MRI having more limited diagnostic utility in crystalline disease. [11]

For suspected retained foreign bodies, CT is generally preferred for precise localization and detection across a wide range of materials, while MRI has a more limited, adjunct role, particularly for identifying nonmetallic objects or associated soft tissue complications. [1] Modality selection depends largely on the composition of the foreign body, as CT provides more reliable detection and characterization, whereas MRI may be limited by artifact or safety concerns with metallic objects. [1]

Conversely, in loose bodies and synovial chondromatosis, CT excels in demonstrating calcified or ossified intra-articular bodies and associated osseous changes, while MRI is most useful for detecting nonmineralized cartilaginous nodules and early disease when radiographs are inconclusive. [158]

**CTA and MRA** [65,67,70]

In the evaluation of lower extremity vascular disease, CTA and MRA are complementary noninvasive modalities, with selection guided by clinical context and imaging goals. CTA offers rapid acquisition and high spatial resolution, making it particularly valuable for detailed evaluation of vessel patency, stenosis, occlusion, aneurysm, and vascular injury, and has become a widely available diagnostic tool with high accuracy, demonstrating sensitivity and specificity for vascular lesions in the mid-90% range. It is particularly useful in acute settings (eg, trauma, hemorrhage, or acute limb ischemia) where prompt diagnosis, localization of arterial injury (eg, thrombosis, dissection, pseudoaneurysm, or extravasation), and preprocedural planning are critical. CTA can also delineate the extent of disease and identify complications contributing to ischemia (eg, infectious pseudoaneurysms, vascular compromise from soft tissue infection, and embolic sources). This rapid, high-resolution assessment is especially important in conditions where timely detection of dissection, aneurysm, or rupture is essential.

MRA, in contrast, offers high-quality vascular imaging without ionizing radiation and provides excellent soft-tissue contrast and functional information, making it particularly useful for characterizing vascular pathology and evaluating vessel wall abnormalities or flow dynamics. It is commonly used in the assessment of vascular malformations, where it can accurately define lesion extent, internal morphology, and flow characteristics, and dynamic contrast-enhanced MRA can differentiate lesion types with high diagnostic performance. Compared with CTA, MRA is often preferred for comprehensive characterization and follow-up of vascular malformations due to superior soft-tissue contrast and ability to evaluate inflow and outflow without radiation, whereas CTA is particularly useful for high-flow lesions and for defining feeding arteries, nidus, and draining veins when detailed anatomic mapping is required. Overall, the evidence supports a scenario-based approach in the lower extremities, where CTA is often favored for rapid, high-resolution anatomic assessment (especially in acute or interventional settings) while MRA provides a nonionizing, contrast-sensitive modality for detailed tissue characterization, flow evaluation, and longitudinal disease assessment.

**In Summary**

Imaging modality recommendations across the lower extremities show consistent trends across the literature. MRI is generally preferred for indications requiring detailed evaluation of soft tissue and marrow structures, as well as for detecting infection and radiographically occult fractures, while CT serves a complementary role for high-resolution assessment of osseous anatomy and structural complications. Similarly, vascular imaging follows a scenario-based approach, with CTA favored for rapid, high-resolution anatomic assessment in acute settings and MRA preferred for comprehensive tissue characterization and flow evaluation without radiation. Overall, modality selection is guided by clinical context, with MRI/MRA emphasized for detailed tissue assessment and CT/CTA for precise structural detail.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | ● This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2073 for Lower Extremity Imaging:<br>○ Evolent Clinical Guideline 2032 for Lower Extremity Computed Tomography (CT)<br>○ Evolent Clinical Guideline 2033 for Lower Extremity Computed Tomography Angiography (CTA)<br>○ Evolent Clinical Guideline 2034 for Lower Extremity Magnetic Resonance Angiography (MRA)<br>○ Evolent Clinical Guideline 2035 for Lower Extremity Magnetic Resonance Imaging (MRI)<br>● This guideline also merges procedural codes from these four Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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*we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Campbell EA, Wilbert CD. Foreign Body Imaging. *StatPearls*. Published online July 30, 2023. https://pubmed.ncbi.nlm.nih.gov/29262105/
2. Bartolotta RJ, Ha AS, Bateni CP, et al. ACR Appropriateness Criteria® Acute Hip Pain: 2024 Update. *Journal of the American College of Radiology*. 2025;22(5):S3-S13. doi:10.1016/j.jacr.2025.02.039
3. Morrison WB, Deely D, Fox MG, et al. ACR Appropriateness Criteria® Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S490-S503. doi:10.1016/j.jacr.2024.08.019
4. Gorbachova T, Chang EY, Ha AS, et al. ACR Appropriateness Criteria® Acute Trauma to the Foot. *Journal of the American College of Radiology*. 2020;17(5):S2-S11. doi:10.1016/j.jacr.2020.01.019
5. Smith SE, Chang EY, Ha AS, et al. ACR Appropriateness Criteria® Acute Trauma to the Ankle. *Journal of the American College of Radiology*. 2020;17(11):S355-S366. doi:10.1016/j.jacr.2020.09.014
6. Taljanovic MS, Chang EY, Ha AS, et al. ACR Appropriateness Criteria® Acute Trauma to the Knee. *Journal of the American College of Radiology*. 2020;17(5):S12-S25. doi:10.1016/j.jacr.2020.01.041
7. Thomas JD, Kehoe JL. Bone Nonunion. *StatPearls*. Published online March 6, 2023. https://www.ncbi.nlm.nih.gov/books/NBK554385/
8. Pierce JL, Perry MT, Wessell DE, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot): 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S473-S487. doi:10.1016/j.jacr.2022.09.013
9. Wu YW, Wang CY, Cheng NC, et al. 2024 TSOC/TSPS Joint Consensus: Strategies for Advanced Vascular Wound Management in Arterial and Venous Diseases. *Acta Cardiol Sin*. 2024;40(1):1-44. doi:10.6515/ACS.202401_40(1).20231220A
10. Baker JC, Northrup BE, Ahlawat S, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis of the Foot in Patients With Diabetes Mellitus: 2025 Update. *Journal of the American College of Radiology*. 2025;22(11):S713-S737. doi:10.1016/j.jacr.2025.08.031
11. Fukuda T, Subramanian M, Noda K, et al. The comprehensive role of dual-energy CT in gout as an advanced diagnostic innovation. *Skeletal Radiol*. 2025;54(11):2253-2263. doi:10.1007/s00256-024-04856-4
12. Subhas N, Wu F, Fox MG, et al. ACR Appropriateness Criteria® Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis, Crystalline Arthritis, or Erosive Osteoarthritis: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S20-S32. doi:10.1016/j.jacr.2023.02.020
13. Colebatch AN, Edwards CJ, Østergaard M, et al. EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis*. 2013;72(6):804-814. doi:10.1136/annrheumdis-2012-203158

14. Mohana-Borges AVR, Chung CB. Imaging of Rheumatic Diseases Affecting the Lower Limb. *Radiol Clin North Am*. 2023;61(2):345-360. doi:10.1016/j.rcl.2022.10.007

15. Malartre S, Bachasson D, Mercy G, et al. MRI and muscle imaging for idiopathic inflammatory myopathies. *Brain Pathology*. 2021;31(3):e12954. doi:10.1111/bpa.12954

16. Nagy H, Veerapaneni KD. Myopathy. *StatPearls*. Published online August 14, 2023. https://www.ncbi.nlm.nih.gov/books/NBK562290/

17. Ong N, Zailan I, Tandon A. Imaging update in arthroplasty. *J Clin Orthop Trauma*. 2021;23:101649. doi:10.1016/j.jcot.2021.101649

18. Weissman BN, Palestro CJ, Fox MG, et al. ACR Appropriateness Criteria® Imaging After Total Hip Arthroplasty. *Journal of the American College of Radiology*. 2023;20(11):S413-S432. doi:10.1016/j.jacr.2023.08.015

19. Lee A, Paiement GD, Penenberg BL, Rajaee SS. Metallosis in Total Hip Arthroplasty. *JBJS Rev*. 2023;11(10). doi:10.2106/JBJS.RVW.23.00105

20. Tandon M, Chetla N, Hodges J, et al. Mechanical Considerations and Clinical Implications of Joint Arthroplasty Metallosis. *Cureus*. Published online December 30, 2024. doi:10.7759/cureus.76592

21. Hart AJ, Sabah SA, Bandi AS, et al. Sensitivity and specificity of blood cobalt and chromium metal ions for predicting failure of metal-on-metal hip replacement. *The Journal of Bone and Joint Surgery-British Volume*. 2011;93-B(10):1308-1313. doi:10.1302/0301-620X.93B10.26249

22. Habusta SF, Mabrouk A, Tuck JA. Synovial Chondromatosis. *StatPearls*. Published online April 22, 2023. https://www.ncbi.nlm.nih.gov/books/NBK470463/

23. Deng X, Liu S, Liu H. Synovial chondromatosis: Novel advances in understanding the pathogenesis and in diagnostic strategies (Review). *Mol Med Rep*. 2026;33(1). doi:10.3892/mmr.2025.13743

24. Garner HW, Wessell DE, Lenchik L, et al. ACR Appropriateness Criteria® Soft Tissue Masses: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S234-S245. doi:10.1016/j.jacr.2023.02.009

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27. Jawetz ST, Fox MG, Blankenbaker DG, et al. ACR Appropriateness Criteria® Chronic Hip Pain: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S33-S48. doi:10.1016/j.jacr.2023.02.019

28. Konarski W, Poboży T, Konarska K, Derczyński M, Kotela I. Understanding Osteochondritis Dissecans: A Narrative Review of the Disease Commonly Affecting Children and Adolescents. *Children*. 2024;11(4). doi:10.3390/children11040498

29. Schonberger A, Bartolotta RJ, Ha AS, et al. ACR Appropriateness Criteria® Chronic Ankle Pain: Update 2025. *Journal of the American College of Radiology*. Published online March 2026. doi:10.1016/j.jacr.2026.02.006

30. Ha AS, Chang EY, Bartolotta RJ, et al. ACR Appropriateness Criteria® Osteonecrosis: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S409-S416. doi:10.1016/j.jacr.2022.09.009

31. Fox MG, Chang EY, Amini B, et al. ACR Appropriateness Criteria® Chronic Knee Pain. *Journal of the American College of Radiology*. 2018;15(11):S302-S312. doi:10.1016/j.jacr.2018.09.016

32. Liu K, Li X, Weng Q, Lei G, Jiang T. Diagnostic accuracy of ultrasound for the assessment of Baker's cysts: a meta-analysis. *J Orthop Surg Res*. 2022;17(1). doi:10.1186/s13018-022-03430-9

33. Katz JN, Brophy RH, Chaisson CE, et al. Surgery versus Physical Therapy for a Meniscal Tear and Osteoarthritis. *New England Journal of Medicine*. 2013;368(18):1675-1684. doi:10.1056/NEJMoa1301408

34. Said N, Fox MG, Nacey NC, et al. ACR Appropriateness Criteria® Chronic Foot Pain: Update 2025. *Journal of the American College of Radiology*. Published online April 1, 2026. doi:10.1016/j.jacr.2026.01.012

35. Beynon A, Le May S, Theroux J. Reliability and validity of physical examination tests for the assessment of ankle instability. *Chiropr Man Therap*. 2022;30(1):58. doi:10.1186/s12998-022-00470-0

36. Netterström-Wedin F, Matthews M, Bleakley C. Diagnostic Accuracy of Clinical Tests Assessing Ligamentous Injury of the Talocrural and Subtalar Joints: A Systematic Review With Meta-Analysis. *Sports Health*. 2022;14(3):336-347. doi:10.1177/19417381211029953

37. Park SH, Lee HS, Young KW, Seo SG. Treatment of Acute Achilles Tendon Rupture. *Clin Orthop Surg*. 2020;12(1):1. doi:10.4055/cios.2020.12.1.1

38. Patch DA, Andrews NA, Scheinberg M, et al. Achilles tendon disorders: An overview of diagnosis and conservative treatment. *J Am Acad Physician Assist*. 2023;36(10):1-8. doi:10.1097/01.JAA.0000977720.10055.c4

39. Tanaka S, Inoue Y, Masuda Y, Tian H, Jung H, Tanaka R. Diagnostic Accuracy of Physical Examination Tests for Suspected Acute Anterior Cruciate Ligament Injury: A Systematic Review and Meta-Analysis. *Int J Sports Phys Ther*. 2022;17(5):742-752. doi:10.26603/001c.36434

40. Rinonapoli G, Lucchetta L, Ancillai G, Manfreda F, Ceccarini P, Caraffa A. Clinical reliability of 6 meniscal tests: a diagnostic accuracy study of 255 patients. *Acta Orthop*. 2025;(96):452-458. doi:10.2340/17453674.2025.43906

41. Winkler PW, Zsidai B, Wagala NN, et al. Evolving evidence in the treatment of primary and recurrent posterior cruciate ligament injuries, part 1: anatomy, biomechanics and diagnostics. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2021;29(3):672-681. doi:10.1007/s00167-020-06357-y

42. Braaten JA, Banovetz MT, Rodriguez AN, Thomas P, LaPrade RF. From Anatomy to Complex Reconstruction: A Modern Review on the Medial Collateral Ligament of the Knee. *Archives of Bone and Joint Surgery*. 2022;10(10):818-826. doi:10.22038/ABJS.2022.66697.3179

43. Chahla J, Murray IR, Robinson J, et al. Posterolateral corner of the knee: an expert consensus statement on diagnosis, classification, treatment, and rehabilitation. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2019;27(8):2520-2529. doi:10.1007/s00167-018-5260-4

44. Abelleyra Lastoria DA, Kenny B, Dardak S, Brookes C, Hing CB. Is the patella apprehension test a valid diagnostic test for patellar instability? A systematic review. *J Orthop*. 2023;42:54-62. doi:10.1016/j.jor.2023.07.005

45. Li X, Hou Q, Zhan X, Chang L, Ma X, Yuan H. The accuracy of MRI in diagnosing and classifying acute traumatic multiple ligament knee injuries. *BMC Musculoskelet Disord*. 2022;23(1):43. doi:10.1186/s12891-021-04976-1

46. Rhind JH, Khawar H, Webb M, Guthrie H. The locked knee. *Br J Hosp Med*. 2024;85(1). doi:10.12968/hmed.2022.0215

47. Vetrano M. I.S.Mu.L.T. first-time patellar dislocation guidelines. *Muscle, Ligaments and Tendons Journal*. 2017;7(1):1. doi:10.11138/mltj/2017.7.1.001

48. Bailey MEA, Metcalfe A, Hing CB, Eldridge J. Consensus guidelines for management of patellofemoral instability. *Knee*. 2021;29:305-312. doi:10.1016/j.knee.2021.02.018

49. Dhillon J, Hernandez EJ, Keeter C, Kraeutler MJ. Sensitivity and Specificity for Physical Examination Tests in Diagnosing Prearthritic Intra-Articular Hip Pathology Are Highly Variable: A Systematic Review. *Arthrosc Sports Med Rehabil*. 2025;7(3). doi:10.1016/j.asmr.2025.101117

50. Rosenbaum DG, Cooper AP. Slipped capital femoral epiphysis: emphasis on early recognition and potential pitfalls. *Skeletal Radiol*. 2025;54(4):807-818. doi:10.1007/s00256-024-04798-x

51. Griffin DR, Dickenson EJ, O'Donnell J, et al. The Warwick Agreement on femoroacetabular impingement syndrome (FAI syndrome): an international consensus statement. *Br J Sports Med*. 2016;50(19):1169-1176. doi:10.1136/bjsports-2016-096743

52. Fortier LM, Popovsky D, Durci MM, Norwood H, Sherman WF, Kaye AD. An Updated Review of Femoroacetabular Impingement Syndrome. *Orthop Rev (Pavia)*. 2022;14(3):37513. doi:10.52965/001c.37513

53. Castro MO, Mascarenhas V V., Afonso PD, et al. The Lisbon Agreement on Femoroacetabular Impingement Imaging—part 3: imaging techniques. *Eur Radiol*. 2021;31(7):4652-4668. doi:10.1007/s00330-020-07501-5

54. Polichetti C, Borruto MI, Lauriero F, et al. Adult Acquired Flatfoot Deformity: A Narrative Review about Imaging Findings. *Diagnostics*. 2023;13(2):225. doi:10.3390/diagnostics13020225

55. Golshteyn G, Schneider HP. Tarsal Coalitions. *Clin Podiatr Med Surg*. 2022;39(1):129-142. doi:10.1016/j.cpm.2021.08.004

56. TEPELENIS K, SKANDALAKIS GP, PAPATHANAKOS G, et al. Osteoid Osteoma: An Updated Review of Epidemiology, Pathogenesis, Clinical Presentation, Radiological Features, and Treatment Option. *In Vivo (Brooklyn)*. 2021;35(4):1929-1938. doi:10.21873/invivo.12459

57. Zhao DY, McCann L, Hahn G, Hedrich CM. Chronic nonbacterial osteomyelitis (CNO) and chronic recurrent multifocal osteomyelitis (CRMO). *J Transl Autoimmun*. 2021;4:100095. doi:10.1016/j.jtauto.2021.100095

58. Nico MAC, Araújo FF, Guimarães JB, et al. Chronic nonbacterial osteomyelitis: the role of whole-body MRI. *Insights Imaging*. 2022;13(1). doi:10.1186/s13244-022-01288-3

59. Safdar NM, Rigsby CK, Iyer RS, et al. ACR Appropriateness Criteria® Acutely Limping Child Up To Age 5. *Journal of the American College of Radiology*. 2018;15(11):S252-S262. doi:10.1016/j.jacr.2018.09.030

60. Fortier LM, Markel M, Thomas BG, Sherman WF, Thomas BH, Kaye AD. An Update on Peroneal Nerve Entrapment and Neuropathy. *Orthop Rev (Pavia)*. 2021;13(2):24937. doi:10.52965/001c.24937

61. Griffith JF, Guggenberger R. Peripheral Nerve Imaging. In: *Musculoskeletal Diseases 2021-2024: Diagnostic Imaging [Internet]*. Springer; 2021:259-268. doi:10.1007/978-3-030-71281-5_18

62. Brinkman JC, Reeson E, Chhabra A. Acute Patellar Tendon Ruptures: An Update on Management. *JAAOS: Global Research and Reviews*. 2024;8(4). doi:10.5435/JAAOSGlobal-D-24-00060

63. Paton BM, Court N, Giakoumis M, et al. London International Consensus and Delphi study on hamstring injuries part 1: classification. *Br J Sports Med*. 2023;57(5):254-265. doi:10.1136/bjsports-2021-105371

64. Singh Hans S. MRA and CT Angiography of Lower Extremity Aneurysmal Disease. In: Spring K, ed. *Contemporary Management of Lower Extremity Aneurysmal Disease*. Springer Nature Switzerland AG; 2025:25-30. doi:10.1007/978-3-032-00159-7

65. Kontopodis N, Tosounidis T, Kehagias E, Kouraki A, Tzirakis K, Ioannou C V. Concomitant vascular and orthopedic trauma: 10 points to consider. *J Clin Orthop Trauma*. 2024;51. doi:10.1016/j.jcot.2024.102407

66. Lee JT, Camacho MA, Diercks DB, et al. ACR Appropriateness Criteria® Major Blunt Trauma: Update 2025. *Journal of the American College of Radiology*. Published online February 2026. doi:10.1016/j.jacr.2026.01.030

67. Obara P, McCool J, Kalva SP, et al. ACR Appropriateness Criteria® Clinically Suspected Vascular Malformation of the Extremities. *Journal of the American College of Radiology*. 2019;16(11):S340-S347. doi:10.1016/j.jacr.2019.05.013

68. Schmidt VF, Masthoff M, Czihal M, et al. Imaging of peripheral vascular malformations — current concepts and future perspectives. *Mol Cell Pediatr*. 2021;8(1):19. doi:10.1186/s40348-021-00132-w

69. Gornik HL, Aronow HD, Goodney PP, et al. 2024 ACC/AHA/AACVPR/APMA/ABC/SCAI/SVM/SVN/SVS/SIR/VESS Guideline for the

Management of Lower Extremity Peripheral Artery Disease. *J Am Coll Cardiol*. 2024;83(24):2497-2604. doi:10.1016/j.jacc.2024.02.013

70. Browne WF, Sung J, Majdalany BS, et al. ACR Appropriateness Criteria® Sudden Onset of Cold, Painful Leg: 2023 Update. *Journal of the American College of Radiology*. 2023;20(11):S565-S573. doi:10.1016/j.jacr.2023.08.012
71. Arnold J, Koyfman A, Long B. High risk and low prevalence diseases: Acute limb ischemia. *American Journal of Emergency Medicine*. 2023;74:152-158. doi:10.1016/j.ajem.2023.09.052
72. Rochon PJ, Reghunathan A, Kapoor BS, et al. ACR Appropriateness Criteria® Lower Extremity Chronic Venous Disease. *Journal of the American College of Radiology*. 2023;20(11):S481-S500. doi:10.1016/j.jacr.2023.08.011
73. Azene EM, Steigner ML, Aghayev A, et al. ACR Appropriateness Criteria® Lower Extremity Arterial Claudication-Imaging Assessment for Revascularization: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S364-S373. doi:10.1016/j.jacr.2022.09.002
74. Nordanstig J, Behrendt CA, Baumgartner I, et al. Editor's Choice -- European Society for Vascular Surgery (ESVS) 2024 Clinical Practice Guidelines on the Management of Asymptomatic Lower Limb Peripheral Arterial Disease and Intermittent Claudication. *European Journal of Vascular and Endovascular Surgery*. 2024;67(1):9-96. doi:10.1016/j.ejvs.2023.08.067
75. Francois CJ, Skulborstad EP, Kalva SP, et al. ACR Appropriateness Criteria® Nonatherosclerotic Peripheral Arterial Disease. *Journal of the American College of Radiology*. 2019;16(5):S174-S183. doi:10.1016/j.jacr.2019.02.026
76. Mazzolai L, Teixido-Tura G, Lanzi S, et al. 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases. *Eur Heart J*. 2024;45(36):3538-3700. doi:10.1093/eurheartj/ehae179
77. Cooper K, Majdalany BS, Kalva SP, et al. ACR Appropriateness Criteria® Lower Extremity Arterial Revascularization—Post-Therapy Imaging. *Journal of the American College of Radiology*. 2018;15(5):S104-S115. doi:10.1016/j.jacr.2018.03.011
78. Troum OM, Pimienta OL, Wells A. Imaging in vasculitis. *Curr Opin Rheumatol*. 2025;37(1):39-44. doi:10.1097/BOR.0000000000001055
79. Hanley M, Steigner ML, Ahmed O, et al. ACR Appropriateness Criteria® Suspected Lower Extremity Deep Vein Thrombosis. *Journal of the American College of Radiology*. 2018;15(11):S413-S417. doi:10.1016/j.jacr.2018.09.028
80. Diagnostics and Therapy of Venous Thrombosis and Pulmonary Embolism – AWMF S2k Guideline. *Vasa - European Journal of Vascular Medicine*. 2023;52:16-146. doi:10.1024/0301-1526/a001089
81. Richarz S, Isaak A, Aschwanden M, Partovi S, Staub D. Pre-procedure imaging planning for dialysis access in patients with end-stage renal disease using ultrasound and upper extremity computed tomography angiography: a narrative review. *Cardiovasc Diagn Ther*. 2023;13(1):122-132. doi:10.21037/cdt-21-797

82. Neubauer TM, Chin JJ, Hill RD, Hu YWE. Popliteal Artery Entrapment Syndrome: Updates for Evaluation, Diagnosis, and Treatment. *Curr Sports Med Rep*. 2024;23(9):310-315. doi:10.1249/JSR.0000000000001194

83. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews®*. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

84. Hughes DA, Pastores GM. Gaucher Disease. *GeneReviews®*. Published online December 7, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1269/

85. Friedman J. Neurofibromatosis 1. *GeneReviews®*. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

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87. Miller DT, Freedenberg D, Schorry E, et al. Health Supervision for Children With Neurofibromatosis Type 1. *Pediatrics*. 2019;143(5):e20190660. doi:10.1542/peds.2019-0660

88. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Acute Lymphoblastic Leukemia Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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108. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

109. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

110. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

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139. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

140. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

141. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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156. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

157. Eisenberg RL. *What Radiology Residents Need to Know: Musculoskeletal Radiology*. 1st ed. (Eisenberg RL, ed.). Springer Cham; 2022. doi:10.1007/978-3-030-72382-8

158. Habusta SF, Mabrouk A, Tuck JA. Synovial Chondromatosis. *StatPearls*. Published online April 22, 2023. https://www.ncbi.nlm.nih.gov/books/NBK470463/

# Evolent Clinical Guideline 2074 for Spine Imaging

## *Cervical, Thoracic, Lumbar*

| **Guideline Number:** Evolent_CG_2074 | **Applicable Codes** | |
|---|---|---|
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| **Original Date:** January 2027 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Imaging of the cervical spine is from the skull base/foramen magnum through T1. Thoracic spine imaging is from C7 through L1-L2. Lumbar spine imaging is from T11/T12 through the mid-sacrum. The spinal cord ends at the conus medullaris, typically L1/L2. Computed tomography (CT)/Magnetic Resonance (MR) of the cervical and thoracic cord typically images the entire spinal cord. Lumbar spine imaging is not indicated to evaluate the spinal cord unless there is suspected or known low-lying conus medullaris or tethered cord. CT uses ionizing radiation to generate images of organs and structures. MR Imaging (MRI) generates images of organs and structures without the use of ionizing radiation. CT Angiography (CTA) generates images of vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. MR Angiography (MRA) generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without radiation.

NOTE: Authorizations for CT Angiography and MR Angiography cover both arterial and venous imaging. The term *angiography* refers both to arteriography and venography.

## Special Note

When overlapping imaging modalities for the same body part are requested simultaneously or sequentially (within the past 3 months), the prior imaging needs to either be indeterminate or clear documentation of how management will change must be provided unless the combination is explicit in the combination section.

When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS FOR SPINE IMAGING

## Autoimmune Disease

### *Demyelinating Disorders* [1–11]

The most common demyelinating disease is multiple sclerosis (MS), including clinically isolated syndrome (CIS) and radiologically isolated syndrome (RIS). Myelin oligodendrocyte glycoprotein associated disease (MOGAD), neuromyelitis optica spectrum disorder (NMOSD), acute disseminated encephalomyelitis (ADEM), progressive multifocal leukoencephalopathy (PML), and others are also considered central nervous system (CNS) demyelinating diseases. Peripheral demyelinating diseases include Guillain-Barre syndrome (GBS), chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), anti-myelin associated glycoprotein (MAG) neuropathy, and others.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** and **Thoracic Spine MRI** (with Brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging).

- Suspected MS with acute or subacute abnormal neurological symptoms and/or exam findings
  - With documentation of concern for MS with neurologic signs and symptoms [2,3]
- CIS (single suspicious clinical episode but MS not diagnosed) and RIS (suspicious brain lesions but asymptomatic and MS not diagnosed) and ONE of the following:
  - New neurological signs/symptoms suggestive of spinal cord involvement
  - Documented concern for an alternative diagnosis (eg, NMOSD or MOGAD) [3–5]
- Established/diagnosed MS [2,3,5]:
  - New neurologic signs or symptoms suggestive of either thoracic spine or both cervical and thoracic spine
  - Known active lesions in the thoracic spine [3,5]:
    - 3 – 6 months after starting or changing treatment, then annually, less frequently when stable on treatment for the first few years (2 – 3 years)
  - Suspected silent lesions and there is clear documentation of imaging would change management
  - Clinically worsening MS or progressive MS
  - Prior to changing treatment
- Suspected transverse myelitis, NMOSD, or MOGAD with acute or subacute abnormal neurological symptoms and/or exam findings [12–14]
- Established/diagnosed NMOSD
  - To evaluate treatment response, if no improvement or clinically worsening (based on signs and/or symptoms)

- New baseline when changing therapies
- New signs or symptoms, or worsening of pre-existing neurological abnormalities, suggestive of recurrence or clinical worsening/new attack

- Established/diagnosed MOGAD or other demyelinating disease
  - New signs or symptoms, localizing to the spinal cord, suggestive of relapse or clinical worsening

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** (with Brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging).

- Established/diagnosed MS
  - 3 – 6 months after starting or changing treatment, then annually, less frequently if stable on treatment for the first few years (2-3 years)
  - New neurological signs or symptoms suggestive of clinical worsening

IMAGING MODALITY: When any ONE of the following criteria are met AND medical necessity criteria above has been met for MS, the indicated study is **Lumbar Spine MRI** (with Brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging), **Cervical Spine MRI**, and/or **Thoracic Spine MRI**.

