CIGNA MEDICAL COVERAGE POLICIES - RADIOLOGY

Musculoskeletal Imaging Guidelines

Effective Date: May 15, 2025

Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by EviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures EviCore does not review for Cigna. Please refer to the **Cigna CPT code list** for the current list of high-tech imaging procedures that EviCore reviews for Cigna.

Table of Contents

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

General Guidelines (MS-1)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Procedure Codes associated with Musculoskeletal Imaging (MS)

MS.GG.ProcedureCodes.C
v2.0.2025

MRI/MRA	CPT®
MRI Upper Extremity, other than joint, without contrast	73218
MRI Upper Extremity, other than joint, with contrast	73219
MRI Upper Extremity, other than joint, without and with contrast	73220
MRI Upper Extremity, any joint, without contrast	73221
MRI Upper Extremity, any joint, with contrast	73222
MRI Upper Extremity, any joint, without and with contrast	73223
MR Angiography Upper Extremity without or with contrast	73225
MRI Lower Extremity, other than joint, without contrast	73718
MRI Lower Extremity, other than joint, with contrast	73719
MRI Lower Extremity, other than joint, without and with contrast	73720
MRI Lower Extremity, any joint, without contrast	73721
MRI Lower Extremity, any joint, with contrast	73722
MRI Lower Extremity, any joint, without and with contrast	73723
MR Angiography Lower Extremity without or with contrast	73725
MRI Pelvis without contrast	72195
MRI Pelvis with contrast	72196

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

MRI/MRA	CPT®
MRI Pelvis without and with contrast	72197

CT/CTA	CPT®
CT Upper Extremity without contrast	73200
CT Upper Extremity with contrast	73201
CT Upper Extremity without and with contrast	73202
CT Angiography Upper Extremity without and with contrast	73206
CT Lower Extremity without contrast	73700
CT Lower Extremity with contrast	73701
CT Lower Extremity without and with contrast	73702
CT Angiography Lower Extremity without and with contrast	73706
CT Pelvis without contrast	72192
CT Pelvis with contrast	72193
CT Pelvis without and with contrast	72194
Bone Mineral Density CT, one or more sites, axial skeleton	77078

Ultrasound	CPT®
Ultrasound, complete joint (ie, joint space and peri-articular soft tissue structures) real-time with image documentation	76881
Ultrasound, limited, joint or other nonvascular extremity structure(s) (e.g., joint space, peri-articular tendon[s], muscle[s], nerve[s], other soft tissue structure[s], or soft tissue mass[es]), real-time with image documentation	76882

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Ultrasound	CPT®
Ultrasound, pelvic (nonobstetric), real time with image documentation	76857

General Guidelines (MS-1.0)

MS.GG.0001.0.A

v2.0.2025

- Before advanced diagnostic imaging can be considered, there must be an in-person clinical evaluation as well as a clinical re-evaluation after a trial of failed conservative treatment; the clinical re-evaluation may consist of an in-person evaluation or other meaningful contact with the provider's office such as email, web, telephone communications, or clinical documentation from a provider.
- An in-person clinical evaluation for the current episode of the condition is required to have been performed before advanced imaging can be considered. This may have been either the initial clinical evaluation or the clinical re-evaluation.
- The in-person clinical evaluation should include a relevant history and physical examination, appropriate laboratory studies, and non-advanced imaging modalities. Other forms of meaningful contact (e.g., telephone call, electronic mail, telemedicine, or messaging) are not acceptable as an in-person evaluation.
- Prior to advanced imaging consideration, the results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider of the advanced imaging study for all musculoskeletal conditions, unless otherwise noted in the guidelines.
  - Initial plain x-ray can rule out those situations that do not often require advanced imaging, such as osteoarthritis, acute/healing fracture, dislocation, osteomyelitis, acquired/congenital deformities, and tumors of bone amenable to biopsy or radiation therapy (in known metastatic disease), etc.
  - X-ray may provide complementary clinical information regarding detailed bony anatomy, and may assist with preoperative planning when surgery is being contemplated.
  - X-ray may provide clinically significant details for soft tissue masses, such as soft tissue calcification, presence or absence of phleboliths, radiographic density, and effect on adjacent bone.
  - X-ray often has a larger field of view than MRI or CT and has the potential to identify more proximal or distal pathology in an extremity.
- Clinical re-evaluation is required prior to consideration of advanced diagnostic imaging to document failure of significant clinical improvement following a recent (within 12 weeks) six week trial of provider-directed conservative treatment. Clinical re-evaluation can include documentation of an in-person encounter with a provider or documentation of other meaningful contact with a provider’s office by the individual (e.g. telephone call, electronic mail, telemedicine, or messaging).
- Provider-directed conservative treatment may include rest, ice, compression, and elevation (R.I.C.E.), non-steroidal anti-inflammatories (NSAIDs), narcotic

and non-narcotic analgesic medications, oral or injectable corticosteroids, viscosupplementation injections, a provider-directed home exercise program, cross-training, and/or physical/occupational therapy or immobilization by splinting/casting/bracing.

- Orthopedic specialist evaluation can be helpful in determining the need for advanced imaging.
  - The need for repeat advanced imaging should be carefully considered and may not be indicated if prior imaging has been performed.
  - Serial advanced imaging, whether CT or MRI, for surveillance of healing or recovery from musculoskeletal disease is not supported by the medical evidence in the majority of musculoskeletal conditions.

Evidence Discussion (MS-1)

For most patients with a musculoskeletal complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs.

X-rays can determine whether an advanced diagnostic imaging study is actually needed, what specific advanced diagnostic imaging study is warranted and if contrast is needed. X-rays often have a larger field-of-view than an MRI or CT and have the potential to identify more proximal or distal pathology in an extremity that could ultimately assist in determining the patient's diagnosis. Advanced imaging results are better interpreted when compared to plain x-rays, which provide complementary clinical information regarding detailed bony anatomy and may assist with pre-operative planning when surgery is being contemplated. Taljanovic, et al. concluded when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs. Initial plain x-rays (prior to obtaining advanced imaging) for musculoskeletal conditions are also recommended by the American College of Radiology Appropriate Use Criteria.

Advanced imaging is typically not necessary for the initial evaluation for patients with a musculoskeletal complaint. Treatment for many musculoskeletal conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. Advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. It has been reported that approximately 30 – 40 percent of middle-aged patients and an even higher percentage of older patients have asymptomatic meniscus, rotator cuff and superior labral tears. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Additional risks to the patient associated with advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

In general, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

References (MS-1)

v2.0.2025

1. Reinus WR. Clinician's guide to diagnostic imaging. New York, NY: *Springer Science*; 2014.
2. Visconti AJ, Biddle J, Solomon M. Follow-up imaging for vertebral osteomyelitis a teachable moment. *JAMA*. 2014;174(2):184. doi: 10.1001/jamainternmed.2013.12742.
3. Fabiano V, Franchino G, Napolitano M, Ravelli A, Dilillo D, Zuccotti GV. Utility of magnetic resonance imaging in the follow-up of children affected by acute osteomyelitis. *Curr Pediatr Res*. 2017;21(2):354-358.
4. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
5. Sher JS, Uribe JW, Posada A, Murphy BJ, Zlatkin MB. Abnormal findings on magnetic resonance images of asymptomatic shoulders. *J Bone Joint Surg Am*. 1995;77(1):10-15.
6. Yamaguchi K, Ditsios K, Middleton WD, Hildebolt CF, Galatz LM, Teefey SA. The demographic and morphological features of rotator cuff disease. A comparison of asymptomatic and symptomatic shoulders. *J Bone Joint Surg Am*. 2006;88(8):1699-1704.
7. Ryzewicz M, Peterson B, Siparsky PN, Bartz RL. The diagnosis of meniscus tears: the role of MRI and clinical examination. *Clin Orthop Relat Res*. 2007;455:123-133.
8. Englund M, Guermazi A, Gale D, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med*. 2008;359(11):1108-1115.
9. Schwartzberg R, Reuss BL, Burkhart BG, et al. High prevalence of superior labral tears diagnosed by MRI in middle-aged patients with asymptomatic shoulders. *Orthop J Sports Med*. 2016 Jan 5;4(1):2325967115623212. doi: 10.1177/2325967115623212. PMID: 26779556; PMCID: PMC4710128.
10. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
11. Nacey N, Fox MG, Blankenbaker DG, et al. ACR Appropriateness Criteria® Chronic Shoulder Pain. Available at https://acsearch.acr.org/docs/3101482/Narrative/. American College of Radiology. Revised 2022.
12. Fox, MG, Chang, EY, Amini, B, et al. ACR Appropriateness Criteria® Chronic Knee Pain. Available at https://acsearch.acr.org/docs/69432/Narrative/. American College of Radiology. Revised 2018.
13. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
14. Bradley MP, Tung G, Green A. Overutilization of shoulder magnetic resonance imaging as a diagnostic screening tool in patients with chronic shoulder pain. *J Shoulder Elbow Surg*. 2005 May-Jun;14(3):233-7.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Imaging Techniques (MS-2)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Plain X-Ray (MS-2.1)

MS.IM.0002.1.A

v2.0.2025

- The results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider of the advanced imaging study for all musculoskeletal conditions, unless otherwise noted in the guidelines, to rule out those situations that do not often require advanced imaging, such as: osteoarthritis, acute/healing fracture, dislocation, osteomyelitis, acquired/congenital deformities, and tumors of bone amenable to biopsy or radiation therapy (in known metastatic disease), etc.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

MRI or CT (MS-2.2)

MS.IM.0002.2.A
v2.0.2025

- Magnetic Resonance Imaging (MRI) is often the preferred advanced imaging modality in musculoskeletal conditions because it is superior in imaging the soft tissues and can also define physiological processes in some instances [e.g. edema, loss of circulation (AVN), and increased vascularity (tumors)].
- Computed Tomography (CT) is preferred for imaging cortical bone anatomy; thus, it is useful for studying complex fractures (particularly of the joints), dislocations, and assessing delayed union or non-union of fractures, if plain X-rays are equivocal. CT may be the procedure of choice in individuals who cannot undergo an MRI, such as those with pacemakers.

Positional MRI

- Positional MRI is also referred to as dynamic, standing, weight-bearing, or kinetic MRI. Currently, there is inadequate scientific evidence to support the medical necessity of this study. As such, it should be considered not medically necessary.

Positional CT

- Positional CT, also referred to as weight-bearing or cone beam CT, may be useful in imaging of the foot and ankle.
  - If a request for foot or ankle imaging with positional CT meets medical necessity criteria for standard CT imaging (as defined in the condition-specific guidelines), the request may be approved.
    - Positional CT of anatomic areas other than the foot and ankle are considered not medically necessary.

dGEMRIC Evaluation of Cartilage

- Delayed gadolinium enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC) is a technique where an MRI estimates joint cartilage glycosaminoglycan content after penetration of the contrast agent in order to detect cartilage breakdown. Currently, there is inadequate scientific evidence to support the medical necessity of this study. As such, it should be considered not medically necessary for the diagnosis and surveillance of, or preoperative planning related to chondral pathology.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Ultrasound (MS-2.3)

MS.IM.0002.3.A

v2.0.2025

- Ultrasound (US) uses sound waves to produce images that can be used to evaluate a variety of musculoskeletal disorders. As with US in general, musculoskeletal US is highly operator-dependent, and proper training and experience are required to perform consistent, high-quality evaluations.

Contrast Issues (MS-2.4)

MS.IM.0002.4.A

v2.0.2025

- Most musculoskeletal imaging (MRI or CT) is without contrast; however, the following examples may be considered with contrast:
  - Tumors, osteomyelitis, and soft tissue infection (without and with contrast)
  - MRI arthrography (with contrast only)
  - MRI for rheumatoid arthritis and inflammatory arthritis (contrast as requested)
  - For individuals with a contrast contraindication, if the advanced imaging recommendation specifically includes contrast, the corresponding advanced imaging study without contrast may be approved as an alternative, although the non-contrast study may not provide an adequate evaluation of the condition of concern.

Positron Emission Tomography (PET/CT) (MS-2.5)

MS.IM.0002.5.C
v2.0.2025

- PET/CT is a nuclear medicine/computed tomography (CT) fusion study that uses a positron emitting radiotracer to create cross-sectional and volumetric images based on tissue metabolism. PET imaging fusion with CT allows for better anatomic localization of the areas of abnormal increased tissue activity seen on PET.
- PET/CT is indicated for imaging of certain musculoskeletal conditions when MRI or CT is equivocal or cannot be performed. See condition-specific guidelines for specific indications.
  - At this time, FDG is the only indicated radiotracer for use with PET/CT in the imaging of musculoskeletal conditions.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Evidence Discussion (MS-2)

v2.0.2025

MRI is an excellent advanced imaging modality for musculoskeletal conditions. It is highly sensitive and specific for evaluation of soft tissue secondary to its superior soft tissue contrast resolution. It is highly sensitive for detection of occult fractures. MRI also carries the benefit of no ionizing radiation exposure. MRI is limited by its longer acquisition times, limited availability, distortion artifacts and incompatibility with some implantable devices and metallic objects. There is lack of high level evidence to support positional MRI.

Currently, there is inadequate high level scientific evidence to support the medical necessity of delayed gadolinium enhanced Magnetic Resonance Imaging of Cartilage (dGEMRIC). As such, it should be considered not medically necessary for the diagnosis and surveillance of, or preoperative planning related to chondral pathology.

CT is preferred for the evaluation of cortical bone anatomy. CT has the advantage of being widely available, especially in acute care settings. CT does carry the risk of ionizing radiation and it is estimated that 2% of all cancers in the United States may be attributable to radiation exposure from CT scans. Positional CT has been shown to be useful in the evaluation of foot and ankle conditions, however, there is there is insufficient evidence to support the use of positional CT for other anatomic areas.

FDG-PET/CT scan is highly sensitive (81-100%) and specific (87-100%) for the detection of osteomyelitis. However, FDG is the only indicated radiotracer for use with PET/CT in the imaging of musculoskeletal conditions.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-2)

v2.0.2025

1. DeMuro JP, Simmons S, Smith K, et al. Utility of MRI in blunt trauma patients with a normal cervical spine CT and persistent midline neck pain on palpation. *Global Journal of Surgery*. 2013;1(1):4-7. doi:10.12691/js-1-1-2.
2. Hsu W, Hearty TM. Radionuclide imaging in the diagnosis and management of orthopaedic disease. *J Am Acad Orthop Surg.* 2012;20(3):151-159. doi:10.5435/JAAOS-20-03-151.
3. Kayser R, Mahlfeld K, Heyde CE. Partial rupture of the proximal Achilles tendon: a differential diagnostic problem in ultrasound imaging. *Br J Sports Med*. 2005;9(11):838–842. doi:10.1136/bjsm.2005.018416.
4. Ward RJ, Weissman BN, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute hip pain-suspected fracture. *Am Coll Radiol (ACR);* Date of Origin: 2013. Revised: 2018. https://acsearch.acr.org/docs/3082587/Narrative/.
5. Mosher TJ, Kransdorf MJ, Adler R, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute trauma to the ankle. *Am Coll Radiol (ACR);* Date of Origin: 2013. Revised: 2020. https://acsearch.acr.org/docs/69436/Narrative/.
6. Small KM, Adler RS, Shah SH, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Atraumatic. *Am Coll Radiol (ACR)*; New 2018. https://acsearch.acr.org/docs/3101482/Narrative/.
7. Amini B, Beckmann NM, Beaman FD, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Traumatic. *Am Coll Radiol (ACR)*; Revised 2017. https://acsearch.acr.org/docs/69433/Narrative/.
8. Hayes CW, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic elbow pain. *Am Coll Radiol (ACR*); Date of Origin:1998. Revised: 2022. https://acsearch.acr.org/docs/69423/Narrative/.
9. Wise JN, Weissman BN, Appel M, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic foot pain. *Am Coll Radiol (ACR*); Date of Origin:1998. Revised: 2020. https://acsearch.acr.org/docs/69424/Narrative/.
10. Jawetz ST, Fox MG, Blankenbaker DG, et al. ACR Appropriateness Criteria® Chronic Hip Pain. Available at https://acsearch.acr.org/docs/69425/Narrative/. American College of Radiology. Revised 2022.
11. Rubin DA, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic wrist pain. *Am Coll Radiol (ACR)*; Revised: 2017. https://acsearch.acr.org/docs/69427/Narrative/.
12. Bennett DL, Nelson JW, Weissman BN, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® nontraumatic knee pain. *Am Coll Radiol (ACR);*1995. Revised: 2018. https://acsearch.acr.org/docs/69432/Narrative/.
13. Murphey MD, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® osteonecrosis of the hip. *Am Coll Radiol (ACR);*Date of Origin: 1995. Revised: 2022. https://acsearch.acr.org/docs/69420/Narrative/.
14. Bruno MA, Weissman BN, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® acute hand and wrist trauma. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2018. https://acsearch.acr.org/docs/69418/Narrative/.
15. Bencardino JT, Stone TJ, Roberts CC, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® stress (fatigue/insufficiency) fracture, including sacrum, excluding other vertebrae. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69435/Narrative/.
16. Luchs JS, Flug JA, Weissman BN, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic ankle pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2017. https://acsearch.acr.org/docs/69422/Narrative/.

17. Pierce JL, Perry MT, Wessell DE, et. al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). Available at https://acsearch.acr.org/docs/3094201/Narrative. American College of Radiology. Revised: 2022.
18. Kransdorf MJ, Weissman BN, Appel M, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® suspected osteomyelitis of the foot in patients with diabetes mellitus. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2019. https://acsearch.acr.org/docs/69340/Narrative/.
19. Zoga AC, Weissman BN, Kransdorf MJ, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® soft-tissue masses. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2017. https://acsearch.acr.org/docs/69434/Narrative/.
20. Morrison WB, Weissman BN, Kransdorf MJ, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® primary bone tumors. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2019. https://acsearch.acr.org/docs/69421/Narrative/.
21. Weissman BN, Palestro CJ, Appel M, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® imaging after total hip arthroplasty. *Am Coll Radiol (ACR);* Date of Origin:1998. Revised: 2015. https://acsearch.acr.org/docs/3094200/Narrative/.
22. Hochman MG, Melenevsky YV, Metter DF, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® imaging after total knee arthroplasty. *Am Coll Radiol (ACR);* Revised: 2017. https://acsearch.acr.org/docs/69430/Narrative/.
23. Gyftopoulos S, Rosenberg ZS, Roberts CC, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® imaging after shoulder arthroplasty. *Am Coll Radiol (ACR);* Date of Origin: 2016. Revised: 2021https://acsearch.acr.org/docs/3097049/Narrative/.
24. Patel ND, Broderick DF, Burns J, et al. Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria®: low back pain. *Am Coll Radiol (ACR);* Date of Origin:1996. Last Review: 2021. https://acsearch.acr.org/docs/69483/Narrative/.
25. Shetty VS, Reis MN, Aulino JM, et al. Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria®: head trauma. *Am Coll Radiol (ACR);* Date of Origin:1996. Last Review: 2020. https://acsearch.acr.org/docs/69481/Narrative/.
26. Li X, Yi P, Curry EJ, Murakami AM. Ultrasonography as a diagnostic, therapeutic, and research tool in orthopaedic surgery. *J Am Acad Orthop Surg*. 2018;26(6):187-196. doi: 10.5435/JAAOS-D-16-00221.
27. de Cesar Netto C, Myerson MS, Day J, et. al. Consensus for the use of weightbearing CT in the assessment of progressive collapsing foot deformity. *Foot Ankle Int*. 2020;41(10):1277-1282.
28. Conti MS, Ellis SJ. Weight-bearing ct scans in foot and ankle surgery. *J Am Acad Orthop Surg*. 2020;28(14):e595-e603.
29. de Cesar Netto C, Schon LC, Thawait GK, et. al. Flexible adult acquired flatfoot deformity: comparison between weight-bearing and non-weight-bearing measurements using cone-beam computed tomography. *J Bone Joint Surg Am*. 2017;99(18):e98.
30. Chung, C.B., Pathria, M.N. & Resnick, D. MRI in MSK: is it the ultimate examination?. *Skeletal Radiol*. 2024;53(9):1727-1735. doi:10.1007/s00256-024-04601-x.
31. D'Amore T, Klein G, Lonner J. The Use of Computerized Tomography Scans in Elective Knee and Hip Arthroplasty-What Do They Tell Us and at What Risk?. *Arthroplast Today*. 2022;15:132-138. Published 2022 May 5.
32. Rutgers M, Bartels LW, Tsuchida AI, Castelein RM, Dhert WJ, Vincken KL, van Heerwaarden RJ, Saris DB. dGEMRIC as a tool for measuring changes in cartilage quality following high tibial osteotomy: a feasibility study. *Osteoarthritis Cartilage*. 2012 Oct;20(10):1134-41.
33. Bulat E, Bixby SD, Siversson C, Kalish LA, Warfield SK, Kim YJ. Planar dGEMRIC Maps May Aid Imaging Assessment of Cartilage Damage in Femoroacetabular Impingement. *Clin Orthop Relat Res*. 2016 Feb;474(2):467-78.
34. Kim SD, Jessel R, Zurakowski D, Millis MB, Kim YJ. Anterior delayed gadolinium-enhanced MRI of cartilage values predict joint failure after periacetabular osteotomy. *Clin Orthop Relat Res*. 2012 Dec;470(12):3332-41.
35. Palestro CJ. FDG-PET in musculoskeletal infections. *Semin Nucl Med.* 2013;43:367-76.
36. Wenter V, Muller JP, Albert NL, et al. The diagnostic value of [(18)F]FDG PET for the detection of chronic osteomyelitis and implant-associated infection. *Eur J Nucl Med Mol Imaging.* 2016;43:749-61.