- Lumbar spine imaging may be considered on a case-by-case basis only for the following situations [2–4,6]:
  - Known elongated cord from prior imaging
  - Specific concern for conus involvement/evaluating for nerve root enhancement to confirm diagnosis and/or differentiate between different disease entities
  - Presence of longitudinally enhancing lesions with specific concern for alternative diagnosis (eg, neurosarcoidosis, infection, neoplastic disorder)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** and/or **Thoracic Spine MRI** and/or **Lumbar Spine MRI**.

- Initial workup for other suspected demyelinating diseases with abnormal neurological exam findings and ALL of the following:
  - Abnormal laboratory and/or cerebrospinal fluid [CSF] studies
  - Abnormal or indeterminate electrophysiology findings
  - Indeterminate ultrasound
  - Atypical clinical presentation (eg, atypical presentation of GBS or CIDP)

## *Other Autoimmune/Inflammatory Disorders*

Autoimmune/inflammatory conditions include N-methyl-D-aspartate receptor encephalitis (NMDAR), glial fibrillar acidic protein meningoencephalitis (GFAP), IgG related disease,

paraneoplastic syndromes, neurosarcoidosis, CNS vasculitides (primary or secondary), Susac syndrome, systemic lupus erythematosus (SLE), granulomatosis with polyangiitis, Behcet's, and others. All are typically diagnosed by clinical findings, imaging, labs, and/or cerebrospinal fluid (CSF) studies [1]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** and/or **Thoracic Spine MRI** and/or **Lumbar Spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed. The level of the spine that is indicated is based on either the localization of exam finding or the location of suspected abnormality to that level.

- Initial workup for suspected autoimmune/inflammatory conditions (based on neurological symptoms and/or exam findings along with laboratory/CSF studies) [1,15,16]
- Known autoimmune/inflammatory condition(s) and ONE of the following:
  - Treatment monitoring, if no improvement/worsening, and imaging will change management
  - New signs or symptoms suggestive of recurrence or progression
- Suspected amyotrophic lateral sclerosis (ALS) [17–19]
- Suspected and/or known inflammatory back pain/axial spondyloarthritis (ankylosing spondylitis, reactive arthritis, psoriatic arthritis, enteropathic arthritis, juvenile spondyloarthritis, undifferentiated spondyloarthritis) and rheumatoid arthritis (RA) [20]
  - To confirm diagnosis of RA versus undifferentiated inflammatory arthritis (UIA) when x-rays and clinical laboratory workup are indeterminate [21]
  - Treatment monitoring of RA [21]
  - Other spondyloarthropathies and any ONE of the following [20,22]:
    - Disease activity needs clarification (ie, unclear on x-ray) AND imaging results will alter treatment
    - Clinical and laboratory data regarding disease activity are conflicting AND imaging results will alter treatment

    NOTE: Imaging in stable patients, patients with clearly active disease, or for confirming inactivity is not indicated.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI.** CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Cervical subluxation/atlantoaxial articulation suspected based on neurological signs/symptoms or x-rays findings in high-risk disorders (eg, RA, Ehlers-Danlos, Down Syndrome, Goldenhar syndrome, Morquio syndrome, spondyloepiphyseal dysplasia, occipitalization of the atlas) [21,23–26]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** (or **Cervical Spine CT**), **Thoracic Spine MRI** (or **Thoracic Spine CT**), or **Lumbar Spine MRI** (or **Lumbar Spine CT**). Only one imaging modality type (CT or MRI) is appropriate to provide information for patient management. The level of the spine that is indicated is based on either the localization of exam finding to that level or the location of suspected abnormality.

- Known axial spondyloarthritis with spine ankylosis and suspicion for new fracture

## CSF Abnormalities

CSF leaks may be idiopathic (spontaneous intracranial hypotension [SIH]) or secondary (eg, trauma, iatrogenic, tumor, inflammatory, complication of elevated intracranial pressure). Intracranial hypotension is suggested by orthostatic headache (absent or mild on waking, onset of headache [HA] within 2 hours of being upright, > 50% improvement after lying flat for 2 or more hours, and HA is consistent upon positioning).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** and **Lumbar Spine MRI** (with Brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging). CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Chiari malformations and any ONE of the following [27–33]:
  - Suspected (based on prior imaging or abnormal neurological exam findings) Chiari, or known Chiari, to evaluate for associated spinal cord abnormalities (eg, syrinx, hydrosyringomyelia, myelomeningocele)
  - New neurologic signs/symptoms (eg, ataxia or neurologic deficit localizing to the spine)
  - Pre-surgical planning
  - Asymptomatic pediatrics (< 18 years of age) during growth as clinically indicated [32]
- Syrinx/syringomyelia/hydrosyringomyelia with or without Chiari [34–36]
  - Suspected, based on neurological exam or underlying conditions (eg, Chiari, trauma, tumor, infection), for diagnosis
  - Known, and any ONE of the following:
    - New neurologic signs/symptoms
    - Surgical planning

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical MRI** (may also be referred to as a CSF Flow Study or phase-contrast MRI).

- Evaluation of CSF flow disorders or craniocervical junction abnormalities (eg, hydrocephalus, syrinx, Dandy-Walker spectrum malformations) [29,37]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** or **Thoracic Spine MRI** or **Lumbar Spine MRI**. Cervical Spine CT or Thoracic Spine CT or Lumbar spine CT is appropriate only when the preferred study is contraindicated or cannot be performed. The level of the spine that is indicated is based on either the localization of exam finding to that level or the location of suspected abnormality.

- Suspected CSF leak when there is reason to suspect leak at one spinal cord level (eg, post-procedural, localizing exam findings, known fracture/trauma) [38–41]
- Post-procedural orthostatic headache (eg, post-epidural/spinal intervention) that does not resolve after 7 days or post-blood patch [38–41]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** and **Lumbar Spine MRI** (with Brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging).

- Suspected CSF leak from secondary source without intermittent otorrhea, rhinorrhea, or otorhinorrhea [38–41]
- Suspected primary/spontaneous intracranial hypotension [38–41]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies are **Cervical Spine MRI** (or **Cervical Spine CT**), **Thoracic Spine MRI** (or **Thoracic Spine CT**), and **Lumbar Spine MRI** (or **Lumbar Spine CT**) (may be referred to as myelography or cisternography).

- To guide treatment such as epidural fibrin glue, endovascular embolization, or surgical repair [38–42]
- Negative (brain and spine) MRI imaging and clinical suspicion for CSF leak (eg, suspected dural tear/defect, CSF-venous fistula, or leaking meningeal diverticulum) [38–42]

# Fractures

## *Vertebral Compression Fractures (VCF) [43,44]*

NOTE: Medical management, not imaging, is recommended for asymptomatic osteoporotic compression fractures.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** (or **Cervical Spine CT**), or **Thoracic Spine MRI** (or **Thoracic Spine CT**), or **Lumbar Spine MRI** (or **Lumbar Spine CT**). Only one imaging modality type (CT or MRI) is appropriate to provide information for patient management. The level of the spine that is indicated is based on what level is affected based on x-ray.

- Fracture with imaging characteristics concerning for underlying malignancy in a patient with no history of malignancy
- Fracture on initial imaging in a patient < 50 years of age with no history of trauma and concern for pathologic fracture

- New focal neurological exam abnormality
- Prior to a planned surgery/intervention or if the results of imaging will change management

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI**, **Thoracic Spine MRI**, or **Lumbar Spine MRI**. The level of the spine that is indicated is based on what level is affected based on x-ray.

- History of malignancy to aid in differentiation of benign osteoporotic fractures from pathologic fractures (malignancy/metastatic disease)
    - Follow-up imaging is indicated 6-8 weeks after initial imaging if initial imaging could not decipher (indeterminate) benign osteoporotic fracture from metastatic disease [43,45]

## Infection [46,47]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** or **Lumbar Spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed. The level of the spine that is indicated is based on the level of the known finding.

- Suspected spine infection (eg, epidural abscess, discitis, osteomyelitis) with worsening pain and ONE of the following:
    - Abnormal labs (white blood cell count, ESR, CRP, and/or blood cultures)
    - Risk factors such as diabetes mellitus, IV drug use, cancer, pre-existing extraspinal infections (eg, tuberculosis [TB], human immunodeficiency viruses [HIV], coccidioidomycosis, neurocysticercosis, endocarditis), immunosuppression, or dialysis.
    - Recent surgery or injection
    - New neurologic abnormalities on exam
    - Overlying decubitus ulcer or wound
    - Abnormality seen on other imaging (x-ray or CT) that needs follow-up
- Known spine infection follow-up
    - With worsening symptoms, laboratory values (white blood cell count, ESR, CRP), or x-ray findings
    - Follow-up of subcutaneous fluid collection, or abscess, with suspected treatment failure (clinical worsening or worsening labs)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine CT** (or **Cervical Spine MRI**), **Thoracic Spine CT** (or **Thoracic Spine MRI**), or **Lumbar Spine CT** (or **Lumbar Spine MRI**)

- Suspected spine infection and ONE of the following:

- Hardware evaluation
- Guide biopsy
- Surgical planning

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** or **Lumbar Spine MRI**. CT is appropriate when the preferred study is contraindicated, cannot be performed, or on a case-by-case basis. The level of the spine that is indicated is based on the level of the known finding.

- Suspected spinal or paraspinal mass or lesion based on any ONE of the following and no current or past cancer history:
  - Paraspinal mass or lesion seen on other imaging (eg, ultrasound, CT) that requires further clarification
  - Osseous mass/lesion seen on other imaging (eg, x-ray, bone scan, CT) that requires further clarification

## *Known Malignancy*

NOTE: For patients with known malignancy, dedicated spine imaging is not considered overlapping with Chest CT/MRI and Abdomen and Pelvis CT/MRI when medical necessity criteria are met for each study.

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment.

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** or **Lumbar Spine MRI**. CT is appropriate when the preferred study is contraindicated, cannot be performed, or on a case-by-case basis. The level of the spine that is indicated is based on the level of the known finding.

- Newly diagnosed malignancy with indeterminate or suspicious spine lesion seen on other imaging and the patient is asymptomatic

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI,** and **Lumbar Spine MRI** (ie, total spine MRI). Total Spine CT is appropriate when the preferred study is contraindicated, cannot be performed, or is noted specifically below.

- Indications that apply to all cancers [48]:
  - Newly diagnosed malignancy and signs/symptoms concerning for spine metastasis (neurologic signs, myelopathy, or new, severe or progressive pain)

- Newly diagnosed malignancy and known spine metastasis seen on other imaging
- Known or suspected leptomeningeal disease from any primary tumor site

- Cancer-specific indications
  - Bone tumors [49]:
    - Chordoma
    - Ewing sarcoma (including primitive neuroectodermal tumor of bone, Askin tumor, and extraosseous Ewing sarcoma)
    - Other bone tumor with primary site in the spine
  - Breast cancer: for pregnant patients with T3 primary tumor (ie, > 5 cm) and/or involved lymph node(s) [50]
  - CNS tumors [48]
    - Ependymoma
      - When diagnosed intraoperatively, should be delayed 2-3 weeks after surgery
    - Medulloblastoma
      - When diagnosed intraoperatively, should be delayed 2-3 weeks after surgery
    - Pediatric Diffuse High-Grade Glioma
    - Pediatric Medulloblastoma: initial staging can be done before surgery, or as soon as 10-14 days after surgery if diagnosed intraoperatively
    - Primary CNS lymphoma
    - Primary spinal cord tumor
  - Histiocytic neoplasms (Langerhans cell histiocytosis, Erdheim-Chester disease, or Rosai-Dorfman disease): if either of the following is present [51]:
    - Neurologic signs/symptoms
    - Other imaging showing vertebral bone lesion(s)
  - Kidney cancer: as clinically indicated in patients with surgically unresectable or stage IV disease [52]
  - Myxoid/Round Cell Liposarcoma [53]
  - Neuroblastoma: when there is concern for paraspinal disease or concern for involvement of nerve roots or spinal cord [54]
  - Non-small cell lung cancer: for tumors abutting the spine, subclavian vessels, or brachial plexus
  - Plasma cell dyscrasias [55]:
    - Multiple myeloma: if concern for CNS involvement (eg, confusion, headache, visual symptoms, weakness, cranial nerve palsies)
    - Smoldering myeloma: if whole body low dose CT or PET is negative, entire spine MRI indicated to differentiate smoldering myeloma from multiple myeloma

        - Solitary plasmacytoma and solitary plasmacytoma with minimal marrow involvement (CT is an appropriate alternative to MRI)
    - Pediatric aggressive mature B cell lymphomas (Burkitt lymphoma, primary mediastinal large B-cell lymphoma, and post-transplant lymphoproliferative disorder) [56]
    - Retinoblastoma if any ONE of the following is present: optic nerve invasion, midline embryonal tumor, or extension along the meningeal sheath [57]
    - Small cell lung cancer: if other imaging shows spine metastases [58]
    - Waldenstrom macroglobulinemia/lymphoplasmacytic lymphoma with CNS symptoms concerning for Bing Neel syndrome (headaches, seizures, cranial nerve palsies, weakness, neuropathy) [59]

## Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. 'Active treatment' includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), chimeric antigen receptor (CAR) T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: during active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg, chemotherapy, targeted therapy, or immunotherapy) is typically every 2-3 cycles of treatment or every 3 months. Active systemic treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When the following criteria are met, the indicated study is indicated **Cervical Spine MRI,** or **Thoracic Spine MRI,** or **Lumbar Spine MRI**. The level of the spine that is indicated is based on the level of the known finding. Level-appropriate CT is appropriate when the preferred study is contraindicated or cannot be performed and on a case-by-case basis.

- Current or past history of malignancy with indeterminate or suspicious spine lesion seen on other imaging and the patient is asymptomatic [48]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI** (or **Cervical Spine CT**) and **Thoracic Spine MRI** (or **Thoracic Spine CT**).

- Non-small cell lung cancer: for tumors abutting the spine, subclavian vessels, or brachial plexus [60]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Thoracic Spine MRI** and **Lumbar Spine MRI**.

- Medullary thyroid cancer: with concern for recurrent or persistent disease after surgery

with calcitonin ≥ 150 [61]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI, Thoracic Spine MRI, and Lumbar Spine MRI** (total spine MRI) are indicated. Total spine CT is appropriate when the preferred study is contraindicated or cannot be performed and on a case-by-case basis.

- Indications that apply to all cancers [48]:
  - Any patient with current or past history of malignancy and signs/symptoms concerning for spine metastasis (neurologic signs, myelopathy, or new, severe or progression pain)
  - Leptomeningeal disease from any primary tumor site
  - Spine metastases from any primary tumor at any ONE of the following time points:
    - Once 6-8 weeks after diagnosis of spine metastasis then
    - Every 2-3 months during treatment
    - Postoperative imaging as soon as 2-3 weeks after surgery
- Cancer-specific indications
  - Bone tumors [49]:
    - Chordoma: during treatment if known spinal disease
    - Ewing sarcoma (including primitive neuroectodermal tumor of bone, Askin tumor, and extraosseous Ewing sarcoma): during treatment if known spinal disease
    - Other bone tumor with primary site in the spine
  - CNS tumors [48]:
    - Ependymoma
      - During treatment
      - As early as 2-3 weeks after surgery
      - End of treatment study 3 months after treatment
    - Medulloblastoma, adult
    - Pediatric Diffuse High-Grade Glioma
      - During treatment
      - As soon as 10-14 days postoperatively
    - Pediatric Medulloblastoma
      - During treatment
      - As soon as 10-14 days postoperatively
    - Primary CNS lymphoma
    - Primary spinal cord tumor

- During treatment
- As early as 2-3 weeks postoperatively
- End of treatment study 3 months after treatment for low-grade (1-2) tumors and 2-6 weeks after treatment for high-grade (3-4) tumors

- Histiocytic neoplasms (Langerhans Cell Histiocytosis, Erdheim-Chester disease, or Rosai-Dorfman disease): during treatment if known spinal disease [51]
- Kidney cancer: as clinically indicated in patients with relapsed, surgically unresectable, or stage IV disease [52]
- Myxoid/Round Cell Liposarcoma [53]
- Neuroblastoma: when there is concern for paraspinal disease or concern for involvement of nerve roots or spinal cord [54]
- Plasma cell dyscrasias [55]:
  - Multiple myeloma: if concern for CNS involvement (eg, confusion, headache, visual symptoms, weakness, cranial nerve palsies)
- Pediatric aggressive mature B cell lymphomas (Burkitt lymphoma, Primary Mediastinal Large B-Cell Lymphoma, and Post-Transplant Lymphoproliferative Disorder): as clinically indicated [56]

## Surveillance

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is "as clinically indicated," routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

Refer to the **Cancer Surveillance Table** for cancer-specific indications. Additionally, the below indications apply to all malignancies.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** (or **Cervical Spine CT**), **Thoracic Spine MRI** (or **Thoracic Spine CT**), **and Lumbar Spine MRI** (or **Lumbar Spine CT**) (total spine MRI or CT).

- Leptomeningeal metastases from any primary tumor
  - Every 2-3 months for 2 years then
  - Every 3-6 months for 3 years then
  - Annually indefinitely
- Metastatic spine tumors

- 1-3 months after treatment then
- Every 3-4 months for 1 year then
- As clinically indicated

## Neurological Findings [62–71]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies is **Cervical Spine MRI**, **Thoracic Spine MRI**, or **Lumbar Spine MRI**. CT (may also be referred to as a CT Myelogram) is appropriate only when the preferred study is contraindicated or cannot be performed. The level of the spine that is indicated is based on either localization of exam finding or the location of pain to that level. This section applies when there is not another specific section in the guideline that applies.

- With new or worsening objective neurological abnormalities on exam with a motor, sensory, or reflex abnormality corresponding to the level of spine requested
- Hypoesthesia or hyperesthesia on exam localizing to the level of spinal imaging request and ONE of the following:
  - Localizes to one or more specific dermatomes (unilateral or bilateral)
  - Sensory level finding (ie, a level below which sensation on exam is altered below; imaging of the level where sensation changes is appropriate)
- Weakness on exam as evidenced by ONE of the following:
  - Asymmetric extremity muscular weakness and ALL of the following:
    - Weakness is new onset
    - Graded on exam as 4/5 or less (based on the Medical Research Council [MRC] Scale for Muscle Strength 0-5)
    - Level of spine requested correlates to the area of weakness (cervical spine for upper extremity weakness; lumbar spine for lower extremity weakness)
  - Symmetric extremity weakness and ALL of the following:
    - History, exam, and/or laboratory testing done and do not clearly indicate a peripheral neuropathy or neuromuscular disorder
    - Graded on exam as 3/5 or less (based on the MRC Scale for Muscle Strength 0-5)
    - Weakness is new onset
    - Level of spine requested correlates to the area of weakness (cervical spine for upper extremity weakness; lumbar spine for lower extremity weakness; thoracic spine for lower extremity on a case-by-case basis)

    NOTE: “Break-away” weakness (good initial contraction followed by collapse) is not a pattern seen with true neurologic injury.
- Pathologic reflexes corresponding to the level of the spine requested:
  - Cervical and/or thoracic spine symptoms and ALL of the following:

- Babinski, clonus, crossed adductor, Lhermitte's sign, Chaddock Sign, Hoffman's, spasticity, and other upper motor neuron signs [72]
- Level of spine requested correlates to the pattern of reflex abnormality (cervical spine for upper extremity hyperreflexia; thoracic spine for lower extremity hyperreflexia)
- Abnormality is not likely caused by peripheral neuropathy or neuromuscular disorder

- Lumbar spine symptoms:
  - Asymmetric lower extremity hyporeflexia

NOTE: Normal deep tendon reflex is 2/4, hyperreflexia is 3-4/4, hyporeflexia is 1/4, absent is 0/4. For some people, diffuse hyporeflexia is their normal and more common with age. Hyporeflexia is also usually multifactorial (eg, diabetes, vascular disease, obesity).

- New onset bladder and/or bowel dysfunction (retention or incontinence) not attributed to an inherent bowel or bladder process and ONE of the following:
  - Lumbar spine imaging in the setting of suspected cauda equina syndrome and ONE of the following [73]:
    - Areflexic/flaccid bladder (detrusor underactivity/neurogenic bladder)
    - Areflexic bowel (often incontinence with Valsalva or transfers)
    - Absent bulbocavernosus and anal wink reflexes (ie, flaccid anal sphincter)
    - Lower extremity areflexia
    - Asymmetric lower extremity weakness with or without muscle atrophy
    - Saddle anesthesia and asymmetric or unilateral lower extremity sensory changes
    - Low back pain with asymmetric radiculopathy
  - Thoracic spine imaging and ALL of the following:
    - Neurogenic detrusor overactivity/hyperreflexic bladder (including detrusor sphincter dyssynergia [DSD]) OR spastic/hyperreflexic bowel (constipation and stool retention)
    - Lower extremity hyperreflexia (upper motor neuron [UMN] sign/lesion above conus), no cortical signs (eg, aphasia, neglect, hemianopia), no upper motor weakness, truncal sensory abnormalities present, spasticity, and/or intact bulbocavernosus and anal wink reflexes (normal anal sphincter)
  - Thoracic and lumbar spine imaging in the setting of mixed UMN and lower motor neuron (LMN) pattern and ONE of the following:
    - Variable reflexes (eg, hyperreflexia at knees, areflexia at ankles, preserved anal sphincter muscle contraction)
    - Saddle anesthesia and symmetric or bilateral lower extremity sensory changes
    - Lower extremity weakness

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI**. Cervical Spine CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Loss of fine motor skills of hands/clumsiness and concern for myelopathy
- Gait abnormalities with concern for spinal cord damage AND the following [64,74–76]:
    - Spastic hemiparetic gait (eg, spasticity/increased tone, unilateral circumduction on paretic side)

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI** or **Thoracic Spine MRI**. Thoracic Spine CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Gait abnormalities with concern for spinal cord damage and any ONE of the following [74–76]:
    - Spastic paraparetic/diplegic gait (eg, spastic/stiff, bilateral circumduction)
    - Myelopathic gait (eg, wide-based, paraparetic spastic/weak and stiff, or spastic ataxic/uncoordinated)
    - Sensory ataxic gait (eg, broad-based, short steps/stomping, worse with loss of visual input, positive Romberg's)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lumbar Spine MRI**. Lumbar Spine CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Gait abnormalities with concern for spinal cord damage AND the following [74–76]:
    - Steppage/neuropathic gait (eg, unable to stand/walk on heels or toes, high lifting of leg/foot because of paretic muscles) not related to peripheral nerve/peroneal nerve injury
- New onset foot drop with either hip abduction weakness, ankle inversion weakness, or ankle plantarflexion weakness (ie, not related to a peripheral nerve or peroneal nerve injury) [77]

# Pain

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI**, **Thoracic Spine MRI**, or **Lumbar Spine MRI**. CT is appropriate only when the preferred study is contraindicated or cannot be performed. Instances in which more than one level of imaging is indicated are specified, otherwise only one level is appropriate. The level of the spine that is indicated is based on either the localization of exam finding or the location of pain to that level.

- With new or worsening objective neurological abnormalities on exam with a motor, sensory, or reflex abnormality corresponding to the level of spine requested (see

**Neurological Findings** section above for site-specific signs) [73,78–81]:

- Failure of **conservative treatment*** for a minimum of six (6) weeks within the last six (6) months:

  **NOTE** - Failure of conservative treatment is defined as ONE of the following:

  - Lack of meaningful improvement after a full course of treatment; OR
  - Progression or worsening of symptoms during treatment; OR
  - Documentation of a medical reason the member is unable to participate in treatment

    *Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.*

- With progression or worsening of symptoms during the course of **conservative treatment***
- An abnormal electromyography (EMG) or nerve conduction study (if performed) indicating an acute radiculopathy corresponding to the level of the spine requested [62,82,83]
- Pars defect (spondylolysis) with or without spondylolisthesis and ONE of the following:
  - Flexion/extension x-rays of that level that show instability (translation of 3 mm or more, or angulation of 10 degrees or more) [84,85]
  - Failure of active conservative therapy for 6 weeks in the last 6 months
  - Documentation of how imaging would change management (ie, procedure planning)
  - Age < 18 years and x-ray showing spondylolysis (pars defect; flexion/extension instability not required) [86,87]
- Suspected or known malignancy with acute or increasing pain and/or radicular symptoms [80,88]
- **Pediatric patients** (< 18 years of age) with neck and/or back pain and any ONE of the following red flags are present (conservative care is not required if red flags are present) [89,90]:
  - Age 10 years or younger
  - Abnormal neurologic examination
  - Morning stiffness
  - Pain characteristics; radicular, night pain, constant pain for over 4 weeks
  - History of trauma
  - Bowel or bladder dysfunction
  - Fever, weight loss, tachycardia, lymphadenopathy (ie, concern for infection or malignancy)
  - Limp/gait abnormality (or refusal to walk in a younger child)
- See **Malignancy** and **Preoperative or Postoperative Assessment** for additional

indications

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI**. Cervical Spine CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Cervicogenic headache after failure of active conservative care for neck pain

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated studies is **Thoracic Spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Prior to spinal cord stimulator placement [91]
- Prior to surgical revision after abnormal x-ray

## Trauma [45,92,93]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine CT**. Cervical Spine MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Acute blunt trauma of the cervical spine that meets either NEXUS or CCR criteria
  - Any of the following NEXUS criteria (2 – 100 years of age):
    - Focal neurological deficit
    - Midline spinal tenderness
    - Altered level of consciousness
    - Intoxication
    - Distracting injury (other injuries severe enough to distract from neck pain such as large lacerations or long bone fractures)
  - Any of the following CCR criteria:
    - Age > 65 years
    - Paresthesia's in extremities
    - Dangerous mechanism (fall from 3 feet/5 stairs or greater, axial load to head such as diving, high speed (> 60 mph)/rollover/ejection MVA, bicycle collision, motorized recreational vehicle accident)
    - If accident was NOT low risk as determined by ONE of the following:
      - Simple rear and motor vehicle collision (MVC)
      - Patient ambulatory after accident and or sitting after accident
      - Delayed onset of neck pain
      - No midline cervical spine tenderness

- Unable to rotate neck 45 degrees or more to the right or left

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine CT** or **Cervical Spine MRI**.

- Follow-up of cervical spine collar removal with discrepancy between radiologic and clinical findings AND requested by a spine surgeon

  NOTE: Persistent pain alone is not an indication for repeat imaging for cervical collar removal/clearance
- Acute cervical spine trauma in pediatric patients (< 18 years of age):
  - Abnormal or indeterminate x-ray
  - Altered mental status
  - Focal neurological deficit
  - Neck pain
  - Torticollis
  - Substantial torso injury
  - Conditions predisposing to cervical spine injury (eg, Down syndrome, achondroplasia, mucopolysaccharidosis type VI/Maroteaux-Lamy syndrome, Marfan syndrome, systemic glucocorticoid steroid therapy for inflammatory disease)
  - High-risk motor vehicle crash (patient ejection from car, death of another passenger, speed > 55 mph, or rollover)
  - Diving injury
  - Age < 8 and clinical symptoms of myelopathy but spinal cord injury without radiological abnormality (SCIWORA) [94,95]

IMAGING MODALITY: When the following criteria are met, the indicated studies **Thoracic Spine CT** or **Lumbar Spine CT**. MRI is appropriate only when the preferred study is contraindicated or cannot be performed. Instances in which more than one level of imaging is indicated are specified, otherwise only one level is appropriate. The level of the spine that is indicated is based on either localization of exam finding or the location of pain to that level.

- Injury with any ONE of the following:
  - Mid-line tenderness to palpation
  - High-energy mechanism of injury (fall, crush injury, rollover or ejection MVA, automobile vs pedestrian)
  - Age > 60 years
  - Underlying spinal abnormalities (such as diffuse idiopathic skeletal hyperostosis or ankylosing spondylitis) that cause spinal rigidity
  - Patients less than 16 years of age with abnormal or indeterminate x-ray findings [94,95]

- Abnormalities on neurological exam (imaging determined by localization/level of involvement)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Thoracic Spine MRI** or **Lumbar Spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Patients < 16 years of age and ONE of the following [94,95]:
  - Focal neurological abnormality on exam
  - Abnormal or indeterminate x-rays
- Patients < 8 years of age with clinical symptoms of myelopathy but spinal cord injury without radiological abnormality (SCIWORA) [94,95]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** and/or **Thoracic Spine MRI** and/or **Lumbar Spine MRI**. The level of the spine that is indicated is based on either localization of exam finding or the location of pain to that level.