37. Bruno F, Barile A, Arrigoni F, Laporta A, Russo A, Carotti M, Splendiani A, Di Cesare E, Masciocchi C. Weight-bearing MRI of the knee: a review of advantages and limits. *Acta Biomed*. 2018 Jan 19;89(1-S):78-88.
38. Bruno F, Arrigoni F, Palumbo P, Natella R, Splendiani A, Di Cesare E, Guglielmi G, Masciocchi C, Barile A. Weight-bearing MR Imaging of Knee, Ankle and Foot. *Semin Musculoskelet Radiol*. 2019 Dec;23(6):594-602.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

3D Rendering (MS-3)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

3D Rendering (MS-3)

MS.TD.0003.A
v2.0.2025

- Indications for musculoskeletal 3-D image post-processing for preoperative planning when conventional imaging is insufficient for:
  - Complex fractures (comminuted or displaced)/dislocations of any joint.
  - Spine fractures, pelvic/acetabulum fractures, intra-articular fractures.
  - Preoperative planning for other complex surgical cases.
- The code assignment for 3-D rendering depends upon whether the 3-D post-processing is performed on the scanner workstation (CPT® 76376) or on an independent workstation (CPT® 76377).
  - 2-D reconstruction (i.e. reformatting axial images into the coronal plane) is considered part of the tomography procedure, is not separately reportable, and does not meet the definition of 3-D rendering.
  - It is not indicated to report 3-D rendering in conjunction with CTA and MRA because those procedure codes already include the post-processing.
  - In addition to the term "3-D," the following terms may also be used to describe 3-D post-processing:
    - Maximum intensity projection (MIP)
    - Shaded surface rendering
    - Volume rendering
- Additionally - If multiple CPT codes are performed for the same indication on the same day, one 3D rendering code is required. If they are performed on separate days, 3D rendering codes are required for each study on each day.
- The 3-D rendering codes require concurrent supervision of image post-processing 3-D manipulation of volumetric data set and image rendering.

Evidence Discussion (MS-3)

3D CT improves both the reliability and the accuracy of radiographic characterization of articular fractures of the distal radius and influences treatment decisions, compared to 2D imaging alone. 3D reconstructions can be particularly helpful in preoperative planning for complex articular injuries. The addition of 3D reconstructions to standard 2D CT images has been shown to change operative management in up to 48% of intra-articular distal radius fractures.

In the evaluation of traumatic elbow injuries, 3D CT reconstruction of coronoid and olecranon fractures can identify specific shapes, sizes, and orientations of fracture fragments associated with various patterns of traumatic elbow instability which can impact surgical treatment planning.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

In shoulder trauma, 3D CT images may better characterize fracture patterns and humeral neck angulation, which can affect functional outcomes. 3D CT images can better visualize scapula fracture displacement and angulation.

Pelvic and acetabular fractures can be difficult to appreciate on routine radiographs. Complex injuries and subtle fractures, especially in the axial plane, can be better demonstrated on 3D CT images.

For the assessment of postoperative alignment in trauma patients with ankle pilon fractures, studies have found 3D reconstruction with MRI to be comparable to that of 3D CT reconstructions. Evaluations of complex trauma, articular surfaces, and osseous alignment are potential indications in ankle imaging that may benefit from 3D reconstruction.

In a study of 35 patients with multiple rib fractures requiring surgical stabilization, imaging with 3D CT in addition to 2D CT and plain radiography changed the surgical plan in 65.7% of the cases, compared to imaging with plain radiography and 2D CT alone.

Reference (MS-3)

v2.0.2025

1. Torabi M, Lenchik L, Beaman FD, et al. ACR Appropriateness Criteria® Acute Hand and Wrist Trauma. Available at https:// acsearch.acr.org/docs/69418/Narrative/. American College of Radiology. Revised 2018.
2. Harness NG, Ring D, Zurakowski D, Harris GJ, Jupiter JB. The influence of three-dimensional computed tomography reconstructions on the characterization and treatment of distal radial fractures. *J Bone Joint Surg Am.* 2006;88:1315-23.
3. Siriwanarangsun P, Bae WC, Statum S, Chung CB. Advanced MRI Techniques for the Ankle. *AJR Am J Roentgenol*. 2017 Sep;209(3):511-524.
4. Chen KC, Ha AS, Bartolotto RJ, et al. ACR Appropriateness Criteria® Acute Elbow and Forearm Pain. Available at https://acsearch.acr.org/docs/3195154/Narrative/. American College of Radiology. Revised 2024.
5. Amini B, Beckmann NM, Beaman, FD, et al. Expert Panel on Musculoskeletal Imaging. American College of Radiology ACR Appropriateness Criteria® Shoulder Pain-Traumatic. Am Coll Radiol (ACR); Revised: 2017.
6. Falchi M, Rollandi GA. CT of pelvic fractures. *Eur J Radiol*. 2004 Apr;50(1):96-105.
7. Pulley BR, Taylor BC, Fowler TT, et al. Utility of three-dimensional computed tomography for the surgical management of rib fractures. *Journal of Trauma and Acute Care Surgery*. 2015 Mar; 78(3):530-4.

Avascular Necrosis (AVN)/ Osteonecrosis (MS-4)

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

AVN (MS-4.1)

MS.AN.0004.1.A
v2.0.2025

- MRI without contrast, MRI without and with contrast, or CT without contrast of the area of interest can be performed when plain x-ray findings are negative or equivocal and clinical symptoms warrant further investigation for suspected avascular necrosis.
- Advanced imaging for AVN confirmed by plain x-ray is appropriate for treatment planning in the following situations:
  - Femoral head:
    - MRI Hip without contrast (CPT® 73721) or CT Hip without contrast (CPT® 73700)
  - Distal Femur:
    - MRI Knee without contrast (CPT® 73721) or CT Knee without contrast (CPT® 73700)
  - Talus:
    - MRI Ankle without contrast (CPT® 73721) or CT Ankle without contrast (CPT® 73700)
  - Tarsal navicular (Kohler Disease):
    - MRI Foot without contrast (CPT® 73718) or CT Foot without contrast (CPT® 73700)
  - Metatarsal head (Frieberg's Infraction):
    - MRI Foot without contrast (CPT® 73718) or CT Foot without contrast (CPT® 73700)
  - Humeral head:
    - MRI Shoulder without contrast (CPT® 73221) or CT Shoulder without contrast (CPT® 73200)
  - Lunate (Kienbock's Disease)/Scaphoid (Preiser's Disease):
    - CT Wrist without contrast (CPT® 73200) or MRI Wrist without contrast (CPT® 73221)
- Individuals with acute lymphoblastic leukemia and known or suspected osteonecrosis should be imaged according to guidelines in **Acute Lymphoblastic Leukemia (PEDONC-3.2)** in the Pediatric and Special Populations Oncology Imaging Guidelines.
- Known or suspected osteonecrosis in long-term cancer survivors should be imaged according to guidelines in **Osteonecrosis in Long Term Cancer Survivors (PEDONC-19.4)** in the Pediatric and Special Populations Oncology Imaging Guidelines.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Background and Supporting Information

- Classification systems use a combination of plain x-rays, MRI, and clinical features to stage avascular necrosis.

Evidence Discussion (MS-4)

Multiple articles report that obtaining plain radiographs is fundamental in the work-up and follow-up of patients presenting with symptoms suspicious for osteonecrosis/ avascular necrosis (AVN). The American College of Radiology Appropriateness Criteria for Osteonecrosis (revised 2022) also supports radiography as the initial imaging study for clinically suspected osteonecrosis. Also noted was that although radiographs are less sensitive for detection of early osteonecrosis, they help to exclude other causes of extremity pain such as fracture, primary arthritis, or tumor. In late stage osteonecrosis, x-rays will also show findings of secondary osteoarthritis.

Plain x-rays are also valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

The literature and the American College of Radiology Appropriateness Criteria for Osteonecrosis (revised 2022) support advanced imaging when initial x-rays are negative or equivocal and osteonecrosis is still suspected. MRI has been shown to be the most sensitive and specific imaging modality for the diagnosis of osteonecrosis, with a sensitivity and specificity nearing 100%. Advanced imaging for AVN is also supported for treatment planning when AVN is confirmed by plain x-ray.

It should be noted, however, that advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience. Risks of advanced imaging also include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

Although the use of any coverage criteria includes the possible risk of delayed care, EviCore firmly believes the benefits of our evidence based criteria best ensure patient safety and highly outweigh any clinical harm from perhaps briefly delaying advanced imaging if needed.

References (MS-4)

v2.0.2025

1. Calder JD, Hine AL, Pearse MF, Revell PA. The relationship between osteonecrosis of the proximal femur identified by MRI and lesions proven by histological examination. *J Bone Joint Surg Br*. 2008;90(2):154-158.
2. Karantanas AH, Drakonaki EE. The role of MR imaging in avascular necrosis of the femoral head. *Semin Musculoskelet Radiol*. 2011;15(3):281-300. doi:10.1055/s-0031-1278427.
3. Karim AR, Cherian JJ, Jauregui JJ, et al. Osteonecrosis of the knee: review. *Ann Transl Med*. 2015;3(1). doi:10.3978/j.issn.2305-5839.2014.11.13.
4. Mintz DN, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic hip pain. *Am Coll Radiol (ACR)*; Revised:2016. https://acsearch.acr.org/docs/69425/Narrative/.
5. Rubin DA, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic wrist pain. *Am Coll Radiol (ACR)*; Revised:2017. https://acsearch.acr.org/docs/69427/Narrative/.
6. Bennett DL, Nelson JW, Weissman BN, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® nontraumatic knee pain. *Am Coll Radiol (ACR)*; Date of Origin:1995. Revised: 2018. https://acsearch.acr.org/docs/69432/Narrative/.
7. Ha AS, Chang EY, Bartolotta FJ, et al. ACR Appropriateness Criteria® Osteonecrosis. Available at https://acsearch.acr.org/docs/69420/Narrative/. American College of Radiology. Revised 2022.
8. Pierce TP, Jauregui JJ, Cherian JJ, Elmallah RK, Mont MA. Imaging evaluation of patients with osteonecrosis of the femoral head. *Curr Rev Musculoskelet Med*. 2015 Sep;8(3):221-7.
9. Lespasio MJ, Sodhi N, Mont MA. Osteonecrosis of the Hip: A Primer. *Perm J*. 2019;23:18-100.
10. Hernigou P, Hernigou J, Scarlat M. Shoulder Osteonecrosis: Pathogenesis, Causes, Clinical Evaluation, Imaging, and Classification. *Orthop Surg*. 2020 Oct;12(5):1340-1349.
11. Parekh, Selene G. MD; Kadakia, Rishin J. MD. Avascular Necrosis of the Talus. *Journal of the American Academy of Orthopaedic Surgeons.* 29(6):p e267-e278, March 15, 2021.
12. Zhang H, Fletcher AN, Scott DJ, Nunley J. Avascular Osteonecrosis of the Talus: Current Treatment Strategies. *Foot & Ankle International*. 2022;43(2):291-302.
13. DiGiovanni, Christopher W. MD; Patel, Amar MD; Calfee, Ryan MD; Nickisch, Florian MD. Osteonecrosis in the Foot. *Journal of the American Academy of Orthopaedic Surgeons.* 15(4):p 208-217, April 2007
14. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
15. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
16. Zalavras CG, Lieberman JR. Osteonecrosis of the femoral head: evaluation and treatment. *J Am Acad Orthop Surg.* 2014;22:455-64.
17. Choi HR, Steinberg ME, E YC. Osteonecrosis of the femoral head: diagnosis and classification systems. *Curr Rev Musculoskelet Med.* 2015;8:210-20.
18. Register B, Pennock AT, Ho CP, Strickland CD, Lawand A, Philippon MJ. Prevalence of abnormal hip findings in asymptomatic participants: a prospective, blinded study. *Am J Sports Med*. 2012 Dec;40(12):2720-4.
19. Englund M, Guermazi A, Gale D, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med*. 2008;359(11):1108-1115.
20. Tocci SL, Madom IA, Bradley MP, Langer PR, DiGiovanni CW. The diagnostic value of MRI in foot and ankle surgery. *Foot Ankle Int*. 2007 Feb;28(2):166-8.
21. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
22. Ganguli I, Simpkin AL, Lupo C, et al. Cascades of care after incidental findings in a US national survey of physicians [published correction appears in *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325.

Fractures (MS-5)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Acute Fracture (MS-5.1)

MS.FX.0005.1.A
v2.0.2025

- CT or MRI without contrast if **ANY** of the following:
  - Complex (comminuted or displaced) fracture with or without dislocation on plain x-ray.
    - CT is preferred unless it is associated with neoplastic disease when MRI without/with contrast is preferred unless MRI contraindicated.
  - Individual presents initially to the requesting provider with a documented history of an acute traumatic event at least two weeks prior with a negative plain x-ray at the time of this face-to-face encounter and a clinical suspicion for an occult/stress/ insufficiency fracture see: **Suspected Occult/ Stress/ Insufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)**.
- For osteochondral fracture or osteochondral injury, see: **Chondral/Osteochondral Lesions, Including Osteochondritis Dissecans and Fractures (MS-13.1)**

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Suspected Occult/Stress/Insufficiency Fracture/Stress Reaction and Shin Splints (MS-5.2)

MS.FX.0005.2.C
v2.0.2025

This section does not include indications for periprosthetic fractures. See **Post-Operative Joint Replacement Surgery - General (MS-16.1)** and anatomical area tables for individual joints.

- MRI without contrast can be performed for suspected hip/femoral neck, tibia, pelvis/sacrum, tarsal navicular, proximal fifth metatarsal, or scaphoid occult/stress/insufficiency fractures, and suspected atypical femoral shaft fractures related to bisphosphonate use if the initial evaluation of history, physical exam and plain x-ray fails to establish a definitive diagnosis.
  - CT without contrast can be performed as an alternative to MRI for suspected occult/insufficiency fractures of the pelvis/hip and suspected atypical femoral shaft fractures related to bisphosphonate see: **Pelvis (MS-23)** and **Hip (MS-24)**, and suspected occult fractures of the scaphoid see: **Wrist (MS-21)**.
- MRI or CT without contrast can be performed for all other suspected occult/stress/insufficiency fractures with either of the following:
  - Repeat plain x-rays remain non-diagnostic for fracture after a minimum of 10 days of provider-directed conservative treatment **OR**
  - Initial plain x-rays obtained a minimum of 14 days after the onset of symptoms are non-diagnostic for fracture
- MRI of the lower leg without contrast (CPT® 73718) for suspected shin splints when **BOTH** of the following are met:
  - Initial plain x-ray **AND**
  - Failure of a 6-week trial of provider-directed conservative treatment
- For stress reaction, advanced imaging is not medically necessary for surveillance or “return to play” decisions regarding a stress reaction identified on an initial imaging study.
- MRI without contrast of the area of interest for stress fracture follow-up imaging for "return to play" evaluation at least 3 months after the initial imaging study for stress fracture.
- For periprosthetic fractures related to joint replacement see: **Post-Operative Joint Replacement Surgery (MS-16.1)**, **Shoulder (MS-19)**, **Elbow (MS-20)**, **Hip (MS-24)**, **Knee (MS-25)**, and **Ankle (MS-26)**.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Other Indications (MS-5.3)

MS.FX.0005.3.A
v2.0.2025

- CT or MRI without contrast after recent (within 30 days) plain x-ray if **ONE** of the following is present:
  - Concern for delayed union or non-union of fracture, osteotomy, or joint fusions.
  - Part of preoperative evaluation for a planned surgery of a complex fracture with or without dislocation.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Evidence Discussion (MS-5)

v2.0.2025

The vast majority of acute fractures can be easily diagnosed via plain radiography. Therefore, it is widely accepted that the initial imaging for a patient with a suspected fracture should be plain radiographs. For patients noted to have a complex fracture (comminuted or displaced) on initial plain radiographs, CT can provide detailed bony information to allow further evaluation and treatment planning.

Initial imaging for a suspected stress fracture should begin with plain radiographs. Although initial x-rays may not identify the fracture, repeat x-ray imaging in 10 – 14 days is supported by the American College of Radiology Appropriateness Criteria for Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae (revised 2024). Repeat radiographs may show osseous reaction confirming the presence of an occult or stress fracture. However, if repeat x-rays remain negative and there is still suspicion of an occult or stress fracture, MRI is recommended as it has been shown to be the most sensitive and specific imaging modality for workup of suspected stress injuries. CT, Bone scan, SPECT and SPECT/CT are also considered as options per American College of Radiology Appropriateness Criteria for Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae (revised 2024).

There exists a subset of occult/stress/insufficiency fractures that have an increased risk of fracture progression, delayed healing, non-union and avascular necrosis. For these high risk injuries, advanced imaging is recommended if initial x-rays are negative or indeterminate as these injuries require early diagnosis and immediate treatment.

The evaluation of patients with suspected shin splints/medial tibial stress syndrome includes a detailed history, physical examination and plain x-rays. Most patients will improve with conservative care, however, MRI is recommended if the patient fails to respond to an adequate trial of conservative treatment.