- Abnormalities on neurological exam but with a normal CT [94,95]
- X-ray or CT findings suggestive of spinal cord, ligamentous injury, or other soft tissue injury (eg, hematoma, asymmetric disc space widening, inter-spinous space widening, facet joint widening or dislocations, acute disc herniation) [94,95]
- Obtunded patients/impaired neurological status with suspected cord abnormalities on x-ray or CT to assess need for cervical collar [94,95]
- Treatment/surgical planning [94,95]

## Vascular [78,96–98]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRA** (or **Cervical Spine CTA**) and/or **Thoracic Spine MRA** (or **Thoracic Spine CTA**) and/or **Lumbar Spine MRA** (or **Lumbar Spine CTA**). The level of the spine that is indicated is based on either the localization of exam finding or the location of suspected abnormality seen on prior imaging.

- Evaluation of spinal dural arteriovenous fistulas (SDAVFs), spinal epidural arteriovenous fistulas (SEDAVFs), non-traumatic hematomyelia, spinal arteriovenous malformations (AVMs), spinal cavernomas (SCs), or intrasyringeal hemorrhage associated with scoliosis or Chiari malformation Type I [96]
- Evaluation of acute ischemic myelopathy (predisposing conditions include systemic hypotension, aneurysms, dissection, sickle cell, fibrocartilaginous embolic disease) [78,96]
- Vertebral artery injury/dissection with concern for associated spinal infarct
- Preoperative evaluation/planning (eg, localization of the spinal arteries/Adamkiewicz artery prior to complex spinal surgery, aortic aneurysm repair, or characterization of

suspected vascular lesion of the spinal canal and its contents) [99]

## Other

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Cervical Spine MRI** and/or **Thoracic Spine MRI** and/or **Lumbar spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed. The level of the spine that is indicated is based on either the localization of exam finding or the suspected location to that level.

- Suspected spinal cavernous malformation in patients with known intracranial cavernous malformations AND neck/back pain not explained by the brain lesions [100]
- Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10 [101]
- Scoliosis in patients 10-17 years of age with ANY of the following risk factors [101,102]:
  - Progressive spinal deformity (> 1 degree per month)
  - Neurologic deficit (new or unexplained)
  - Atypical curve (eg, short segment curve of 4-6 levels, left thoracic curve, hyperkyphosis)
  - Pre-operative planning
- Pediatric low-grade gliomas (pLGG) for ONE of the following [103]:
  - Screening in infants (< 1 year of age) with a newly diagnosed brain pLGG
  - Known brain pLGG and new neurological signs or symptoms localizing to the spine

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine MRI** and/or **Thoracic Spine MRI** (with or without brain MRI, see Evolent Clinical Guideline 2070 for Brain Imaging). CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Horner's syndrome, not previously worked up, with symptoms and/or exam findings localizing to the spinal cord (eg, abnormal neurological exam findings, upper extremity/hand muscle atrophy, arm/shoulder pain and paresthesia's, history of trauma, demyelinating disease, or prior spine surgery) [104,105]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lumbar Spine MRI** and/or **Thoracic Spine MRI** and/or **Cervical Spine MRI**. CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Suspected spinal dysraphism (neural tube defects) including open (eg, spina bifida aperta, meningocele/myelomeningocele, split cord, myeloschisis) and/or closed (eg, dermal sinus, tethered cord, neurenteric cyst) defects and ONE of the following [89,106–109]:
  - Abnormal neurological exam, high risk markers (eg, dermal sinus, vestigial/human tail, subcutaneous lipoma), or multiple high-risk cutaneous stigmata (eg, atypical

sacral dimple and/or multiple dimples, hypertrichosis, hemangiomas, skin tags, pigmentary abnormalities)

NOTE: Sacral dimple (also known as sacrococcygeal or coccygeal dimples or pits) is atypical if > 5 mm, > 2.5 cm from anus, or associated with drainage or other cutaneous stigmata (hypertrichosis, hemangiomas, skin tags, vestigial tails, subcutaneous lipoma, deviated gluteal cleft).

- Suspicious/abnormal ultrasound infants < 2-6 months of age (if neurological exam abnormalities, high risk markers, or multiple cutaneous stigmata screening ultrasound note needed first)

  NOTE: Spinal ultrasound is the initial screening modality prior to ossification of posterior vertebral arch in infants 2-6 months of age

- Toe walking in children after 2-3 years of age (ie, toddler has learned to walk) and ONE of the following [110–113]:
  - Abnormal neurological exam findings (eg, progressive or sudden lower extremity weakness, asymmetric sensory abnormalities, urinary incontinence, unilateral toe walking, learning to ambulate after 18 months of age, late-onset toe walking, upper extremity weakness, hyperreflexia, and/or spasticity)
  - Exam findings suggestive of spinal dysraphism (see **above**)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Lumbar Spine MRI.** CT is appropriate when the preferred study is contraindicated or cannot be performed.

- Known anorectal malformations with concern for associated spinal cord anomalies (eg, tethered cord syndrome) [114,115]
- Known tethered cord and ONE of the following [89,116]:
  - Imaging results will alter management (ie, surgical planning)
  - New or worsening motor or sensory neurologic exam findings and/or bowel or bladder dysfunction

IMAGING MODALITY: When the following criteria are met, the indicated study is **Cervical Spine CT.** MRI is appropriate when the preferred study is contraindicated or cannot be performed.

- Ossification of the posterior longitudinal ligament (OPLL) for ONE of the following [80,117]:
  - Suspected (OPLL) with ALL of the following:
    - Abnormal x-ray
    - New or worsening neck pain with radiculopathy
  - Known OPLL for preoperative planning

  NOTE: OPLL can occur in the thoracic and lumbar spine but is rare.

## Preoperative or Postoperative Assessment

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications
    - A clinical reason is provided how imaging may change management

  NOTE**:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

IMAGING MODALITY: When any ALL of the following criteria are met, ONE of the following studies is indicated: **Cervical Spine CT**, **Thoracic Spine CT**, or **Lumbar Spine CT** (may also be referred to as CT Myelogram) depending on the level for which surgery was performed on. Multiple levels may be considered on a case-by-case basis when anatomy of the level above or below the operative region is needed.

- Concern for abnormal fusion with persistent axial or radicular pain and ONE of the following:
  - Abnormal x-ray [118,119]
  - Surgery done over 6 months ago
- Presurgical planning (surgeon preference) [42]

## Further Evaluation of Indeterminate Findings

Unless follow-up is otherwise specified within the guideline

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam).

## Genetic Conditions

NOTES: When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Cervical Spine MRI** or **CT**

- Down Syndrome [120]:
  - With signs or symptoms suggestive of possible atlantoaxial instability (such as neck pain, neck stiffness, head tilt, gait changes, radicular pain or a new onset neurologic deficit)

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Whole Body MRI** or ANY combination of the following: **Brain/Cervical/Thoracic/Lumbar Spine MRI**

- LZTR1-related Schwannomatosis [121]:
  - Every 2 years starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Lumbar Spine MRI**

- Marfan Syndrome [122]:
  - For low back pain, proximal leg pain, genital/rectal pain OR weakness and numbness above knee

IMAGING MODALITY: When any of the following criteria is met, the indicated studies is **Brain MRI.** When any ONE of the below criteria are met for spine imaging, **Cervical Spine MRI, Thoracic Spine MRI,** and/or **Lumbar Spine MRI** are additionally indicated**.** CT is indicated only when the preferred study is contraindicated or cannot be performed.

- NF2-Related Schwannomatosis [123]:
  - Brain MRI annually beginning at age 10
  - Signs and symptoms concerning for spinal tumor (any level)
  - Cervical Spine MRI prior to cranial surgery
  - Lumbar Spine MRI prior to regional anesthesia

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine/Whole Body MRI**

- SMARCA4 and SMARCB1 (Includes SMARCB1-associated Schwannomatosis and Rhabdoid Tumor Predisposition Syndrome) [121,124]:
  - At diagnosis
  - Monthly from age 0–6 months
  - Every 2 months from age 7–18 months
  - Every 3 months from age 19 months – 5 years
  - Annually after age 5

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine MRI** AND **Abdomen MRI** or **CT**

- Von Hippel-Lindau (VHL) [125]:
  - Annually (including at diagnosis) starting at age 11
  - IAC MRI with or without Brain MRI is additionally indicated at the onset of hearing loss, tinnitus or vertigo

    NOTE: If it has been > 9 months since the last brain MRI, then brain MRI with IAC is more appropriate in order to bundle IAC evaluation with needed annual screening. If there has been a brain MRI without IAC within the last 9 months then MRI IAC is more appropriate.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [126–128]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 72125 | Computed tomography, cervical spine; without contrast material |
| 72126 | Computed tomography, cervical spine; with contrast material |
| 72127 | Computed tomography, cervical spine; without contrast material, followed by contrast material(s) and further sections |
| 72128 | Computed tomography, thoracic spine; without contrast material |
| 72129 | Computed tomography, thoracic spine; with contrast material |
| 72130 | Computed tomography, thoracic spine; without contrast material, followed by contrast material(s) and further sections |
| 72131 | Computed tomography, lumbar spine; without contrast material |
| 72132 | Computed tomography, lumbar spine; with contrast material |
| 72133 | Computed tomography, lumbar spine; without contrast material, followed by contrast material(s) and further sections |
| 72141 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, cervical; without contrast material |
| 72142 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, cervical; with contrast material(s) |
| 72146 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, thoracic; without contrast material |
| 72147 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, thoracic; with contrast material(s) |
| 72148 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, lumbar; without contrast material |
| 72149 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, lumbar; with contrast material(s) |
| 72156 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, without contrast material, followed by contrast material(s) and further sequences; cervical |

| Code | Description |
|---|---|
| 72157 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, without contrast material, followed by contrast material(s) and further sequences; thoracic |
| 72158 | Magnetic resonance (eg, proton) imaging, spinal canal and contents, without contrast material, followed by contrast material(s) and further sequences; lumbar |
| 72159 | Magnetic resonance angiography, spinal canal and contents, with or without contrast material(s) |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## *Conservative Treatment

Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

**Active Modalities**

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

**Inactive Modalities**

- Medications (eg, NSAIDs, steroids, analgesics)
- Injections (eg, epidural injection, selective nerve root block)
- Medical Devices (eg, TENS unit, bracing)

## **Home Exercise Program

The following two elements are required to meet conservative therapy guidelines for HEP:

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**
- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (eg, increased pain or inability to physically perform exercises).

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds wight limit/dimensions of MRI machine

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** [129,130] | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** [131] | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** [132] | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** [133] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** [134] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** [135] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** (56,136) | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** (137) | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** (138) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for up to 5 years |
| **Bladder Cancer** (139) | **Non-Muscle Invasive (NMIBC)**<br>● Low-intermediate Risk NMIBC treated without cystectomy<br>○ Routine surveillance imaging is not indicated<br>● High Risk* NMIBC treated without cystectomy |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ Once 12 months after diagnosis then<br>■ Every 1-2 years 9 additional years<br>■ No routine surveillance imaging after 10 years<br>● NMICBC after cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ 3 months after surgery then<br>■ 1 year after surgery then<br>■ Annually for 4 additional years<br>■ No routine surveillance imaging after 5 years<br><br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br><br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Annually for 3 additional years<br><br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** (49) | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors<br>○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then<br>■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • CT or MRI of primary tumor site as clinically indicated<br>• Chest CT<br>  ○ Every 6-12 months for 4 years then<br>  ○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>• CT or MRI of primary tumor site and Chest CT<br>  ○ Every 3 months for 2 years then<br>  ○ Every 4 months for year 3 then<br>  ○ Every 6 months year 4 and 5 then<br>  ○ Annually after year 5, as clinically indicated |
| **Breast** (50) | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>• Stage I-III disease:<br>  ○ Routine surveillance imaging not indicated (followed with mammography)<br>**NOTE: See Restaging section for recurrence**<br>• Stage IV disease not currently on therapy<br>  ○ Chest CT and Abdomen and Pelvis CT<br>  ■ Every 3-6 months |
| **Castleman's Disease** (140) | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>• Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** (141) | **Stage I disease treated with non-fertility sparing**<br>• Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>• Pelvis MRI<br>  ○ Once 6 months after completion of treatment then<br>  ○ Annually for 2-3 additional years<br>**Stage II-IV** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Pelvis MRI<br>  ○ Once 3-6 months after completion of treatment<br>  ○ Routine surveillance imaging not indicated thereafter<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>• Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>  ○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** (142) | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** (143) | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** (48,144–147) | **Choroid plexus tumors and carcinoma**<br>• Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>• Malignant choroid plexus carcinoma<br>  ○ Brain MRI<br>  ■ Every 3-4 months for 2 years then<br>  ■ Every 6 months for years 3-5 then<br>  ■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>• Circumscribed glioma (not otherwise listed) post gross total resection<br>  ○ Brain MRI<br>  ■ Every 3-6 months for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ■ Annually after 5 years<br>● Oligodendroglioma and astrocytoma grade 2<br>○ After chemotherapy and radiation<br>■ Brain MRI: Every 6-9 months<br>○ After chemotherapy OR radiation<br>■ Brain MRI: Every 3-4 months<br>○ After surgery only<br>■ Brain MRI: Every 3-4 months<br>NOTE: Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma<br>○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ▫ As clinically indicated after 5 years<br><br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>NOTE: High-grade glioma includes ALL histologies if grade 3 and 4<br><br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br><br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated<br>● MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br><br>**Primary CNS Lymphoma**<br>● MRI Brain +/- MRI C/T/L Spine<br>○ Every 3 months for 2 years, then<br>○ Every 6 months for 3 years, then<br>○ Annually, indefinitely<br><br>**Primary Spinal Cord Tumors**<br>● Low grade tumors (grade 1-2)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Every 3-6 months for 5 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-12 months indefinitely<br>● High grade tumors (grade 3-4)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Once 2-6 weeks after treatment then<br>○ Every 2-4 months for 3 years then<br>○ Every 3-6 months for 2 years, then<br>○ Every 6-12 months indefinitely<br>NOTE: Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br>**Meningiomas**<br>● Grade 1 and 2 or unresected tumors:<br>○ MRI Brain (include spine if spinal involvement)<br>■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>NOTE: SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** [148] | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** (149) | Routine surveillance imaging is not indicated |
| **Dermatofibrosarcoma Protuberans (DFSP)** (150) | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** (151) | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Gastric** [152] | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |
| **Gastrointestinal Stroma Tumor (GIST)** [153] | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>NOTE: More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [154] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [155] | Routine surveillance imaging is not indicated |
| **Head and Neck** [156] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by extensive treatment change). |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** [157] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |
| **Histiocytic Neoplasms** [51] | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** [158,159] | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** [160] | Routine surveillance imaging is not indicated |
| **Kidney Cancer** [52] | See **Active Surveillance** section for indications related to that management strategy. |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after 5 years<br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then<br>○ Annually during year 5 then<br>○ As clinically indicated after year 5<br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5 |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | **Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery*** <br>● Chest CT and Abdomen and Pelvis CT/MRI <br>○ Baseline within 3-6 months then <br>○ Every 3-6 months for 3 years then <br>○ Annually for 2 additional years <br>○ As clinically indicated beyond 5 years <br>**Stage IV, relapsed, or surgically unresectable disease*** <br>● Chest CT and Abdomen and Pelvis CT/MRI <br>○ Every 1.5-4 months <br>● Brain MRI (preferred) or brain CT <br>○ Annually, or as clinically indicated <br>● Entire spine MRI <br>○ As clinically indicated <br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (161) | **Stage 0/in situ, Stage I, Stage IIA** <br>● No routine imaging needed <br>**Stage IIB-IV** <br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck <br>○ Every 3-12 months for 2 years then <br>○ Every 6-12 months for 3 additional years <br>● Brain MRI if stage IIIB or higher <br>○ Every 3-12 months for 2 years then <br>○ Every 6-12 months for 3 additional years <br>NOTE: More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Melanoma: Uveal** [162] | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months for years 6-10 then<br>○ As clinically indicated after year 10<br>NOTE: Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [163] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** [164] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** [165] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Multiple Myeloma** [55] | **Solitary plasmacytoma, Solitary plasmacytoma with minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Annually for 5 years<br><br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** [132] | **Well-differentiated NET, Grade 1-2**<br>● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br><br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br><br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br><br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |
| **Neuroblastoma** [54] | **All risk groups**<br>● CT or MRI of primary site |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br><br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** (60) | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br><br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |
| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** (166) | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer** |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | • Chest CT and Abdomen and Pelvis CT/MRI<br>• Every 3-6 months for 2 years then<br>• Every 6-12 months for 3 additional years then<br>• As clinically indicated after 5 years<br>NOTE: These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br>**Benign Teratoma**<br>• Abdomen and Pelvis CT/MRI<br>  ○ Every 3-6 months for 2 years then<br>  ○ Every 6-12 months for 3 additional years then<br>  ○ As clinically indicated after 5 years<br>**Small cell carcinoma of ovary**<br>• Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>  ○ Every 3-6 months for 2 years then<br>  ○ Annually |
| **Pancreatic Adenocarcinoma** (167) | Chest CT and Abdomen and Pelvis CT<br>• Every 3-6 months for 3 years then<br>• Every 6-12 months for 2 years then<br>• As clinically indicated after 5 years |
| **Penile Cancer** (168) | **pN0 and pN1**<br>• Abdomen and Pelvis CT<br>  ○ Every 6 months for 2 years then<br>  ○ Annually during years 3-4<br>**pN2 and pN3**<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Every 3 months for 1 then<br>  ○ Every 6 months during years 2-4 |

| Cancer | Cancer Imaging After Definitive Treatment |
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| **Prostate Cancer** (169) | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** (170) | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** (57,171,172) | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** (173) | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then<br>● Annually during years 3-5 |
| **Small Cell Lung Cancer** | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and |

| Cancer | Cancer Imaging After Definitive Treatment |
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| **(SCLC)** [58] | CT/MRI of any previously treated metastatic sites (eg, neck, spine)<br>NOTE: Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** [53,174] | **<u>General surveillance guidelines for other sarcomas, based on site:</u>**<br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**<u>Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)</u>**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI (preferred) or CT<br>● **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>● **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>● **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>● **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>● **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**<u>Specific sarcoma surveillance guidelines (above general guidance does not apply):</u>**<br>**Desmoid tumor (aggressive fibromatosis)**<br>● Site-specific MRI (preferred) or CT<br>○ Every 3-6 months for 3 years then<br>○ Every 6-12 months<br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br>**Borderline Phyllodes Tumor**<br>● Chest or Breast MRI<br>○ Every 6 months for 2 years then<br>○ Annually for 3 additional years<br>**Malignant Phyllodes Tumor**<br>● Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually after 5 years |
| **Squamous Cell Skin Cancer (SCC)** [175] | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | for following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** [176]<br><br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** [177] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br><br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br><br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br><br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year<br>○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3 |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | **Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** (177) | See **Active Surveillance** section for indications related to that management strategy.<br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (178) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 8 years<br>○ As clinically indicated after year 10 |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | **Thymic Carcinoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** (61) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>● Neck CT/MRI +/- Chest CT<br>○ Once 6-12 post thyroidectomy<br>○ Routine surveillance imaging thereafter not indicated<br><br>**Medullary Carcinoma**<br>● Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br><br>**Anaplastic Carcinoma**<br>● Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (179) | **Endometrial Cancer treated with non-fertility sparing**<br>● Routine surveillance imaging thereafter not indicated<br><br>**Endometrial Cancer treated with fertility sparing**<br>● Pelvis MRI<br>○ Once 6-9 months after treatment<br>○ Routine surveillance imaging thereafter not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence.<br>● **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (180) | Chest CT and Abdomen and Pelvis CT/MRI<br>● End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>● Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** (181) | Pelvis MRI (Indicated in addition to PET/CT)<br>● End of treatment restaging once 3-6 months after completion of treatment<br>● Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** (59) | Routine surveillance imaging not indicated |
| **Wilms Tumor (Nephroblastoma)** (182) | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>● Every 3 months for 2 years<br>● Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate 3D renderings that display the nuances of tissue beyond the capability of an x-ray, computed tomographic and magnetic resonance imaging have become integral diagnostic tools.

Computed Tomography (CT) is based on the differential absorption of x-rays by various tissues and uses X-rays to create cross-sectional images of the body. The X-ray source and detectors rotate around the patient, and a computer reconstructs the data into detailed images. [183] Its strengths are rapid image acquisition and high sensitivity and specificity for many conditions. It is excellent for evaluating trauma, acute emergencies (eg, injury, spinal fracture, hardware complications, etc.), staging cancers, spinal fusion assessment and can assess multiple organ systems simultaneously.

Magnetic resonance imaging (MRI) is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. It uses strong magnetic fields and radiofrequency pulses to manipulate hydrogen atoms in the body. The resulting signals are detected and converted into images by a computer. [183] MRI provides superior soft tissue contrast and high-resolution images of the spinal cord, making it the modality of choice for most spine indications. MRI also does not use ionizing radiation, making it safer for repeated imaging and for children and pregnant patients. [184]

## Choosing Between CT and MRI

Because CT is fast, widely available, and good for general organ assessment, it is preferred for [184]:

- Assessment of traumatic injury causing fractures
- Evaluation of hardware complications
- Postoperative complications (eg, spinal stenosis, CSF leak)

Because MRI provides superior soft tissue detail, it is preferred for [184]:

- Evaluation of spinal cord inflammation, demyelination, and infection
- Neurological abnormalities (eg, motor, sensory, or reflex abnormality)
- Evaluation of and follow up on CSF flow disorders
- Diagnosis of and follow up on Chiari malformation
- Neck/back pain with signs of neurological abnormalities, abnormal EMG, or malignancy
- Pre- and post-procedural vascular mapping

## The Use of Contrast Agents

Contrast agents are used in advanced imaging to enhance visibility of specific organs and structures. The chemical nature of the contrast agent chosen can highlight differences in specific tissue density, composition, perfusion, or vascularity. [184] CT contrast agents are typically iodinated compounds used to highlight differences in tissue density, while MRI contrast agents are usually gadolinium-based, capitalizing on its paramagnetic properties to highlight differences in tissue composition. [183] Contrast agents are employed when diagnosis requires

enhanced visualization of blood vessels, organ perfusion, or tissue differentiation, but can present a risk to patients with impaired kidney function. [183] While contrast agents are highly useful in identifying vascular pathologies and mapping vascular anatomy for procedural planning or monitoring vascular conditions, it should be kept in mind that in cases of trauma, acute bleeding, and other emergent situations, contrast agents are not typically necessary. [183,184]

# ANALYSIS OF EVIDENCE

## Whole Spine

For the diagnosis of multiple sclerosis, spinal cord MRI with contrast (with or without brain MRI) is crucial for confirming demyelinating lesions, especially in patients with spinal symptoms, and for differentiating multiple sclerosis from AQP4+NMOSD, MOGAD, vascular disease, and migraine. It is also valuable for prognosis and treatment planning. Spinal cord imaging recommended sequences sagittal T2-weighted, proton density, short tau inversion recovery (STIR), or PSIR, axial T2-weighted spin echo/gradient echo, and post-gadolinium T1-weighted (for active lesions) according to 2024 MAGNIMS–CMSC–NAIMS consensus recommendations. [2] Spinal cord MRI can reveal lesions not seen on brain MRI, increasing diagnostic certainty in challenging cases. [4] Spinal cord involvement is common in neurosarcoidosis, with MRI being the gold standard for diagnosis and monitoring. [15] For amyotrophic lateral sclerosis, routine MRI is used primarily to exclude ALS mimics (other diseases that can present similarly), especially in cerebral and spinal regions. [17] In inflammatory back pain with axial spondyloarthritis and negative radiographs or negative MRI of the sacroiliac joints, MRI spine with and without IV contrast (for isolated spinal involvement detection) and CT spine without IV contras (for structural assessment) are the appropriate imaging modalities. In axial spondyloarthritis with spine ankylosis and fracture, CT spine without IV contrast is rapid and excellent for structural assessment; MRI spine without IV contrast is complementary, especially for soft tissue and neurologic injury. Both are more sensitive than radiographs for fracture detection. [20]

MRI is consistently highlighted as the ideal imaging technique for evaluating CSF flow disorders, both in the brain and spine, especially in pediatric populations and for complex pathologies. CT is mainly used for rapid assessment of shunt malfunction, especially in acute settings. It is less preferred due to radiation exposure and limited functional information compared to MRI. MRI helps distinguish between types, localize obstruction, and assess flow dynamics. PC-MRI quantifies flow through the aqueduct and basal cisterns, aiding diagnosis and treatment planning. It also helps differentiate syringomyelia from hydromyelia and myelomalacia, and provides quantitative data on flow velocities that correlate with clinical status. [29,37] MRI is the central imaging technique for diagnosing and evaluating Chiari Malformation type 1 and its variations with hydrosyringomyelia due to its high-resolution, multi-sequence images of both the brain and spinal cord, allowing precise identification of the downward displacement of the cerebellar tonsils through the foramen magnum, detection and characterization of syrinxes (fluid-filled cavities) within the spinal cord, and assessment of CSF flow dynamics, which are crucial for both diagnosis and surgical planning. [27] Spine MRI informs further imaging and risk assessment but is less likely to localize the leak. CT myelography/digital subtraction myelography are superior for leak localization due to dynamic imaging capabilities, especially when MRI findings are positive and non-targeted epidural blood patches have failed or when

MRI is normal but clinical suspicion remains high, particularly with meningeal diverticula or suspected CSF-venous fistula. In the case of subdural hematoma/hygroma, MRI brain with contrast and whole spine are recommended to investigate spinal CSF leak. In the case of cerebral venous thrombosis, brain and spine CT or MR venography is recommended for sudden changes in headache or neurological exam. For superficial siderosis, MRI brain and spine with blood-sensitive sequences are recommended. [38] In intradural extramedullary cysts, meningeal disease, postoperative CSF leak, spinal canal stenosis with hardware, nerve root avulsion, calcium pyrophosphate deposition disease/pseudogout, and ossification of the posterior longitudinal ligament, CT myelography is often the preferred imaging modality. [42]

In follow-up study for new symptomatic VCF and in initial imaging for new back pain with multiple VCFs, both spine CT without IV contrast and spine MRI without IV contrast are the preferred imaging modalities. MRI is preferred for soft tissue, marrow, and fracture acuity assessment, and for distinguishing benign from malignant fractures. It is superior for detecting bone marrow edema, fracture clefts, and soft tissue extension. CT is preferred for detailed bony anatomy, hardware/cement complications, and malignancy features. [43] Radiographs, however, is usually the first-line imaging for suspected VCFs because it's quick, widely available, low cost and good for detecting vertebral height loss, wedge/burst fractures, and spinal alignment changes. [44]

According to the American College of Radiology (ACR) Appropriateness Criteria, most spine infection with comorbidities, post intervention, MRI spine with and without IV contrast are usually the appropriate imaging modalities for characterization of fracture acuity (acute vs. chronic), assessment of bone marrow edema, soft tissue injuries, spinal cord/nerve root compression, and differentiation between benign and malignant fractures. CT is preferred for detailed assessment of fracture morphology, complex or subtle fractures, surgical planning, evaluation of retropulsion and spinal canal compromise, pathologic fractures (eg, metastatic disease) and when MRI is contraindicated or unavailable. [47]

In the assessment of spinal fusion success (cervical, thoracic, lumbar) for pain, instability, and deformity, plain radiography is the first-line imaging for hardware assessment (alignment, loosening, migration), spinal alignment, and initial surveillance, but limited for soft tissue and early complications. Radiography is often performed at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year post surgery. MRI is the gold standard for soft tissue, neural elements, infection, recurrent pain, and complications (eg, arachnoiditis, radiculitis, recurrent disc herniation, spinal stenosis). CT (including multidetector CT) is good for the assessment of hardware mispositioning, bone continuity, graft fusion, pseudarthrosis, infection, and spinal/foraminal stenosis. [119]

In suspected ligamentous, spinal cord, or nerve root injury, MRI without IV contrast is the reference standard for soft tissue injuries, cord contusions, epidural hematomas, and nerve root avulsions. [92]

MRI is the primary modality for evaluating spinal cord lesions, including vascular myelopathies, ischemia, venous congestion, hemorrhage, and malformations. CTA is mainly used for identifying the artery of Adamkiewicz (AKA) in pre-surgical planning for aortic dissection/aneurysm and sometimes for spinal tumors. MRA is used for visualization of normal and abnormal spinal vessels, including the artery of AKA with sensitivity between 69% to 100%. Spinal angiography is essential for detailed evaluation of spinal cord vasculature, spinal vascular malformations, and is used after clinical and MRI assessment, especially when spinal vascular malformations are suspected. [96,99]