For the assessment of bony healing, serial x-ray imaging is usually sufficient. However, if there are still concerns for delayed union or non-union, CT scanning can provide detail as to the presence or absence of bridging callus. MRI can also assist in the evaluation of bone healing.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-5)

v2.0.2025

1. Bencardino JT, Stone TJ, Roberts CC, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69435/Narrative/.
2. Mintz DN, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Hip Pain. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69425/Narrative/.
3. Bruno MA, Weissman BN, Kransdorf MJ, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute Hand and Wrist Trauma. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2018. https://acsearch.acr.org/docs/69418/Narrative/.
4. Luchs JS, Flug JA, Weissman BN, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Ankle Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2017. https://acsearch.acr.org/docs/69422/Narrative/.
5. Ross AB, Lee, KS, Chang, EY, et al. ACR Appropriateness Criteria® Acute Hip Pain-Suspected Fracture. Available at https://acsearch.acr.org/docs/3082587/Narrative/. American College of Radiology. Revised 2018.
6. Mosher TJ, Kransdorf MJ, Adler R, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute Trauma to the Ankle. *Am Coll Radiol (ACR);* Date of Origin: 2013. Revised: 2020. https://acsearch.acr.org/docs/69436/Narrative/.
7. Hayes CW, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Elbow Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2022. https://acsearch.acr.org/docs/69423/Narrative/.
8. Wise JN, Weissman BN, Appel M, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Foot Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2020. https://acsearch.acr.org/docs/69424/Narrative/.
9. Greene WB. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:568-570.
10. Galbraith RM, Lavallee ME. Medial tibial stress syndrome: conservative treatment options. *Curr Rev Muscuolskelet Med.* 2009;2:127-133. doi:10.1007/s12178-009-9055-6.
11. Boks SS, Vroegindeweij D, Kroes BW, et al. MRI follow-up of posttraumatic bone bruises of the knee in general practice. *AJR Am J Roentgenol.* 2007;189 556-562. doi:10.2214/AJR.07.2276.
12. Kaeding CC, Yu JR, Wright R, et al. Management and return to play of stress fractures. *Clin J Sport Med.* 2005;15:442-7.
13. Sormaala MJ, Niva MH, Kiuru MJ, et al. Stress injuries of the calcaneus detected with magnetic resonance imaging in military recruits. *J Bone Joint Surg Am.* 2006;88:2237-42. doi:10.2106/JBJS.E.01447.
14. Shin AY, Morin WD, Gorman JD, et al. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. *Am J Sports Med.* 1996;24:168-76. doi:10.1177/036354659602400209.
15. Slocum KA, Gorman JD, Puckett ML, et al. Resolution of abnormal MR signal intensity in patients with stress fractures of the femoral neck. *AJR Am J Roentgenol.* 1997;168:1295-9. doi:10.2214/ajr.168.5.9129429.
16. Fredericson M, Bergman AG, Hoffman KL, et al. Tibial stress reaction in runners. Correlation of clinical symptoms and scintigraphy with a new magnetic resonance imaging grading system. *Am J Sports Med.* 1995;23(4):472-81. doi:10.1177/036354659502300418.
17. Bernstein EM, Kelsey TJ, Cochran GK, Deafenbaugh BK, Kuhn KM. Femoral neck stress fractures: An updated review. *J Am Acad Orthop Surg*. 2022;30:302-311. doi:10.5435/JAAOS-D-21-00398.
18. De Smet AA, Doherty MP, Norris MA, Hollister MC, Smith DL. Are oblique views needed for trauma radiography of the distal extremities? *AJR Am J Roentgenol.* 1999;172:1561-5.
19. Bica D, Sprouse RA, Armen J. Diagnosis and Management of Common Foot Fractures. *Am Fam Physician*. 2016 Feb 1;93(3):183-91.

20. Pecci M, Kreher JB. Clavicle fractures. *Am Fam Physician*. 2008 Jan 1;77(1):65-70.
21. Patel DS, Statuta SM, Ahmed N. Common Fractures of the Radius and Ulna. *Am Fam Physician*. 2021 Mar 15;103(6):345-354.
22. Mujoomdar M, Russell E, Dionne F, et al. Optimizing Health System Use of Medical Isotopes and Other Imaging Modalities [Internet]. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2012. APPENDIX 2.4, Diagnosis of Fracture.
23. Tornetta P 3rd, Gorup J. Axial computed tomography of pilon fractures. *Clin Orthop Relat Res*. 1996 Feb; (323):273-6.
24. Misra S, Vaishya R, Trikha V, Maheshwari J. Practice guidelines for proximal humeral fractures. *J Clin Orthop Trauma*. 2019 May-Jun;10(3):631-633.
25. Bahrs, C., Rolauffs, B., Südkamp, N.P. et al. Indications for computed tomography (CT-) diagnostics in proximal humeral fractures: a comparative study of plain radiography and computed tomography. *BMC Musculoskelet Disord*. 10, 33 (2009).
26. Morrey ME, Morrey BF, Sanchez-Sotelo J, Barlow JD, O'Driscoll S. A review of the surgical management of distal humerus fractures and nonunions: From fixation to arthroplasty. *J Clin Orthop Trauma*. 2021 Jun 12;20:101477.
27. Morrison WB, Deely D, Fox MG, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. Am Coll Radiol (ACR); Revised: 2024. https://acsearch.acr.org/docs/69435/Narrative/.
28. Fredericson M, Jennings F, Beaulieu C, Matheson GO. Stress fractures in athletes. *Top Magn Reson Imaging*. 2006 Oct;17(5):309-25.
29. Wright AA, Hegedus EJ, Lenchik L, Kuhn KJ, Santiago L, Smoliga JM. Diagnostic Accuracy of Various Imaging Modalities for Suspected Lower Extremity Stress Fractures: A Systematic Review With Evidence-Based Recommendations for Clinical Practice. *Am J Sports Med*. 2016 Jan;44(1):255-63.
30. McInnis KC, Ramey LN. High-Risk Stress Fractures: Diagnosis and Management. *PM R*. 2016 Mar;8(3 Suppl):S113-24.
31. Boden BP, Osbahr DC. High-risk stress fractures: evaluation and treatment. *J Am Acad Orthop Surg*. 2000 Nov-Dec;8(6):344-53.
32. Blood T, Feller RJ, Cohen E, Born CT, Hayda R. Atypical fractures of the femur: Evaluation and treatment. *JBJS Reviews*. 2015 Mar 3;3:3.
33. Nicholson JA, Yapp LZ, Keating JF, Simpson AHRW. Monitoring of fracture healing. Update on current and future imaging modalities to predict union. *Injury*. 2021 Jun;52 Suppl 2:S29-S34.

Foreign Body (MS-6)

Guideline Page

Foreign Body – General (MS-6.1)

MS.FB.0006.1.A

v2.0.2025

- Ultrasound (CPT® 76881 or CPT® 76882) or CT without contrast or MRI without and with contrast or MRI without contrast of the area of interest can be approved after plain x-rays rule out the presence of radiopaque foreign bodies.
  - Ultrasound (CPT® 76881 or CPT® 76882) is the preferred imaging modality for radiolucent (non-radiopaque) foreign bodies (e.g. wood, plastic)
  - CT without contrast is recommended when plain x-rays are negative and a radiopaque foreign body is still suspected, as CT is favored over MRI for the identification of foreign bodies
  - MRI without and with contrast is an alternative to US and CT for assessing the extent of infection associated with a suspected foreign body

Evidence Discussion (MS-6.1)

- X-ray is a good initial screening examination in suspected foreign bodies of the musculoskeletal system. X-rays provide an excellent overview of the anatomic area of interest.
- X-rays have 98% sensitivity in the evaluation of radiopaque foreign bodies. Metallic foreign bodies are radiopaque and are readily detectable by x-ray.
- If a foreign body is not visualized on x-rays, Ultrasound can be performed for further evaluation. Ultrasound has high sensitivity and specificity in detecting radiolucent objects like wood, and plastic. Ultrasound is also widely available, accessible and does not involve ionized radiation. Ultrasound can also help to evaluate complications of foreign body such as infections and vascular or tendon injuries.
- CT is useful when X-rays are negative but a radiopaque foreign body is still suspected. MRI is better than CT in the assessment of infection associated with a foreign body.

References (MS-6)

v2.0.2025

1. Gorbachova T, Chang EY, Ha AS, et. al. ACR Appropriateness Criteria® Acute Trauma to the Foot. Available at https://acsearch.acr.org/docs/70546/Narrative/. American College of Radiology. Revised: 2019.
2. Pierce JL, Perry MT, Wessell DE, et. al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). Available at https://acsearch.acr.org/docs/3094201/Narrative. American College of Radiology. Revised: 2022.
3. Chan C, Salam GA. Splinter removal. *Am Fam Physician.* 2003;67(12):2557-2562.
4. Peterson JJ, Bancroft LW, Kransdorf MJ. Wooden foreign bodies: imaging appearance. (*AJR) Am J Roentgenol.* 2002;178(3):557-562. doi:10.2214/ajr.178.3.1780557.
5. Jarraya M, Hayashi D, de Villiers RV, et al. Multimodality imaging of foreign bodies of the musculoskeletal system. (*AJR) Am J Roentgenol*. 2014;203(1):W92-102. doi:10.2214/AJR.13.11743.

Ganglion Cysts (MS-7)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Ganglion Cysts – General (MS-7.1)

MS.GC.0007.1.A
v2.0.2025

- Plain x-ray is the initial imaging study for ganglion cysts.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI without contrast or MRI without and with contrast or US (CPT® 76881 or CPT® 76882) is appropriate for surgical planning.
- Advanced imaging is not indicated for ganglions that can be diagnosed by history and physical examination.

Evidence Discussion (MS-7.1)

The most appropriate initial imaging test for ganglion is an x-ray. Some conditions need additional imaging tests for diagnosis or to plan for treatment, when x-rays are normal or equivocal. When there is a cystic mass for which surgery is being considered, Ultrasound or MRI can be considered. Ultrasound is often sufficient for evaluating typical cysts and MRI is useful for preoperative purposes, for cysts with atypical features or when neurologic symptoms are present. High resolution MRI was also found to be diagnostic for occult dorsal wrist ganglion.

References (MS-7)

v2.0.2025

1. Stensby JD, Fox MG, Nacey N, et al. ACR Appropriateness Criteria®Chronic Hand and Wrist Pain. Available at https://acsearch.acr.org/docs/69427/Narrative/. American College of Radiology. Revised 2023.
2. Rubin DA, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Soft-Tissue Masses. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2017. https://acsearch.acr.org/docs/69434/Narrative/.
3. Freire V, Guerini H, Campagna R, et al. Imaging of hand and wrist cysts: a clinical approach. (*AJR) Am J R Roentgenol.* 2012;199(5):W618-W628. doi:10.2214/AJR.11.8087.
4. Vo P, Wright T, Hayden F, Dell P, et al. Evaluating dorsal wrist pain: MRI diagnosis of occult dorsal wrist ganglion. *J Hand Surg Am.* 1995;20(4):667-670. doi:10.1016/S0363-5023(05)80288-6.
5. Teefey SA, Dahiya N, Middleton WD, et al. Ganglia of the hand and wrist: a sonographic analysis. *AJR Am J Roentgenol.* 2008;191(3):716-720. doi:10.2214/AJR.07.3438.

Gout/Calcium Pyrophosphate Deposition Disease (CPPD)/ Pseudogout/ Chondrocalcinosis (MS-8)

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Gout – General (MS-8.1)

MS.GD.0008.1.A

v2.0.2025

- CT without contrast, MRI without contrast, or MRI without and with contrast of the area of interest is indicated when **BOTH** of the following are met:
  - Initial plain x-ray to rule out other potential disease processes
  - Infection or neoplasm is in the differential diagnosis for soft-tissue tophi

Background and Supporting Information

- Early stages of gout can be diagnosed clinically since radiographic findings are not present early in the disease course.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

CPPD (Pseudogout/Chondrocalcinosis) – General (MS-8.2)

MS.GD.0008.2.A

v2.0.2025

- Calcium pyrophosphate deposition disease (CPPD), also called pseudogout, can often be diagnosed from plain x-rays; advanced diagnostic imaging is generally not medically necessary.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Evidence Discussion (MS-8)

v2.0.2025

The American College of Radiology (ACR) Appropriateness Criteria for Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis, Crystalline Arthritis, or Erosive Osteoarthritis (revised 2022) recommends plain radiography as the initial imaging study for chronic extremity joint pain where crystalline arthritis is suspected. X-rays may contain sufficient findings for the diagnosis of gout or calcium pyrophosphate deposition disease (CPPD). Plain x-rays may also rule out or rule in alternative causes of pain such as arthritis, infection or trauma.

Advanced imaging is typically not required for the evaluation of patients with suspected crystalline arthropathy, as a definitive diagnosis can be made based on the presence of monosodium urate crystals or calcium pyrophosphate crystals on synovial fluid microscopy. However, advanced imaging can be helpful in the evaluation of tophi when neoplasm or infection are included in the differential diagnosis.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-8)

v2.0.2025

1. Hsu CY, Shih TT, Huang KM, et al. Tophaceous gout of the spine: MR imaging features. *Clin Radiol*. 2002;57(10):919.
2. Schumacher HR Jr, Becker MA, Edwards NL, et al. Magnetic resonance imaging in the quantitative assessment of gouty tophi. *Int J Clin Pract*. 2006;60(4):408. doi:10.1111/j.1368-5031.2006.00853.x.
3. McQueen FM, Doyle A, Reeves Q, Gao A. Bone erosions in patients with chronic gouty arthropathy are associated with tophi but not bone oedema or synovitis: new insights from a 3 T MRI study. *Rheumatology*. 2014;53(1):95-103. doi:10.1093/rheumatology/ket329.
4. Dore RK. Gout: What primary care physicians want to know. *J Clin Rheumatol.* 2008;14(5S):S47-S54. doi:10.1097/RHU.0b013e3181896c35.
5. Eggebeen AT. Gout: an update. *Am Fam Physician.* 2007;76(6):801-808.
6. Burns C, Wortmann RL. Gout. In: Imboden JB, Hellmann DB, Stone JH, eds. *CURRENT Diagnosis & Treatment: Rheumatology*. 3rd edition. New York: McGraw-Hill; 2013:332-338.
7. Jacobson JA, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic extremity joint pain-suspected inflammatory arthritis. *Am Coll Radiol (ACR);* 2017;14(5):S81-S89. http://www.jacr.org/article/S1546-1440(17)30183-7/fulltext.
8. Subhas N, Wu F, Fox MG, et al. ACR Appropriateness Criteria® Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis, Crystalline Arthritis, or Erosive Osteoarthritis. Available at https://acsearch.acr.org/docs/3097211/Narrative/. American College of Radiology. Revised 2022.
9. McQueen FM, Doyle A, Dalbeth N. Imaging in gout--what can we learn from MRI, CT, DECT and US? *Arthritis Res Ther*. 2011;13(6):246.

Infection/ Osteomyelitis (MS-9)

Guideline Page

Infection – General (MS-9.1)

MS.OI.0009.1.C
v2.0.2025

- MRI without contrast, MRI without and with contrast, CT without contrast, CT with contrast, or Ultrasound (CPT® 76881 or CPT® 76882) of the affected area is appropriate after plain x-ray(s) in the following scenarios:
  - Plain x-ray(s) do not demonstrate infection, **AND**
  - Plain x-ray(s) do not suggest alternative diagnoses such as neuropathic arthropathy or fracture, **AND**
  - Soft tissue or bone infection (osteomyelitis) is suspected; **OR**
  - Plain x-ray(s) are positive for infection, **AND**
  - The extent of infection into the soft tissues and any skip lesions require evaluation.
- If MRI or CT cannot be done, and when infection is multifocal, or when the infection is associated with orthopedic hardware or chronic bone alterations from trauma or surgery:
  - FDG PET/CT (CPT® 78815 for multifocal infection, or CPT® 78811 for unifocal/ limited area of interest)
  - At this time, FDG is the only indicated radiotracer for use with PET/CT in the imaging of musculoskeletal conditions.
- Individuals with suspected spinal infections
  - See: **Red Flag Indications (SP-1.2)** for advanced imaging guidelines
- Individuals with diabetic foot infections after plain x-ray(s)
  - See: **Foot (MS-27)** for advanced imaging guidelines

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Septic Joint (MS-9.2)

MS.OI.0009.2.A
v2.0.2025

- MRI without and with contrast, MRI without contrast, CT without contrast, CT with contrast, or Ultrasound (CPT® 76881 or CPT® 76882) of the affected joint is appropriate when standard or image-guided arthrocentesis is contraindicated, unsuccessful, or non-diagnostic, and the clinical documentation satisfies ALL of the following criteria:
  - History and physical examination findings [One of the following]:
    - Development of an acutely hot and swollen joint (< 2 weeks)
    - Decreased range of motion due to pain
    - Documented fever
  - Laboratory tests [One of the following]:
    - Leukocytosis
    - Elevated ESR or C-reactive protein
    - Analysis of the joint fluid is non-diagnostic
  - Plain x-ray of the joint
    - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI without and with contrast, MRI without contrast, CT without contrast, or CT with contrast of the affected joint is appropriate after plain x-rays if the arthrocentesis is diagnostic and if there is a confirmed septic joint, to evaluate the extent of infection into the soft tissues and any skip lesions that would require evaluation.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider

Background and Supporting Information

- Analysis of joint fluid is most often sufficient to diagnose a septic joint.

Evidence Discussion (MS-9)

v2.0.2025

Radiographs should be used for the initial evaluation of musculoskeletal infections, including osteomyelitis, septic arthritis, and soft tissue infection. Obtaining the initial radiograph provides an excellent overview of the anatomic area of interest and can exclude fractures and tumors as the cause of swelling or pain.

Radiographs also help with the interpretation of future imaging studies such as CT, MRI, ultrasound (US), and nuclear medicine scans.

The clinical presentation of a hot swollen joint is common and has wide differential diagnosis. Septic arthritis is traditionally a clinical diagnosis based on physical examination and prompt arthrocentesis.

In many cases, imaging cannot distinguish infected from non-infected joints or fluid collections, and aspiration and culture are needed for diagnosis.

US, MRI, or CT is usually appropriate as the next imaging study for suspected septic arthritis, soft tissue infection, or osteomyelitis following normal radiographs. They may also be helpful to evaluate the adjacent soft tissues for infection. These procedures are equivalent alternatives (i.e., only one procedure will be ordered to provide the clinical information to effectively manage the patient's care).

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-9)

v2.0.2025

1. Coakley G, Mathews C, Field M, et al. BSR & BHPR, BOA, RCGP and BSAC guidelines for management of the hot swollen joints in adults. *Rheumatology.* 2006;45(8):1039-1041. doi:10.1093/rheumatology/kel163a.
2. Karchevsky M, Schweitzer ME, Morrison WB, et al. MRI findings of septic arthritis and associated osteomyelitis in adults. (*AJR) Am J Roentgenol.* 2004;182(1):119-122. doi:10.2214/ajr.182.1.1820119.
3. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:918.
4. Staheli LT. Septic arthritis. In: Staheli LT, ed. *Fundamentals of Pediatric Orthopedics.* 4th edition. Philadelphia, PA: Lippincott Williams & Wilkins; 2008:110-111.
5. Kransdorf MJ, Weissman BN, Appel M, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected osteomyelitis of the foot in patients with diabetes mellitus. *Am Coll Radiol (ACR).* 2012. https://acsearch.acr.org/docs/69340/Narrative/.
6. Pierce JL, Perry MT, Wessel DE, et. al. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). Available at: https://acsearch.acr.org/docs/3094201/Narrative/. American College of Radiology. Revised 2022.
7. Rubin DA, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic wrist pain. *Am Coll Radiol (ACR);* Revised: 2017. https://acsearch.acr.org/docs/69427/Narrative/.
8. Small KM, Adler RS, Shah SH, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Atraumatic. Am Coll Radiol (ACR); New 2018. https://acsearch.acr.org/docs/3101482/Narrative/.
9. Amini B, Beckmann NM, Beaman FD, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Traumatic. Am Coll Radiol (ACR); Revised 2017. https://acsearch.acr.org/docs/69433/Narrative/.
10. Mintz DN, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic hip pain. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69425/Narrative/.
11. Reinus WR. Clinician's Guide to Diagnostic Imaging. 2014. Springer-Verlag New York.
12. Visconti AJ, Biddle J, Solomon M. Follow-up imaging for vertebral osteomyelitis a teachable moment. *JAMA Itern Med*. 2014;174(2):184. doi:10.1001/jamainternmed.2013.12742.
13. Fabiano V, Franchino G, Napolitano M, et. al. Utility of magnetic resonance imaging in the follow-up of children affected by acute osteomyelitis. *Curr Pediatr Res*. 2017;21(2):354-358.
14. Patel ND, Broderick DF, Burns J, et. al. Expert Panel on Neurologic Imaging. ACR Appropriateness Criteria®: Low back pain. *Am Coll Radiol (ACR).* 2015; Revised: 2021. https://acsearch.acr.org/docs/69483/Narrative/.
15. Simpfendorfer CS. Radiologic Approach to Musculoskeletal Infections. *Infect Dis Clin North Am.* 2017;31:299-324.
16. Chan BY, Crawford AM, Kobes PH, et al. Septic Arthritis: An Evidence-Based Review of Diagnosis and Image-Guided Aspiration. *AJR Am J Roentgenol.* 2020;215:568-81.
17. Porrino J, Richardson ML, Flaherty E, et al. Septic Arthritis and Joint Aspiration: The Radiologist's Role in Image-Guided Aspiration for Suspected Septic Arthritis. *Semin Roentgenol.* 2019;54:177-89.

Soft Tissue Mass or Lesion of Bone (MS-10)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Soft Tissue Mass (MS-10.1)

MS.ST.0010.1.A
v2.0.2025

- History and physical exam of any palpable soft tissue mass should include documentation of any one or more of the following clinical features:
  - Increase in volume/size
  - More than 5 cm in diameter
  - Painful
  - Deep or subfascial location[9,10]
- Plain x-ray is indicated as the initial imaging study, with the exception of individuals with cancer predisposition syndrome.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI without and with contrast or without contrast or US of the area of interest (CPT® 76881 or 76882) is appropriate when ANY of the following are met after plain x-ray:
  - Soft tissue mass(es) which are increasing in volume/size, more than 5 cm in diameter, painful or deep or in a subfascial location[9,10]
  - Surgical planning
- Known or suspected soft tissue mass in an individual with a cancer predisposition syndrome, see **Screening Imaging in Cancer Predisposition Syndromes (PEDONC-2)** in the Pediatric and Special Populations Oncology Imaging Guidelines.
- CT with contrast or CT without and with contrast is appropriate when MRI is contraindicated or after a metal limiting MRI evaluation.
- Advanced imaging is not indicated for:
  - Subcutaneous lipoma with no surgery planned
  - Ganglia, see: **Ganglion Cysts (MS-7)**
  - Sebaceous cyst

Background and Supporting Information

- Plain x-rays can determine if an advanced imaging procedure is indicated, and if so, which modality is most appropriate. If non-diagnostic, these initial plain x-rays can provide complementary information if advanced imaging is indicated.

Evidence Discussion (MS-10.1)

- After a relevant history and physical exam that does not define the etiology of a subcutaneous lesion, plain radiographs are indicated. A plain film may show a benign soft tissue or bone lesion as the etiology and no advanced imaging would be necessary. If plain film is non-diagnostic, it could better direct initial imaging to the

correct modality. Furthermore, plain x-ray may provide complementary information to advanced imaging allowing a better interpretation.

- Clearly benign findings on exam (lipoma, ganglion, sebaceous cyst) do not need additional imaging prior to treatment unless the imaging was necessary for surgical management or for a possible malignancy.
- Magnetic Resonance Imaging (MRI) is a superior modality for evaluation of soft tissue masses but Computed Tomography (CT) is appropriate for contraindications to CT. Ultrasound can be useful following plain radiograph to further characterize a mass or better delineate extent and origin of the lesion.

Lesion of Bone (MS-10.2)

MS.ST.0010.2.C
v2.0.2025

- Complete x-ray of the entire bone containing the lesion of bone is required prior to consideration of advanced imaging. Many benign bone tumors have a characteristic appearance on plain x-ray and advanced imaging is not necessary.
- MRI without and with contrast, MRI without contrast, or CT without contrast may be indicated if ONE of the following applies:
  - Diagnosis uncertain based on plain x-ray appearance.
  - Imaging requested for preoperative planning.
- MRI without and with contrast or without contrast is appropriate when plain x-ray reveals an osteochondroma with clinical concern of malignant transformation.
- For Paget's Disease:
  - Bone scan **OR**
  - MRI (contrast as requested) can be considered if the diagnosis (based on plain x-rays and laboratory studies) is in doubt.
  - MRI (contrast as requested) can be considered if malignant degeneration, which occurs in up to 10% of cases, is suspected.

Evidence Discussion (MS-10.2)

- After a relevant history and physical exam that does not define the etiology of a bone tumor, plain radiographs are indicated. Plain radiography of the entire bone containing the lesion is necessary because many benign bone tumors have a characteristic appearance on plain x-ray and the risks of advanced imaging would be unnecessary. If plain imaging is equivocal, it may still direct initial imaging to the correct modality. Furthermore, plain x-ray may provide complementary information to advanced imaging allowing a better interpretation.
- If diagnostic uncertainty remains, concerns for malignant degeneration exist, or imaging is requested for surgical planning, advanced imaging is indicated.
- Magnetic Resonance Imaging (MRI) is a superior modality for evaluation of many bone tumors but Computed Tomography (CT) is appropriate for contraindications to MRI.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-10)

v2.0.2025

1. American College of Radiology. ACR–SPR–SSR practice parameter for the performance and interpretation of magnetic resonance imaging (mri) of bone and soft-tissue tumors. 2020; Available at: https://www.acr.org/-/media/ACR/Files/Practice-Parameters/MR-SoftTissue-Tumors.pdf.
2. Garner HW, Wessell DE, Lenchik L, et al. ACR Appropriateness Criteria® Soft Tissue Masses. Available at https:// acsearch.acr.org/docs/69434/Narrative/. American College of Radiology. Revised 2022.
3. Thomas JM, Chang, EY, Ha AS, et al. ACR Appropriateness Criteria® Chronic Elbow Pain. Available at https:// acsearch.acr.org/docs/69423/Narrative/. American College of Radiology. Revised 2022.
4. Musculoskeletal Tumor Society: Systematic Literature Review on the Use of Imaging Prior to Referral to a Musculoskeletal Oncologist. Rosemont, IL, Musculoskeletal Tumor Society, February 2018.
5. Schneider D, Hofmann MR, and Peterson JA. Diagnosis and treatment of Paget's Disease of Bone. *Am Fam Physician.* 2002;65(10):2069-2072.
6. Theodorou DJ, Theodorou SJ, and Kakitsubata Y. Imaging of Paget Disease of bone and its musculoskeletal complications: review. (*AJR)) Am J Roentgenol.* 2012;196(6):S64-S75. doi:10.2214/AJR.10.7222
7. Sinha S and Peach AH. Diagnosis and management of soft tissue sarcoma. *BMJ.* 2010;341:c7170. doi:10.1136/bmj.c7170.
8. Wu JS, Hochman MG. Soft-tissue tumors and tumorlike lesions: a systematic imaging approach. *Radiology.* 2009;253(2):297-316. doi:10.1148/radiol.2532081199.
9. Rochwerger A, Mattei JC. Management of soft tissue tumors of the musculoskeletal system. *Orthop Traumatol Surg Res*. 2018;104(1S):S9-S17. doi:10.1016/j.otsr.2017.05.031.
10. Johnson CJ, Pynsent PB, Grimer RJ. Clinical features of soft tissue sarcomas. *Ann R Coll Surg Engl*. 2001;83(3):203-205.

Muscle/Tendon Unit Injuries/Diseases (MS-11)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Muscle/Tendon Unit Injuries/Diseases (MS-11.1)

MS.MI.0011.1.A
v2.0.2025

- Plain x-ray is the initial imaging study for muscle/tendon unit injuries.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI without contrast or US (CPT® 76881 or CPT® 76882) is supported for **EITHER** of the following:
  - Suspected partial tendon rupture of a specific (named) tendon
  - Complete tendon rupture of a specific named tendon for preoperative planning
- MRI is not medically necessary for muscle belly strains/muscle tears
- See: **Shoulder (MS-19)** for clinical suspicion of a partial or complete rotator cuff tear
- See: **Inflammatory Muscle Diseases (PN-6.2)** in the Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines and **Inflammatory Muscle Diseases (PEDMS-10.3)** in the Pediatric Musculoskeletal Imaging Guidelines

Acute Compartment Syndrome (MS-11.2)

MS.MI.0011.2.A

v2.0.2025

- Advanced imaging is not indicated. Diagnosis is made clinically and by direct measurement of compartment pressure and is a surgical emergency.

Background and Supporting Information

- Noninvasive methods of measuring compartment pressures and diagnosing acute compartment syndrome are under study, but are currently not medically necessary and unproven.

Chronic Exertional Compartment Syndrome (MS-11.3)

MS.MI.0011.3.A

v2.0.2025

- Advanced imaging should only be considered when ruling out other potential causes of extremity pain following a plain x-ray and conservative treatment as indicated.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider

Background and Supporting Information

- Direct measurement of compartment pressure remains the diagnostic standard. Noninvasive methods of measuring compartment pressures and diagnosing chronic exertional compartment syndrome are under study, but are currently not medically necessary and unproven.

Evidence Discussion (MS-11)

v2.0.2025

Initial evaluation of a patient with a suspected tendon injury should include an accurate history, careful examination and plain radiographs. After x-ray, additional imaging may include MRI or ultrasound, both of which can demonstrate changes to tendons as a result of disease and/or injury. Both MRI and ultrasound findings have been validated against surgical and histological findings. Complete and partial tendon tears can be easily visualized with these modalities and results of advanced imaging can play a role in treatment planning.

There is lack of evidence to support surgical repair of muscle belly strains/tears. As these injuries are treated non-operatively, advanced imaging will typically not change the treatment plan and is not required.

Acute compartment syndrome is diagnosed based on clinical findings and the measurement of compartmental pressures. Advanced imaging does not play a role in the diagnosis or management of this condition and may delay the time to surgical treatment.

For chronic exertional compartment syndrome, dynamic intracompartmental pressure measurements are considered the gold standard for diagnosis. MRI has lacked validity as a non-invasive diagnostic tool for this condition. However, MRI may be useful to rule out other possible sources of pain if plain x-rays fail to find a source.

References (MS-11)

v2.0.2025

1. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:452.
2. Kayser R, Mahlfeld K, Heyde CE. Partial rupture of the proximal Achilles tendon: a differential diagnostic problem in ultrasound imaging. *Br J Sports Med*. 2005;39:838-842. doi:10.1136/bjsm.2005.018416.
3. Rominger MB, Lukosch CJ, Bachmann GF. MR imaging of compartment syndrome of the lower leg: a case control study. *Eur Radiol*. 2004;14:1432-1439. doi:10.1007/s00330-004-2305-5.
4. McDonald S, Bearcroft P. Compartment syndromes. *Semin Musculoskelet Radiol.* 2010;14(2):236-244. doi:10.1055/s-0030-1253164.
5. Ringler MD, Litwiller DV, Felmlee JP, et al. MRI accurately detects chronic exertional compartment syndrome: a validation study. *Skeletal Radiology.* 2013;42:385-392. doi:10.1007/s00256-012-1487-1.
6. van den Brand JG, Nelson T, Verleisdonk EJ, van der Werken C. The diagnostic value of intracompartmental pressure measurement, magnetic resonance imaging, and near-infrared spectroscopy in chronic exertional compartment syndrome: a prospective study in 50 patients. *Am J Sports Med.* 2005;33:699-704. doi:10.1177/0363546504270565.
7. Heer ST, Callander JW, Kraeutler MJ, Mei-Dan O, Mulcahey MK. Hamstring Injuries. *The Journal of Bone and Joint Surgery*. 2019;101(9):843-853. doi:10.2106/jbjs.18.00261.
8. Chang, EY, Tadros AS, Amini B, et al. ACR Appropriateness Criteria® Chronic Ankle Pain. Available at https://acsearch.acr.org/docs/69422/Narrative/. American College of Radiology. Revised 2017.
9. Vishwanathan K, Soni K. Distal biceps rupture: Evaluation and management. *J Clin Orthop Trauma*. 2021 May 20;19:132-138.
10. Hodgson RJ, O'Connor PJ, Grainger AJ. Tendon and ligament imaging. *Br J Radiol*. 2012 Aug;85(1016):1157-72.
11. Chang A, Miller TT. Imaging of tendons. *Sports Health*. 2009 Jul;1(4):293-300.
12. Almekinders LC. Results of surgical repair versus splinting of experimentally transected muscle. *J Orthop Trauma*. 1991;5(2):173-6.
13. Ramos LA, de Carvalho RT, Abdalla RJ, Ingham SJ. Surgical treatment for muscle injuries. *Curr Rev Musculoskelet Med*. 2015 Jun;8(2):188-92.
14. Beiner JM, Jokl P. Muscle contusion injuries: current treatment options. *J Am Acad Orthop Surg*. 2001 Jul-Aug;9(4):227-37.
15. American Academy of Orthopaedic Surgeons Appropriate Use Criteria for the Diagnosis and Management of Acute Compartment Syndrome aaos.org/acsauc Published September 20, 2019
16. Schmidt AH. Acute compartment syndrome. *Injury*. 2017 Jun;48 Suppl 1:S22-S25. doi: 10.1016/j.injury.2017.04.024. Epub 2017 Apr 24.
17. van der Kraats AM, Winkes M, Janzing HMJ, Eijkelenboom RPR, de Koning MTG. Review of Reliable and Valid Noninvasive Tools for the Diagnosis of Chronic Exertional Compartment Syndrome. *Orthop J Sports Med*. 2023 Jan 13;11(1): 23259671221145151. Published 2023 Jan 13. doi:10.1177/23259671221145151

Osteoarthritis (MS-12)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Osteoarthritis (MS-12.1)

MS.OT.0012.1.A
v2.0.2025

- Plain x-ray is the initial imaging study for osteoarthritis.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider

Background and Supporting Information

- Plain x-rays are performed initially and will reveal characteristic joint space narrowing, osteophyte formation, cyst formation, and subchondral sclerosis.

Treatment Planning (Non-Surgical and Surgical, Other Than Joint Replacement) (MS-12.2)

MS.OT.0012.2.A

v2.0.2025

- Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider, unless otherwise specified below.
- CT without contrast is appropriate when ALL of the following apply:
  - Requested for treatment planning, AND
  - Congenital or significant atypical post-traumatic arthritic deformities are identified on plain x-ray, AND
  - The aforementioned deformities require further evaluation of their clinical significance, AND
  - The request is related to the shoulder, elbow, wrist, hip, knee, or ankle
- MRI Knee without contrast (CPT® 73721) is appropriate in an individual with osteoarthritis for clinical suspicion of a symptomatic degenerative meniscus tear following plain x-rays and conservative treatment. See: **Knee (MS-25)**
- MRI arthrogram or CT arthrogram is appropriate when joint sparing/salvage reconstructive surgery is planned for the following:
  - Suspected concomitant rotator cuff tear of the shoulder - See: **Shoulder (MS-19)**
  - Suspected concomitant labral tear of the shoulder - See: **Shoulder (MS-19)**
  - Suspected concomitant labral tear of the hip - See: **Hip (MS-24)**
  - Suspected concomitant internal derangement of the knee - See: **Knee (MS-25)**

Imaging Prior to Non-Customized-to-Patient Joint Replacement Surgery/Not for Intraoperative Navigation (MS-12.3)

MS.OT.0012.3.A
v2.0.2025

- **ALL** of the following are required for ***elbow, wrist, hip, knee, or ankle*** advanced imaging after plain x-ray has been performed:
  - Imaging is requested for pre-operative planning for non-customized-to-patient joint replacement surgery/not for intra-operative navigation **AND**
  - Congenital or significant atypical post-traumatic arthritic deformities are identified on plain x-ray **AND**
  - The aforementioned deformities require further evaluation of their clinical significance
  - One of the following advanced imaging studies are indicated after the above criteria are satisfied:
    - **Elbow:** CT Elbow without contrast (CPT® 73200)
    - **Wrist:** CT Wrist without contrast (CPT® 73200)
    - **Hip:** CT Hip without contrast (CPT® 73700) or CT Pelvis without contrast (CPT® 72192)
    - **Knee:** CT Knee without contrast (CPT® 73700)
    - **Ankle:** CT Ankle without contrast (CPT® 73700)
- **ALL** of the following are required for ***shoulder*** advanced imaging after plain x-ray has been performed:
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider **AND**
  - Imaging is requested for pre-operative planning for non-customized-to-patient joint replacement surgery/not for intra-operative navigation
  - The following advanced imaging study(ies) is/are indicated after the above criteria are satisfied:
    - CT Shoulder without contrast (CPT® 73200) **AND/OR**
    - MRI Shoulder without contrast (CPT® 73221)

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Customized-to-Patient Joint Replacement Surgery/Intraoperative Navigation (MS-12.4)

MS.OT.0012.4.A

v2.0.2025

- The following imaging studies are appropriate per the listed criteria after plain x-ray has been performed.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- CT without contrast or MRI without contrast of the shoulder, elbow, wrist, hip, knee, or ankle is appropriate* when the request is for:
  - Treatment planning for customized-to-patient joint replacement surgery **OR**
  - Surgical planning using intraoperative navigation for joint replacement surgery (e.g. MAKOplasty) **AND**
  - The joint replacement surgery has been approved or does not require prior authorization
- *The preoperative imaging listed above is considered **not medically necessary** if any of the following are deemed not medically necessary, not a covered benefit, or experimental, investigational, or unproven by the health plan:
  - Joint replacement surgery
  - Customized-to-patient implant
  - Computer assisted surgical navigation (e.g. MAKOplasty)
- See: **Unlisted Procedures/Therapy Treatment Planning (Preface-4.3)** in the Preface Imaging Guidelines

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Evidence Discussion (MS-12)

v2.0.2025

The diagnosis of osteoarthritis can be made based on history, physical exam and plain x-rays. Advanced imaging is typically not necessary for the initial evaluation. For the vast majority of patients, treatment of osteoarthritis does not rely on advanced imaging findings and many can improve with conservative care. Advanced imaging, when not indicated, can result in incidental findings and possible overtreatment with referral to specialists and possibly unnecessary surgery.

However, for patients who are poorly responding to conservative care and there is a concern for concomitant joint pathology (e.g. degenerative meniscus tear, rotator cuff tear, labral tear of the hip or shoulder), advanced imaging may be able to identify additional sources of symptoms. Additionally, when congenital or significant atypical post-traumatic arthritic deformities are present on plain x-ray, CT imaging would be able to provide additional bony detail for treatment planning.