MRI is the appropriate imaging modality for brain and spinal cord cavernous malformations. Brain MRI, especially with susceptibility-weighted imaging is essential for diagnosis, follow-up, and detection of large and small cavernous malformations, distinguishes them from other lesions, and identifies recent hemorrhage. Spinal MRI with susceptibility-sensitive sequences is critical for spinal cavernous malformations, as CT and standard MRI may miss small lesions. [100]

## Cervical Spine

In suspected structural lesions near the craniocervical junction (eg, cervical myelopathy, motor neuron disease with progressive lower extremity weakness), cervical spine MRI is generally preferred for its superior detail for spinal cord, nerve roots, and soft tissue, which is critical for diagnosing myelopathy and differentiating it from peripheral neuropathy or other causes. CT may be used if MRI is contraindicated. In neurological abnormalities associated with upper limb sensory symptoms, cervical spine MRI is preferred for its ability to show cord compression, degenerative changes, and ligamentous hypertrophy. [64,72,74,75]

Routine imaging is not indicated for acute/subacute/chronic cervical pain with no red flags or radiculopathy. In cervical pain with radiculopathy, MRI without IV contrast is the modality of choice for nerve root impingement. CT myelography is an alternative when MRI is nondiagnostic or contraindicated. Radiography is complementary for instability (flexion/extension views). In patients with history of prior surgery, CT is best for fusion and hardware assessment, and MRI is best for soft tissue and adjacent level disease. In suspected infection or malignancy, MRI with and without IV contrast is preferred for infection, neoplasm, and soft tissue extension. [80]

Cervical spine CT without IV contrast is the reference standard for detecting cervical spine fractures due to its superior sensitivity (close to 100%) and specificity. Multidetector CT with multiplanar reformations is recommended for initial assessment in patients meeting NEXUS or CCR criteria. MRI is not routinely recommended for clearance after negative CT. MRI has a high false-positive rate (20–40%), may overestimate soft tissue injuries, and rarely changes management in neurologically intact patients with negative CT. [92,93]

For Horner syndrome with localizing spinal cord signs, MRI of the cervical and thoracic spine with and without IV contrast are the preferred imaging modalities. MRI is the gold standard for evaluating spinal cord pathology (eg, infarction, demyelination, epidural hematoma, abscess, disc herniation, syringomyelia). MRI provides superior soft tissue contrast and can assess both central (first-order neuron) and preganglionic (second-order neuron) lesions. [104]

## Thoracic Spine

For thoracic back pain with myelopathy/radiculopathy, MRI without IV contrast is usually appropriate for initial imaging, as it best evaluates compressive etiologies and neural structures. CT without IV contrast may be appropriate for preoperative planning or osseous detail. CT Myelography is complementary to MRI for certain causes (eg, ventral cord herniation, dorsal arachnoid web) or when MRI is limited by hardware. In trauma, osteoporosis, elderly, chronic steroid use, radiography, MRI, and CT without IV contrast are usually appropriate. In patients with suspicion of cancer, infection, immunosuppression, MRI with and without IV contrast is preferred for infection/neoplasm, as it detects marrow lesions, cord signal abnormality, and abscesses. In post-surgical assessment, radiography, MRI, and CT are complementary for hardware integrity, fusion, alignment, and complications. MRI with and without IV contrast is

helpful for infection, hematoma, or canal compromise. Routine imaging is not indicated for acute/subacute/chronic thoracic back pain with no red flags. [73,81]

Prior to implantation of epidural paddle spinal cord stimulator leads in any patient with symptoms referable to thoracic spine pathology (eg, thoracic radiculopathy, hyperreflexia, spasticity, weakness, bowel/bladder deficits), MRI is the recommended imaging modality as it can detect both minor and major anatomical abnormalities that may not be clinically apparent but could significantly impact surgical planning and patient safety. In Best et al 2021 retrospective study, 22% of patients had MRI findings that changed surgical planning, and 3% required additional decompression based on MRI findings. Without MRI, patients could be at risk for intraoperative complications or long-term neurological injury due to undetected stenosis or lesions. [91]

CT thoracic/lumbar spine without IV contrast is the reference standard for detecting thoracolumbar fractures (sensitivity 94–100%) in patients with midline tenderness, high-energy trauma, age > 60, distracting injuries, or inability to be examined (eg, intoxication, altered consciousness). [92]

## Lumbar Spine

In foot drop and lower extremity neurologic deficit, lumbar spine MRI is widely appreciated for ruling out spinal etiologies (eg, nerve root compression, disk herniation, spinal mass) and confirming peripheral nerve injuries when lumbar causes are less likely. [77] In suspected radiculopathy, degenerative joint disease causing gait disturbance or symptoms of neurogenic claudication (pain, sensory deficits, paresis in lower limbs, worsened by walking/standing, relieved by sitting), MRI is the gold standard for diagnosing lumbar spinal stenosis, cauda equina compression, nerve impingement, disc herniation, and other causes of radicular pain that may not be visible on initial plain radiographs. [74,75]

Routine imaging is not indicated for acute/subacute/chronic low back pain with no red flags. In patients who are surgery candidates with persistent/progressive symptoms, MRI without IV contrast is usually appropriate for identifying actionable pain generators. CT myelography is useful for canal patency, especially with hardware or MRI contraindications. Radiography is complementary for functional assessment (flexion/extension views). In patients with history of prior surgery, radiography, MRI (with and without IV contrast), CT (without IV contrast) are complementary. MRI with contrast distinguishes recurrent disc from scar, evaluates infection. CT assesses fusion and hardware. For suspicion of cancer, infection, immunosuppression, MRI (with and without IV contrast) is preferred for infection/neoplasm. [73]

CT thoracic/lumbar spine (without IV contrast) is the reference standard for detecting thoracolumbar fractures (sensitivity 94–100%) in patients with midline tenderness, high-energy trauma, age > 60, distracting injuries, or inability to be examined (eg, intoxication, altered consciousness). [92] For sacral dimples and occult spinal dysraphism, imaging is not needed for simple sacral dimples (solitary, midline, < 5 mm diameter, within 2.5 cm of the anus, no other skin markers). Spinal ultrasonography is indicated for atypical dimples (large, deep, off-midline, multiple, or with cutaneous stigmata like hair tufts, hemangiomas, skin tags, or deviated gluteal cleft) in neonates and infants under 4–6 months. MRI is preferred in older infants (after 4–6 months, when ossification limits ultrasound utility), or if equivocal or abnormal ultrasound findings or for high-risk clinical features (neurological/orthopedic impairment, multiple stigmata, dermal sinus, human tail, subcutaneous lipoma). [106] For tethered cord syndrome (TCS) in spina bifida, MRI is the gold standard for diagnosing TCS and related spinal dysraphism (eg,

myelomeningocele, lipomeningocele, diastematomyelia). It provides high-resolution images of the spinal cord, conus medullaris, filum terminale, and associated anomalies, and is essential for surgical planning and follow-up. [107] Brain and lumbar MRI are preferred in the initial evaluation for neurological causes of toe walking and lower extremity weakness, followed by cervical and thoracic spine MRI when symptoms progressed to assess for spinal cord compression or mass. [110]

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2074 for Spine Imaging:<br>○ ECG 2016 for Cervical Spine CT<br>○ ECG 2017 for Cervical Spine MRI<br>○ ECG 2036 for Lumbar Spine CT<br>○ ECG 2037 for Lumbar Spine MRI<br>○ ECG 2053 for Spinal Canal MRA_MRV<br>○ ECG 2056 for Thoracic Spine CT<br>○ ECG 2057 for Thoracic Spine MRI<br>• This guideline also merges the procedure codes from the above Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

*Evolent Clinical Guidelines do not constitute medical advice. Treating health care professionals are solely responsible for diagnosis, treatment, and medical advice. Evolent uses Clinical Guidelines in accordance with its contractual obligations to provide utilization management. Coverage for services varies for individual members according to the terms of their health care coverage or government program. Individual members' health care coverage may not utilize some Evolent Clinical Guidelines. Evolent clinical guidelines contain guidance that requires prior authorization and service limitations. A list of procedure codes, services or drugs may not be all inclusive and does not imply that a service or drug is a covered or non-*

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*Evolent Clinical Guidelines are comprehensive and inclusive of various procedural applications for each service type. Our guidelines may be used to supplement Medicare criteria when such criteria is not fully established. When Medicare criteria is determined to not be fully established, we only reference the relevant portion of the corresponding Evolent Clinical Guideline that is applicable to the specific service or item requested in order to determine medical necessity.*

# REFERENCES


1. Shadmani G, Simkins TJ, Assadsangabi R, et al. Autoimmune diseases of the brain, imaging and clinical review. *Neuroradiology Journal*. 2022;35(2):152-169. doi:10.1177/19714009211042879
2. Barkhof F, Reich DS, Oh J, et al. 2024 MAGNIMS-CMSC-NAIMS consensus recommendations on the use of MRI for the diagnosis of multiple sclerosis. *www.thelancet.com/neurology*. 2025;24. www.thelancet.com/neurology
3. Wattjes MP, Ciccarelli O, Reich DS, et al. 2021 MAGNIMS–CMSC–NAIMS consensus recommendations on the use of MRI in patients with multiple sclerosis. *Lancet Neurol*. 2021;20(8):653-670. doi:10.1016/S1474-4422(21)00095-8
4. Thompson AJ, Banwell BL, Barkhof F, et al. Diagnosis of multiple sclerosis: 2017 revisions of the McDonald criteria. *Lancet Neurol*. 2018;17(2):162-173. doi:10.1016/S1474-4422(17)30470-2
5. Traboulsee A, Simon JH, Stone L, et al. Revised recommendations of the consortium of MS centers task force for a standardized MRI protocol and clinical guidelines for the diagnosis and follow-up of multiple sclerosis. *American Journal of Neuroradiology*. 2016;37(3):394-401. doi:10.3174/ajnr.A4539
6. Baskaran AB, Grebenciucova E, Shoemaker T, Graham EL. Multiple Sclerosis. *Journal of Clinical Neurology (Korea)*. 2023;19(3):217-229. doi:10.3988/jcn.2022.0208
7. Kalnins A, Lewis LM, Soderlund KA, et al. ACR Appropriateness Criteria® Demyelinating Diseases. *Journal of the American College of Radiology*. Published online 2026. doi:10.1016/j.jacr.2026.02.003
8. Kümpfel T, Giglhuber K, Aktas O, et al. Update on the diagnosis and treatment of neuromyelitis optica spectrum disorders (NMOSD) – revised recommendations of the Neuromyelitis Optica Study Group (NEMOS). Part II: Attack therapy and long-term management. *J Neurol*. 2024;271(1):141-176. doi:10.1007/s00415-023-11910-z
9. Gausmann KM, May RA, Sichtermann T, Heussen NM, Schulz JB, Brunkhorst R. Magnetic Resonance Imaging of Nerve Roots in the Diagnosis of Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) – A Systematic Review and Meta-Analysis. *Eur J Neurol*. 2026;33(5). doi:10.1111/ene.70612
10. Van den Bergh PYK, van Doorn PA, Hadden RDM, et al. European Academy of Neurology/Peripheral Nerve Society guideline on diagnosis and treatment of chronic inflammatory demyelinating polyradiculoneuropathy: Report of a joint Task Force—Second revision. *Eur J Neurol*. 2021;28(11):3556-3583. doi:10.1111/ene.14959
11. van Doorn PA, Van den Bergh PYK, Hadden RDM, et al. European Academy of Neurology/Peripheral Nerve Society Guideline on diagnosis and treatment of Guillain–Barré syndrome. *Journal of the Peripheral Nervous System*. 2023;28(4):535-563. doi:10.1111/jns.12594
12. Banwell B, Bennett JL, Marignier R, et al. Diagnosis of myelin oligodendrocyte glycoprotein antibody-associated disease: International MOGAD Panel proposed criteria. *Lancet Neurol*. 2023;22(3):268-282. doi:10.1016/S1474-4422(22)00431-8

13. Jarius S, Aktas O, Ayzenberg I, et al. Update on the diagnosis and treatment of neuromyelits optica spectrum disorders (NMOSD) – revised recommendations of the Neuromyelitis Optica Study Group (NEMOS). Part I: Diagnosis and differential diagnosis. *J Neurol*. 2023;270(7):3341-3368. doi:10.1007/s00415-023-11634-0

14. Wingerchuk DM, Banwell B, Bennett JL, et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. *Neurology*. 2015;85(2):177-189. doi:10.1212/WNL.0000000000001729

15. Bradshaw MJ, Pawate S, Koth LL, Cho TA, Gelfand JM. Neurosarcoidosis. *Neurol Neuroimmunol Neuroinflamm*. 2021;8(6):e1084. doi:10.1212/NXI.0000000000001084

16. Voortman M, Drent M, Baughman RP. Management of neurosarcoidosis: a clinical challenge. *Curr Opin Neurol*. 2019;32(3):475-483. doi:10.1097/WCO.0000000000000684

17. Goutman SA, Hardiman O, Al-Chalabi A, et al. Recent advances in the diagnosis and prognosis of amyotrophic lateral sclerosis. *Lancet Neurol*. 2022;21(5):480-493. doi:10.1016/S1474-4422(21)00465-8

18. Feldman EL, Goutman SA, Petri S, et al. Amyotrophic lateral sclerosis. *The Lancet*. 2022;400(10360):1363-1380. doi:10.1016/S0140-6736(22)01272-7

19. Kleinerova J, Querin G, Pradat PF, Siah WF, Bede P. New developments in imaging in ALS. *J Neurol*. 2025;272(6). doi:10.1007/s00415-025-13143-8

20. Czuczman GJ, Mandell JC, Wessell DE, et al. ACR Appropriateness Criteria® Inflammatory Back Pain: Known or Suspected Axial Spondyloarthritis: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S340-S360. doi:10.1016/j.jacr.2021.08.003

21. Colebatch AN, Edwards CJ, Østergaard M, et al. EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis*. 2013;72(6):804-814. doi:10.1136/annrheumdis-2012-203158

22. Ward MM, Deodhar A, Gensler LS, et al. 2019 Update of the American College of Rheumatology/Spondylitis Association of America/Spondyloarthritis Research and Treatment Network Recommendations for the Treatment of Ankylosing Spondylitis and Nonradiographic Axial Spondyloarthritis. *Arthritis and Rheumatology*. 2019;71(10):1599-1613. doi:10.1002/art.41042

23. Mańczak M, Gasik R. Cervical spine instability in the course of rheumatoid arthritis – imaging methods. *Rheumatology*. 2017;55(4):201-207. doi:10.5114/reum.2017.69782

24. Siempis T, Tsakiris C, Anastasia Z, Alexiou GA, Voulgaris S, Argyropoulou MI. Radiological assessment and surgical management of cervical spine involvement in patients with rheumatoid arthritis. *Rheumatol Int*. 2022;43(2):195-208. doi:10.1007/s00296-022-05239-5

25. Henderson FC, Austin C, Benzel E, et al. Neurological and spinal manifestations of the Ehlers–Danlos syndromes. *Am J Med Genet C Semin Med Genet*. 2017;175(1):195-211. doi:10.1002/ajmg.c.31549

26. Yang SY, Boniello AJ, Poorman CE, Chang AL, Wang S, Passias PG. A Review of the Diagnosis and Treatment of Atlantoaxial Dislocations. *Global Spine J*. 2014;4(3):197-210. doi:10.1055/s-0034-1376371

27. Hatgaonkar AM, Mahajan SM, Hatgoankar KA, Bandre GR. MRI Imaging Insights in Chiari Malformation Type 1 and Variations With Hydrosyringomyelia. *Cureus*. 2024;16(3):e55676. doi:10.7759/cureus.55676

28. Whitson WJ, Lane JR, Bauer DF, Durham SR. A prospective natural history study of nonoperatively managed Chiari I malformation: does follow-up MRI surveillance alter surgical decision making? *J Neurosurg Pediatr*. 2015;16(2):159-166. doi:10.3171/2014.12.PEDS14301

29. Mohammad SA, Osman NM, Ahmed KA. The value of CSF flow studies in the management of CSF disorders in children: a pictorial review. *Insights Imaging*. 2019;10(1):3. doi:10.1186/s13244-019-0686-x

30. Costa F, Benali SA, Dantas F, et al. Chiari Malformation: Diagnosis, Classifications, Natural History, and Conservative Management. World Federation of Neurosurgical Societies Spine Committee Recommendations. *Spine (Phila Pa 1976)*. 2025;50(11):767-778. doi:10.1097/BRS.0000000000005289

31. Friedlander RM. Congenital and Acquired Chiari Syndrome. *New England Journal of Medicine*. 2024;390(23):2191-2198. doi:10.1056/nejmra2308055

32. Massimi L, Peretta P, Erbetta A, et al. Diagnosis and treatment of Chiari malformation type 1 in children: the International Consensus Document. *Neurol Sci*. 2022;43(2):1311-1326. doi:10.1007/s10072-021-05317-9

33. Visocchi M, Signorelli F, Alves ÓL, et al. Indications for Surgery and Surgical Options in Chiari Malformation: WFNS Spine Committee Recommendations. *Spine (Phila Pa 1976)*. 2025;50(11):760-766. doi:10.1097/BRS.0000000000005288

34. Yuan C, Du Y, Yao Q, et al. Natural history of Chiari I malformation-syringomyelia: longitudinal cohort study. *J Neurol Neurosurg Psychiatry*. 2025;96(12):1204-1214. doi:10.1136/jnnp-2025-336023

35. Sayal PP, Zafar A, Carroll TA. Syringomyelia secondary to “occult” dorsal arachnoid webs: Report of two cases with review of literature. *J Craniovertebr Junction Spine*. 2016;7(2):101-104. doi:10.4103/0974-8237.181862

36. Van Der Veken J, Harding M, Hatami S, Agzarian M, Vrodos N. Syringomyelia intermittens: highlighting the complex pathophysiology of syringomyelia. Illustrative case. *Journal of Neurosurgery: Case Lessons*. 2021;2(11). doi:10.3171/CASE21341

37. Korbecki A, Zimny A, Podgórski P, Sąsiadek M, Bladowska J. Imaging of cerebrospinal fluid flow: Fundamentals, techniques, and clinical applications of phase-contrast magnetic resonance imaging. *Pol J Radiol*. 2019;84:240-250. doi:10.5114/pjr.2019.86881

38. Cheema S, Anderson J, Angus-Leppan H, et al. Multidisciplinary consensus guideline for the diagnosis and management of spontaneous intracranial hypotension. *J Neurol Neurosurg Psychiatry*. 2023;94(10):835-843. doi:10.1136/jnnp-2023-331166

39. Govindappa SKG, Adiga CP, Kumar S, Goolahally LN, Kumar S. Spontaneous Intracranial Hypotension: A Review of Neuroimaging and Current Concepts. *Indian Journal of Radiology and Imaging*. 2023;34(1):128-138. doi:10.1055/s-0043-1774301

40. Timpone VM, Parsons MS, Boulter DJ, et al. ACR Appropriateness Criteria® Imaging of Suspected Intracranial Hypotension. *J Am Coll Radiol*. 2024;21(11S):S396-S412. doi:10.1016/j.jacr.2024.08.020

41. Utukuri PS, Shih RY, Ajam AA, et al. ACR Appropriateness Criteria® Headache: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S70-S93. doi:10.1016/j.jacr.2023.02.018

42. Patel DM, Weinberg BD, Hoch MJ. CT Myelography: Clinical Indications and Imaging Findings. *RadioGraphics*. 2020;40(2):470-484. doi:10.1148/rg.2020190135

43. Khan MA, Jennings JW, Baker JC, et al. ACR Appropriateness Criteria® Management of Vertebral Compression Fractures: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S102-S124. doi:10.1016/j.jacr.2023.02.015

44. Miao KH, Miao JH, Belani P, et al. Radiological Diagnosis and Advances in Imaging of Vertebral Compression Fractures. *J Imaging*. 2024;10(10). doi:10.3390/jimaging10100244

45. Kumar Y, Hayashi D. Role of magnetic resonance imaging in acute spinal trauma: a pictorial review. *BMC Musculoskelet Disord*. 2016;17(1):310. doi:10.1186/s12891-016-1169-6

46. Berbari EF, Kanj SS, Kowalski TJ, et al. 2015 Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines for the Diagnosis and Treatment of Native Vertebral Osteomyelitis in Adults. *Clinical Infectious Diseases*. 2015;61(6):e26-e46. doi:10.1093/cid/civ482

47. Ortiz AO, Levitt A, Shah LM, et al. ACR Appropriateness Criteria® Suspected Spine Infection. *Journal of the American College of Radiology*. 2021;18(11):S488-S501. doi:10.1016/j.jacr.2021.09.001

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57. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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62. Larson ST, Wilbur J. Muscle Weakness in Adults: Evaluation and Differential Diagnosis. *Am Fam Physician*. 2020;101(2):95-108.

63. Kim H, Chang BS, Park S, Nam Y, Chang SY. Different Neurogenic Bladders in Patients with Cervical and Thoracic Myelopathy: Direct Comparison from a Prospective Case Series. *J Clin Med*. 2024;13(14). doi:10.3390/jcm13144155

64. Kane SF, Abadie K V, Willson A. Degenerative Cervical Myelopathy: Recognition and Management. *Am Fam Physician*. 2020;102(12):740-750.

65. Zileli M, Borkar SA, Sinha S, et al. Cervical Spondylotic Myelopathy: Natural Course and the Value of Diagnostic Techniques –WFNS Spine Committee Recommendations. *Neurospine*. 2019;16(3):386-402. doi:10.14245/ns.1938240.120

66. Crausaz L, Baumgartner T, Loser V. Clinical Reasoning: A 62-Year-Old Man With Symmetric Saddle Hypoesthesia and Sphincter Dysfunction. *Neurology*. 2025;104(11). doi:10.1212/WNL.0000000000213712

67. Rupp R, Biering-Sørensen F, Burns SP, et al. International standards for neurological classification of spinal cord injury. *Top Spinal Cord Inj Rehabil*. 2021;27(2). doi:10.46292/sci2702-1

68. Durney P, Stillman M, Montero W, Goetz L. A primary care provider's guide to neurogenic bowel dysfunction in spinal cord injury. *Top Spinal Cord Inj Rehabil*. 2020;26(3):172-176. doi:10.46292/SCI2603-172

69. Hanna SS, Jewell R, Anker CJ, Dewitt JC, Tranmer B, Thomas AA. Clinical Reasoning: A 67-Year-Old Woman with Abdominal Pain, Constipation, and Urinary Retention. *Neurology*. 2022;99(3):117-122. doi:10.1212/WNL.0000000000200748

70. Best Practices Guidelines Spine Injury. Published online 2022. https://www.facs.org/media/k45gikqv/spine_injury_guidelines.pdf

71. Milligan J, Goetz LL, Kennelly MJ. A primary care provider's guide to management of neurogenic lower urinary tract dysfunction and urinary tract infection after spinal cord injury. *Top Spinal Cord Inj Rehabil*. 2020;26(2):108-115. doi:10.46292/SCI2602-108

72. Hilton B, Gardner EL, Jiang Z, et al. Establishing Diagnostic Criteria for Degenerative Cervical Myelopathy [AO Spine RECODE-DCM Research Priority Number 3]. *Global Spine J*. 2022;12(1_suppl):55S-63S. doi:10.1177/21925682211030871

73. Hutchins TA, Peckham M, Shah LM, et al. ACR Appropriateness Criteria® Low Back Pain: 2021 Update. *J Am Coll Radiol*. 2021;18(11S):S361-S379. doi:10.1016/j.jacr.2021.08.002

74. Pirker W, Katzenschlager R. Gait disorders in adults and the elderly. *Wien Klin Wochenschr*. 2017;129(3-4):81-95. doi:10.1007/s00508-016-1096-4

75. Marshall FJ. Approach to the elderly patient with gait disturbance. *Neurol Clin Pract*. 2012;2(2):103-111. doi:10.1212/CPJ.0b013e31825a7823

76. Tetreault L, Kalsi-Ryan S, Benjamin Davies, et al. Degenerative Cervical Myelopathy: A Practical Approach to Diagnosis. *Global Spine J*. 2022;12(8):1881-1893. doi:10.1177/21925682211072847

77. Swiatek P, Giakas AM, Narayanan R, Dalton J, Vaccaro AR. Examining the Anatomy, Pathophysiology, and Clinical Presentation of Lower Extremity Neurologic Deficits: A Spine Surgeon's Guide to Foot Drop. *Journal of the American Academy of Orthopaedic Surgeons* . 2025;33(18):e1060-e1071. doi:10.5435/JAAOS-D-24-00705

78. Agarwal V, Shah LM, Parsons MS, et al. ACR Appropriateness Criteria® Myelopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(5):S73-S82. doi:10.1016/j.jacr.2021.01.020

79. Boulter DJ, Job J, Shah LM, et al. ACR Appropriateness Criteria® Plexopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S423-S441. doi:10.1016/j.jacr.2021.08.014

80. Eldaya RW, Parsons MS, Hutchins TA, et al. ACR Appropriateness Criteria® Cervical Pain or Cervical Radiculopathy: 2024 Update. *J Am Coll Radiol*. 2025;22(5S):S136-S162. doi:10.1016/j.jacr.2025.02.035

81. Shah VN, Parsons MS, Boulter DJ, et al. ACR Appropriateness Criteria® Thoracic Back Pain. *J Am Coll Radiol*. 2024;21(11S):S504-S517. doi:10.1016/j.jacr.2024.08.016

82. American Association of Electrodiagnostic Medicine, American Academy of Physical Medicine and Rehabilitation. Practice parameter for needle electromyographic evaluation of patients with suspected cervical radiculopathy. *Muscle Nerve Suppl*. 1999;8:S209-21. https://www.aanem.org/docs/default-source/documents/cervicalradiculopathy.pdf?sfvrsn=c8c8d654_1

83. Cho SC, Ferrante MA, Levin KH, Harmon RL, So YT. Utility of electrodiagnostic testing in evaluating patients with lumbosacral radiculopathy: An evidence-based review. *Muscle Nerve*. 2010;42(2):276-282. doi:10.1002/mus.21759

84. Mohile N V., Kuczmarski AS, Lee D, Warburton C, Rakoczy K, Butler AJ. Spondylolysis and Isthmic Spondylolisthesis: A Guide to Diagnosis and Management. *Journal of the American Board of Family Medicine*. 2022;35(6):1204-1216. doi:10.3122/jabfm.2022.220130R1

85. Fong AM, Duculan R, Endo Y, et al. Instability Missed by Flexion-Extension Radiographs Subsequently Identified by Alternate Imaging in L4-L5 Lumbar Degenerative Spondylolisthesis. *Spine (Phila Pa 1976)*. 2023;48(3):E33-E39. doi:10.1097/BRS.0000000000004483

86. Tofte JN, Carllee TL, Holte AJ, Sitton SE, Weinstein SL. Imaging Pediatric Spondylolysis. *Spine (Phila Pa 1976)*. 2017;42(10):777-782. doi:10.1097/BRS.0000000000001912

87. Choi JH, Ochoa JK, Lubinus A, Timon S, Lee Y po, Bhatia NN. Management of lumbar spondylolysis in the adolescent athlete: a review of over 200 cases. *Spine Journal*. 2022;22(10):1628-1633. doi:10.1016/j.spinee.2022.04.011

88. Childress MA, Becker BA. Nonoperative Management of Cervical Radiculopathy. *Am Fam Physician*. 2016;93(9):746-754.

89. Dahmoush H, Gaddam DS, Ho ML, et al. ACR Appropriateness Criteria® Back Pain-Child: 2024 Update. *Journal of the American College of Radiology*. 2025;22(5):S79-S107. doi:10.1016/j.jacr.2025.02.037

90. Frosch M, Mauritz MD, Bielack S, et al. Etiology, Risk Factors, and Diagnosis of Back Pain in Children and Adolescents: Evidence- and Consensus-Based Interdisciplinary Recommendations. *Children*. 2022;9(2):192. doi:10.3390/children9020192

91. Best BJ, Porwal MH, Pahapill PA. Preoperative Thoracic Spine Magnetic Resonance Imaging for Spinal Cord Stimulation: Should Such a Recommendation Be an Absolute Requirement? *Neuromodulation*. 2022;25(5):758-762. doi:10.1111/ner.13518