Plain x-rays are typically sufficient for preoperative planning for the majority of patients undergoing joint replacement surgery. However, for those with congenital or significant atypical post-traumatic arthritic deformities, CT scan can be of value for further evaluation/planning. Also, if the joint replacement surgery will use a custom implant, patient specific instrumentation or computer assisted navigation, advanced imaging will be required prior to the surgery.

References (MS-12)

v2.0.2025

1. Bennett DL, Nelson JW, Weissman BN, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Nontraumatic Knee Pain. *Am Coll Radiol (ACR);* Date of Origin: 1995. Last Review: 2018. https:// acsearch.acr.org/docs/69432/Narrative/.
2. Manek NJ, Lane NE. Osteoarthritis: Current concepts in diagnosis and management. *Am Fam Physician* 2000 March;61(6):1795-1804. https://www.aafp.org/afp/2000/0315/p1795.html.
3. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:84.
4. Quatman CE, Hettrich CM, Schmitt LC, et. al. The Clinical Utility and Diagnostic Performance of MRI for Identification of Early and Advanced Knee Osteoarthritis: A Systematic Review. *Am J Sports Med.* 2011;39(7):1557–1568. doi:10.1177/0363546511407612.
5. Braun HJ, Gold GE. Diagnosis of osteoarthritis: imaging. *Bone.* 2012;51(2):278–288. doi:10.1016/ j.bone.2011.11.019.
6. Sinusas K. Osteoarthritis: diagnosis and treatment. *Am Fam Physician*. 2012 Jan 1;85(1):49-56. Erratum in: *Am Fam Physician*. 2012 Nov 15;86(10):893.
7. Jawetz ST, Fox MG, Blankenbaker DG , et al. ACR Appropriateness Criteria® Chronic Hip Pain. Available at https:// acsearch.acr.org/docs/69425/Narrative/. American College of Radiology. Revised 2022.
8. DeRogatis M, Anis HK, Sodhi N, Ehiorobo JO, Chughtai M, Bhave A, Mont MA. Non-operative treatment options for knee osteoarthritis. *Ann Transl Med*. 2019 Oct;7(Suppl 7):S245.
9. Nunna B Jr, 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 Nov 17;15(11):e48974.
10. Shi XT, Li CF, Cheng CM, Feng CY, Li SX, Liu JG. Preoperative Planning for Total Hip Arthroplasty for Neglected Developmental Dysplasia of the Hip. *Orthop Surg*. 2019 Jun;11(3):348-355.
11. O'Connor MI, Kransdorf MJ. Customized knee arthroplasty and the role of preoperative imaging. *AJR Am J Roentgenol*. 2013 Sep;201(3):W443-50.
12. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.

Chondral/Osteochondral Lesions (MS-13)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Chondral/Osteochondral Lesions, Including Osteochondritis Dissecans and Fractures (MS-13.1)

MS.OD.0013.1.A
v2.0.2025

- MRI without contrast, MRI with contrast (arthrogram), or CT with contrast (arthrogram) of the joint or area of interest is indicated when **EITHER** of the following are met:
  - Plain x-rays are negative and an osteochondral fracture is still suspected
  - Plain x-ray and clinical exam suggest an unstable osteochondral injury
- If plain x-rays show a non-displaced osteochondral fragment, follow-up imaging should be with plain x-rays. Advanced imaging is not necessary.
- MRI without contrast or CT without contrast is indicated when healing (including post-operative fixation) cannot be adequately assessed on follow-up plain x-rays.
- See anatomical table sections for recommendations on anatomy-specific osteochondral injuries
  - See: **Ankle (MS-26)** for suspected osteochondral injury of the ankle
  - See: **Elbow (MS-20)** for suspected osteochondral injury of the elbow

Evidence Discussion (MS-13.1)

Radiography should be the first imaging test performed to evaluate chondral/ osteochondral lesions.

Radiographs help to exclude other causes of pain and to determine skeletal maturity, which significantly affects prognosis and management of Osteochondritis Dissecans lesions (OCD), because open physes have a much higher potential for healing with conservative treatment. In patients with Osteochondritis Dissecans(OCD) or subchondral insufficiency fracture on radiographs or if radiograph is negative but osteochondral fracture is still suspected, MRI without IV contrast maybe indicated to evaluate cartilage for additional injuries and for grading of osteochondral fractures and OCD. MRI is also useful to determine the best method of treatment.

CT without contrast maybe indicated to evaluate patients with OCD to confirm loose bodies or when MRI is not definitive. MR arthrography or CT arthrography is an effective test for locating intra-articular osteochondral fragments, loose bodies and grading chondral and osteochondral lesions.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Radiographs were found to be substantial to excellent at detecting healing of OCD lesions. In clinical practice, serial radiographs are recommended for monitoring healing of juvenile OCD lesions. Repeat MRI is suggested only if radiographs are not diagnostic for healing and for worsening symptoms, or change in examination.

References (MS-13)

v2.0.2025

1. Bridges MD, Berland LL, Cernigliaro JG, et al. ACR Practice Guideline. ACR-SSR Practice Guideline for the Performance and Interpretation of Magnetic Resonance Imaging (MRI). *Am Coll Radiol (ACR)*. 2017. https://www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-perf-interpret.pdf?la=en.
2. Fox, MG, Chang, EY, Amini, B, et al. ACR Appropriateness Criteria® Chronic Knee Pain. Available at https://acsearch.acr.org/docs/69432/Narrative/. American College of Radiology. Revised 2018.
3. American College of Radiology. ACR–SPR–SSR practice parameter for the performance and interpretation of magnetic resonance imaging (mri) of the elbow. 2021; Available at: https: //www.acr.org/-/media/ACR/Files/Practice-Parameters/mr-elbow.pdf?la=en.
4. Nammour MA, Mauro CS, Bradley JP, Arner JW. Osteochondritis Dissecans Lesions of the Knee: Evidence-Based Treatment. *Journal of the American Academy of Orthopaedic Surgeons*. 2024;32(13):587-596. doi:https://doi.org/10.5435/jaaos-d-23-00494.

Osteoporosis (MS-14)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Osteoporosis (MS-14)

MS.OP.0014.C
v2.0.2025

- Plain x-ray is not required.
- Quantitative CT (CPT® 77078) can be approved for screening when DXA scanner is unavailable or known to be inaccurate for ANY of the following populations:
  - Women age ≥65 years
  - Postmenopausal women younger than 65 years who are at increased risk of osteoporosis, as determined by a formal clinical risk assessment tool (e.g., FRAX*)
  - Man, age >50 years with at least one factor related to an increased risk of osteoporosis (i.e., age >70, low body weight, weight loss >10%, physical inactivity, corticosteroid use, androgen deprivation therapy, hypogonadism and previous fragility fracture)

    *Fracture Risk Assessment (FRAX) tool, developed by the World Health Organization (Sheffield, United Kingdom)

Note: Repeat screening quantitative computed tomography (QCT) can be approved no sooner than every two years.

- Quantitative CT scan (CPT® 77078) can be approved for non-screening/monitoring when DXA scanner is unavailable or known to be inaccurate for ANY of the following circumstances:
  - Follow-up in cases where QCT was the original study
  - Multiple healed vertebral compression fractures
  - Significant scoliosis
  - Advanced arthritis of the spine due to increased cortical sclerosis often with large marginal osteophytes.
  - Obese individual over the weight limit of the dual-energy x-ray absorptiometry (DXA) exam table
  - Individuals with BMI >35kg/m^2
  - Extremes in body height (i.e. very large and very small individuals)
  - Individuals with extensive degenerative disease of the spine
  - A clinical scenario that requires sensitivity to small changes in trabecular bone density (parathyroid hormone and glucocorticoid treatment monitoring).

Note: Repeat non-screening/monitoring QCT can be approved no earlier than one year following a change in treatment regimen, and only when the results will directly impact a treatment decision.

Evidence Discussion (MS-14)

Osteoporotic fractures are associated with disability, loss of independence, limitation of ambulation, chronic pain, and decreased quality of life. Approximately 20% of hip fracture patients require long-term nursing care, and 21-30% of patients who experience a hip fracture die within one year.

The primary diagnostic test used to screen for osteoporosis is the central DXA (dual xray absorptiometry) which accurately measures bone mineral density at the hip and lumbar spine. DXA accuracy and reproducibility has led to the established standards for diagnosis of osteoporosis by the World Health Organization. The radiation dose for both lumbar spine and hip scanning in a DXA scan is approximately equivalent to that of a chest xray.

Quantitative CT is regarded as a secondary tool after DXA for screening for osteoporosis. QCT provides a volumetric bone mineral density, as opposed to DXA which is based on a 2-D area measurement. QCT can be performed on most commercially available CT scanners, with the required densitometry analysis software. Quantitative CT is highly accurate in determining tissue density within a region of interest. Indications for QCT are the same as for DXA, however DXA is recommended as the first-line screening and follow-up test for bone density. If DXA is not available, QCT may be used as a secondary technique. Selected conditions in which QCT is considered superior to DXA include extremes in body height, BMI >35, clinical scenarios when an increased sensitivity to small changes in trabecular bone density is required, and in patients with advanced degenerative bony changes in the spine. A potential harm of Quantitative CT is increased radiation exposure (1-10 mSv) as compared to <0.1 mSv for DXA scan.

Radiography has a lower sensitivity for bone loss than DXA. Osteopenia is not a reliable finding on xray until 30-40% of the bone has been lost. There is insufficient evidence to support the use of xray as a screening tool in patients suspected of having low bone mineral density. Patients whose xrays report osteopenia and/or fragility fractures should be referred for DXA for further characterization of bone density.

There is insufficient evidence to support the current use of quantitative ultrasound as a screening tool in patients suspected of having low bone mineral density.

The American College of Radiology Appropriateness Criteria supports DXA as the primary diagnostic choice to screen women >65 years of age and men >70 years of age for osteoporosis, and for postmenopausal women <65 years of age with additional risk factors for fracture.

The National Osteoporosis Foundation recommends bone mineral density testing in all women age 65 and older and all men age 70 and older, and in postmenopausal women younger than 65 years and men aged 50-69 years based on their risk factor profile, including if they had a fracture as an adult.

The USPSTF found convincing evidence that bone measurement tests are accurate for detecting osteoporosis and predicting osteoporotic fractures in women and men, and that drug therapies reduce subsequent fracture rates in postmenopausal women. The USPSTF recommends screening for osteoporosis with bone measurement testing to prevent osteoporotic fractures in women 65 years and older (B recommendation), and in postmenopausal women younger than 65 who are at increased risk of osteoporosis (B recommendation). The USPSTF concluded that current evidence is insufficient to assess the balance of benefits and harms of screening for osteoporosis in men.

One trial (Shepstone et al) evaluated the effect of screening for osteoporosis on anxiety and quality of life and found no difference between screened and unscreened intervention groups. Potential harms of screening for osteoporosis include false negative results, as well as false positive results that can lead to unnecessary treatment, although the USPSTF determined that the potential harms of osteoporosis drug therapies are small.

Central DXA is the "gold standard" for serial assessment of BMD and an important component of osteoporosis management. Biological changes in bone density are small compared to the inherent error in the test itself, and interpretation of serial bone density studies depends on appreciation of the smallest change in BMD that is beyond the range of error of the test. This least significant change (LSC) varies with the specific instrument used, patient population, measurement site, technologist's skill with patient positioning and test analysis, and the confidence intervals used. QCT of the lumbar spine can also be used for serial assessment of bone mineral density changes in men and women. The National Osteoporosis Foundation recommends repeat bone mineral density assessments one to two years after initiating medical therapy for osteoporosis and every two years thereafter, but recognizes that testing more frequently may be warranted in certain clinical situations, and may be needed less frequently in patients without major risk factors or significant bone density loss on initial BMD testing.

References (MS-14)

v2.0.2025

1. American Association of Clinical Endocrinologists (AACE) Menopause Guidelines Revision Task Force. American Association of Clinical Endocrinologists medical guidelines for clinical practice for the diagnosis and treatment of postmenopausal osteoporosis. *Endocr Pract*. 2016;22(Suppl 4):1-42. https://www.aace.com/files/postmenopausal-guidelines.pdf.
2. Coleman F, de Buer SJ, LeBoff MS, et al. National Osteoporosis Foundation (NOF). Clinician's guide to prevention and treatment of osteoporosis. *Osteoporos Int.* 2014;25(10):2359–2381. doi:10.1007/s00198-014-2794-2.
3. Final Recommendation Statement Osteoporosis to Prevent Fractures: Screening uspreventiveservicestaskforce.org. Updated June 26, 2018. Accessed June 3, 2024. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/osteoporosis-screening
4. Yu JS, Krishna NG, Fox MG, et. al. ACR Appropriateness Criteria® Osteoporosis and Bone Mineral Density. Available at https://acsearch.acr.org/docs/69358/Narrative/. American College of Radiology. Revised 2022.
5. Cosman F, de Beur SJ, LeBoff MS, et al. Clinician's Guide to Prevention and Treatment of Osteoporosis [published correction appears in *Osteoporos Int*. 2015 Jul;26(7):2045-7. doi: 10.1007/s00198-015-3037-x]. *Osteoporos Int*. 2014;25(10):2359-2381. doi:10.1007/s00198-014-2794-2.
6. Shepstone L, Lenaghan E, Cooper C, et al; SCOOP Study Team. Screening in the community to reduce fractures in older women (SCOOP): a randomised controlled trial. *Lancet*. 2018;391(10122):741-747. doi:10.1016/S0140-6736(17)32640-5

Rheumatoid Arthritis (RA) and Inflammatory Arthritis (MS-15)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Rheumatoid Arthritis (RA) and Inflammatory Arthritis (MS-15.1)

MS.RA.0015.1.A
v2.0.2025

- Plain x-ray, physical exam and appropriate laboratory studies* are required prior to advanced imaging.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI without contrast OR MRI without and with contrast or US (CPT® 76881 or CPT® 76882) is appropriate for the most symptomatic joint, or of the dominant hand or wrist, in **ALL** of the following situations:
  - When diagnosis is uncertain prior to initiation of drug therapy.
  - To study the effects of treatment with disease modifying anti-rheumatic drug (DMARD) therapy.
  - To identify seronegative RA individuals that might benefit from early DMARD therapy.
  - To determine change in treatment, such as:
    - Switching from standard DMARD therapy to tumor necrosis factor (TNF) therapy.
    - Changing to a different TNF drug therapy, then one MRI (contrast as requested) of a single joint can be performed.
    - Addition of other treatments, including joint injections
- MRI or US should NOT be considered for routine follow-up of treatment.

Background and Supporting Information

- *Examples of appropriate laboratory studies may include: Lyme titers, rheumatoid factor (RF), anti-cyclic citrullinated peptide (anti-CCP), sedimentation rate (ESR), C-reactive protein (CRP), and antinuclear antibody (ANA)], joint fluid analysis

Evidence Discussion (MS-15.1)

Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by persistent inflammation and joint damage. Clinical and laboratory assessment of RA remains the cornerstone of diagnosis and response to treatment. Imaging modalities such as plain radiographs serve as important adjuncts to examination and laboratory findings in the evaluation of suspected inflammatory arthritis. Plain radiographs should be obtained first, and inconclusive or non-diagnostic imaging results can be further evaluated with advanced imaging. They have a low sensitivity compared with CT, MRI, or Ultrasound (US) in detecting erosions and multiple views are often needed but location and

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

distribution of erosions are usually adequate for diagnosis. MRI allows assessment of all structures as well as bone edema and baseline bone edema on low and high field MRI in patients with early RA is predictive of future radiographic damage. Joints and bones in the hand are often affected in RA and assessing changes in these joints can help in therapy monitoring. MRI and US play important roles in detecting subclinical disease in patients with inflammatory arthritis. These modalities have higher sensitivity in detecting subclinical synovitis, tenosynovitis, osteitis, and early erosive disease compared with physical exam and xray, therefore useful in early diagnosis and evaluating response to treatment.

Pigmented Villonodular Synovitis (PVNS) (MS-15.2)

MS.RA.0015.2.A

v2.0.2025

- MRI of the affected joint without contrast or CT of the affected joint with contrast (arthrogram) if MRI contraindicated is supported following plain x-rays.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider

Evidence Discussion (MS-15.2)

Pigmented villonodular synovitis (PVNS) is a benign, hypertrophic synovial process characterized by villous, nodular, and villonodular proliferation and pigmentation from hemosiderin. Hemosiderin deposition is more prominent with diffuse disease. Radiographs are non-specific and may appear normal 20% of the time but joint effusion, soft-tissue swelling, extrinsic erosion of bone, absence of calcification, preservation of joint space, and/or normal bone mineralization may be seen in diffuse intraarticular PVNS. Localized form my appear normal on plain radiographs. CT shows nonspecific synovial thickening and optimally demonstrates bone erosion but the extent of lesions are not well depicted with this modality, whereas MR can demonstrate extent of disease. MR is used after plain radiography because monoarticular arthropathy can be nonspecific but there can be pathopnomic low signal intensity lesions seen on T2-weighted. MR is optimal for demonstrating the relationship of extraarticular lesions to the the tendon sheath to suggest the diagnosis.

References (MS-15)

v2.0.2025

1. Rubin DA, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Wrist Pain. *Am Coll Radiol (ACR);* Revised: 2017. https://acsearch.acr.org/docs/69427/Narrative/.
2. Luchs JS, Flug JA, Weissman BN, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Ankle Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2017. https://acsearch.acr.org/docs/69422/Narrative/.
3. Hayes CW, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Elbow Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2022. https://acsearch.acr.org/docs/69423/Narrative/.
4. Jacobson JA, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis. *Am Coll Radiol (ACR);* New: 2016. https://acsearch.acr.org/docs/3097211/Narrative/.
5. Wise JN, Weissman BN, Appel M, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Foot Pain. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2020. https://acsearch.acr.org/docs/69424/Narrative/.
6. Mintz DN, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Hip Pain. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69425/Narrative/.
7. Boutry N, Morel M, Flipo RM, et al. Early rheumatoid arthritis: a review of MRI and sonographic findings. *AJR Am J Roentgenol*. 2007;189:1502-1509. doi:10.2214/AJR.07.2548.
8. Murphey MD, Rhee JH, Lewis RB, et al. Pigmented villonodular synovitis: radiologic-pathologic correlation. *Radiographics*. 2008;28:1493-1518. doi:10.1148/rg.285085134.
9. Conaghan P, Edmonds J, Emery P, et al. Magnetic resonance imaging in rheumatoid arthritis: summary of OMERACT activities, current status, and plans. *Journal of Rheumatology.* 2001;28(5):1158-1161. http://www.jrheum.org/content/28/5/1158.long.
10. Ostergaard M, McQueen FM, Bird P, et al. Magnetic resonance imaging in rheumatoid arthritis--advances and research priorities. *Journal of Rheumatology.* 2005;32(12):2462-2464. http://www.jrheum.org/content/32/12/2462.long.
11. Mcqueen FM. The use of MRI in early RA. *Rheumatology.* 2008;47(11):1597-1599. doi:10.1093/rheumatology/ken332.
12. Gossec L, Fautrel B, Pham T, et al. Structural evaluation in the management of patients with rheumatoid arthritis: development of recommendations for clinical practice based on published evidence and expert opinion. *Joint Bone Spine*. 2005;72(3):229-234. doi:10.1016/j.jbspin.2004.10.011.
13. Cohen SB, Potter H, Deodhar A, et al. Extremity magnetic resonance imaging in rheumatoid arthritis: updated literature review. *Arthritis Care & Research*. 2011;63(5):660-665. doi:10.1002/acr.20413.
14. Singh JA, Furst DE, Bharat A, et al. 2012 update of the 2008 American College of Rheumatology recommendations for the use of disease-modifying antirheumatic drugs and biologic agents in the treatment of rheumatoid arthritis. *Arthritis Care & Research.* 2012;64(5):625-639. doi:10.1002/acr.21641.
15. Saag KG, Teng GG, Patkar NM, et al. American College of Rheumatology 2008 recommendations for the use of nonbiologic and biologic disease-modifying antirheumatic drugs in rheumatoid arthritis. *Arthritis & Rheumatism (Arthritis Care & Research).* 2008;59:762-784. doi:10.1002/art.23721.
16. 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. *J Am Coll Radiol.* 2023;20:S20-S32.
17. Kgoebane K, Ally MMTM, Duim-Beytell MC, Suleman FE. The role of imaging in rheumatoid arthritis. *S Afr J Rad*. 2018; 22(1), a1316. https://doi.org/10.4102/sajr. v22i1.1316

18. Schleich C, Buchbender C, Sewerin P, Miese F, Aissa J, Brinks R, Evaluation of a simplified version of the Rheumatoid Arthritis Magnetic Resonance Imaging Score (RAMRIS) comprising 5 joints (RAMRIS). *Clin Exp Rheumatol*. 2015; 33(2): 209-215.
19. Terslev L, Ostergaard M. Rheumatoid Arthritis Relapse and Remission - Advancing Our Predictive Capability Using Modern Imaging. *J Inflamm Res*. 2021;14:2547-2555. Published 2021 Jun 16. doi:10.2147/JIR.S284405.

Post-Operative Joint Replacement Surgery (MS-16)

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Post-Operative Joint Replacement Surgery – General (MS-16.1)

MS.PS.0016.1.C
v2.0.2025

- CT without contrast or MRI without contrast with **ALL** of the following:
  - Recent plain x-ray is nondiagnostic
  - Suspected aseptic loosening of orthopaedic joint replacements
    - CT shoulder without contrast (CPT® 73200) can be performed following plain x-rays regardless of plain x-ray findings. See: **Shoulder (MS-19)**
      - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- CT without contrast or MRI without contrast with **ALL** of the following:
  - Negative plain x-ray
  - High suspicion for a periprosthetic fracture
    - CT shoulder without contrast (CPT® 73200) can be performed following plain x-rays regardless of plain x-ray findings. See: **Shoulder (MS-19)**
      - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- Joint aspiration is the initial evaluation after plain x-ray for a painful joint replacement when periprosthetic infection is suspected.
  - Results of plain x-rays performed after the current episode of symptoms started or changed need to be available to the requesting provider
- MRI Hip without contrast (CPT® 73721) or Ultrasound (CPT® 76881 or CPT® 76882) are both appropriate for **EITHER** of the following:
  - Diagnosis of ALVAL (aseptic lymphocytic-dominated vasculitis-associated lesion) pseudotumors surrounding metal-on-metal (MoM) hip prostheses. One of these two imaging modalities can be approved but not both. See: **Soft Tissue Mass or Lesion of Bone (MS-10)**
  - Metal-On-Metal (MoM) Hip Prostheses that are considered high-risk for implant performance issues from THA (Total hip arthroplasty) cup-neck impingement and subsequent ALTR (adverse local tissue reaction) with Co and Cr ion levels greater than 10 ppb.
- CT Hip without contrast (CPT® 73700) or MRI Hip without contrast (CPT® 73721):
  - Evaluate suspected particle disease (aggressive granulomatous disease) of the hip when infection has been excluded.
- For specific joints post-operative from replacement surgery:
  - See: **Shoulder (MS-19)**

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

- See: **Elbow (MS-20)**
- See: **Wrist (MS-21)**
- See: **Hip (MS-24)**
- See: **Knee (MS-25)**
- See: **Ankle (MS-26)**

Background and Supporting Information

- Complications following joint replacement surgery include (not limited to) periprosthetic fracture, infection, aseptic loosening, failure of fixation/component malposition, and wear.

Evidence Discussion (MS-16.1)

- The American College of Radiology (ACR) recommends plain x-rays as the initial study for routine follow up of asymptomatic patients and for symptomatic patients who have undergone joint replacement surgery. Plain x-rays can identify fractures or show signs of loosening, wear, osteolysis or infection. When plain x-rays are negative or inconclusive and there is a suspicion for aseptic loosening or fracture, advanced imaging can help to identify these conditions.
- The first line of preoperative evaluation for a suspected prosthetic joint infection should be plain x-rays, blood tests and joint aspiration with synovial fluid laboratory analysis. Although both false-positive and false-negative results may occur, joint aspiration with synovial fluid analysis remains the most useful test for confirming the presence or absence of infection and identifying the causative organism. If there is a negative or inconclusive joint aspiration and infection is still suspected, advanced imaging can provide additional information.
- For patients with negative or non-diagnostic x-rays for whom there is suspicion of a soft tissue abnormality (e.g. tendinitis, tendinopathy, bursitis, arthrofibrosis), a course of conservative care will allow many patients to improve. If there is failure to improve, advanced imaging would be appropriate. However, if there is concern for a rotator cuff tear in a patient who underwent shoulder replacement surgery, conservative care would not be necessary.
- Patients with metal on metal hip replacements are at risk for adverse local tissue reactions (ALTRs) including metallosis, pseudotumor and generalized synovitis that can result in tissue damage. After initial x-rays, advanced imaging is recommended for symptomatic patients.

References (MS-16)

v2.0.2025

1. Mintz DN, Roberts CC, Bencardino JT, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Chronic Hip Pain. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69425/Narrative/.
2. Walker EA, Fox MG, Blankenbaker DG, et. al. ACR Appropriateness Criteria® Imaging After Total Knee Arthroplasty. Available at https://acsearch.acr.org/docs/69430/Narrative/. American College of Radiology. Revised: 2023.
3. Roberts CC, Metter DF, Fox MG, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Imaging After Shoulder Arthroplasty. *Am Coll Radiol (ACR);* Date of Origin: 2016. Revised: 2021. https://acsearch.acr.org/docs/3097049/Narrative/.
4. Weissman BN, Palestro CJ, Fox MG, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Imaging After Total Hip Arthroplasty. Am Coll Radiol (ACR); Revised: 2023. Available at: https://acsearch.acr.org/docs/3094200/Narrative
5. Toms AD, Davidson D, Masri BA, et al. Management of peri-prosthetic infection in total joint arthroplasty. *J Bone Joint Surg Br.* 2006;88(2):149-155. doi:10.1302/0301-620X.88B2.17058.
6. Love C, Marwin SE, Tomas MB, et al. Diagnosing infection in the failed joint replacement: A comparison of coincidence detection 18F-FDG and 111In-labeled leukocyte/99mTc-sulfur colloid marrow imaging. *J Nucl Med.* 2004;45(11):1864-1871.
7. Nawabi DH, Gold S, Lyman SL, et al. MRI predicts ALVAL and tissue damage in metal-on-metal hip arthroplasty. *Clin Orthop Relat Res.* 2014;472(2):471-481. doi:10.1007/s11999-013-2788-y.
8. Verberne SJ, Raijmakers PG, Temmerman OP. The accuracy of imaging techniques in the assessment of periprosthetic hip infection: a systematic review and meta-analysis. *J Bone Joint Surg Am*. 2016;98(19):1638-45. doi:10.2106/JBJS.15.00898.
9. Fritz J, Meshram P, Stern SE, Fritz B, Srikumaran U, McFarland EG. Diagnostic performance of advanced metal artifact reduction MRI for periprosthetic shoulder infection. *J Bone Joint Surg Am*. 2022;104:1352-1361. doi:10.2106/JBJS.21.00912.
10. Zahar A, Sarungi M. Diagnosis and management of the infected total knee replacement: a practical surgical guide. *J Exp Orthop*. 2021 Feb 22;8(1):14.
11. Pérez-Prieto D, Hinarejos P, Alier A, et al. Adherence to a reliable PJI diagnostic protocol minimizes unsuspected positive cultures rate. *BMC Musculoskelet Disord*. 2021;22(1):653. Published 2021 Aug 2. doi:10.1186/s12891-021-04431-1
12. Schinsky MF, Della Valle CJ, Sporer SM, Paprosky WG. Perioperative testing for joint infection in patients undergoing revision total hip arthroplasty. *J Bone Joint Surg Am*. 2008 Sep;90(9):1869-75. doi: 10.2106/JBJS.G.01255. Erratum in: *J Bone Joint Surg Am*. 2010 Mar;92(3):707.
13. Capogna BM, Shenoy K, Youm T, Stuchin SA. Tendon Disorders After Total Hip Arthroplasty: Evaluation and Management. *J Arthroplasty*. 2017 Oct;32(10):3249-3255.
14. Chalmers BP, Perry KI, Taunton MJ, Mabry TM, Abdel MP. Diagnosis of adverse local tissue reactions following metal-on-metal hip arthroplasty. *Curr Rev Musculoskelet Med*. 2016 Mar;9(1):67-74.
15. Hall DJ, Pourzal R, Jacobs JJ. What Surgeons Need to Know About Adverse Local Tissue Reaction in Total Hip Arthroplasty. *J Arthroplasty*. 2020 Jun;35(6S):S55-S59.

Limb Length Discrepancy (MS-17)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Limb Length Discrepancy (MS-17.1)

MS.LL.0017.1.A
v2.0.2025

- Either plain radiographic or “CT scanogram,” both reported with CPT® 77073, is appropriate to radiographically evaluate limb length discrepancy due to congenital anomalies, acquired deformities, growth plate (physeal injuries or surgery), or inborn errors of metabolism.
  - A diagnostic advanced imaging CPT code (e.g., CPT® 73700, CPT® 73701, or CPT® 73702) is not indicated for evaluation of limb length discrepancy.

Evidence Discussion (MS-17)

- X-ray (standing anteroposterior radiograph) is the most reliable choice for evaluation of limb length discrepancy. Imaging may be done using a CT scanogram as an analogue to conventional x-ray.
- Advanced imaging modalities are not indicated for evaluating limb length discrepancy. Alfuth, et al state that MRI "may be more expensive, may require sedation in some patients, often needs a longer time to schedule and to carry out the examination, and may be not allowed in patients with specific implanted devices".

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-17)

v2.0.2025

1. Leitzes A, Potter HG, Amaral T, et al. Reliability and accuracy of MRI scanogram in the evaluation of limb length discrepancy. *J Pediatr Orthop*. 2005;25(6):747-749.
2. Alfuth M, Fichter P, Knicker A. Leg length discrepancy: A systematic review on the validity and reliability of clinical assessments and imaging diagnostics used in clinical practice. *PLoS One*. 2021 Dec 20;16(12):e0261457. doi: 10.1371/journal.pone.0261457. PMID: 34928991; PMCID: PMC8687568.

Anatomical Area Tables – General Information (MS-18)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Anatomical Area Tables – General Information (MS-18)

MS.AA.0018.A
v2.0.2025

The imaging guidelines for each anatomical area are presented in table format. The table below includes a description of how each column header should be utilized for each guideline **Shoulder (MS-19)** through **Foot (MS-27)**.

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	Comments (Additional comments related to the condition.)

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Shoulder (MS-19)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Shoulder (MS-19)

MS.SH.0019.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Shoulder Pain	Yes	• MRI Shoulder without contrast (CPT® 73221) **OR** • US Shoulder (CPT® 76881 or CPT® 76882) **OR** • CT Shoulder with contrast (arthrogram) (CPT® 73201) if MRI contraindicated	
Symptomatic Loose Bodies	No	• MRI Shoulder without contrast (CPT® 73221)	
Impingement	Yes	• MRI Shoulder without contrast (CPT® 73221) **OR** • MRI Shoulder with contrast (arthrogram) (CPT® 73222) **OR** • US Shoulder (CPT® 76881 or CPT® 76882) • CT Shoulder with contrast (CPT® 73201) if MRI is contraindicated	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Tendonitis/ Bursitis	Yes	• MRI Shoulder without contrast (CPT® 73221) **OR** • US Shoulder (CPT® 76881 or CPT® 76882)	
Tendon Rupture (Biceps Long Head)	No	• When clinical exam is inconclusive due to inability to visualize a “Popeye” sign clinically, or for preoperative planning: ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882)	
Tendon Rupture (Pectoralis Major/Minor)	No	• When clinical exam is inconclusive, or for preoperative planning: ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ MRI Chest without contrast (CPT® 71550) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Shoulder Rotator Cuff Tear (Complete and Partial)	Yes*	• MRI Shoulder without contrast (CPT® 73221) **OR** • MRI Shoulder with contrast (arthrogram) (CPT® 73222) **OR** • US Shoulder (CPT® 76881 or CPT® 76882) **OR** • CT Shoulder with contrast (arthrogram) (CPT® 73201) if MRI is contraindicated	*Conservative treatment is not required with an acute shoulder injury prior to the onset of symptoms and consideration of surgery. If surgery is being considered, MRI without contrast, MRI with contrast (arthrogram), or CT arthrogram are required

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Partial Tendon Rupture (Excluding Partial Rotator Cuff Tears)	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/ muscle tears.
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Shoulder Labral Tear (e.g., SLAP, ALPSA, HAGL)	Yes	• MRI Shoulder with contrast (arthrogram) (CPT® 73222) **OR** • MRI Shoulder without contrast (CPT® 73221) **OR** • CT Shoulder with contrast (arthrogram) (CPT® 73201)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Shoulder Dislocation/ Subluxation/ Instability, or Bankart/ Hill-Sachs Lesions	Yes*	• Individuals 40 years of age or younger with a first time dislocation, and in individuals with recurrent dislocations, conservative treatment not required: ◦ MRI Shoulder with contrast (arthrogram) (CPT® 73222) **OR** ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ CT Shoulder with contrast (arthrogram) (CPT® 73201) **OR** ◦ CT Shoulder without contrast (CPT® 73200) if MRI is contraindicated	*Conservative treatment is required in individuals over age 40 with a first time dislocation.

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Frozen Shoulder/ Adhesive Capsulitis	Yes	• MRI Shoulder without contrast (CPT® 73221)	
Avascular Necrosis (AVN) of the Humeral Head	No	• See: **AVN (MS-4.1)**	
Acromio-clavicular (AC) Separation	No	• MRI Shoulder without contrast (CPT® 73221) to rule out possible rotator cuff tear following AC separation	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Sterno-clavicular (SC) Dislocation	No	X-rays are not required For evident or suspected sterno-clavicular dislocations:[24,25,26] • CT Chest without contrast (CPT® 71250) or CT Chest with contrast (CPT® 71260) • MRI Chest without contrast (CPT® 71550) or MRI Chest without and with contrast (CPT® 71552) for: ◦ Differentiating physeal injury from sternoclavicular dislocation in younger patients aged < 25 years[24] **OR** ◦ Planning for operative repair[26] For proximal (medial) 1/3 fractures of the clavicle: • CT Chest with contrast (CPT® 71260) or CT Chest without contrast (CPT® 71250) **OR** • MRI Chest without contrast (CPT® 71550) or MRI Chest without and with contrast (CPT® 71552)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Shoulder Surgery for Impingement, Rotator Cuff Tear, and/or Labral Tear	Yes	• In symptomatic individuals: ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ MRI Shoulder with contrast (arthrogram) (CPT® 73222) • US Shoulder (CPT® 76881 or CPT® 76882) is also appropriate in symptomatic individuals following rotator cuff repair • CT Shoulder with contrast (arthrogram) (CPT® 73201) if MRI contraindicated	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Shoulder (Glenohumeral) Replacement Surgery	No	• For suspected aseptic loosening or fracture as additional imaging following plain x-rays: ◦ CT Shoulder without contrast (CPT® 73200) **OR** ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Shoulder without contrast (CPT® 73321) **OR**	See also: **Post-Operative Joint Replacement (MS-16)**

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
		◦ MRI Shoulder without and with contrast (CPT® 73223) **OR** ◦ CT Shoulder with contrast (CPT® 73201) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882) • For possible rotator cuff tear: ◦ CT Shoulder with contrast (arthrogram) (CPT® 73201) **OR** ◦ MRI Shoulder without contrast (CPT® 73221) **OR** ◦ US Shoulder (CPT® 76881 or CPT® 76882) • For possible nerve injury: ◦ MRI Shoulder without contrast (CPT® 73221) **OR**	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
		◦ US Shoulder (CPT® 76881 or CPT® 76882)	

Evidence Discussion (MS-19)

v2.0.2025

For most patients with a shoulder complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. It has been reported that approximately 30 – 40 percent of middle-aged patients and an even higher percentage of older patients have asymptomatic rotator cuff and superior labral tears. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of shoulder conditions are also recommended by the American College of Radiology Appropriate Use Criteria. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many shoulder conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. However, for some shoulder conditions (e.g., loose bodies, suspected full thickness rotator cuff tear when there is consideration for surgery, issues after shoulder replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications, and contrast complications.

For many shoulder conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possesses its own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-19)

v2.0.2025

1. Amini B, Beckmann NM, Beaman FD, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Traumatic. *Am Coll Radiol (ACR);* Revised 2017. https://acsearch.acr.org/docs/69433/Narrative/.
2. Neviaser RJ, Neviaser TJ. Recurrent instability of the shoulder after age 40. *J Shoulder Elbow Surg.*1995;4(6):416-418.
3. Bradley M, Tung G, Green A. Overutilization of shoulder magnetic resonance imaging as a diagnostic screening tool in patients with chronic shoulder pain. *J Shoulder Elbow Surgery*. 2005;14(3):233-237. doi:10.1016/j.jse.2004.08.002.
4. Fongemie AE, Buss DD, and Rolnick SJ. Management of shoulder impingement syndrome and rotator cuff tears. *Am Fam Physician*. 1998;57(4):667-674. https://www.aafp.org/afp/1998/0215/p667.html.
5. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:212.
6. Gyftopoulos S, Rosenberg ZS, Roberts CC, ET. Al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Imaging After Shoulder Arthroplasty. *Am Coll Radiol (ACR);* Date of Origin: 2016. https://acsearch.acr.org/docs/3097049/Narrative/.
7. Hovelius L, Olofsson A, Sandstrom B, et al. Nonoperative treatment of primary anterior shoulder dislocation in patients forty years of age and younger: a prospective twenty-five year follow-up. *J Bone Joint Surg.* 2008;90:945-52. doi:10.2106/JBJS.G.00070.
8. Lin A, Gasbarro G, Sakr M. Clinical Applications of Ultrasonography in the Shoulder and Elbow. *J Am Acad Orthop Surg*. 2018;26:303-312.
9. Magee T. 3-T MRI of the shoulder: is MR arthrography necessary? *AJR J Am Roentgenol.* 2009:192:86-92. doi:10.2214/AJR.08.1097.
10. Major NM, Browne J, Domzalski T, Cothran RL, Helms CA. Evaluation of the glenoid labrum with 3-T MRI: is intraarticular contrast necessary. *AJR Am J Roentgenol*. 2011;196:1139-1144. doi:10.2214/AJR.08.1734.
11. McDonald LS, Dewing CB, Shupe PG, et al. Disorders of the proximal and distal aspects of the biceps muscle. *J Bone Joint Surg*. 2013;95:1235-1245. doi:10.2106/JBJS.L.00221.
12. Petersen SA, Murphy TP. The timing of rotator cuff repair for the restoration of function. *Journal of Shoulder and Elbow Surgery*. 2011;20(1):62-68. doi:10.1016/j.jse.2010.04.045.
13. Rehman A , Robinson P. Sonographic evaluation of injuries of the pectoralis muscles. *AJR* Am J Roentgenol. 2005;184:1205-1211. doi:10.2214/ajr.184.4.01841205.
14. Small KM, Adler RS, Shah SH, et al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Shoulder Pain - Atraumatic. *Am Coll Radiol (ACR);* New 2018. https://acsearch.acr.org/docs/3101482/Narrative/.
15. Steinbach LS, Chung CB, Yoshioka H. Technical Considerations for MRI of Upper Extremity Joints. In: Chung CB, Steinbach LS, eds. *MRI of the Upper Extremity Shoulder, Elbow, Wrist and Hand* Philadelphia, PA: Lippincott Williams & Wilkins 2010:211.
16. Streubel PN, Krych AJ, Simone JP, et al. Anterior glenohumeral instability: a pathology-based surgical treatment strategy. *J Am Acad Orthop Surg*. 2014;22:283-294. doi:10.5435/JAAOS-22-05-283.
17. Werner BC, Brockmeier SF, and Miller MD. Etiology, diagnosis, and management of failed SLAP repair. *J Am Acad Orthop Surg*. 2014;22(9):554-565. doi:10.5435/JAAOS-22-09-554.
18. Woodward TW and Best TM. The painful shoulder: Part II. Acute and chronic disorders. *Am Fam Physician*. 2000;61(11):3291-3300. https://www.aafp.org/afp/2000/0601/p3291.html.
19. Zappia M, Di Pietto F, Aliprandi A, et al. Multi-modal imaging of adhesive capsulitis of the shoulder. *Insights Imaging*. 2016;7:365-371.
20. Frankle MA, Teramoto A, Luo Z-P, Levy JC, Pupello D. Glenoid morphology in reverse shoulder arthroplasty: Classification and surgical implications. *Journal of Shoulder and Elbow Surgery*. 2009;18(6):874-885. doi:10.1016/j.jse.2009.02.013.

21. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected osteomyelitis, septic arthritis, or soft tissue infection (excluding spine and diabetic foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022.
22. Kowalczuk M, Elmaraghy A. Pectoralis major rupture: Evaluation and management. *J Am Acad Orthop Surg*. 2022;30:e617-e627. doi:10.5435/JAAOS-D-21-00541.
23. Fritz J, Meshram P, Stern SE, Fritz B, Srikumaran U, McFarland EG. Diagnostic performance of advanced metal artifact reduction MRI for periprosthetic shoulder infection. *J Bone Joint Surg Am*. 2022;104:1352-1361. doi:10.2106/JBJS.21.00912.
24. Edwin J, Ahmed S, Verma S, Tytherleigh-Strong G, Karuppaiah K, Sinha J. Swellings of the sternoclavicular joint: review of traumatic and non-traumatic pathologies. *EFORT Open Rev*. 2018 Aug 25;3(8):471-484. doi: 10.1302/2058-5241.3.170078. PMID: 30237905; PMCID: PMC6134883.
25. Morell DJ, Thyagarajan DS. Sternoclavicular joint dislocation and its management: A review of the literature. *World J Orthop*. 2016 Apr 18;7(4):244-50. doi: 10.5312/wjo.v7.i4.244. PMID: 27114931; PMCID: PMC4832225.
26. Garcia JA, Arguello AM, Momaya AM, Ponce BA. Sternoclavicular Joint Instability: Symptoms, Diagnosis And Management. *Orthop Res Rev*. 2020;12:75-87. Published 2020 Jul 28. doi:10.2147/ORR.S170964.
27. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011;83(8):883-4.
28. Sher JS, Uribe JW, Posada A, Murphy BJ, Zlatkin MB. Abnormal findings on magnetic resonance images of asymptomatic shoulders. *J Bone Joint Surg Am*. 1995;77(1):10-15.
29. Yamaguchi K, Ditsios K, Middleton WD, Hildebolt CF, Galatz LM, Teefey SA. The demographic and morphological features of rotator cuff disease. A comparison of asymptomatic and symptomatic shoulders. *J Bone Joint Surg Am*. 2006;88(8):1699-1704.
30. Schwartzberg R, Reuss BL, Burkhart BG, Butterfield M, Wu JY, McLean KW. High Prevalence of Superior Labral Tears Diagnosed by MRI in Middle-Aged Patients With Asymptomatic Shoulders. *Orthop J Sports Med*. 2016 Jan 5;4(1):2325967115623212. doi: 10.1177/2325967115623212. PMID: 26779556; PMCID: PMC4710128.
31. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003;32(7):403-11.
32. Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic shoulder pain: part I. Evaluation and diagnosis. *Am Fam Physician*. 2008;77(4):453-60.
33. Nacey N, Fox MG, Blankenbaker DG, et al. ACR Appropriateness Criteria® Chronic Shoulder Pain. Available at https://acsearch.acr.org/docs/3101482/Narrative/. American College of Radiology. Revised 2022.
34. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023;29(1):27-53.

Elbow (MS-20)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Elbow (MS-20)

MS.EB.0020.C
v2.0.2025

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's Condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Elbow Pain	Yes	• MRI Elbow without contrast (CPT® 73221) **OR** • US Elbow (CPT® 76881 or CPT® 76882)	
Symptomatic Loose Bodies	No	• MRI Elbow without contrast (CPT® 73221) OR • MRI Elbow with contrast (arthrogram) (CPT® 73222) OR • CT Elbow without contrast (CPT® 73200) OR • CT Elbow with contrast (arthrogram) (CPT® 73201)	
Tendonitis	Yes	• MRI Elbow without contrast (CPT® 73221) OR • US Elbow (CPT® 76881 or CPT® 76882)	
Bursitis	Yes	• MRI Elbow without and with contrast (CPT® 73223) OR • MRI Elbow without contrast (CPT® 73221) OR • US Elbow (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's Condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Lateral (tennis elbow) or Medial (golfer's elbow) Epicondylitis	Yes	• To confirm clinical diagnosis of epicondylitis if symptoms persist for longer than 6 months despite at least 6 weeks conservative treatment in the last 3 months: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882)	Epicondylitis, caused by tendon degeneration and tear of the common extensor tendon laterally or of the common flexor tendon medially, is a common clinical diagnosis for which imaging is not medically necessary except as noted.

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's Condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Suspected Osteochondral Injury	No	• If plain x-rays are negative and an osteochondral fracture is still suspected: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ MRI Elbow with contrast (arthrogram) (CPT® 73222) OR ◦ CT Elbow without contrast (CPT® 73200) OR ◦ CT Elbow with contrast (arthrogram) (CPT® 73201)	See: **Chondral/ Osteochondral Lesions (MS-13)** for other osteochondral injury scenarios
Ruptured Biceps Insertion at Elbow	No	• When clinical exam is inconclusive or for preoperative planning: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's Condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Ruptured Triceps Insertion at Elbow	No	• When clinical exam is inconclusive or for preoperative planning: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882)	
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/muscle tears.
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's Condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Trauma	No	• When surgery is being considered: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ CT Elbow without contrast (CPT® 73200)	
Ulnar Collateral Ligament (UCL) Tear	No	• Following acute or repetitive (including overhead throwing athletes) elbow trauma: ◦ MRI Elbow with contrast (arthrogram) (CPT® 73222) OR ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ US Elbow (CPT® 76881 or CPT® 76882) OR ◦ CT Elbow with contrast (arthrogram) (CPT® 73201)	
Suspected Nerve Abnormality	NA	• This condition is imaged according to the criteria found in the Peripheral Nerve and Neuromuscular Disorder Guidelines. See: *Focal Neuropathy (PN-2)* in the Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines	

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's Condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative	Yes	• CT Elbow without contrast (CPT® 73200) in symptomatic post-operative individuals following surgical treatment of complex fractures OR • MRI Elbow without contrast (CPT® 73221) in symptomatic post-operative individuals following soft-tissue surgery	

After an initial plain x-ray has been obtained , and results are available to the provider , the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's Condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Elbow Replacement Surgery	No	• For suspected aseptic loosening or periprosthetic fracture when recent plain x-ray is nondiagnostic: ◦ CT Elbow without contrast (CPT® 73200) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Elbow without contrast (CPT® 73221) OR ◦ MRI Elbow without and with contrast (CPT® 73223) OR ◦ CT Elbow with contrast (CPT® 73201) ◦ US Elbow (CPT® 76881 or CPT® 76882)	

Evidence Discussion (MS-20)

v2.0.2025

A diagnosis for the vast majority of elbow conditions can be made based on a detailed history, physical examination and plain x-rays. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate elbow abnormalities in asymptomatic patients and that the prevalence of asymptomatic abnormalities increases with age. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of elbow conditions are supported in the literature. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many elbow conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. Lateral epicondylitis may take 6 months or longer to improve, however, advanced imaging rarely is needed to make the diagnosis or play a role in treatment decision making. However, for some elbow conditions (e.g. loose bodies, suspected tendon or ligament tears, issues after elbow replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

References (MS-20)

v2.0.2025

1. McDonald LS, Dewing CB, Shupe PG, et al. Disorders of the proximal and distal aspects of the biceps muscle. *J Bone Joint Surg*. 2013;95:1235-1245. doi:10.2106/JBJS.L.00221.
2. Torp-Pedersen TE, Torp-Pedersen ST, Qvistgaard E, et al. Effect of glucocorticosteroid injections in tennis elbow verified on colour Doppler ultrasonography: evidence of inflammation. *Br J Sports Med.* 2008;42(12):978-982. doi:10.1136/bjsm.2007.041285.
3. Johnson GW, Cadwallader K, Scheffel SB, et al.Treatment of lateral epicondylitis. *Am Fam Physician*. 2007;76(6):843-848. https://www.aafp.org/afp/2007/0915/p843.html .
4. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:279-280.
5. Thomas JM, Chang, EY, Ha AS, et al. ACR Appropriateness Criteria® Chronic Elbow Pain. Available at https://acsearch.acr.org/docs/69423/Narrative/. American College of Radiology. Revised 2022.
6. Bruce JR, Andrews JR. Ulnar collateral ligament injuries in the throwing athlete. *J Am Acad Orthop Surg*. 2014;22:315-325.
7. Beltran J, Rosenberg ZS. Diagnosis of compressive and entrapment neuropathies of the upper extremity: value of MR imaging. *AJR Am J Roentgenol*. 1994;163(3):525-531. doi:10.2214/ajr.163.3.8079837.
8. Lin A, Gasbarro G, Sakr M. Clinical Applications of Ultrasonography in the Shoulder and Elbow. *J Am Acad Orthop Surg*. 2018;26:303-312.
9. Stanborough RO, Wessell DE, Elhassan BT, Schoch BS. MRI of the elbow: Interpretation of common orthopaedic injuries. *J Am Acad Orthop Surg*. 2022;30:e573-e583. doi:10.5435/JAAOS-D-21-00193.
10. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022. https://acsearch.acr.org/docs/3094201/Narrative/.
11. Javed M, Mustafa S, Boyle S, Scott F. Elbow pain: a guide to assessment and management in primary care. *Br J Gen Pract*. 2015 Nov;65(640):610-2.
12. Kane SF, Lynch JH, Taylor JC. Evaluation of elbow pain in adults. *Am Fam Physician*. 2014 Apr 15;89(8):649-57.
13. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
14. Bastian SA, Rahmi H, Crues J, Bhanu S, Blout C, Rangarajan R, Lee B, Itamura J. Variations of magnetic resonance imaging findings in asymptomatic elbows. *J Shoulder Elbow Surg*. 2019 Jun;28(6S):S154-S160.
15. Garcia GH, Gowd AK, Cabarcas BC, Liu JN, Meyer JR, White GM, Romeo AA, Verma NN. Magnetic Resonance Imaging Findings of the Asymptomatic Elbow Predict Injuries and Surgery in Major League Baseball Pitchers. *Orthop J Sports Med*. 2019 Jan 29;7(1)
16. Husarik DB, Saupe N, Pfirrmann CW, Jost B, Hodler J, Zanetti M. Ligaments and plicae of the elbow: normal MR imaging variability in 60 asymptomatic subjects. *Radiology*. 2010;257(1):185-194. doi:10.1148/radiol.10092163
17. Paluch AJ, Burden EG, Batten TJ, Knight B, Anaspure R, Aboelmagd S, Evans JP, Smith CD. Defining tennis elbow characteristics - The assessment of magnetic resonance imaging defined tendon pathology in an asymptomatic population. *Shoulder Elbow*. 2024 Apr;16(2):206-213.
18. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
19. Johnson GW, Cadwallader K, Scheffel SB, Epperly TD. Treatment of lateral epicondylitis. *Am Fam Physician*. 2007 Sep 15;76(6):843-8.
20. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1; 29(1):27-53.

Wrist (MS-21)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Wrist (MS-21)

MS.WR.0021.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
General Wrist Pain	Yes	• MRI Wrist without contrast (CPT® 73221) **OR** • MR Wrist with contrast (arthrogram) (CPT® 73222)[2] **OR** • CT Wrist with contrast (arthrogram) (CPT® 73201)[2] **OR** • CT Wrist without contrast (CPT® 73700)[2] **OR** • US Wrist (CPT® 76881 or CPT® 76882)	
Tendonitis	Yes	• MRI Wrist without contrast (CPT® 73221) **OR** • MRI Wrist without and with contrast (CPT® 73220)[2] **OR** • US Wrist (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Kienbock's Disease (Avascular Necrosis (AVN) of the Lunate)/ Preiser's Disease (Avascular Necrosis (AVN) of the Scaphoid)	No	See **AVN (MS-4.1)**	
Suspected Navicular/ Scaphoid Fracture	No	When suspected based on history and physical exam, advanced imaging guided by: **Suspected Occult/ Stress/ Insufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)**	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Distal Radioulnar Joint (DRUJ) Instability	No	• CT of both wrists without contrast (CPT® 73200) (should include wrists in supination and pronation)	
Complex Distal Radius/ Ulna Fracture	No	• CT Wrist without contrast (CPT® 73200)	
Carpal Tunnel Syndrome/ Ulnar Tunnel Syndrome	NA	• This condition is imaged according to the criteria found in the Peripheral Nerve and Neuromuscular Disorders Guidelines. See *Focal Neuropathy (PN-2)* in the Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Intrinsic Ligament (e.g. scapholunate)/ Triangular Fibrocartilage Complex (TFCC) Injuries	Yes	• MRI Wrist with contrast (arthrogram) (CPT® 73222) **OR** • CT Wrist with contrast (arthrogram) (CPT® 73201)	
Complete Rupture of a Specific Named Tendon Not Otherwise Specified	No	• For preoperative planning: ◦ MRI Wrist without contrast (CPT® 73221) **OR** ◦ MRI Wrist without and with contrast (CPT® 73220)[2] **OR** ◦ US Wrist (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Wrist without contrast (CPT® 73221) **OR** ◦ MRI Wrist without and with contrast (CPT® 73220)[2] **OR** ◦ US Wrist (CPT® 76881 or CPT® 76882)	MRI is NOT needed for muscle belly strains/muscle tears.
Post-Operative	Yes	• CT Wrist without contrast (CPT® 73200) in symptomatic individuals following surgery for navicular/scaphoid fractures and complex distal radius/ulna fractures **OR** • MRI Wrist with contrast (arthrogram) (CPT® 73222) in symptomatic individuals following DRUJ or TFCC surgery	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Wrist Replacement Surgery	No	• For suspected aseptic loosening or periprosthetic fracture when recent plain x-ray is nondiagnostic: ◦ CT Wrist without contrast (CPT® 73200) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Wrist without contrast (CPT® 73221) **OR** ◦ MRI Wrist without and with contrast (CPT® 73223) **OR** ◦ CT Wrist with contrast (CPT® 73201) **OR** ◦ US Wrist (CPT® 76881 or CPT® 76882)	

One Study/Area Only

In hand and wrist advanced imaging, studies are frequently ordered of both areas. This is unnecessary since wrist MRI will image from above the wrist to the mid-metacarpal area. **Only one CPT® code should be reported**.

Evidence Discussion (MS-21)

v2.0.2025

For the vast majority of wrist conditions, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate wrist abnormalities in asymptomatic patients and that the prevalence of asymptomatic abnormalities increases with age. Iordache, et. al. concluded the prevalence of incidental TFCC findings in MRI scans of asymptomatic subjects is high. Also concluded was the presence of an abnormal TFCC on MRI may be of questionable clinical meaning, because there is a high incidence of TFCC abnormalities in asymptomatic subjects, particularly those over the age of 50. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of wrist conditions are supported in the literature. The American College of Radiology Appropriate Use Criteria also recommends initial plain x-rays prior to advanced imaging for both chronic wrist pain and acute wrist trauma. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many wrist conditions does not rely on advanced imaging results and many patients will improve within a few weeks or months with conservative care. However, for some wrist conditions (e.g. suspected tendon tears, suspected scaphoid fracture, issues after wrist replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many wrist conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-21)

v2.0.2025

1. Torabi M, Lenchik L, Beaman FD, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute Hand and Wrist Trauma. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2018. https://acsearch.acr.org/docs/69418/Narrative/.
2. Stensby, JD, Fox MG, Nacey N, et al. ACR Appropriateness Criteria® Chronic Hand and Wrist Pain. Available at https://acsearch.acr.org/docs/69427/Narrative/. American College of Radiology. Revised 2023.
3. Hayter CL, Gold SL, Potter HG. Magnetic resonance imaging of the wrist: bone and cartilage injury. *J Magn Reson Imaging*. 2013;37(5):1005-19. doi:10.1002/jmri.23845.
4. Pruitt DL, Gilula LA, Manske PR, et al. Computed tomography scanning with image reconstruction in evaluation of distal radius fractures. *J Hand Surg Am*.1994;19(5):720-727. doi:10.1016/0363-5023(94)90174-0.
5. Magee T. Comparison of 3-T MRI and arthroscopy of intrinsic wrist ligament and TFCC tears. *AJR Am J Roentgenol*. 2009:192:80-85. doi:10.2214/AJR.08.1089.
6. Lee RK, Ng AW, Tong CS, et al. Intrinsic ligament and triangular fibrocartilage complex tears of the wrist: comparison of MDCT arthrography, conventional 3-T MRI, and MR arthrography. *Skeletal Radiol.* 2013;42:1277-85. doi:10.1007/s00256-013-1666-8.
7. Pahwa S, Srivastava DN, Sharma R, et al. Comparison of conventional MRI and MR arthrography in the evaluation wrist ligament tears: A preliminary experience. *Indian J Radiol Imaging.* 2014;3:259-67. doi:10.4103/0971-3026.137038.
8. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022. https://acsearch.acr.org/docs/3094201/Narrative/.
9. Forman TA, Forman SK, Rose NE. A clinical approach to diagnosing wrist pain. *Am Fam Physician*. 2005 Nov 1;72(9):1753-8.
10. Shehab R, Mirabelli MH. Evaluation and diagnosis of wrist pain: a case-based approach. *Am Fam Physician*. 2013 Apr 15;87(8):568-73. Erratum in: *Am Fam Physician*. 2013 Oct 1;88(7):427.
11. Hansford, Barry G. MD. Multimodality Pitfalls of Wrist Imaging With a Focus on Magnetic Resonance Imaging: What the Radiologist Needs to Know. *Top Magn Reson Imaging.*2020: 29(5):263-272. doi:10.1097/RMR.0000000000000254.
12. Portnoff B, Casey JC, Thirumavalavan J, Abbott E, North R, Gil JA. Prevalence of asymptomatic TFCC tears on MRI: A systematic review. *Hand Surg Rehabil*. 2024 Mar 15:101684.
13. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
14. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
15. Chan JJ, Teunis T, Ring D. Prevalence of triangular fibrocartilage complex abnormalities regardless of symptoms rise with age: systematic review and pooled analysis. *Clin Orthop Relat Res*. 2014 Dec;472(12):3987-94.
16. Iordache SD, Rowan R, Garvin GJ, Osman S, Grewal R, Faber KJ. Prevalence of triangular fibrocartilage complex abnormalities on MRI scans of asymptomatic wrists. *J Hand Surg Am*. 2012 Jan;37(1):98-103.
17. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
18. Peters-Veluthamaningal C, Winters JC, Groenier KH, Meyboom-DeJong B. Randomised controlled trial of local corticosteroid injections for de Quervain's tenosynovitis in general practice. *BMC Musculoskelet Disord*. 2009;10:131. Published 2009 Oct 27. doi:10.1186/1471-2474-10-131.
19. Adams JE, Habbu R. Tendinopathies of the Hand and Wrist [published correction appears in *J Am Acad Orthop Surg*. 2016 Feb;24(2):123]. *J Am Acad Orthop Surg*. 2015;23(12):741-750. doi:10.5435/JAAOS-D-14-00216.
20. Jawed A, Ansari MT, Gupta V. TFCC injuries: How we treat? *J Clin Orthop Trauma*. 2020 Jul-Aug;11(4):570-579.