92. Hassankhani A, Freeman CW, Banks J, et al. ACR Appropriateness Criteria® Acute Spinal Trauma: 2024 Update. *J Am Coll Radiol*. 2025;22(5S):S48-S66. doi:10.1016/j.jacr.2025.02.013

93. Moeri M, Rothenfluh DA, Laux CJ, Dominguez DE. Cervical spine clearance after blunt trauma: Current state of the art. *EFORT Open Rev*. 2020;5(4):253-259. doi:10.1302/2058-5241.5.190047

94. Kadom N, Palasis S, Pruthi S, et al. ACR Appropriateness Criteria® Suspected Spine Trauma-Child. *Journal of the American College of Radiology*. 2019;16(5):S286-S299. doi:10.1016/j.jacr.2019.02.003

95. Palombi D, Galeazzi M, Brigato P, et al. Redefining Pediatric SCIWORA: A Systematic Review of the Literature on Clinical Patterns, Imaging Profiles, and Management Insights. *J Clin Med*. 2025;14(17). doi:10.3390/jcm14176338

96. Da Ros V, Picchi E, Ferrazzoli V, et al. Spinal vascular lesions: anatomy, imaging techniques and treatment. *Eur J Radiol Open*. 2021;8. doi:10.1016/j.ejro.2021.100369

97. Vargas MI, Gariani J, Sztajzel R, et al. Spinal Cord Ischemia: Practical Imaging Tips, Pearls, and Pitfalls. *American Journal of Neuroradiology*. 2015;36(5):825-830. doi:10.3174/ajnr.A4118

98. Montalvo M, Bayer A, Azher I, Knopf L, Yaghi S. Spinal Cord Infarction Because of Spontaneous Vertebral Artery Dissection. *Stroke*. 2018;49(11):e314-e317. doi:10.1161/STROKEAHA.118.022333

99. Backes WH, Nijenhuis RJ. Advances in Spinal Cord MR Angiography. *American Journal of Neuroradiology*. 2008;29(4):619-631. doi:10.3174/ajnr.A0910

100. Akers AL, Albanese J, Alcazar-Felix RJ, et al. Guidelines for the Diagnosis and Clinical Management of Cavernous Malformations of the Brain and Spinal Cord: Consensus Recommendations Based on a Systematic Literature Review by the Alliance to Cure Cavernous Malformation Clinical Advisory Board Experts Panel. *Neurosurgery*. Published online 2025. doi:10.1227/neu.0000000000003459

101. Jones JY, Saigal G, Palasis S, et al. ACR Appropriateness Criteria® Scoliosis-Child. *Journal of the American College of Radiology*. 2019;16(5):S244-S251. doi:10.1016/j.jacr.2019.02.018

102. Trenga AP, Singla A, Feger MA, Abel MF. Patterns of congenital bony spinal deformity and associated neural anomalies on X-ray and magnetic resonance imaging. *J Child Orthop*. 2016;10(4):343-352. doi:10.1007/s11832-016-0752-6

103. Roka K, Scheinemann K, Avula S, et al. European standard clinical practice recommendations for primary pediatric low-grade gliomas. *EJC Paediatric Oncology*. 2024;4. doi:10.1016/j.ejcped.2024.100169

104. Dubey P, Shekhrajka N, Juliano AF, et al. ACR Appropriateness Criteria® Horner Syndrome. *Journal of the American College of Radiology*. 2025;22(11):S550-S577. doi:10.1016/j.jacr.2025.08.041

105. Maamouri R, Ferchichi M, Houmane Y, Gharbi Z, Cheour M. Neuro-Ophthalmological Manifestations of Horner's Syndrome: Current Perspectives. *Eye Brain*. 2023;Volume 15:91-100. doi:10.2147/EB.S389630

106. Eun J, Lee KS, Yang SH. Sacral dimple: clinical perspectives of lesions hidden beneath the skin. *Clin Exp Pediatr*. Published online February 15, 2025. doi:10.3345/cep.2025.01802

107. Bradko V, Castillo H, Janardhan S, Dahl B, Gandy K, Castillo J. Towards guideline-based management of tethered cord syndrome in spina bifida: A global health paradigm shift in the era of prenatal surgery. *Neurospine*. 2019;16(4):715-727. doi:10.14245/ns.1836342.171

108. Choi SJ, Yoon HM, Hwang JS, et al. Incidence of Occult Spinal Dysraphism Among Infants With Cutaneous Stigmata and Proportion Managed With Neurosurgery. *JAMA Netw Open*. 2020;3(7):e207221. doi:10.1001/jamanetworkopen.2020.7221

109. Zheng L, Liao Z, Duan H. Holocord syringomyelia caused by tethered cord syndrome: case report and literature review. *BMC Neurol*. 2024;24(1). doi:10.1186/s12883-024-03951-2

110. Ustaris LM, Seidman R, Bindra T, Basak R. Toe walking after three: How serious could it be? *BMJ Case Rep*. 2018;2018. doi:10.1136/bcr-2017-223589

111. Ruzbarsky JJ, Scher D, Dodwell E. Toe walking: Causes, epidemiology, assessment, and treatment. *Curr Opin Pediatr*. 2016;28(1):40-46. doi:10.1097/MOP.0000000000000302

112. Flaugh RA, May CJ, Curran P, Miller PE, Kasser JR, Shore BJ. MRI of the Spine in Patients who Toe Walk: Is There a Role? *Journal of Pediatric Orthopaedics*. 2024;44(4):267-272. doi:10.1097/BPO.0000000000002633

113. Haynes KB, Wimberly RL, VanPelt JM, Jo CH, Riccio AI, Delgado MR. Toe Walking: A Neurological Perspective After Referral From Pediatric Orthopaedic Surgeons. *Journal of Pediatric Orthopaedics*. 2018;38(3):152-156. doi:10.1097/BPO.0000000000001115

114. Stafrace S, Lobo L, Augdal TA, et al. Imaging of anorectal malformations: where are we now? Abdominal imaging task force of the European Society of Paediatric Radiology. *Pediatr Radiol*. 2022;52(9):1802-1809. doi:10.1007/s00247-022-05395-7

115. de Beaufort CMC, Groenveld JC, Mackay TM, et al. Spinal cord anomalies in children with anorectal malformations: a retrospective cohort study. *Pediatr Surg Int*. 2023;39(1). doi:10.1007/s00383-023-05440-y

116. Hsieh P, Apaydin E, Briggs RG, et al. Diagnosis and Treatment of Tethered Spinal Cord: A Systematic Review. *Pediatrics*. 2024;154(5). doi:10.1542/peds.2024-068270

117. Sartip KA, Dong T, Ndukwe M, et al. Ossification of the posterior longitudinal ligament: Imaging findings in the era of cross-sectional imaging. *J Comput Assist Tomogr*. 2015;39(6):835-841. doi:10.1097/RCT.0000000000000303

118. Sanghvi PA, Wiener JM, Meade SM, Boden LM, Shost MD, Steinmetz MP. Development of a unified and comprehensive definition of successful spinal fusion: a systematic review. *J Neurosurg Spine*. 2025;42(4):403-412. doi:10.3171/2024.9.SPINE2465

119. Corona-Cedillo R, Saavedra-Navarrete MT, Espinoza-Garcia JJ, Mendoza-Aguilar AN, Ternovoy SK, Roldan-Valadez E. Imaging Assessment of the Postoperative Spine: An

Updated Pictorial Review of Selected Complications. *Biomed Res Int*. 2021;2021(1):9940001. doi:10.1155/2021/9940001

120. Bull MJ, Trotter T, Santoro SL, Christensen C, Grout RW. Health Supervision for Children and Adolescents With Down Syndrome. *Pediatrics*. 2022;149(5):e2022057010. doi:10.1542/peds.2022-057010

121. Dhamija R, Plotkin S, Gomes A, Babovic-Vuksanovic D. LZTR1- and SMARCB1-Related Schwannomatosis. *GeneReviews®*. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK487394/

122. Dietz H. FBN1-Related Marfan Syndrome. *GeneReviews®*. Published online February 17, 2022. https://www.ncbi.nlm.nih.gov/books/NBK1335/

123. Evans DG. NF2-Related Schwannomatosis. *GeneReviews®*. Published online April 20, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1201/

124. Nemes K, Bens S, Bourdeaut F, et al. Rhabdoid Tumor Predisposition Syndrome. *GeneReviews®*. Published online May 12, 2022. https://www.ncbi.nlm.nih.gov/books/NBK469816/

125. van Leeuwaarde RS van, Ahmad S, van Nesselrooij B, Zandee W, Giles RH. Von Hippel-Lindau Syndrome. *GeneReviews®*. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1463/

126. Friedman J. Neurofibromatosis 1. *GeneReviews®*. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

127. Miller DT, Freedenberg D, Schorry E, et al. Health Supervision for Children With Neurofibromatosis Type 1. *Pediatrics*. 2019;143(5):e20190660. doi:10.1542/peds.2019-0660

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145. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

146. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

147. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

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171. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

172. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

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183. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

184. Vachha BA, Moonis G, Wintermark M, Massoud TF, eds. *What Radiology Residents Need to Know: Neuroradiology*. Springer; 2024.

# Evolent Clinical Guideline 2075 for Upper Extremity Imaging

## *Carpal Joint, Elbow, Hand, Humerus, Scapula, Shoulder, Upper Extremity Joint, Upper Extremity Non-Joint, Wrist*

| **Guideline Number:** Evolent_CG_2075 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** January 2027 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines, and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Computed Tomography (CT) uses ionizing radiation to generate images of the upper extremities. Magnetic Resonance Imaging (MRI) generates images of the upper extremities without the use of ionizing radiation. Computed tomography angiography (CTA) generates images of vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Magnetic resonance angiography (MRA) generates images of blood vessels that can be evaluated for evidence of stenosis, occlusion, or aneurysms without ionizing radiation.

## Special Notes

- Plain X-rays must precede CT/MRI evaluation, unless otherwise indicated
- One authorization for CTA and/or MRA covers both arterial and venous imaging. The term *angiography* refers to both arteriography and venography. Additionally, CTA and MRA refers to angiography not arthrography.
- When a CT/MR Arthrogram is requested, meets medical necessity criteria for the appropriate joint, AND a clinical explanation is given for why an arthrogram is needed instead of MRI, the authorization issued is as a CT or MRI of that joint. A separate or additional authorization for the arthrogram is not needed.
    - If the above criteria are met, contraindication for MRI is not required for approval of CT Arthrogram.
- When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

## Brachial Plexopathy (1–3)

IMAGING MODALITY: When any ONE of the following criteria are met, **Shoulder MRI** (or Chest MRI) is the indicated study (depending on the location of the injury/plexopathy). Only ONE study is indicated.

- Traumatic Brachial Plexopathy: if mechanism of injury is highly suspicious for brachial plexopathy (eg, birth trauma, mid-clavicular fracture, shoulder dislocation, contact injury to the neck (burner or stinger syndrome) or penetrating injury)
- Non-traumatic Brachial Plexopathy (including neurogenic thoracic outlet syndrome): when Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive of brachial plexopathy

## Foreign Body (4)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CT**. Upper Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected or known foreign body of the upper extremity with prior imaging that is indeterminate or abnormal

# Fracture

## *Suspected Fracture (5)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected occult scaphoid fracture
  - Snuffbox pain after initial X-ray
- Suspected non-scaphoid occult, stress, or insufficiency fracture with negative or indeterminate X-rays taken ≥ 10 days after the injury or initial clinical assessment
- Suspected pathologic fracture or impending fracture on prior imaging as documented in the notes OR with any ONE of the following findings on X-ray:
  - Periosteal reaction
  - Cortical breakthrough
  - Permeative/moth-eaten appearance
  - Wide zone of transition
  - Lytic lesion

### *Known Fracture* [6,7]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CT**. Upper Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected nonunion or delayed union as demonstrated by a lack of bone healing on two or more X-rays ≥ 4 months apart [8]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Known traumatic fracture on prior imaging, with suspected associated ligament or tendon injury

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CT**. Upper Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Known traumatic upper extremity fracture on prior imaging, without concern for an associated ligament or tendon injury [9]

## Infection of Bone, Joint, or Soft Tissue Abscess [10]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of infection (including osteomyelitis) of the upper extremity with abnormal or indeterminate findings on any ONE of the following:
  - X-ray for suspected bone/joint infection
  - Ultrasound for suspected soft tissue infection
- Negative prior imaging with a clinical suspicion of advanced infection (including osteomyelitis) based on any ONE of the following:
  - Signs/symptoms of joint or bone infection (eg, pain, swelling, decreased range of motion, fever)
  - Laboratory findings consistent with possible bone or joint infection such as:
    - Elevated erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP)
    - Elevated white blood cell count
    - Positive joint aspiration
- Upper extremity ulcer with suspected advanced infection (including osteomyelitis) with ALL of the following [11]:
  - Signs of advanced infection on exam (eg, redness, warmth, swelling, bone exposed

or encountered when probing the wound, worsening breakdown or smell)

- No improvement despite prior treatment and bone or deep soft tissue infection is now suspected

# Inflammation

## *Crystalline Arthropathy* *(12,13)*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CT** (typically a Dual-energy CT).

- For suspected or known crystal deposition arthropathy (eg, gout, calcium pyrophosphate deposition (CPPD)) after initial rheumatological work up (eg, serum uric acid, calcium, phosphorus, magnesium levels, joint aspiration) and initial X-rays, with any ONE of the following:
  - Inconclusive joint aspiration
  - Joint aspiration cannot be performed
  - Extra-articular crystal deposits (eg, in tendons, joint bursa) identified on prior imaging

## *Inflammatory (Autoimmune) Joint Disease* *(14–16)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected inflammatory joint disease (eg, rheumatoid arthritis, psoriatic arthritis) with any ONE of the following:
  - Prior indeterminate or abnormal imaging
  - Prior normal imaging with lab test results (eg, rheumatoid factor (RF), CRP, antinuclear antibody (ANA), ESR) that suggest autoimmune disease
- For known inflammatory joint disease (eg, rheumatoid arthritis, psoriatic arthritis), with any ONE of the following:
  - Recent indeterminate imaging
  - To assess the response to ongoing active medical therapy where prior imaging and/or labs are currently insufficient or have been insufficient in the past
  - To help determine the need to change ongoing active medical therapy based on new or worsening signs/symptoms (eg, joint swelling, tenderness, effusion, erythema, warmth, restricted motion, prolonged morning stiffness)

## *Inflammatory Myopathies* *(17,18)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected inflammatory myopathy (eg, polymyositis, dermatomyositis, immune-

mediated necrotizing myopathy, inclusion body myositis) with any ONE of the following:

- Clinical suspicion based on presenting symptoms (eg, symmetric extremity weakness)
- Clinical suspicion based on lab test results (eg, muscle enzyme testing)
- Clinical suspicion based on prior EMG results
- Biopsy planning

  **NOTE:** Typically, one study is indicated; requests for additional sites are considered on a case-by-case basis.

- For known inflammatory myopathy (eg, polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis) with any ONE of the following:
  - Prior indeterminate imaging
  - To assess the response to ongoing active medical therapy in which prior imaging and/or labs are or have been insufficient
  - To help determine the need to continue or change ongoing active medical therapy in which prior imaging and/or labs are or have been insufficient

## Joint Prosthesis / Replacement [19,20]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI** or Upper Extremity CT.

- Suspected joint prosthesis complication (eg, prosthesis loosening, dysfunction, pseudotumor formation, or osteolysis), after initial X-rays

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI** (may be referred to as Metal Artifact Reduction Sequence (MARS)). Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected metallosis (ie, increased serum levels of metal ions) with painful metal-on-metal joint replacement [21,22] or trunnionosis (mechanically assisted crevice corrosion (MACC)) after initial X-rays, and any ONE of the following:
  - Significantly elevated Cobalt levels (≥ 1.5 micrograms/liter (ppb)) [23]
  - Significantly elevated Chromium levels (≥ 2.0 micrograms/liter (ppb)) [24]
  - Indeterminate or abnormal joint aspiration (eg, findings of metallic debris and absence of infection)
  - When the study is ordered by an orthopedic surgeon

## Loose Bodies or Synovial Chondromatosis [25,26]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Joint pain or mechanical symptoms suspected to be the result of loose bodies and/or chondromatosis after prior indeterminate or abnormal imaging

# Malignancy

## *Suspected Malignancy*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI.** Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed, or when requested to evaluate mass calcification or bone involvement.

- Superficial upper extremity mass after non-diagnostic ultrasound [27]
- Deep upper extremity mass after non-diagnostic X-ray [27]

## *Known Malignancy [28,29]*

### Initial Staging

Initial staging refers to imaging that is performed after the diagnosis of cancer is made, and generally before any treatment**.**

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI** or **Upper Extremity CT.**

- For initial staging of a biopsy-proven primary extremity tumor
- Newly diagnosed malignancy with physical exam and/or prior imaging suggestive of nodal disease at any of the time points detailed above
- Newly diagnosed malignancy with concern for suspected upper extremity metastatic disease (includes bone metastases) after initial imaging (typically X-ray or bone scan) has been performed

### Restaging

Restaging refers to imaging that is performed during active treatment, at the end of treatment, and for known or suspected cancer recurrence. ‘Active treatment’ includes surgery, radiation, systemic therapy (eg, chemotherapy, immunotherapy), chimeric antigen receptor (CAR) T-cell therapy, and bone marrow/stem cell transplant. Unless noted more specifically, imaging is indicated per the criteria below at the following points: during active systemic treatment, prior to tumor resection, as an end-of-treatment evaluation when requested within the first 6 months after completion of treatment, or for signs or symptoms of recurrence (biopsy not required).

Restaging during active systemic treatment (eg, chemotherapy, targeted therapy, or immunotherapy) is typically every 2-3 cycles of treatment or every 3 months. Active systemic

treatment applies to neoadjuvant therapy (before surgery), adjuvant therapy (after surgery), ongoing systemic treatment for metastatic disease, and maintenance therapy (ongoing treatment after initial cancer therapy has successfully reduced or eliminated the cancer).

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI** or **Upper Extremity CT.**

- For restaging of a primary upper extremity tumor at any of the time points detailed above
- For any malignancy with physical exam and/or prior imaging suggestive of nodal disease at any of the time points detailed above
- For any malignancy with concern for upper extremity metastatic disease (including bone metastases) at any of the time points detailed above after initial imaging (typically X-ray or bone scan) has been performed

### Surveillance

Refer to the **Cancer Surveillance Table** for specific indications.

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. Surveillance begins at the completion of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the **Restaging** criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

## Osteochondral Lesions (30,31)

### *Defects, Fractures, Osteochondritis Dissecans*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of osteochondral lesion with prior X-ray that is indeterminate or abnormal, based on any ONE of the following:
  - Mechanism of injury (eg, prior twisting type joint injury, repeated joint microtrauma)
  - Physical findings (eg, focal pain, decreased range of motion, or joint clicking/catching)

## Osteonecrosis (32)

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- To further characterize a prior abnormal X-ray suggesting osteonecrosis
- Symptomatic and high-risk patients (eg, glucocorticosteroid use, renal transplant, glycogen storage disease, alcohol abuse, sickle cell anemia) after initial X-ray
- Known osteonecrosis (eg, avascular necrosis) to evaluate the contralateral joint after prior abnormal or indeterminate X-ray

# Pain

**NOTE**: Prior completed X-ray showing no clear etiology of joint/extremity pain must precede Upper Extremity CT/MRI evaluation unless otherwise indicated. See **Special Notes** regarding CT Arthrogram.

## *Upper Extremity Pain* *(33,34)*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

In the absence of a positive **joint-specific orthopedic sign** AND prior X-ray showing no clear etiology of the pain, advanced imaging is indicated with any ONE of the following:

- Persistent joint or musculotendinous upper extremity pain unresponsive to **Active Conservative Therapy (ACT)** which includes physical therapy, chiropractic treatments, and/or physician-supervised **Home Exercise Program (HEP)** of at least 4 weeks duration within the last 6 months
- With progression or worsening of symptoms during the course of ACT
- Pediatric patient that is either < 12 years old OR cannot comply with the prescribed therapy

## *Upper Extremity Orthopedic Signs*

**NOTE**: With a positive orthopedic sign from the list below, an initial X-ray is always preferred; however, it is not required unless otherwise specified.

Advanced imaging is indicated for any orthopedic exam test that clearly suggests joint instability, including, but not limited to, any positive orthopedic sign demonstrated by a positive result for any ONE of the following tests listed below:

### Shoulder (9)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests:

| Suspected Injury | Test Name | Description |
|---|---|---|
| Subscapularis tendon [35,36] | Bear hug test | Patient cannot place hand on opposite shoulder or weakness in resisted internal rotation |
| | Belly press test (Napolean Test) | Patient unable to press palm into belly without compensation from wrist flexion |
| | Internal rotation lag | Inability to maintain hand in a behind-the-back position in a full internal rotation position |
| | Lift-off test | Pain/Inability to lift hand off lower back |
| Supraspinatus tendon [37] | Drop arm test | Inability to avoid drop of arm when released from shoulder level (90-degree) abduction |
| | Empty can test (Jobe or supraspinatus test) | Pain/weakness with resistance when in emptying can position (arm 90-degree abducted, thumb down) |
| | Full can test | Pain/weakness with resistance when in full can position (arm 90-degree abducted, thumb up) |
| | Hawkins Test (ONLY for evaluation of suspected rotator cuff tear and NOT for impingement) | Pain with passive internal rotation of shoulder with arm in 90-degree flexion and elbow and hand in below the head position |
| | Neer Test (ONLY for evaluation of suspected rotator cuff tear and NOT for impingement) | Pain with passive internal rotation of shoulder and full elbow extension, arm is forward flexed to overhead position. |
| Infraspinatus / Teres Minor / Biceps tendon [38] | External rotation lag sign at 0 and 90 degrees | Patient cannot maintain external rotation position and arm lags into internal rotation |
| | Hornblower test | Inability to maintain external rotation position (hand towards mouth – horn blower position) against resistance |
| | Resisted external rotation testing | Pain/weakness during resisted shoulder external rotation |

| Suspected Injury | Test Name | Description |
|---|---|---|
| | Biceps Popeye sign (if acute finding and/or for evaluation of surgical correction) | Visible bulge in lower arm (near elbow) resembling the cartoon character Popeye's muscular arms |
| Labral tear/shoulder instability [39,40] | Anterior load and shift Test | Shoulder laxity with axial load and anterior shift of the humeral head across a stabilized scapula |
| | Apprehension Test | Positioning the patient with their arm abducted to 90 degrees and then externally rotating the arm while observing for signs of apprehension or discomfort. |
| | Clunk test | Clunk/grinding while externally rotating the arm and pushing anteriorly on the humeral head |
| | Crank test (Compression-rotation test, Apprehension test, Apley Grind test) | Pain/click with axial compression load on the humerus with internal and external rotation of the arm |
| | Jerk Test | Click with axial load on the humerus and the arm moved horizontally in 90 degrees abduction and internal rotation |
| | O'Brien's test | Pain/click with upward force while in position of pronation of the elbow and full shoulder rotation versus no pain/click while in position of supination of the elbow |
| | Posterior load and shift test | Shoulder laxity with axial load and posterior shift of the humeral head across a stabilized scapula |
| | Sulcus sign (Multidirectional instability) | Visible depression/groove (sulcus) between the acromion and the humeral head with downward traction on the arm |
| Rotator Cuff | Weakness | Weakness specifically of the rotator cuff (no particular 1-5 strength exam score required) |

## Elbow [6,41]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests:

| Suspected Injury | Test Name | Description |
|---|---|---|
| Biceps tendon [42] | Biceps squeeze test | Lack of forearm supination with squeeze of the biceps muscle |
| | Bicipital aponeurosis (BA) flex test | Direct palpation of a defect in the bicipital aponeurosis with arm in flexion |
| | Hook test | Inability to “hook” the distal biceps tendon with resisted forearm supination |
| | Passive forearm pronation test (supination-pronation test) | Absence of the normal proximal-to-distal movement of the biceps muscle belly during passive pronation and supination of the forearm |
| | Reverse Popeye sign (acute finding OR for possible surgical correction) | Visible bulge in upper arm (near shoulder) resembling the cartoon character Popeye’s muscular arms |
| Elbow joint instability [43] | Milking maneuver | Pain/elbow instability with lateral pull on the thumb (like a cow udder) with the arm in a flexed supinated position |
| | Posterolateral rotatory drawer test | Laxity with anterior to posterior force to radial and ulna with the forearm in external rotation |
| | Push-up test | Pain/click while patient pushes up out of a chair from a sitting position |
| | Tabletop relocation test | Pain/click while pushing up from a tabletop position with elbows pointing laterally |
| | Valgus stress | Pain/laxity with medially directed (valgus) pressure with upper arm stabilized |
| | Varus stress | Pain/laxity with laterally directed (varus) pressure with upper arm stabilized |

### Wrist [44]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Physical exam demonstrating a positive result for any ONE of the following tests:

| Suspected Injury | Test Name | Description |
|---|---|---|
| Lunotriquetral (LT) ligament tear [45] | Derby relocation test | Reduced pain with stabilization of LT and moving wrist in dart-throwing motion |
| | Reagan test (lunotriquetral ballottement test, shuck test) | Pain/click/laxity while stabilizing the triquetrum and applying volar/dorsal force to the lunate. |
| | Kleinman shear test | Pain/crepitus/laxity while stabilizing the dorsal lunate and applying palmar load through the pisotriquetral region |
| Triangular Fibrocartilage Complex (TFCC) [46] | Press Test | Pain while pushing up out of a seated position from a chair with armrests with the wrist in extension |
| | Ulnar fovea sign/test | Pain with deep palpation in the space between ulnar styloid process and flexor carpi ulnaris |
| | Ulnocarpal stress test (Sharpey's Test) | Pain with axial load on the wrist in maximum ulnar deviation while supinating and pronating wrist |
| Scaphoid ligament [46] | Scapholunate ballottement test | Pain/click/laxity with volar/dorsal displacement of scaphoid while stabilizing the lunate |
| | Watson test (scaphoid shift test) | Pain/click with dorsally directed pressure on the scaphoid while wrist moved from ulnar to radial deviation |

## Pediatric Specific Indications (≤ 18 Years Old)

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CT**. Upper Extremity MRI is appropriate only when the preferred study is contraindicated or cannot be performed.

- Osteoid osteoma, after prior X-ray is indeterminate or abnormal [47]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Imaging of a single joint in suspected Chronic Recurrent Multifocal Osteomyelitis after initial X-ray and laboratory evaluation (eg, CRP, ESR) [48,49]

**NOTE**: Whole Body MRI (See Evolent Clinical Guideline 2076 for Whole Body MRI and CT) is preferred when imaging of multiple joints is requested.

## Peripheral Nerve Entrapment [50,51]

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- For suspected peripheral nerve entrapment (eg, carpal tunnel) with any ONE of the following:
  - Abnormal EMG or nerve conduction study
  - Abnormal X-ray or ultrasound
  - Failed prior 4-week inactive conservative treatment (active treatment with physical therapy is not required) including at least TWO of the following:
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Pharmacotherapy (eg, nonsteroidal anti-inflammatory drugs [NSAIDs], steroids)

## Shoulder Dislocations [52–55]

**NOTE**: See **Special Notes** regarding CT Arthrogram.

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Recurrent shoulder dislocation
- First dislocation with any ONE of the following:
  - Anterior glenoid bone loss or humeral head bone loss (ie, Hill-Sachs lesion) on prior X-ray
  - Bankart lesion (ie, fracture of the glenoid rim that occurs with a tear in the anterior labrum) on prior X-ray
  - 14 - 40 years old
  - > 40 years old with exam findings concerning for rotator cuff tear (eg, weakness on shoulder exam)

## Tendon Rupture

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity MRI**. Upper Extremity CT is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical suspicion of a specific tendon rupture, after prior X-ray, with mechanism of injury and/or physical findings consistent with possible tendon rupture [6]

## Vascular Disease

### *Aneurysm*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA** or Upper Extremity MRA.

- Clinical suspicion of aneurysm, with prior abnormal or indeterminate imaging [56]

### *Hemorrhage*

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA**. Upper Extremity MRA is appropriate only when the preferred study is contraindicated or cannot be performed.

- Clinical findings (eg, bruit, hemorrhage, hematoma, pulselessness) and/or prior imaging suggestive of upper extremity vascular injury [57,58]

### *Malformation [59,60]*

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity MRA** and/or **Upper Extremity MRI**. Upper Extremity CTA and/or Upper Extremity CT is appropriate only when the preferred study is contraindicated, cannot be performed, or based on surgeon preference.

- For suspected upper extremity vascular malformation with prior indeterminate or abnormal ultrasound
- For known upper extremity vascular malformation with any ONE of the following:
  - Advanced imaging results will potentially change management
  - Preoperative planning
  - Follow-up after prior surgical treatment and/or embolization

### *Systemic Vascular Disease*

#### Arterial Thromboembolism

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA**. Upper Extremity MRA is appropriate only when the preferred study is contraindicated or cannot be performed. Echocardiogram and advanced vascular imaging of the chest, abdomen, and/or pelvis may also be indicated to identify the source of the emboli.

- Clinical concern for upper extremity arterial thromboembolism due to pulselessness,

exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting upper extremity arterial thromboembolism [61]

### Peripheral Vascular Disease

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Upper Extremity CTA**. Upper Extremity MRA is appropriate only when the preferred study is contraindicated or cannot be performed.

- Suspected or known acute upper extremity ischemia with any ONE of the following [61,62]:
  - Ischemic ulceration without segmental temperature change
  - Painful ischemic ulceration
  - Acute sustained loss of perfusion with or without acral ulceration
  - Imminent loss of digit(s)

  **NOTE**: Prior ultrasound is not needed
- Suspected or known upper extremity vascular disease (including Raynaud's) [61,62], with prior abnormal or indeterminate ultrasound, if advanced imaging results will potentially change management
- Upper extremity ulcers on exam from suspected or known peripheral vascular disease, with prior abnormal or indeterminate ultrasound [63,64]
- Known predisposing conditions (eg, Buerger disease, cystic adventitial disease, arterial endofibrosis, fibromuscular dysplasia, segmental arterial mediolysis and/or genetic conditions such as Marfan syndrome, Loeys-Dietz syndrome, or vascular Ehler-Danlos Syndrome) and any ONE of the following [65]:
  - Prior imaging suggestive of non-atherosclerotic peripheral vascular disease of the upper extremity
  - Signs/symptoms of upper extremity vascular disease (eg, claudication, weak pulses)
- After prior stenting or surgery (arterial and/or venous) with any ONE of the following [66]:
  - Recurrent symptoms
  - Signs of recurrent disease on examination
  - Prior abnormal or indeterminate non-invasive testing or imaging

### Vasculitis

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA** or **Upper Extremity MRA**.

- Clinical suspicion of vasculitis with prior abnormal or indeterminate imaging [67]

## *Other*

### Deep Venous Thrombosis (DVT) [68]

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA**. Upper Extremity MRA is appropriate only when the preferred study is contraindicated, cannot be performed, or when ordered for preprocedural planning.

- For suspected or known upper extremity DVT with ALL of the following:
  - Prior ultrasound is abnormal or indeterminate
  - Advanced imaging study results will change management

### Hemodialysis Graft Dysfunction

IMAGING MODALITY: When the following criteria is met, the indicated study is **Upper Extremity CTA** or Upper Extremity MRA.

- If prior ultrasound was not sufficient for required treatment decisions [69]

### Tumor Evaluation

IMAGING MODALITY: When the following criteria is met, the indicated studies are **Upper Extremity CTA** or **Upper Extremity MRA** (may be in combination with CT or MRI of tumor).

- When needed for clarification of vascular involvement from tumor after prior imaging

# Preoperative or Postoperative Assessment

IMAGING MODALITY**:** When any ONE of the following criteria are met, the indicated imaging modality is the one that is stated in the specific section that is linked to. For perioperative situations not addressed in specific sections, the indicated study is CT or MRI of the body part for which surgery is planned or done. Vascular imaging is only indicated when a vascular procedure is planned or done, when vascular imaging is needed to plan a procedure, or when there are concerns for vascular complications.

- Preoperative Evaluation:
  - When not addressed in specific indications:
    - Imaging of the area requested is needed to develop a surgical plan
- Postoperative Evaluation:
  - When not addressed in specific indications and any ONE of the following criteria are met:
    - Known or suspected complications
    - A clinical reason is provided how imaging may change management

  NOTE**:** This section applies to requests within the first 90 days after surgery. Postoperative imaging beyond this timeframe may be considered on a case-by-case basis depending on the relevancy of the current concern to the surgery that was done.

## Further Evaluation of Indeterminate Findings

Further evaluation of indeterminate findings on prior imaging (unless follow-up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

## Genetic Conditions

**NOTES:** When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Upper Extremity MRA** or **Upper Extremity CTA**.

- Vascular Ehlers-Danlos Syndrome (vEDS) [70]:
  - With inconclusive ultrasound or ultrasound suggestive of vascular pathology OR
  - Acute extremity pain and concern for dissection/rupture

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [71–73]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

## Combination Studies

### *General Information*

When multiple studies are listed and medical necessity criteria are met, individual or multiple studies in that combination are indicated.

### *Chest/Upper Extremity CTA (or MRA)*

**NOTE:** MRA is indicated when CTA is contraindicated or cannot be performed.

- Clinical concern for upper extremity arterial thromboembolism due to pulselessness, exam that is concerning for acute limb ischemia, and/or prior imaging findings suggesting upper extremity arterial thromboembolism [61]

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 73200 | Computed tomography, upper extremity; without contrast material |
| 73201 | Computed tomography, upper extremity; with contrast material(s) |
| 73202 | Computed tomography, upper extremity; without contrast material, followed by contrast material(s) and further sections |
| 73206 | Computed tomographic angiography, upper extremity, with contrast material(s), including noncontrast images, if performed, and image postprocessing |
| 73218 | Magnetic resonance (eg, proton) imaging, upper extremity, other than joint; without contrast material(s) |
| 73219 | Magnetic resonance (eg, proton) imaging, upper extremity, other than joint; with contrast material(s) |
| 73220 | Magnetic resonance (eg, proton) imaging, upper extremity, other than joint; without contrast material(s), followed by contrast material(s) and further sequences |
| 73221 | Magnetic resonance (eg, proton) imaging, any joint of upper extremity; without contrast material(s) |
| 73222 | Magnetic resonance (eg, proton) imaging, any joint of upper extremity; with contrast material(s) |

| Code | Description |
|---|---|
| 73223 | Magnetic resonance (eg, proton) imaging, any joint of upper extremity; without contrast material(s), followed by contrast material(s) and further sequences |
| 73225 | Magnetic resonance angiography, upper extremity, with or without contrast material(s) |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Conservative Therapy

Conservative therapy should include a multimodality approach consisting of a combination of active and inactive components. Completion of at least one active modality for four weeks in the past six months is required:

**Active Modalities**

- Physical therapy

- Physician-supervised **Home Exercise Program (HEP)**
- Chiropractic care

**Inactive Modalities**

- Medications (eg, NSAIDs, steroids, analgesics)
- Injections
- Medical Devices (eg, transcutaneous electrical nerve stimulation [TENS] unit, bracing)

## Home Exercise Program (HEP)

The following two elements are required for HEP to meet the criteria for completion of a trial of ACT:

- Information provided on exercise prescription/plan AND
- Follow-up with patient regarding completion of HEP over at least a 4-week period OR documented inability to complete HEP due to increased pain with inability to physically perform the prescribed exercises.

**NOTE**: Patient inconvenience or noncompliance without explanation does not meet the “inability to complete HEP” criterium

## Contraindications and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester).
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds wight limit/dimensions of MRI machine.

## Surveillance Imaging

Surveillance imaging refers to imaging done to detect recurrence in patients who have completed definitive cancer treatment. When calculating time intervals for surveillance, time zero is defined as completion of the last component of treatment. When an imaging modality is not included for a cancer, that modality is not indicated for surveillance of that cancer. When the timeframe for routine surveillance has elapsed, there needs to be a sign or symptom of recurrence to consider imaging. Imaging requests when there is proven recurrence or concern for recurrence should be considered under the Restaging criteria above. When surveillance is “as clinically indicated,” routine surveillance imaging is generally not performed. These requests may be considered on a case-by-case basis, but imaging should not be done more often than the last specified interval.

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Acute Lymphoblastic Leukemia (ALL)** [74,75] | Routine surveillance imaging is not indicated |
| **Acute Myeloid Leukemia (AML)** [76] | Routine surveillance imaging is not indicated |
| **Adrenocortical Carcinoma (ACC)** [77] | Chest CT and Abdomen +/- Pelvis CT/MRI<br>● Every 3-12 months for 5 years then<br>● As clinically indicated after 5 years |
| **Ampullary Adenocarcinoma** [78] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years |
| **Anal Cancer** [79] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Annually for 3 years |
| **Appendiceal Neoplasms and Cancers** [80] | **Resected low-grade appendiceal mucinous neoplasm (LAMN) or high-grade mucinous neoplasm (HMAN) with no high-grade peritoneal deposits:**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 6-12 months for 2 years then<br>○ Every 1-2 years for up to 8 additional years<br>**Resected localized appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Resected metastatic appendiceal adenocarcinoma, goblet cell adenocarcinoma, or carcinoma not otherwise specified, including resected LAMN/HAMN primary with high-grade peritoneal deposits**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then |

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| | ○ Every 6-12 months for 3 additional years |
| **B-cell Lymphomas** [81,82] | **Follicular Lymphoma, Marginal Zone Lymphoma, Mantle Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Not more than annually after 2 years<br>**Diffuse Large B cell Lymphoma, Primary Mediastinal Large B-Cell Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 2 years then<br>○ Only as clinically indicated after 2 years<br>**Burkitt Lymphoma**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 6 months for 1 year then<br>○ Only as clinically indicated after 1 year<br>**Post-Transplant Lymphoproliferative Disorders (PTLD)**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>○ Every 3-6 months for 2 years |
| **Basal Cell Skin Cancer** [83] | Routine imaging not indicated; site-specific imaging may be considered if a reason is documented that clinical exam is insufficient for following the disease. |
| **Biliary Tract Cancers (Intrahepatic Cholangiocarcinoma, Extrahepatic Cholangiocarcinoma, Gallbladder Cancer)** [84] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for up to 5 years |
| **Bladder Cancer** [85] | **Non-Muscle Invasive (NMIBC)**<br>● Low-intermediate Risk NMIBC treated without cystectomy<br>○ Routine surveillance imaging is not indicated<br>● High Risk* NMIBC treated without cystectomy |

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| | ○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ Once 12 months after diagnosis then<br>■ Every 1-2 years 9 additional years<br>■ No routine surveillance imaging after 10 years<br>● NMICBC after cystectomy<br>○ Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>■ 3 months after surgery then<br>■ 1 year after surgery then<br>■ Annually for 4 additional years<br>■ No routine surveillance imaging after 5 years<br><br>**Muscle Invasive Bladder Cancer (MIBC) after cystectomy, partial cystectomy, or chemoradiation AND NMIBC after partial cystectomy or chemoradiation**<br>● Chest CT and Abdomen and Pelvis CT/MRI (may be referred to as CT/MRI Intravenous Pyelogram)<br>○ Every 3-6 months for 2 years then<br>○ Annually for 3 additional years<br>○ No routine surveillance advanced imaging after 5 years (annual renal US recommended from years 5-10)<br><br>**Urothelial Carcinoma of the Prostate and Primary Carcinoma of the Urethra**<br>● Low Risk T1 or < T1<br>○ Routine surveillance imaging is not indicated<br>● High Risk T1 or ≥ T2<br>○ Chest CT and Abdomen and Pelvis CT/MRI<br>■ Every 3-6 months for 2 years then |

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| | ■ Annually for 3 additional years<br><br>* High risk is defined as: high grade (Grade 3) tumor AND any one of the following: associated CIS, T1, tumor > 3 cm or multifocal, BCG refractory (unresponsive to BCG), variant histology (micropapillary, plasmacytoid, small cell), presence of lymphovascular invasion, or prostatic urethral invasion |
| **Bone Tumors** (86) | **Chondrosarcoma**<br>● Atypical Cartilaginous Tumors<br>○ CT or MRI of primary tumor site<br>■ Every 6-12 months for 2 years then<br>■ Annually as clinically indicated after 2 years<br>● All other types of Chondrosarcoma<br>○ CT or MRI of primary tumor site as clinically indicated<br>○ Chest CT<br>■ Every 3-6 months for 5 years then<br>■ Annually for 5 additional years then<br>■ As clinically indicated after year 10<br>**Chordoma**<br>● CT or MRI of primary tumor site as clinically indicated for up to 10 years<br>● Chest CT or LDCT<br>○ Every 6 months for 5 years then<br>○ Annually as clinically indicated for 5 additional years<br>**Ewing Sarcoma**<br>● CT or MRI of primary tumor site and Chest CT<br>○ Every 3 months for 2 years then<br>○ Every 6 months for 3 years then<br>○ Annually<br>**Giant Cell Tumor of Bone** |

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| | • CT or MRI of primary tumor site as clinically indicated<br>• Chest CT<br>  ○ Every 6-12 months for 4 years then<br>  ○ As clinically indicated after 4 years<br>**Osteosarcoma**<br>• CT or MRI of primary tumor site and Chest CT<br>  ○ Every 3 months for 2 years then<br>  ○ Every 4 months for year 3 then<br>  ○ Every 6 months year 4 and 5 then<br>  ○ Annually after year 5, as clinically indicated |
| **Breast** (87) | **Phyllodes tumors: see Soft Tissue Sarcoma section**<br>• Stage I-III disease:<br>  ○ Routine surveillance imaging not indicated (followed with mammography)<br>  **NOTE: See Restaging section for recurrence**<br>• Stage IV disease not currently on therapy<br>  ○ Chest CT and Abdomen and Pelvis CT<br>  ■ Every 3-6 months |
| **Castleman's Disease** (88) | Chest CT, Abdomen and Pelvis CT, +/- Neck CT<br>• Can be considered on a case-by-case basis for the first two years after treatment |
| **Cervical Cancer** (89) | **Stage I disease treated with non-fertility sparing**<br>• Routine surveillance imaging not indicated<br>**Stage I disease treated with fertility sparing (ie, conization; simple or radical trachelectomy)**<br>• Pelvis MRI<br>  ○ Once 6 months after completion of treatment then<br>  ○ Annually for 2-3 additional years<br>**Stage II-IV** |

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| | • Pelvis MRI<br>  ○ Once 3-6 months after completion of treatment<br>  ○ Routine surveillance imaging not indicated thereafter<br>• Chest CT and Abdomen and Pelvis CT<br>  ○ Once 3-6 months after completion of therapy if PET/CT is not able to be performed<br>**Small Cell Neuroendocrine Carcinoma**<br>• Chest CT and Abdomen and Pelvis CT if PET is not done +/- Brain MRI<br>  ○ As clinically indicated<br>**NOTE: See Restaging section when there are signs/symptoms that are worrisome or equivocal for recurrence.** |
| **Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)** (90) | Routine surveillance imaging is not indicated |
| **Chronic Myeloid Leukemia (CML)** (91) | Routine surveillance imaging is not indicated |
| **Central Nervous System (CNS) Tumors** (92–96) | **Choroid plexus tumors and carcinoma**<br>• Benign choroid plexus papilloma and choroid plexus tumors: Routine surveillance imaging is not indicated<br>• Malignant choroid plexus carcinoma<br>  ○ Brain MRI<br>  ■ Every 3-4 months for 2 years then<br>  ■ Every 6 months for years 3-5 then<br>  ■ As clinically indicated<br>**Low grade Gliomas (Pediatric and Adult)**<br>• Circumscribed glioma (not otherwise listed) post gross total resection<br>  ○ Brain MRI<br>  ■ Every 3-6 months for 5 years then |

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| | ■ Annually after 5 years<br>● Oligodendroglioma and astrocytoma grade 2<br>○ After chemotherapy and radiation<br>■ Brain MRI: Every 6-9 months<br>○ After chemotherapy OR radiation<br>■ Brain MRI: Every 3-4 months<br>○ After surgery only<br>■ Brain MRI: Every 3-4 months<br>NOTE: Low-grade glioma includes the following: pilocytic astrocytoma grade 1, subependymal giant cell astrocytoma (SEGA) grade 1, ganglioglioma grade 1, dysembryoplastic neuroepithelial tumor (DNET), pleomorphic xanthoastrocytoma (PXA) grade 2, IDH-mutant astrocytoma grade 2, oligodendroglioma grade 2 and other grade 1 and 2 histologies<br>**Other Pediatric CNS tumors**<br>● Pediatric Diffuse High-Grade Glioma<br>○ Brain MRI<br>■ 2-6 weeks after radiation then<br>■ Every 2-3 months for 1 year then<br>■ Every 3-6 months indefinitely<br>● Pediatric Medulloblastoma<br>○ Brain MRI<br>■ Every 3-4 months for 2 years then<br>■ Every 6 months for 3 years then<br>■ As clinically indicated after 5 years<br>○ Entire spine MRI (cervical/thoracic/lumbar)<br>■ Low or average risk<br>□ Every 6 months for 2 years then<br>□ As clinically indicated after 2 years<br>■ High or very high risk<br>□ Every 3-4 months for 2 years then<br>□ Every 6 months for 3 years then |

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| | ▫ As clinically indicated after 5 years<br><br>**Adult High-grade glioma (including glioblastoma)**<br>● MRI Brain<br>○ Once 2-8 weeks after radiation therapy then<br>○ Every 2-6 months indefinitely<br>NOTE: High-grade glioma includes ALL histologies if grade 3 and 4<br><br>**Ependymoma**<br>● MRI Brain +/- MRI Cervical/Thoracic/Lumbar (C/T/L) Spine<br>○ Every 3 months for 1 year then<br>○ Every 4-6 months for year 2 then<br>○ Every 6-12 months up to 10 years from last treatment<br><br>**Medulloblastoma (adult)**<br>● MRI Brain<br>○ Every 2-3 months for 2 years then<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated<br>● MRI C/T/L Spine concurrently with MRI Brain per the schedule above for patients with prior spine involvement<br><br>**Primary CNS Lymphoma**<br>● MRI Brain +/- MRI C/T/L Spine<br>○ Every 3 months for 2 years, then<br>○ Every 6 months for 3 years, then<br>○ Annually, indefinitely<br><br>**Primary Spinal Cord Tumors**<br>● Low grade tumors (grade 1-2)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Every 3-6 months for 5 years then |

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| | ○ Every 6-12 months indefinitely<br>● High grade tumors (grade 3-4)<br>○ MRI C/T/L Spine +/- MRI Brain<br>○ Once 2-6 weeks after treatment then<br>○ Every 2-4 months for 3 years then<br>○ Every 3-6 months for 2 years, then<br>○ Every 6-12 months indefinitely<br>NOTE: Primary spinal tumors include meningiomas, astrocytomas and ependymomas which originate in the spine. When metastatic from a primary tumor in the brain, see the specific type.<br>**Meningiomas**<br>● Grade 1 and 2 or unresected tumors:<br>○ MRI Brain (include spine if spinal involvement)<br>■ At 1, 3 and 6 months then<br>■ Every 6-12 months for 5 years then<br>■ Annually, as clinically indicated<br>● Grade 3<br>○ MRI Brain (include spine if spinal involvement)<br>■ Every 2-4 months for 3 years then<br>■ Every 3-6 months<br>NOTE: SSTR/Dotatate PET is indicated in surveillance at the above interval in addition to Brain MRI for grade 2, grade 3 or recurrent grade 1 meningioma |
| **Colon Cancer** [97] | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years |

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| | **Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years |
| **Cutaneous Lymphomas (Primary Cutaneous B-Cell Lymphomas, Mycosis Fungoides/Sezary Syndrome, Primary Cutaneous CD30+ T-Cell Lymphoproliferative Disorders, Subcutaneous Panniculitis-Like T-Cell Lymphoma, and Primary Cutaneous Indolent T-Cell Lymphoproliferative Disorder)** (98) | Routine surveillance imaging is not indicated |
| **Dermatofibrosarcoma Protuberans (DFSP)** (99) | **Site-specific MRI**<br>● Every 6-12 months when clinical exam is sufficient to assess for presence of local recurrence |
| **Esophageal and Esophagogastric Junction Cancers** (100) | **In situ cancer (Tis) and T1a**<br>● Routine surveillance imaging not indicated<br>**T1bN0 after endoscopic resection or ablation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After esophagectomy if > T1a**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually for 3 years<br>**After definitive chemoradiation**<br>● Chest CT and Abdomen +/- Pelvis CT<br>○ Every 3-6 months for 2 years then |

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| | ○ Annually for 3 years |
| **Gastric** [101] | **In situ cancer (Tis)**<br>● Routine surveillance imaging not indicated<br>**Stage I-IV**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 6 months for 2 years then<br>○ Annually for up to 3 additional years |
| **Gastrointestinal Stroma Tumor (GIST)** [102] | **Completely resected disease**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 5 years then<br>○ Annually for 5 additional years<br>○ As clinically indicated beyond 10 years<br>NOTE: More frequent imaging surveillance can be considered on a case-by-case basis for patients with high-risk disease who discontinue tyrosine kinase inhibitor (TKI) therapy |
| **Gestational Trophoblastic Neoplasia (GTN)** [103] | **Low-risk and high-risk GTN**<br>● Brain MRI<br>○ As clinically indicated for 2-3 years if there were brain metastases<br>**Intermediate trophoblastic tumor (Placental site trophoblastic tumor [PSTT] or epithelioid trophoblastic tumor [ETT])**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 2-3 years if PET/CT is not used |
| **Hairy Cell Leukemia** [104] | Routine surveillance imaging is not indicated |
| **Head and Neck** [105] | Neck CT/MRI<br>● Routine surveillance imaging not indicated<br>● Annually to visualize areas inaccessible to routine clinical examination (deep-seated anatomic location or areas obscured by |

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| | extensive treatment change).<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Hepatocellular Carcinoma** (106) | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6 months for 3 additional years<br>● As clinically indicated beyond 5 years |
| **Histiocytic Neoplasms** (107) | **Adult Langerhans Cell Histiocytosis (LCH)**<br>● Chest CT and Abdomen and Pelvis CT when PET/CT is not done<br>○ Every 6 months for up to 2 years<br>**Pediatric LCH**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6 months for 2 years<br>● Brain MRI<br>○ Annually for 5 years for patients with CNS risk and high-risk lesions<br>○ As clinically indicated after 5 years<br>**Erdheim-Chester Disease, Rosai Dorfman**<br>● Site-specific CT/MRI (in addition to PET/CT)<br>○ Every 6 months until disease stabilization then<br>○ Every 6-12 months |
| **Hodgkin Lymphoma** (108,109) | Chest CT and Abdomen and Pelvis CT (+/- Neck CT)<br>● Every 3-6 months for 2 years as clinically indicated<br>○ Routine surveillance imaging is not indicated beyond 2 years |
| **Kaposi Sarcoma** (110) | Routine surveillance imaging is not indicated |
| **Kidney Cancer** (111) | See **Active Surveillance** section for indications related |

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| | to that management strategy.<br><br>**After prior ablation of primary tumor**<br>● Abdomen CT/MRI<br>○ At 1-3 months post-ablation, 6 months post-ablation, and 12 months post-ablation then<br>○ Annually<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after 5 years<br><br>**After Stereotactic Body Radiation Therapy (SBRT) for primary tumor**<br>● Chest CT and Abdomen CT/MRI<br>○ Every 3 months during year 1 then<br>○ Every 6 months during year 2 then<br>○ Every 9 months during years 3-4 then<br>○ Annually during year 5 then<br>○ As clinically indicated after year 5<br><br>**Stage I after partial or radical nephrectomy***<br>● Abdomen MRI/CT<br>○ Once within 3-12 months of surgery then<br>○ Annually up to 5 years then<br>○ As clinically indicated after year 5<br>● Chest CT<br>○ Annually for 5 years then<br>○ As clinically indicated after year 5<br><br>**Stage II after partial or radical nephrectomy***<br>● Abdomen and Pelvis MRI/CT<br>○ Every 6 months for 2 years<br>● Chest CT<br>○ Annually for 5 years then |

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| | ○ As clinically indicated after year 5<br><br>**Stage III, T4NxM0 after partial or radical nephrectomy, or any stage that received adjuvant therapy after surgery***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Baseline within 3-6 months then<br>○ Every 3-6 months for 3 years then<br>○ Annually for 2 additional years<br>○ As clinically indicated beyond 5 years<br><br>**Stage IV, relapsed, or surgically unresectable disease***<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Every 1.5-4 months<br>● Brain MRI (preferred) or brain CT<br>○ Annually, or as clinically indicated<br>● Entire spine MRI<br>○ As clinically indicated<br>* More frequent follow up can be considered after resection if there were positive margins or adverse pathologic factors. |
| **Melanoma: Cutaneous** (112) | **Stage 0/in situ, Stage I, Stage IIA**<br>● No routine imaging needed<br><br>**Stage IIB-IV**<br>● Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years<br>● Brain MRI if stage IIIB or higher<br>○ Every 3-12 months for 2 years then<br>○ Every 6-12 months for 3 additional years |

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| | NOTE: More frequent brain MRI surveillance is appropriate for patients with a prior history of brain metastases |
| **Melanoma: Uveal** [113] | **Low risk (Class 1A, Class 1 PRAME (-), Disomy 3, Gain of chromosome 6p, *EIF1AX* mutation, or T1)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Annually for 5 years<br>**Moderate risk (Class 1B, Class 1 PRAME (+), *SF3B1* mutation, T2, or T3)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 6-12 months for 10 years then<br>○ As clinically indicated after year 10<br>**High risk (Class 2, Monosomy 3, gain of chromosome 8q, *GAP1* somatic mutation, T4)**<br>● Chest CT and Abdomen +/- Pelvis MRI/CT<br>○ Every 3-6 months for 5 years then<br>○ Every 6-12 months for years 6-10 then<br>○ As clinically indicated after year 10<br>NOTE: Risk stratification into the 3 categories is based on the highest risk factor present. |
| **Merkel Cell Carcinoma** [114] | Chest CT, Abdomen and Pelvis CT, +/- Neck CT if the primary lesion was on the head/neck<br>● Every 3-6 months for 3 years then<br>● Every 6-12 months |
| **Mesothelioma: Peritoneal** [115] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Mesothelioma: Pleural** [116] | Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 5 years then<br>● Annually after 5 years |
| **Multiple Myeloma** [117] | **Solitary plasmacytoma, Solitary plasmacytoma with** |

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| | **minimal marrow involvement**<br>● CT whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually for 5 years<br><br>**Smoldering Myeloma, Multiple Myeloma**<br>● CT Whole-body low-dose (CPT 76497) or Bone Marrow MRI (77084) if PET/CT is not done<br>○ Annually |
| **Neuroendocrine Tumors (NET)** [77] | **Well-differentiated NET, Grade 1-2**<br>● Chest CT and Abdomen +/- Pelvis CT/MRI<br>○ Once 3-12 months after resection then<br>○ Every 12-24 months for 10 years then<br>○ As clinically appropriate after 10 years<br><br>**Well-differentiated NET, Grade 3**<br>● Chest CT and Abdomen Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for years 3-10 then<br>○ As clinically appropriate after 10 years<br><br>**Extrapulmonary poorly-differentiated NET (including neuroendocrine carcinoma, large or small cell carcinoma, and mixed neuroendocrine-non-neuroendocrine neoplasms [MiNEN])**<br>● Chest CT AND Abdomen and Pelvis CT/MRI<br>○ Every 3 months for 1 year then<br>○ Every 6 months<br><br>**Pheochromocytoma/Paraganglioma**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>○ Once 3-12 months post-resection then<br>○ Every 6-12 months in years 1-3<br>○ Annually in years 4-10<br>○ As clinically indicated after year 10 |

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| **Neuroblastoma** [118] | **All risk groups**<br>● CT or MRI of primary site<br>○ Every 3-6 months in year 1 then<br>○ Every 6 months in year 2 then<br>○ Annually in year 3 then<br>○ As clinically indicated after 3 years<br>**Intermediate and high risk only**<br>● I-123 MIBG scan with SPECT if positive at diagnosis and at completion of therapy until a negative scan is achieved or patient is 36 months from completion of therapy<br>○ Every 3-6 months in year 1 then<br>○ Every 6-12 months in year 2<br>○ Annually in year 3 then<br>○ As clinically indicated after year 3 |
| **Non-Small Cell Lung Cancer (NSCLC)** [119] | **Stage I-II treated with surgery +/- chemotherapy**<br>● CT Chest<br>○ Every 6 months for 2-3 years then<br>● CT Chest or Low Dose CT (LDCT)<br>○ Annually<br>**Stage I-II treated prior radiation, Stage III, or oligometastatic stage IV with all sites treated with definitive intent**<br>● CT Chest and site-specific CT/MRI of any treated oligometastatic sites<br>○ Every 3-6 months for 3 years then<br>● CT Chest or Low Dose CT (LDCT) and site-specific CT/MRI of any treated oligometastatic sites<br>○ Annually<br>● Brain MRI (regardless of stage)<br>○ As clinically indicated |

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| **Ovarian Cancer, Primary Peritoneal Cancer and Fallopian Tube Cancer** [120] | **Epithelial Ovarian Cancer, Primary Peritoneal and Fallopian Tube Cancer**<br>● Chest CT and Abdomen and Pelvis CT/MRI<br>● Every 3-6 months for 2 years then<br>● Every 6-12 months for 3 additional years then<br>● As clinically indicated after 5 years<br>NOTE: These criteria also apply to less common ovarian cancers (low-grade serous carcinoma, ovarian serous borderline epithelial tumor, malignant germ cell tumors, and malignant sex cord stromal tumors)<br>**Benign Teratoma**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 additional years then<br>○ As clinically indicated after 5 years<br>**Small cell carcinoma of ovary**<br>● Chest CT and Abdomen and Pelvis CT/MRI if PET/CT is not done<br>○ Every 3-6 months for 2 years then<br>○ Annually |
| **Pancreatic Adenocarcinoma** [121] | Chest CT and Abdomen and Pelvis CT<br>Every 3-6 months for 3 years then<br>Every 6-12 months for 2 years then<br>As clinically indicated after 5 years |
| **Penile Cancer** [122] | **pN0 and pN1**<br>● Abdomen and Pelvis CT<br>○ Every 6 months for 2 years then<br>○ Annually during years 3-4<br>**pN2 and pN3**<br>● Chest CT and Abdomen and Pelvis CT |

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| | ○ Every 3 months for 1 then<br>○ Every 6 months during years 2-4 |
| **Prostate Cancer** [123] | Routine surveillance imaging is not indicated. Patients are followed with serial PSA measurements after definitive treatment. Imaging for recurrence is addressed in the **Restaging** section. See **Active Surveillance** section for indications related to that management strategy. |
| **Rectal Cancer** [124] | **Stage I**<br>● Routine surveillance imaging is not indicated<br>**Stage II-III**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 6-12 months for 5 years<br>**Stage IV**<br>● Chest CT and Abdomen and Pelvis CT<br>○ Every 3-6 months for 2 years then<br>○ Every 6-12 months for 3 years<br>**Stages I-III:** if documentation states that the patient had non-operative management (radiation +/- chemo but no resection of primary tumor)<br>● MRI Pelvis<br>○ Every 6 months for 3 years<br>● Chest CT and Abdomen CT (or Abdomen and Pelvis CT after Pelvis MRI is no longer being done)<br>○ Every 6-12 months for 5 years |
| **Retinoblastoma** [125–127] | ● Brain MRI (with or without orbit MRI)<br>○ Every 6 months until the age of 5 years then<br>○ As clinically indicated |
| **Small Bowel Adenocarcinoma** [128] | Chest CT and Abdomen and Pelvis CT<br>● Every 6-12 months for 2 years then |

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| | ● Annually during years 3-5 |
| **Small Cell Lung Cancer (SCLC)** (129) | Chest CT, Brain MRI, +/- Abdomen and Pelvis CT, and CT/MRI of any previously treated metastatic sites (eg, neck, spine)<br>NOTE: Brain CT is indicated for patients who have a contraindication to MRI.<br>● Every 2-6 months, indefinitely (imaging frequency should decrease with time) |
| **Soft Tissue Sarcoma** (130,131) | **<u>General surveillance guidelines for other sarcomas, based on site:</u>**<br>**Soft tissue sarcoma of extremity, superficial/trunk, or head and neck (See below for additional histology-specific imaging)**<br>● Stage I<br>○ Chest CT and primary site MRI (preferred) or CT<br>■ Once postoperatively as a baseline then<br>■ Periodically as clinically indicated<br>● Stage II-IV<br>○ Chest CT, primary site MRI (preferred) or CT, and CT/MRI of any other metastatic site(s)<br>■ Every 2-6 months for 3 years then<br>■ Every 6 months for 2 years then<br>■ Annually thereafter<br>**Retroperitoneal or intra-abdominal soft tissue sarcoma**<br>● Chest CT/MRI and Abdomen and Pelvis CT/MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually thereafter<br>**<u>Histology-specific imaging (Indicated in addition to site-specific imaging listed above, at the same intervals listed above)</u>**<br>● **Alveolar Soft Part Sarcoma:** Brain MRI |

| Cancer | Cancer Imaging After Definitive Treatment |
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| | (preferred) or CT<br>● **Angiosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done) and Brain MRI (preferred) or Brain CT<br>● **Cardiac Sarcoma (left sided):** Brain MRI (preferred) or Brain CT if MRI is contraindicated<br>● **Clear Cell Sarcoma, Epithelioid Sarcoma, and Rhabdomyosarcoma:** Abdomen and Pelvis CT/MRI (if PET/CT is not done)<br>● **Leiomyosarcoma:** Abdomen and Pelvis CT/MRI<br>● **Round Cell/Myxoid Liposarcoma:** Whole Body MRI (preferred) or MRI Brain, MRI entire spine CT Abdomen and Pelvis in addition to the above at the same intervals<br>**<u>Specific sarcoma surveillance guidelines (above general guidance does not apply):</u>**<br>**Desmoid tumor (aggressive fibromatosis)**<br>● Site-specific MRI (preferred) or CT<br>○ Every 3-6 months for 3 years then<br>○ Every 6-12 months<br>**Benign Phyllodes Tumor:** Routine surveillance imaging is not indicated (continue with breast cancer screening)<br>**Borderline Phyllodes Tumor**<br>● Chest or Breast MRI<br>○ Every 6 months for 2 years then<br>○ Annually for 3 additional years<br>**Malignant Phyllodes Tumor**<br>● Chest CT, Abdomen and Pelvis CT, and Chest or Breast MRI<br>○ Every 3-6 months for 3 years then<br>○ Every 6 months for 2 additional years then<br>○ Annually after 5 years |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Squamous Cell Skin Cancer (SCC)** [132] | Routine surveillance imaging not indicated. Imaging of the regional nodal basin and/or to evaluate for distant disease can be considered if clinical exam is insufficient for following disease, based on risk of recurrence, or as clinically indicated. |
| **T-cell Lymphomas** [133]<br><br>**NOTE:** Most T-cell lymphomas are specified as such in their name. Anaplastic Large Cell Lymphoma (which may be breast implant-associated) is also a T-cell Lymphoma. | Chest CT and Abdomen and Pelvis if PET/CT is not used (PET/CT is preferred)<br>● Every 6 months for 2 years then<br>● Annually for 5 years |
| **Testicular Cancer – Pure Seminoma** [134] | **Stage I: No adjuvant therapy (orchiectomy alone)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Once 4-6 months for 1 year then<br>○ Every 6-12 months during years 2-3 then<br>○ Every 1-2 years during years 4-5 then<br>○ As clinically indicated after year 5<br><br>**Stage I, received adjuvant therapy**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 3 years<br>○ As clinically indicated after year 3<br><br>**Stage IIA and non-bulky IIB seminoma, received radiotherapy or chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Once at 3 months then<br>○ 9-12 months post treatment then<br>○ Annually for 2 years<br>○ As clinically indicated after year 3<br><br>**Stage II after retroperitoneal lymph node dissection +/- chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4-6 months for 1 year |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Every 6-2 months for 2 years<br>○ As clinically indicated after year 3<br><br>**Bulky stage IIB, IIC, and III seminoma, received chemotherapy**<br>● Abdomen and Pelvis CT/MRI<br>○ Every 4 months for 1 year then<br>○ Every 6 months for 1 year then<br>○ Annually for 2 years<br>○ As clinically indicated after year 4 |
| **Testicular Cancer – Non-Seminomatous Germ Cell Tumor (NSGCT)** (134) | See **Active Surveillance** section for indications related to that management strategy.<br><br>**Stage I with prior chemo or retroperitoneal lymph node dissection (RPLND)**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Annually for 2 years<br>○ As clinically indicated after year 2<br><br>**Stage II-III, no prior RPLND**<br>● Abdomen +/- Pelvis CT/MRI<br>○ Every 4-6 months for 1 year then<br>○ Every 6-12 months during year 2<br>○ Annually during year 3 then<br>○ As clinically indicated after year 3<br><br>**Stage II with prior RPLND**<br>● Abdomen and Pelvis CT/MRI<br>○ 4 months after RPLND then<br>○ Once during year 2 then<br>○ As clinically indicated after year 2 |
| **Thymoma/Thymic Carcinoma** (135) | **Thymoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Annually for an additional 8 years<br>○ As clinically indicated after year 10<br><br>**Thymic Carcinoma**<br>● Chest CT or Chest MRI<br>○ Every 3-6 months for 2 years then<br>○ Annually for an additional 3 years<br>○ As clinically indicated after year 5 |
| **Thyroid Cancer** (136) | **Follicular, Papillary, or Oncocytic Carcinoma**<br>● Neck CT/MRI +/- Chest CT<br>○ Once 6-12 post thyroidectomy<br>○ Routine surveillance imaging thereafter not indicated<br><br>**Medullary Carcinoma**<br>● Neck CT/MRI, Chest CT/MRI, and Abdomen CT/MRI<br>○ Once 2-3 months after surgery if baseline calcitonin is ≥ 150 pg/mL<br>○ For calcitonin persistently ≥ 150 pg/mL, the **Restaging** section should be used<br><br>NOTE: Whole body MRI or Thoracic/Lumbar Spine MRI and Pelvis MRI can be considered based on high burden of disease, if calcitonin levels > 500 pg/mL or elevated CEA levels.<br><br>**Anaplastic Carcinoma**<br>● Brain, Neck, Chest, Abdomen, Pelvis CT/MRI<br>○ Every 3-6 months as clinically indicated |
| **Uterine Neoplasms** (137) | **Endometrial Cancer treated with non-fertility sparing**<br>● Routine surveillance imaging thereafter not indicated<br><br>**Endometrial Cancer treated with fertility sparing**<br>● Pelvis MRI |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| | ○ Once 6-9 months after treatment<br>○ Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence.<br>● **Uterine Sarcoma**<br>Chest CT, Abdomen and Pelvis CT, +/- Pelvis MRI<br>○ Every 3-6 months for 3 years<br>○ Every 6-12 months for 2 additional years then<br>○ Every 1-2 years until 10 years post-treatment |
| **Vaginal Cancer** (138) | Chest CT and Abdomen and Pelvis CT/MRI<br>● End of treatment restaging once 3-4 months after completion of radiation if PET/CT unable to be obtained or if needed to clarify PET/CT or exam findings<br>● Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Vulvar Cancer (see Melanoma section for vulvar and vulvovaginal melanoma)** (139) | Pelvis MRI (Indicated in addition to PET/CT)<br>● End of treatment restaging once 3-6 months after completion of treatment<br>● Routine surveillance imaging thereafter not indicated<br>NOTE: The **Restaging** section should be used for signs/symptoms that are worrisome or equivocal for recurrence. |
| **Waldenstrom Macroglobulinemia/ Lymphoplasmacytic Lymphoma** (140) | Routine surveillance imaging not indicated |

| Cancer | Cancer Imaging After Definitive Treatment |
|---|---|
| **Wilms Tumor (Nephroblastoma)** [141] | Chest CT and Abdomen CT/MRI +/- Pelvis CT/MRI<br>● Every 3 months for 2 years<br>● Every 6 months for 2 additional years |

# SUMMARY OF EVIDENCE

Since the development of advanced imaging techniques that use complex computing to generate 3D renderings that display the nuances of tissue beyond the capability of an X-ray, CT and MRI have become integral diagnostic tools.

CT is based on the differential absorption of X-rays by various tissues and uses X-rays to create cross-sectional images of the body. The X-ray source and detectors rotate around the patient, and a computer reconstructs the data into detailed images. [142] It is well suited for upper extremity imaging in the setting of trauma and acute conditions, providing rapid, detailed assessment of osseus structures and the ability to evaluate complex injuries for surgical planning. [143]

MRI is based on the magnetic properties of hydrogen nuclei. Tissue contrast is determined by differences in magnetization decay and repolarization. It uses strong magnetic fields and radiofrequency pulses to manipulate hydrogen atoms in the body. The resulting signals are detected and converted into images by a computer. [142] MRI provides superior soft-tissue and bone marrow contrast, making it particularly useful for evaluating joints, ligaments, tendons, muscles, and tumor extent in the upper extremities, and does not use ionizing radiation, making it safer for repeated imaging and for children and pregnant patients. [143]

**Choosing Between CT and MRI**

Because CT provides superior bony detail and fracture characterization, it is preferred for [143]:

- Complex or intra-articular fractures
- Fracture evaluation and characterization
- Preoperative osseous surgical planning
- Postoperative assessment of bone or hardware complications
- Bone integrity, cortical involvement, and mineralization
- Evaluation limited by MRI contraindication or hardware artifact

Because MRI provides superior marrow and soft-tissue contrast, it is preferred for [143]:

- Occult fractures and stress injuries
- Ligamentous and tendon injuries

- Muscle and soft-tissue injury
- Bone marrow abnormalities
- Tumor characterization and local extent
- Classification of vascular involvement by tumor (non-procedural)
- Postoperative soft-tissue complications

# ANALYSIS OF EVIDENCE

For patients with joint pain or instability identified on physical examination (including subtle or atraumatic instability) MRI serves as the central advanced imaging modality, given its ability to comprehensively assess intra- and extra-articular soft tissues and evaluate labroligamentous injury. [6,9,44,144,145] It enables detailed evaluation of both osseous and soft tissue structures, with high reported sensitivities and specificities for brachial plexopathy, rotator cuff, labral, biceps tendon, scaphoid, and TFCC injuries. [6,9,44,144,145] CT is primarily used to quantify osseous defects such as glenoid or humeral head bone loss. [55] CT arthrography can further aid in the evaluation of ligament tears and cartilage abnormalities but is otherwise limited by lower soft tissue contrast. [44]

In the setting of suspected or known fractures, MRI is the preferred advanced modality, given its high sensitivity for stress-related abnormalities and ability to demonstrate fracture lines, marrow edema, and associated prognostic features. [5] CT complements MRI, offering lower sensitivity for early or occult fractures but greater specificity for confirming fractures, evaluating cortical detail, and defining fracture extent or complications, particularly when MRI is equivocal or for surgical planning. [5]

For evaluation of prosthesis-related complications, MRI and CT function as complementary modalities. MRI, especially with metal artifact–reduction techniques, enables assessment of soft tissue abnormalities and component loosening. [20] CT provides detailed evaluation of hardware position and surrounding bone, with greater sensitivity for detecting periprosthetic lucency, osteolysis, and component alignment or migration. [20]

In osteonecrosis and osteochondral lesions, MRI is favored due to its high sensitivity for early disease and superior soft tissue and cartilage characterization, with reported sensitivity and specificity approaching 100% for osteonecrosis. [30–32] It also allows assessment of lesion size, subchondral edema, cartilage integrity, and fragment stability. CT provides complementary value, with superior delineation of osseous detail—particularly subchondral collapse, lesion size and location, and osseous healing—and is useful for staging and surgical planning, though it remains limited in cartilage evaluation without arthrography. [30–32]

In suspected infection, MRI is the preferred modality owing to its high sensitivity for bone marrow and soft tissue abnormalities and its ability to delineate abscesses, fistulas, and joint involvement. [10] CT serves an adjunctive role, aiding in the identification of osseous destruction, sequestra, soft tissue gas, and procedural planning. [10]

For suspected soft tissue masses or malignancy, MRI is preferred given its superior soft tissue contrast, multiplanar capability, and ability to provide intrinsic tumor characterization and local

staging, including assessment of neurovascular involvement and differentiation of benign from malignant lesions. [27] CT is complementary, particularly for evaluating mineralization, osseous involvement, and complex anatomy, and may provide comparable staging when MRI is contraindicated. [27]

In inflammatory conditions, imaging selection varies by disease process: MRI is generally favored for inflammatory joint diseases and inflammatory myopathies, whereas CT (particularly dual-energy CT) is preferred for crystalline arthropathies. [13,14,17] MRI provides superior evaluation of synovitis, bone marrow edema, and muscle inflammation, detecting early structural changes not visible on radiographs. [14,17] In contrast, CT enables direct visualization and characterization of crystal deposition and is more sensitive for detecting osseous erosions and mineralization, with MRI having more limited diagnostic utility in crystalline disease. [13]

For suspected retained foreign bodies, CT is generally preferred for precise localization and detection across a wide range of materials, while MRI has a more limited, adjunct role, particularly for identifying nonmetallic objects or associated soft tissue complications. [4] Modality selection depends largely on the composition of the foreign body, as CT provides more reliable detection and characterization, whereas MRI may be limited by artifact or safety concerns with metallic objects. [4]

Conversely, in loose bodies and synovial chondromatosis, CT excels in demonstrating calcified or ossified intra-articular bodies and associated osseous changes, while MRI is most useful for detecting nonmineralized cartilaginous nodules and early disease when radiographs are inconclusive. [146]

**CTA and MRA** [59,61]

In the evaluation of upper extremity vascular disease, CTA and MRA are complementary noninvasive modalities, with selection guided by clinical context and imaging goals. CTA provides high spatial resolution and rapid acquisition, allowing detailed evaluation of vessel patency, stenosis, occlusion, aneurysm, and vascular injury, and has become an excellent and widely available diagnostic tool with sensitivity and specificity for vascular lesions approaching 100%. It is particularly valuable in acute settings (eg, trauma, hemorrhage, or acute limb ischemia) where prompt diagnosis, localization of arterial injury (eg, thrombosis, dissection, pseudoaneurysm, or extravasation), and preprocedural planning are critical. CTA can also delineate the extent of disease and identify complications contributing to ischemia (eg, infectious pseudoaneurysms, vascular compromise from soft tissue infection, and embolic sources). This rapid, high-resolution assessment is particularly important in conditions with increased vascular fragility, such as vEDS, where prompt detection of dissection, aneurysm, or rupture is critical. [70]

MRA, in contrast, offers high-quality vascular imaging without ionizing radiation and provides excellent soft-tissue contrast and functional information, making it particularly useful for characterizing vascular pathology and evaluating vessel wall abnormalities or flow dynamics. It is commonly used in the assessment of vascular malformations, where it can accurately define lesion extent, internal morphology, and flow characteristics, and dynamic contrast-enhanced MRA can differentiate lesion types with high diagnostic performance. Compared with CTA, MRA is generally preferred for comprehensive characterization and follow-up of vascular malformations due to superior soft-tissue contrast and ability to evaluate inflow and outflow without radiation, whereas CTA is particularly useful for high-flow lesions and for defining feeding arteries, nidus, and draining veins when detailed anatomic mapping is required. Overall, the evidence supports a scenario-based approach in the upper extremities, where CTA is

emphasized for rapid, high-resolution anatomic assessment (especially in acute or interventional settings) while MRA provides a nonionizing, contrast-sensitive modality for detailed tissue characterization, flow evaluation, and longitudinal disease assessment.

**In Summary**

Imaging modality recommendations across the upper extremities show consistent trends in the literature. MRI is generally preferred for indications requiring detailed evaluation of soft tissue and marrow structures, as well as for detecting infection and radiographically occult fractures, while CT serves a complementary role for high-resolution assessment of osseous anatomy and structural complications. Similarly, vascular imaging follows a scenario-based approach, with CTA favored for rapid, high-resolution anatomic assessment in acute settings and MRA preferred for comprehensive tissue characterization and flow evaluation without radiation. Overall, modality selection is guided by clinical context, with MRI/MRA emphasized for detailed tissue assessment and CT/CTA for precise structural detail.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • This guideline merges and replaces the guidelines listed below to ECG 2075 for Upper Extremity Imaging:<br>  ○ Evolent Clinical Guideline 2062 for Upper Extremity Computed Tomography (CT)<br>  ○ Evolent Clinical Guideline 2063 for Upper Extremity Computed Tomography Angiography (CTA)<br>  ○ Evolent Clinical Guideline 2064 for Upper Extremity Magnetic Resonance Angiography (MRA)<br>  ○ Evolent Clinical Guideline 2065 for Upper Extremity Magnetic Resonance Imaging (MRI)<br>• This guideline also merges procedural codes from these four Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# REFERENCES


1. Szaro P, McGrath A, Ciszek B, Geijer M. Magnetic resonance imaging of the brachial plexus. Part 1: Anatomical considerations, magnetic resonance techniques, and non-traumatic lesions. *Eur J Radiol Open*. 2022;9:100392. doi:10.1016/j.ejro.2021.100392
2. Szaro P, Geijer M, Ciszek B, McGrath A. Magnetic resonance imaging of the brachial plexus. Part 2: Traumatic injuries. *Eur J Radiol Open*. 2022;9:100397. doi:10.1016/j.ejro.2022.100397
3. Boulter DJ, Job J, Shah LM, et al. ACR Appropriateness Criteria® Plexopathy: 2021 Update. *Journal of the American College of Radiology*. 2021;18(11):S423-S441. doi:10.1016/j.jacr.2021.08.014
4. Campbell EA, Wilbert CD. Foreign Body Imaging. *StatPearls*. Published online July 30, 2023. https://pubmed.ncbi.nlm.nih.gov/29262105/
5. Morrison WB, Deely D, Fox MG, et al. ACR Appropriateness Criteria® Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae: 2024 Update. *Journal of the American College of Radiology*. 2024;21(11):S490-S503. doi:10.1016/j.jacr.2024.08.019
6. Chen KC, Ha AS, Bartolotta RJ, et al. ACR Appropriateness Criteria® Acute Elbow and Forearm Pain. *Journal of the American College of Radiology*. 2024;21(11):S355-S363. doi:10.1016/j.jacr.2024.08.012
7. Torabi M, Lenchik L, Beaman FD, et al. ACR Appropriateness Criteria ® Acute Hand and Wrist Trauma. *Journal of the American College of Radiology*. 2019;16(5):S7-S17. doi:10.1016/j.jacr.2019.02.029
8. Nicholson JA, Yapp LZ, Keating JF, Simpson AHRW. Monitoring of fracture healing. Update on current and future imaging modalities to predict union. *Injury*. 2021;52:S29-S34. doi:10.1016/j.injury.2020.08.016
9. Laur O, Ha AS, Bartolotta RJ, et al. ACR Appropriateness Criteria® Acute Shoulder Pain: 2024 Update. *Journal of the American College of Radiology*. 2025;22(5):S36-S47. doi:10.1016/j.jacr.2025.02.015
10. Pierce JL, Perry MT, Wessell DE, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot): 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S473-S487. doi:10.1016/j.jacr.2022.09.013
11. Wu YW, Wang CY, Cheng NC, et al. 2024 TSOC/TSPS Joint Consensus: Strategies for Advanced Vascular Wound Management in Arterial and Venous Diseases. *Acta Cardiol Sin*. 2024;40(1):1-44. doi:10.6515/ACS.202401_40(1).20231220A
12. Shang J, Zhou LP, Wang H, Liu B. Diagnostic Performance of Dual-energy CT Versus Ultrasonography in Gout: A Meta-analysis. *Acad Radiol*. 2022;29(1):56-68. doi:10.1016/j.acra.2020.08.030
13. Fukuda T, Subramanian M, Noda K, et al. The comprehensive role of dual-energy CT in gout as an advanced diagnostic innovation. *Skeletal Radiol*. 2025;54(11):2253-2263. doi:10.1007/s00256-024-04856-4

14. Subhas N, Wu F, Fox MG, et al. ACR Appropriateness Criteria® Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis, Crystalline Arthritis, or Erosive Osteoarthritis: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S20-S32. doi:10.1016/j.jacr.2023.02.020

15. Colebatch AN, Edwards CJ, Østergaard M, et al. EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis*. 2013;72(6):804-814. doi:10.1136/annrheumdis-2012-203158

16. Østergaard M, Rolland MAJ, Terslev L. Imaging in clinical trials of rheumatoid arthritis: where are we in 2025? *Skeletal Radiol*. 2025;54(11):2541-2555. doi:10.1007/s00256-025-05004-2

17. Malartre S, Bachasson D, Mercy G, et al. MRI and muscle imaging for idiopathic inflammatory myopathies. *Brain Pathology*. 2021;31(3):e12954. doi:10.1111/bpa.12954

18. Nagy H, Veerapaneni KD. Myopathy. *StatPearls*. Published online August 14, 2023. https://www.ncbi.nlm.nih.gov/books/NBK562290/

19. Ong N, Zailan I, Tandon A. Imaging update in arthroplasty. *J Clin Orthop Trauma*. 2021;23:101649. doi:10.1016/j.jcot.2021.101649

20. Blankenbaker DG, Nacey NC, French CN, et al. ACR Appropriateness Criteria Imaging After Shoulder Arthroplasty: Updated 2026. *Journal of the American College of Radiology*. Published online April 2026. doi:10.1016/j.jacr.2026.03.008

21. Lee A, Paiement GD, Penenberg BL, Rajaee SS. Metallosis in Total Hip Arthroplasty. *JBJS Rev*. 2023;11(10). doi:10.2106/JBJS.RVW.23.00105

22. Ji JH, Park SE, Parikh D, et al. Metallosis-Induced Conversion Shoulder Arthroplasty: A Unique Experience and Literature Review. *Orthop Surg*. 2023;15(10):2736-2740. doi:10.1111/os.13832

23. Tandon M, Chetla N, Hodges J, et al. Mechanical Considerations and Clinical Implications of Joint Arthroplasty Metallosis. *Cureus*. Published online December 30, 2024. doi:10.7759/cureus.76592

24. Hart AJ, Sabah SA, Bandi AS, et al. Sensitivity and specificity of blood cobalt and chromium metal ions for predicting failure of metal-on-metal hip replacement. *The Journal of Bone and Joint Surgery-British Volume*. 2011;93-B(10):1308-1313. doi:10.1302/0301-620X.93B10.26249

25. Habusta SF, Mabrouk A, Tuck JA. Synovial Chondromatosis. *StatPearls*. Published online April 22, 2023. https://www.ncbi.nlm.nih.gov/books/NBK470463/

26. Deng X, Liu S, Liu H. Synovial chondromatosis: Novel advances in understanding the pathogenesis and in diagnostic strategies (Review). *Mol Med Rep*. 2026;33(1). doi:10.3892/mmr.2025.13743

27. Garner HW, Wessell DE, Lenchik L, et al. ACR Appropriateness Criteria® Soft Tissue Masses: 2022 Update. *Journal of the American College of Radiology*. 2023;20(5):S234-S245. doi:10.1016/j.jacr.2023.02.009

28. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Soft Tissue Sarcoma Version

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30. Konarski W, Poboży T, Konarska K, Derczyński M, Kotela I. Understanding Osteochondritis Dissecans: A Narrative Review of the Disease Commonly Affecting Children and Adolescents. *Children*. 2024;11(4). doi:10.3390/children11040498

31. Anderson MW, Chung CB. Elbow Imaging with an Emphasis on MRI. In: Musculoskeletal Diseases 2021-2024: Diagnostic Imaging; 2021.

32. Ha AS, Chang EY, Bartolotta RJ, et al. ACR Appropriateness Criteria® Osteonecrosis: 2022 Update. *Journal of the American College of Radiology*. 2022;19(11):S409-S416. doi:10.1016/j.jacr.2022.09.009

33. Pieters L, Lewis J, Kuppens K, et al. An Update of Systematic Reviews Examining the Effectiveness of Conservative Physical Therapy Interventions for Subacromial Shoulder Pain. *Journal of Orthopaedic & Sports Physical Therapy*. 2020;50(3):131-141. doi:10.2519/jospt.2020.8498

34. Park JY, Park HK, Choi JH, et al. Prospective Evaluation of the Effectiveness of a Home-Based Program of Isometric Strengthening Exercises: 12-Month Follow-up. *Clin Orthop Surg*. 2010;2(3):173. doi:10.4055/cios.2010.2.3.173

35. Ghasemi SA, McCahon JAS, Yoo JC, et al. Subscapularis tear classification implications regarding treatment and outcomes: consensus decision-making. *JSES Reviews, Reports, and Techniques*. 2023;3(2):201-208. doi:10.1016/j.xrrt.2022.12.004

36. Zhao Q, Palani P, Kassab NS, et al. Evidence-based approach to the shoulder examination for subacromial bursitis and rotator cuff tears: a systematic review and meta-analysis. *BMC Musculoskelet Disord*. 2024;25(1). doi:10.1186/s12891-024-08144-z

37. Nicolao FA, Junior JAY, Matsunaga FT, Netto NA, Belloti JC, Tamaoki MJS. Comparing shoulder maneuvers to magnetic resonance imaging and arthroscopic findings in patients with supraspinatus tears. *World J Orthop*. 2022;13(1):102-111. doi:10.5312/wjo.v13.i1.102

38. Diplock B, Hing W, Marks D. The long head of biceps at the shoulder: a scoping review. *BMC Musculoskelet Disord*. 2023;24(1):232. doi:10.1186/s12891-023-06346-5

39. Dean RS, Onsen L, Lima J, Hutchinson MR. Physical Examination Maneuvers for SLAP Lesions: A Systematic Review and Meta-analysis of Individual and Combinations of Maneuvers. *Am J Sports Med*. 2023;51(11):3042-3052. doi:10.1177/03635465221100977

40. Fenton C, Mughal I, Bayne G, Desai A. *Clinical Assessment of the Shoulder*.

41. Kane SF, Lynch JH, Taylor JC. Evaluation of elbow pain in adults. *Am Fam Physician*. 2014;89(8):649-657.

42. Vishwanathan K, Soni K. Distal biceps rupture: Evaluation and management. *J Clin Orthop Trauma*. 2021;19:132-138. doi:10.1016/j.jcot.2021.05.012

43. Marinelli A, Graves BR, Bain GI, Pederzini L. Treatment of elbow instability: State of the art. *Journal of ISAKOS*. 2021;6(2):102-115. doi:10.1136/jisakos-2019-000316

44. Stensby JD, Fox MG, Nacey N, et al. ACR Appropriateness Criteria® Chronic Hand and Wrist Pain: 2023 Update. *Journal of the American College of Radiology*. 2024;21(6):S65-S78. doi:10.1016/j.jacr.2024.02.016

45. Faucher GK, Moody MC. LT Ligament Tears. *Hand Clin*. 2021;37(4):537-543. doi:10.1016/j.hcl.2021.06.008

46. Margulies IG, Xu H, Gopman JM, et al. Narrative Review of Ligamentous Wrist Injuries. *J Hand Microsurg*. 2021;13(2):55-64. doi:10.1055/s-0041-1724224

47. TEPELENIS K, SKANDALAKIS GP, PAPATHANAKOS G, et al. Osteoid Osteoma: An Updated Review of Epidemiology, Pathogenesis, Clinical Presentation, Radiological Features, and Treatment Option. *In Vivo (Brooklyn)*. 2021;35(4):1929-1938. doi:10.21873/invivo.12459

48. Zhao DY, McCann L, Hahn G, Hedrich CM. Chronic nonbacterial osteomyelitis (CNO) and chronic recurrent multifocal osteomyelitis (CRMO). *J Transl Autoimmun*. 2021;4:100095. doi:10.1016/j.jtauto.2021.100095

49. Nico MAC, Araújo FF, Guimarães JB, et al. Chronic nonbacterial osteomyelitis: the role of whole-body MRI. *Insights Imaging*. 2022;13(1). doi:10.1186/s13244-022-01288-3

50. Fortier LM, Markel M, Thomas BG, Sherman WF, Thomas BH, Kaye AD. An Update on Peroneal Nerve Entrapment and Neuropathy. *Orthop Rev (Pavia)*. 2021;13(2):24937. doi:10.52965/001c.24937

51. Griffith JF, Guggenberger R. Peripheral Nerve Imaging. In: *Musculoskeletal Diseases 2021-2024: Diagnostic Imaging [Internet]*. Springer; 2021:259-268. doi:10.1007/978-3-030-71281-5_18

52. Doehrmann R, Frush TJ. Posterior Shoulder Instability. *StatPearls*. Published online July 10, 2023. https://www.ncbi.nlm.nih.gov/books/NBK557648/

53. Nunna B, Parihar P, Wanjari M, Shetty N, Bora N. High-Resolution Imaging Insights into Shoulder Joint Pain: A Comprehensive Review of Ultrasound and Magnetic Resonance Imaging (MRI). *Cureus*. 2023;15(11):e48974. doi:10.7759/cureus.48974

54. Tupe RN, Tiwari V. Anteroinferior Glenoid Labrum Lesion (Bankart Lesion). *StatPearls*. Published online August 3, 2023. https://www.ncbi.nlm.nih.gov/books/NBK587359/

55. Keeling LE, Wagala N, Ryan PM, Gilbert R, Hughes JD. Bone loss in shoulder instability: putting it all together. *Ann Jt*. 2023;8. doi:10.21037/aoj-23-6

56. Kuntz S, Lejay A, Georg Y, Thaveau F, Chakfé N. Management of upper extremity aneurysms: A systematic review. *International Angiology*. 2020;39(2):161-170. doi:10.23736/S0392-9590.20.04307-2

57. Kontopodis N, Tosounidis T, Kehagias E, Kouraki A, Tzirakis K, Ioannou C V. Concomitant vascular and orthopedic trauma: 10 points to consider. *J Clin Orthop Trauma*. 2024;51. doi:10.1016/j.jcot.2024.102407

58. Lee JT, Camacho MA, Diercks DB, et al. ACR Appropriateness Criteria® Major Blunt Trauma: Update 2025. *Journal of the American College of Radiology*. Published online February 2026. doi:10.1016/j.jacr.2026.01.030

59. Obara P, McCool J, Kalva SP, et al. ACR Appropriateness Criteria® Clinically Suspected Vascular Malformation of the Extremities. *Journal of the American College of Radiology*. 2019;16(11):S340-S347. doi:10.1016/j.jacr.2019.05.013

60. Schmidt VF, Masthoff M, Czihal M, et al. Imaging of peripheral vascular malformations — current concepts and future perspectives. *Mol Cell Pediatr*. 2021;8(1):19. doi:10.1186/s40348-021-00132-w

61. Friedman DD, Ponkowski MJ, Shetty AS, et al. CT Angiography of the Upper Extremities: Review of Acute Arterial Entities. *Radiographics*. 2025;45(1). doi:10.1148/rg.240077

62. Hotchkiss R, Marks T. Management of acute and chronic vascular conditions of the hand. *Curr Rev Musculoskelet Med*. 2014;7(1):47-52. doi:10.1007/s12178-014-9202-6

63. Kakkos SK, Gohel M, Baekgaard N, et al. Editor's Choice – European Society for Vascular Surgery (ESVS) 2021 Clinical Practice Guidelines on the Management of Venous Thrombosis. *European Journal of Vascular and Endovascular Surgery*. 2021;61(1):9-82. doi:10.1016/j.ejvs.2020.09.023

64. Mazzolai L, Teixido-Tura G, Lanzi S, et al. 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases. *Eur Heart J*. 2024;45(36):3538-3700. doi:10.1093/eurheartj/ehae179

65. Francois CJ, Skulborstad EP, Kalva SP, et al. ACR Appropriateness Criteria® Nonatherosclerotic Peripheral Arterial Disease. *Journal of the American College of Radiology*. 2019;16(5):S174-S183. doi:10.1016/j.jacr.2019.02.026

66. Zierler RE, Jordan WD, Lal BK, et al. The Society for Vascular Surgery practice guidelines on follow-up after vascular surgery arterial procedures. *J Vasc Surg*. 2018;68(1):256-284. doi:10.1016/j.jvs.2018.04.018

67. Troum OM, Pimienta OL, Wells A. Imaging in vasculitis. *Curr Opin Rheumatol*. 2025;37(1):39-44. doi:10.1097/BOR.0000000000001055

68. Desjardins B, Hanley M, Steigner ML, et al. ACR Appropriateness Criteria® Suspected Upper Extremity Deep Vein Thrombosis. *Journal of the American College of Radiology*. 2020;17(5):S315-S322. doi:10.1016/j.jacr.2020.01.020

69. Richarz S, Isaak A, Aschwanden M, Partovi S, Staub D. Pre-procedure imaging planning for dialysis access in patients with end-stage renal disease using ultrasound and upper extremity computed tomography angiography: a narrative review. *Cardiovasc Diagn Ther*. 2023;13(1):122-132. doi:10.21037/cdt-21-797

70. Byers PH. Vascular Ehlers-Danlos Syndrome. *GeneReviews®*. Published online April 10, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1494/

71. Friedman J. Neurofibromatosis 1. *GeneReviews®*. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

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73. Miller DT, Freedenberg D, Schorry E, et al. Health Supervision for Children With Neurofibromatosis Type 1. *Pediatrics*. 2019;143(5):e20190660. doi:10.1542/peds.2019-0660

74. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Acute Lymphoblastic Leukemia Version 2.2025. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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94. Akade E, Aslani F, Verdi K, Bahadoram M, Kaydani GA. Diagnosis of choroid plexus papilloma: Current perspectives and future directions. *Cancer Pathogenesis and Therapy*. 2024;2(3):173-179. doi:10.1016/j.cpt.2023.09.005

95. Anghileri E, Gaviani P, Amato A, et al. Choroid plexus tumors in adults: a retrospective mono-institutional study. *Neurological Sciences*. 2025;46(4):1859-1866. doi:10.1007/s10072-024-07894-x

96. King D, Bison B, Cruz O, et al. An overview of the European standard clinical practice recommendations for choroid plexus tumours. *EJC Paediatric Oncology*. 2025;5:100226. doi:10.1016/j.ejcped.2025.100226

97. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Colon Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

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125. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652

126. Pai V, Muthusami P, Ertl-Wagner B, et al. Diagnostic Imaging for Retinoblastoma Cancer Staging: Guide for Providing Essential Insights for Ophthalmologists and Oncologists. *RadioGraphics*. 2024;44(4). doi:10.1148/rg.230125

127. Cardoen L, Sirin S, Galluzzi P, et al. Practical guidelines on imaging of retinoblastoma: a 2025 update on behalf of the European Retinoblastoma Imaging Collaboration and the European Retinoblastoma Group. *Eur Radiol*. 2025;36(2):1215-1228. doi:10.1007/s00330-025-11853-1

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142. Cogbill TH, Ziegelbein KJ. Computed Tomography, Magnetic Resonance, and Ultrasound Imaging: Basic Principles, Glossary of Terms, and Patient Safety. *Surgical Clinics of North America*. 2011;91(1):1-14. doi:10.1016/j.suc.2010.10.006

143. Eisenberg RL. *What Radiology Residents Need to Know: Musculoskeletal Radiology*. 1st ed. (Eisenberg RL, ed.). Springer Cham; 2022. doi:10.1007/978-3-030-72382-8

144. Sinn C. Brachial Plexopathy: Differential Diagnosis and Treatment. PM&R Knowledge NOW®. June 8, 2022. https://now.aapmr.org/brachial-plexopathy-differential-diagnosis-and-treatment-2/

145. Doehrmann R, Frush TJ, Frush TJ. Posterior Shoulder Instability. *StatPearls*. Published online July 10, 2023. https://www.ncbi.nlm.nih.gov/books/NBK557648/

146. Habusta SF, Mabrouk A, Tuck JA. Synovial Chondromatosis. *StatPearls*. Published online April 22, 2023. https://www.ncbi.nlm.nih.gov/books/NBK470463/

# Evolent Clinical Guideline 2076 for Whole Body Magnetic Resonance Imaging (MRI) and Computed Tomography (CT)

## *Including Bone Marrow MRI*

| **Guideline Number:** Evolent_CG_2076 | **Applicable Codes** | |
|---|---|---|
| ***"Evolent" refers to Evolent Health LLC and Evolent Specialty Services, Inc.*** <br> ***© 2027 Evolent. All rights Reserved.*** | | |
| **Original Date:** January 2027 | **Last Revised Date:** June 2026 | **Implementation Date:** January 2027 |

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# STATEMENT

## General Information

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*
- *The guideline criteria in the following sections were developed utilizing evidence-based and peer-reviewed resources from medical publications and societal organization guidelines as well as from widely accepted standard of care, best practice recommendations.*

## Purpose

Whole Body Magnetic Resonance Imaging (MRI) generates images of the whole body (skull base to mid-thigh) without the use of ionizing radiation. It is used to evaluate conditions where imaging of the whole body is needed such as certain genetic syndromes and rare diseases. MRI can also be used for radiation planning. CPT 76498 is used for either Whole Body MRI or radiation planning MRI. Bone marrow MRI is primarily used for detection of tumor in the bone marrow (metastatic or primary) or for disorders of the bone marrow. CPT 77084 is used for evaluation of the bone marrow.

Whole Body Low Dose Computed Tomography (CT) generates images of the whole skeleton and can be used when images of the entire skeletal system are needed such as for certain hematologic malignancies. CPT 76497 is used when Whole Body Low Dose CT is needed.

## Special Note

When used for CT or MRI, another CPT code should be selected that describes the specific service being requested. This code is only to be used when there is not an existing CPT code to describe the requested imaging study. As there is no dedicated CPT code for whole body MRI or CT, the unlisted code is used when whole body imaging is needed rather than individual body part studies.

When medical necessity is met for an individual study AND conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

# INDICATIONS

IMAGING MODALITY: When the following criteria is met, either **Unlisted MRI (Whole Body MRI)**, **Bone Marrow MRI**, or **Unlisted CT (Whole Body CT)** is indicated. Only ONE of these three studies is indicated.

- Multiple Myeloma, Monoclonal Gammopathy of Undetermined Significance (MGUS), Solitary Plasmacytoma and Smoldering Myeloma at timepoints below [1,2]:
  - Suspected Disease
  - Initial Staging of Known Disease
  - Restaging on Active Treatment
  - Surveillance
    - Annually if asymptomatic

      **NOTE:** More frequent imaging as clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression

IMAGING MODALITY: When the following criteria are met, the indicated study is **Unlisted MRI (Whole Body MRI)** or **Bone Marrow MRI**.

- Chronic Recurrent Multifocal Osteomyelitis (CRMO) [3–5]
  - Suspected disease after initial X-ray and laboratory evaluation (eg, CRP, ESR)
  - Treatment response assessment as clinically indicated

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Unlisted MRI (Whole Body MRI)**.

- Radiation treatment planning
- Opsoclonus-Myoclonus-Ataxia Syndrome (OMAS) [6]:
  - At diagnosis and
  - As clinically indicated

IMAGING MODALITY: When any ONE of the following criteria are met, the indicated study is **Bone Marrow MRI**:

- Assessment of bone marrow involvement in malignancy
- Evaluation of bone marrow involvement in metabolic storage diseases (i.e. Gaucher disease) [7]

IMAGING MODALITY: When the following criteria are met, the indicated study is **Unlisted CT (Whole Body CT)**.

- Systemic Light Chain Amyloidosis [8]
  - Suspected Disease
  - Initial Staging of Known Disease
  - Restaging on Active Treatment
  - Surveillance
    - Annually if asymptomatic

      **NOTE:** More frequent imaging as clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression

## Genetic Conditions

NOTES: When medical necessity is met for an individual study **AND** conscious sedation is required (such as for young pediatric patients or patients with significant developmental delay), the entire combination is indicated.

For genetic syndromes not addressed in the guideline, coverage is based on a case-by-case basis using societal guidance.

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Whole Body MRI**

- Hereditary Retinoblastoma (RB1) [9]:
  - Annually after age 8

IMAGING MODALITY: When any of the following criteria are met, the indicated study is **Whole Body MRI** or ANY combination of the following: **Brain/Cervical/Thoracic/Lumbar Spine MRI**

- LZTR1-related Schwannomatosis [10]:
  - Every 2 years starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Whole Body MRI**

- Constitutional Mismatch Repair Deficiency (CMMRD) syndrome [11]:
  - Annually starting at age 6
  - Brain MRI alone is indicated at diagnosis then every 6 months (regardless of age)
- POT1 Tumor Predisposition Syndrome [12]:
  - Annually starting at age 18

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Breast/Whole Body MRI** and **Chest CT** (or low-dose CT)

- Li Fraumeni (TP53) [13,14]:
  - Annually

    NOTE: Can also include Abdomen MRI annually starting at age 50 when ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant. This may start 10 years younger than the earliest pancreatic cancer diagnosis in the family.

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Breast MRI** and **Whole Body MRI.** Additional site-specific MRI(s) are indicated as below.

- Neurofibromatosis 1 (NF1) [14–16]:
  - Annually (Breast MRI is included starting at age 30; whole body MRI starts at any age)
  - Site-specific MRI(s) to monitor known plexiform neurofibroma(s)
    - Annually
    - With signs or symptoms concerning for growth or change
  - Site-appropriate vascular imaging as needed to monitor known or suspected vascular abnormalities (including concern for renal artery stenosis)

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Abdomen MRI** and **Whole Body MRI.** Neck/Chest/Abdomen/Pelvis CT is appropriate only when the preferred studies are contraindicated or cannot be performed.

- Hereditary PGL/PCC Syndromes (including SDHx mutations) [17,18]:
  - Every 2 years (including at diagnosis) starting at age 12

IMAGING MODALITY: When any of the following criteria are met, the indicated studies can include any combination of the following: **Brain/Cervical Spine/Thoracic Spine/Lumbar Spine/Whole Body MRI**

- SMARCA4 and SMARCB1 (Includes SMARCB1-associated Schwannomatosis and Rhabdoid Tumor Predisposition Syndrome) [10,19]:
  - At diagnosis
  - Monthly from age 0-6 months
  - Every 2 months from age 7-18 months

- Every 3 months age 19 months – 5 years
- Annually after age 5

# CODING AND STANDARDS

## Codes

| Code | Description |
|---|---|
| 76497 | Unlisted computed tomography procedure (eg, diagnostic, interventional) |
| 76498 | Unlisted magnetic resonance procedure (eg, diagnostic, interventional) |
| 77084 | Magnetic resonance (eg, proton) imaging, bone marrow blood supply |
| +0698T | Quantitative magnetic resonance for analysis of tissue composition (eg, fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (eg, organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure) |
| +0722T | Quantitative computed tomography (CT) tissue characterization, including interpretation and report, obtained with concurrent CT examination of any structure contained in the concurrently acquired diagnostic imaging dataset (List separately in addition to code for primary procedure) |

## Applicable Lines of Business

| | |
|---|---|
| ☒ | CHIP (Children's Health Insurance Program) |
| ☒ | Commercial |
| ☒ | Exchange/Marketplace |
| ☒ | Medicaid |
| ☒ | Medicare Advantage |

# BACKGROUND

## Contraindicated and Preferred Studies

- Contraindications and reasons why a CT/CTA cannot be performed may include: impaired renal function, significant allergy to IV contrast, pregnancy (depending on trimester)
- Contraindications and reasons why an MRI/MRA cannot be performed may include: impaired renal function, claustrophobia, non-MRI compatible devices (such as non-compatible defibrillator or pacemaker), metallic fragments in a high-risk location, patient exceeds wight limit/dimensions of MRI machine

# SUMMARY OF EVIDENCE

**International Myeloma Working Group risk stratification model for smoldering multiple myeloma (SMM)** [(2)]

- **When Imaging Is Indicated**
  - Imaging is recommended for SMM patients at diagnosis and during follow-up to assess risk and guide management. **Whole body imaging with MRI or CT** (including **Bone marrow MRI**) is indicated for SMM patients to detect focal lesions in the bones which are associated with a high risk of progression. If >1 focal lesion is found, this is a strong indication for treatment.
- **Supporting Evidence**
  - The IMWG criteria are supported by studies showing that imaging findings (especially >1 focal lesion on MRI or PET-CT) are highly predictive of progression to symptomatic MM within 2 years.
  - These imaging modalities are used alongside other biomarkers (percentage of clonal bone marrow plasma cells, M-protein and involved/uninvolved sFLC ratio) to stratify risk and guide early intervention.

**Chronic nonbacterial osteomyelitis: the role of whole-body MRI** [(4)]

- **Whole Body MRI (WB-MRI):** WB-MRI is primarily indicated in the evaluation of chronic recurrent multifocal osteomyelitis (CRMO), which is a noninfectious autoinflammatory disorder occurring mainly in children and adolescents. The evidence highlights several key indications:
  - **Early Diagnosis:** WB-MRI is fundamental for early diagnosis of CRMO, especially when the clinical picture is compatible and a characteristic lesion is found on initial imaging. It can assess both symptomatic and asymptomatic lesions, confirming the multifocal nature of the disease.
  - **Detection of Typical Patterns:** WB-MRI enables detection of typical patterns of lesion location and distribution (e.g., metaphyses of long bones, clavicle, vertebrae,

mandible), which helps in differentiating CRMO from other conditions such as infection or malignancy.

- **Avoiding Invasive Procedures:** When characteristic clinical and imaging features are present (multifocal bone lesions at typical sites, normal lab results, no constitutional symptoms), WB-MRI can help avoid bone biopsy.
- **Assessment of Disease Burden:** WB-MRI quantifies the number and extent of lesions, which is useful for staging disease activity, monitoring therapeutic response, and individualizing treatment plans.

- **Bone Marrow MRI:** Bone Marrow MRI of the most frequently affected regions (spine, pelvis, feet, legs including distal femur) is recommended. Bone marrow MRI is useful for:
  - **Evaluation of Painful Sites:** Bone Marrow MRI of painful sites is used to detect active disease, especially when WB-MRI is unavailable.
  - **Detection of Subclinical Lesions:** Bone marrow MRI can reveal additional subclinical lesions, supporting the diagnosis of multifocal disease.
  - **Differentiation from Other Diseases:** MRI is highly sensitive for detecting inflammatory lesions and distinguishing CRMO from pyogenic osteomyelitis, bone tumors, and other conditions.

**Imaging of bone marrow pitfalls with emphasis on MRI [5]**

- **Whole Body MRI (WB-MRI)**
  - **Multiple Myeloma & Solitary Plasmacytoma:**
    Whole body diffusion-weighted MRI (WB-DWI) is now considered the gold standard for imaging patients with asymptomatic myeloma and solitary plasmacytoma. WB-DWI quantifies disease burden using apparent diffusion coefficient (ADC) values, and is superior to FDG-PET CT for detecting small marrow lesions, assessing disease burden, and monitoring response to therapy.
  - **Chronic Recurrent Multifocal Osteomyelitis (CRMO):**
    Whole body MRI is valuable for assessing multifocal skeletal involvement in chronic inflammatory conditions such as CRMO (common in children/adolescents). It helps differentiate these from metastatic disease, Langerhans cell histiocytosis, or leukemia, especially when widespread skeletal lesions are present.
- **Bone Marrow MRI**
  - **Suspected Marrow Infiltration (Neoplastic vs. Non-Neoplastic):**
    Bone marrow MRI is useful for differentiating between benign marrow patterns (e.g., reconversion, hyperplasia) and malignant infiltration (e.g., metastases, myeloma). Chemical shift imaging (CSI) and diffusion-weighted imaging (DWI) are particularly useful for distinguishing benign from malignant lesions.
  - **Hematological Disorders:**
    Bone marrow MRI is indicated for evaluating diffuse marrow changes in myeloproliferative disorders (e.g., polycythemia vera, essential thrombocythemia, and primary myelofibrosis) and myelodysplastic syndromes. These conditions often

present with reduced T1-weighted marrow signal intensity due to increased cellularity or fibrosis.

# ANALYSIS OF EVIDENCE

**Shared Conclusions & Evidence** [2,4,5]

- **Role of MRI:** All three articles underscore the centrality of MRI (especially WB-MRI) in diagnosis, disease assessment, and monitoring. MRI is highlighted as the most sensitive and specific modality for detecting marrow abnormalities, differentiating benign from malignant processes, and guiding management.
- **Diagnostic Challenges:** Each article discusses the complexity of interpreting marrow signals, the risk of misdiagnosis, and the need for careful correlation with clinical and laboratory data. Both Saifuddin et al and Nico et al 2022 emphasize the importance of recognizing benign variants and non-neoplastic conditions to avoid unnecessary interventions.
- **Individualized Management:** The articles advocate for individualized approaches—whether in risk stratification for SMM, [2] or in monitoring disease burden and response in CRMO [4] – with imaging as a cornerstone.
- **Evidence Reiteration:** All articles reiterate the importance of advanced imaging (especially MRI) in the accurate diagnosis and management of marrow disorders. They collectively caution against misinterpretation of imaging findings, which can lead to unnecessary biopsies, treatments, or delayed diagnosis.

# POLICY HISTORY

| Date | Summary |
|---|---|
| June 2026 | • This guideline merges and replaces the guidelines listed below to Evolent Clinical Guideline 2076 for Whole Body Magnetic Resonance Imaging (MRI) and Computed Tomography (CT):<br>  ○ ECG 2007 for Bone Marrow Magnetic Resonance Imaging (MRI)<br>  ○ ECG 2061 for Unlisted Study<br>• This guideline also merges the procedure codes from the above Evolent guidelines |

# LEGAL AND COMPLIANCE

## Guideline Approval

### *Committee*

**Reviewed / Approved by Evolent Specialty Services Clinical Guideline Review Committee**

## Disclaimer

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# REFERENCES


1. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Multiple Myeloma Version 5.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
2. Mateos MV, Kumar S, Dimopoulos MA, et al. International Myeloma Working Group risk stratification model for smoldering multiple myeloma (SMM). *Blood Cancer J*. 2020;10(10):102. doi:10.1038/s41408-020-00366-3
3. Zhao DY, McCann L, Hahn G, Hedrich CM. Chronic nonbacterial osteomyelitis (CNO) and chronic recurrent multifocal osteomyelitis (CRMO). *J Transl Autoimmun*. 2021;4:100095. doi:10.1016/j.jtauto.2021.100095
4. Nico MAC, Araújo FF, Guimarães JB, et al. Chronic nonbacterial osteomyelitis: the role of whole-body MRI. *Insights Imaging*. 2022;13(1). doi:10.1186/s13244-022-01288-3
5. Saifuddin A, Tyler P, Rajakulasingam R. Imaging of bone marrow pitfalls with emphasis on MRI. *Br J Radiol*. 2023;96(1142). doi:10.1259/bjr.20220063
6. Rossor T, Yeh EA, Khakoo Y, et al. Diagnosis and Management of Opsoclonus-Myoclonus-Ataxia Syndrome in Children. *Neurol Neuroimmunol Neuroinflamm*. 2022;9(3). doi:10.1212/NXI.0000000000001153
7. Degnan AJ, Ho-Fung VM, Ahrens-Nicklas RC, et al. Imaging of non-neuronopathic Gaucher disease: recent advances in quantitative imaging and comprehensive assessment of disease involvement. *Insights Imaging*. 2019;10(1):70. doi:10.1186/s13244-019-0743-5
8. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Systemic Light Chain Amyloidosis Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.
9. Kamihara J, Bourdeaut F, Foulkes WD, et al. Retinoblastoma and Neuroblastoma Predisposition and Surveillance. *Clinical Cancer Research*. 2017;23(13):e98-e106. doi:10.1158/1078-0432.CCR-17-0652
10. Dhamija R, Plotkin S, Gomes A, Babovic-Vuksanovic D. LZTR1- and SMARCB1-Related Schwannomatosis. *GeneReviews*®. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK487394/
11. Tabori U, Hansford JR, Achatz MI, et al. Clinical Management and Tumor Surveillance Recommendations of Inherited Mismatch Repair Deficiency in Childhood. *Clinical Cancer Research*. 2017;23(11):e32-e37. doi:10.1158/1078-0432.CCR-17-0574
12. Accardo ML, Osborne J, Else T. POT1 Tumor Predisposition. *GeneReviews*®. Published online December 4, 2025. https://www.ncbi.nlm.nih.gov/books/NBK563529/
13. Schneider K, Zelley K, Nichols KE, Schwartz Levine A, Garber J. Li-Fraumeni Syndrome. *GeneReviews*®. Published online May 1, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1311/

14. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate Version 3.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

15. Friedman J. Neurofibromatosis 1. *GeneReviews*®. Published online April 3, 2025. https://www.ncbi.nlm.nih.gov/books/NBK1109/

16. Miller DT, Freedenberg D, Schorry E, et al. Health Supervision for Children With Neurofibromatosis Type 1. *Pediatrics*. 2019;143(5):e20190660. doi:10.1542/peds.2019-0660

17. Else T, Greenberg S, Fishbein L. Hereditary Paraganglioma-Pheochromocytoma Syndromes. *GeneReviews*®. Published online September 21, 2023. https://www.ncbi.nlm.nih.gov/books/NBK1548/

18. Referenced with permission from the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Kidney Cancer Version 1.2026. © National Comprehensive Cancer Network, Inc. 2026. All rights reserved. To view the most recent and complete version of the guideline, go online to NCCN.org.

19. Nemes K, Bens S, Bourdeaut F, et al. Rhabdoid Tumor Predisposition Syndrome. *GeneReviews*®. Published online May 12, 2022. https://www.ncbi.nlm.nih.gov/books/NBK469816/