21. Michelotti BF, Mathews A, Chung KC. Appropriateness of the Use of Magnetic Resonance Imaging in the Diagnosis and Treatment of Wrist Soft Tissue Injury. *Plast Reconstr Surg*. 2018 Feb;141(2):410-419.

Hand (MS-22)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Hand (MS-22)

MS.HA.0022.A
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
General Hand Pain	Yes	• MRI Hand or Finger without contrast (CPT® 73218) **OR** • MRI Hand or Finger without and with contrast (CPT® 73220)[3] **OR** • US Hand (CPT® 76881 or CPT® 76882)	
Tendonitis	Yes	• MRI Hand or Finger without contrast (CPT® 73218) **OR** • MRI Hand or Finger without and with contrast (CPT® 73220)[3]**OR** • US Hand or Finger (CPT® 76881 or CPT® 76882)	
Occult Fracture	No	• Advanced imaging guided by: **Suspected Occult/ Stress/ Insufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)**	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
Complex Fracture	No	• CT Hand or Finger without contrast (CPT® 73200) when plain x-ray shows a complex fracture	
Ulnar Collateral Ligament (UCL) Thumb Injury	No	• If rule out for Stener lesion or complete tear of UCL of the thumb MCP joint: ◦ MRI Thumb without contrast (CPT® 73218) **OR** ◦ US Thumb (CPT® 76881 or CPT® 76882)	Also called "Gamekeeper's Thumb" or "Skier's Thumb"
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Hand or Finger without contrast (CPT® 73218) **OR** ◦ MRI Hand or Finger without and with contrast (CPT® 73220)[3] **OR** ◦ US Hand or Finger (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Hand or Finger without contrast (CPT® 73218) **OR** ◦ MRI Hand or Finger without and with contrast (CPT® 73220)[3] **OR** ◦ US Hand or Finger (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/muscle tears.
Post-Operative	Yes	• In symptomatic post-operative individuals following surgical treatment for complex hand or finger fractures or following soft-tissue surgery: ◦ CT Hand or Finger without contrast (CPT® 73200) **OR** ◦ MRI Hand or Finger without contrast (CPT® 73218)	

One Study/Area Only

In hand and wrist advanced imaging, studies are frequently ordered of both areas. This is unnecessary since wrist MRI will image from above the wrist to the mid-metacarpal area. **Only one CPT ® code should be reported**.

Evidence Discussion (MS-22)

v2.0.2025

For most patients with a hand complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms and that the prevalence of asymptomatic abnormalities increases with age. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. The American College of Radiology Appropriate Use Criteria recommends initial plain x-rays prior to advanced imaging for both chronic hand pain and acute hand trauma. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for some hand conditions such as tendonitis and generalized hand pain does not rely on advanced imaging results and many patients will improve within a few weeks or months with conservative care. However, for some hand conditions (e.g. suspected tendon tears, suspected ulnar collateral ligament tear, complex fractures), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many hand conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-22)

v2.0.2025

1. Torabi M, Lenchik L,Beaman FD, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute Hand and Wrist Trauma. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2018. https://acsearch.acr.org/docs/69418/Narrative/.
2. Hayter CL, Gold SL, Potter HG. Magnetic resonance imaging of the wrist: Bone and cartilage injury. *J Magn Reson Imaging*. 2013;37(5):1005-19. doi:10.1002/jmri.23845.
3. Stensby, JD, Fox MG, Nacey, N, et al. ACR Appropriateness Criteria® Chronic Hand and Wrist Pain. Available at https://acsearch.acr.org/docs/69427/Narrative/. American College of Radiology. Revised 2023.
4. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
5. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
6. Adams JE, Habbu R. Tendinopathies of the Hand and Wrist [published correction appears in *J Am Acad Orthop Surg*. 2016 Feb;24(2):123]. *J Am Acad Orthop Surg*. 2015;23(12):741-750. doi:10.5435/JAAOS-D-14-00216.
7. Vassa R, Garg A, Omar IM. Magnetic resonance imaging of the wrist and hand. *Pol J Radiol*. 2020 Aug 26;85:e461-e488.
8. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
9. Kenney RJ, Hammert WC. Physical examination of the hand. *J Hand Surg Am*. 2014 Nov;39(11):2324-34.
10. Tsai P, Beredjiklian PK. Physical diagnosis and radiographic examination of the thumb. *Hand Clin*. 2008 Aug;24(3):231-7.
11. Hirschmann A, Sutter R, Schweizer A, Pfirrmann CW. MRI of the thumb: anatomy and spectrum of findings in asymptomatic volunteers. *AJR Am J Roentgenol*. 2014;202(4):819-827. doi:10.2214/AJR.13.11397.
12. Chan JJ, Teunis T, Ring D. Prevalence of triangular fibrocartilage complex abnormalities regardless of symptoms rise with age: systematic review and pooled analysis. *Clin Orthop Relat Res*. 2014;472(12):3987-3994. doi:10.1007/s11999-014-3825-1.
13. Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, Rosenthal MB, Colla CH, Sequist TD. Cascades of Care After Incidental Findings in a US National Survey of Physicians. [published correction appears in *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325.
14. Portnoff B, Casey JC, Thirumavalavan J, Abbott E, North R, Gil JA. Prevalence of asymptomatic TFCC tears on MRI: A systematic review. *Hand Surg Rehabil*. 2024 Mar 15:101684.
15. Gil JA, Hresko AM, Weiss AC. Current Concepts in the Management of Trigger Finger in Adults. *J Am Acad Orthop Surg*. 2020 Aug 1;28(15):e642-e650.

Pelvis (MS-23)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Pelvis (MS-23)

MS.PE.0023.A
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
General Pain-Pelvis	Yes	• MRI Pelvis without contrast (CPT® 72195) **OR** • MRI RT and/or LT Hip without contrast (CPT® 73721)	
Tendonitis	Yes	• MRI Pelvis without contrast (CPT® 72195) **OR** • MRI RT and/or LT Hip without contrast (CPT® 73721)	
Occult/Stress/ Insufficiency Fracture	No	When suspected based on history and physical exam, advanced imaging guided by: **Suspected Occult/ Stress/ Insufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)** for occult/ stress/insufficiency fractures of the pelvis	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
Complex Fracture/ Dislocation - Pelvis, Sacrum and Acetabulum	No	• CT Pelvis without contrast (CPT® 72192)	Additionally, 3D rendering may be appropriate for preoperative planning. See: **3D Rendering (MS-3)**
Sacro-iliac (SI) Joint Pain, Sacroiliitis, Coccydynia	Yes	• Advanced imaging guided by: ◦ **Sacroiliac (SI) Joint Pain/ Sacroiliitis (SP-10.1)** in the Spine Imaging Guidelines ◦ **Coccydynia without Neurological Features (SP-5.2)** in the Spine Imaging Guidelines	
Piriformis Syndrome	NA	• This condition is imaged according to the criteria found in the Peripheral Nerve and Neuromuscular Disorders Guidelines. See: **Focal Neuropathy (PN-2)** in the Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)**	**Advanced Imaging (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments (Additional comments related to the condition.)**
Partial Tendon Rupture	No	• MRI Pelvis without contrast (CPT® 72195) for a suspected partial tendon rupture of a specific named tendon not otherwise specified	MRI is *NOT* needed for muscle belly strains/muscle tears.
Osteitis Pubis/ Symphysis Pubis Diastasis	Yes	• MRI Pelvis without contrast (CPT® 72195)	
Athletic Pubalgia (Sports Hernia)	Yes	• To evaluate for the cause of suspected athletic pubalgia: ◦ MRI Pelvis without contrast (athletic pubalgia protocol) (CPT® 72195) **OR** ◦ Dynamic pelvic ultrasound (CPT® 76857)	
Post-Operative	Yes	• CT Pelvis without contrast (CPT® 72192) in symptomatic individuals following surgery for complex pelvic ring/acetabular fractures	

Evidence Discussion (MS-23)

v2.0.2025

For many patients with musculoskeletal pelvic issue, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. Register et. al. found labral tears in 69% of asymptomatic volunteers. It was also reported that the asymptomatic participants in their study older than 35 years were 13.7 time more likely to have a chondral defect and 16.7 times more likely to have a subchondral cyst compared with participants 35 or younger. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of musculoskeletal pelvic and hip conditions are also recommended by the American College of Radiology Appropriate Use Criteria. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for some musculoskeletal pelvic conditions (e.g. tendonitis, osteitis pubis) do not rely on advanced imaging results and many patients will improve within a few weeks or months with conservative care. However, for some musculoskeletal pelvic conditions (e.g. complex fractures, suspected tendon tear), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many patients with a musculoskeletal pelvic condition, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

References (MS-23)

v2.0.2025

1. Morrison WB, Deely D, Fox MG, et al. ACR Appropriateness Criteria® Stress (Fatigue-Insufficiency) Fracture Including Sacrum Excluding Other Vertebrae. Available at https://acsearch.acr.org/docs/69435/Narrative/. American College of Radiology. Revised 2024.
2. Mehta S, Auerbach JD, Born CT, et al. Sacral fractures. *J Am Acad Orthop Surg*. 2006;14:656-665.
3. Omar IM, Zoga AC, Kavanagh EC, et al. Athletic Pubalgia and "Sports Hernia": Optimal MR Imaging Technique and Findings. *RadioGraphics*. 2008;28:1415-1438. doi:10.1148/rg.285075217.
4. Khan W, Zoga AC, Meyers WC. Magnetic Resonance Imaging of Athletic Pubalgia and the Sports Hernia - Current Understanding and Practice. *Magn Reson Imaging Clin N Am*. 2013;21:97-110. doi:10.1016/j.mric.2012.09.008.
5. Morley N, Grant T, Blount K, et al. Sonographic evaluation of athletic pubalgia. *Skeletal Radiol*. 2016 May;45(5):689-99. doi:10.1007/s00256-016-2340-8.
6. Caudill P, Nyland J, Smith C, et al. Sports hernias: a systematic literature review. *British Journal of Sports Medicine*. 2008;42(12):954-964. doi:10.1136/bjsm.2008.047373.
7. Suarez JC, Ely EE, Mutnal AB, et al. Comprehensive approach to the evaluation of groin pain. *Journal of the American Academy of Orthopaedic Surgeons*. 2013;21:558-570. doi:10.5435/JAAOS-21-09-558.
8. Heer ST, Callander JW, Kraeutler MJ, Mei-Dan O, Mulcahey MK. Hamstring Injuries. *The Journal of Bone and Joint Surgery*. 2019;101(9):843-853. doi:10.2106/jbjs.18.00261.
9. Kopscik M, Crisman JL, Lomasney L, Smith S, Jadidi S. Sports Hernias: A Comprehensive Review for Clinicians. *Cureus*. 2023;15(8):e43283. Published 2023 Aug 10. doi:10.7759/cureus.43283.
10. Childs DD, Leyendecker JR. MRI of the pelvis: a guide to incidental findings for musculoskeletal radiologists. *Semin Musculoskelet Radiol*. 2008 Mar;12(1):83-103.
11. Papavasiliou A, Siatras T, Bintoudi A, Milosis D, Lallas V, Sykaras E, Karantanas A. The gymnasts' hip and groin: a magnetic resonance imaging study in asymptomatic elite athletes. *Skeletal Radiol*. 2014 Aug;43(8):1071-7.
12. Jawetz ST, Fox MG, Blankenbaker DG , et al. ACR Appropriateness Criteria® Chronic Hip Pain. Available at https:// acsearch.acr.org/docs/69425/Narrative/. American College of Radiology. Revised 2022.
13. Ross AB, Lee, KS, Chang, EY, et al. ACR Appropriateness Criteria® Acute Hip Pain-Suspected Fracture. Available at https://acsearch.acr.org/docs/3082587/Narrative/. American College of Radiology. Revised 2018.
14. Chan BY, Allen H, Davis KW, Blankenbaker DG. MR Imaging of the hip: Avoiding pitfalls, identifying normal variants. *Appl Radiol*. 2018; 47(12):8-14.
15. Register B, Pennock AT, Ho CP, Strickland CD, Lawand A, Philippon MJ. Prevalence of abnormal hip findings in asymptomatic participants: a prospective, blinded study. *Am J Sports Med*. 2012 Dec;40(12):2720-4.
16. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
17. Via AG, Frizziero A, Finotti P, Oliva F, Randelli F, Maffulli N. Management of osteitis pubis in athletes: rehabilitation and return to training - a review of the most recent literature. *Open Access J Sports Med*. 2018 Dec 24;10:1-10. Published 2018 Dec 24. doi:10.2147/OAJSM.S155077.
18. Lynch, T. Sean MD; Bedi, Asheesh MD; Larson, Christopher M. MD. Athletic Hip Injuries. *Journal of the American Academy of Orthopaedic Surgeons.* 25(4):p 269-279, April 2017.
19. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
20. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
21. Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, Rosenthal MB, Colla CH, Sequist TD. Cascades of Care After Incidental Findings in a US National Survey of Physicians. *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325
22. De Grove V, Buls N, Vandenbroucke F, Shahabpour M, Scafoglieri A, de Mey J, De Maeseneer M. MR of tendons about the hip: A study in asymptomatic volunteers. *Eur J Radiol*. 2021 Oct;143:109876.

Hip (MS-24)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Hip (MS-24)

MS.HI.0024.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Hip Pain	Yes	• MRI Hip without contrast (CPT® 73721) **OR** • US Hip (CPT® 76881 or CPT® 76882)	
Symptomatic Loose Bodies	No	• MRI Hip without contrast (CPT® 73721)	
Tendonitis/ Bursitis	Yes	• MRI Hip without contrast (CPT® 73721) **OR** • US Hip (CPT® 76881 or CPT® 76882)	
Hip Abductor Tendon Tear/ Avulsion	No	• MRI Hip without contrast (CPT® 73721) **OR** • US Hip (CPT® 76881 or CPT® 76882)	
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Hip without contrast (CPT® 73721) **OR** ◦ US Hip (CPT® 76881 or CPT® 76882)	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Hip without contrast (CPT® 73721) **OR** ◦ US Hip (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/ muscle tears.

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Occult/Stress/ Insufficiency Fracture	No	When suspected based on history and physical exam, advanced imaging guided by: **Suspected Occult/ Stress/ Insufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)** for occult/ stress/insufficiency fractures of the hip	
Avascular Necrosis (AVN) of the Femoral Head	No	• See: **AVN (MS-4.1)**	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Labral Tear	Yes	• MRI Hip with contrast (arthrogram) (CPT® 73722) **OR** • CT Hip with contrast (arthrogram) (CPT® 73701) **OR** • MRI Hip without contrast (CPT® 73721)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Femoroacetabular Impingement	Yes	• For preoperative planning for femoroacetabular impingement: ◦ MRI Hip without contrast (CPT® 73721) **OR** ◦ MRI Hip with contrast (arthrogram) (CPT® 73722) **IN ADDITION TO:** • CT Hip without contrast (CPT® 73700) **OR** • CT Pelvis without contrast (CPT® 72192)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Piriformis Syndrome	NA	• This condition is imaged according to the criteria found in the Peripheral Nerve and Neuromuscular Disorders Guidelines. See Focal Neuropathy (PN-2) in the Peripheral Nerve and Neuromuscular Disorders Imaging Guidelines	
Post-Operative	Yes	• Symptomatic individuals following surgery for labral tears and femoroacetabular impingement: ◦ MRI Hip with contrast (arthrogram) (CPT® 73722) • Symptomatic individuals following surgery for hip fracture and/or hip avascular necrosis: ◦ CT Hip without contrast (CPT® 73700) **OR** ◦ MRI Hip without contrast (CPT® 73721)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Hip Replacement Surgery	No*	• For suspected aseptic loosening of hip replacement when recent plain x-ray is nondiagnostic: ◦ CT Hip without contrast (CPT® 73700) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Hip without contrast (CPT® 73721) **OR** ◦ MRI Hip without and with contrast (CPT® 73723) **OR**	See: **Post-Operative Joint Replacement Surgery (MS-16)**

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
		◦ CT Hip with contrast (CPT® 73701) **OR** ◦ CT Hip without contrast (CPT® 73700)[9] **OR** ◦ US Hip (CPT® 76881 or CPT® 76882) • For suspicion of a periprosthetic fracture when recent plain x-ray is nondiagnostic: ◦ CT Hip without contrast (CPT® 73700) • To evaluate component malposition or heterotopic bone after plain x-ray:	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
		◦ CT Hip without contrast (CPT® 73700) • For possible nerve injury: ◦ MRI Hip without contrast (CPT® 73721) • For suspected tendinitis/bursitis abductor injury, or other soft tissue abnormality (*requires conservative treatment): ◦ MRI Hip without contrast (CPT® 73721) **OR** ◦ US Hip (CPT® 76881 or CPT® 76882)	

Evidence Discussion (MS-24)

v2.0.2025

For most patients with a hip complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. Register et. al. found labral tears in 69% of asymptomatic volunteers. It was also reported that the asymptomatic participants in their study older than 35 years were 13.7 time more likely to have a chondral defect and 16.7 times more likely to have a subchondral cyst compared with participants 35 or younger. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of hip conditions are also recommended by the American College of Radiology Appropriate Use Criteria It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for several hip conditions (e.g. tendonitis, bursitis, generalized hip pain) do not rely on advanced imaging results and many patients will improve within a few weeks or months with conservative care. However, for some hip conditions (e.g. loose bodies, suspected tendon tear, particular issues after hip replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many hip conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-24)

v2.0.2025

1. Greene WB (Ed.). *Essentials of Musculoskeletal Care.* 2nd Ed. Rosemont, IL, American Academy of Orthopaedic Surgeons, 2001.
2. Manek NJ and Lane NE. Osteoarthritis: Current concepts in diagnosis and management. *Am Fam Physician*. 2000;61(6):1795-1804. https://www.aafp.org/afp/2000/0315/p1795.html .
3. Papadoupoulos EC and Kahn SN. Piriformis syndrome and low back pain: a new classification and review of the literature. *Orthop Clin North Am.* 2004;35(1):65-71. doi:10.1016/S0030-5898(03)00105-6.
4. Reurink G, Sebastian, Bisselink JM, et al. Reliability and Validity of Diagnostic Acetabular Labral Lesions with Magnetic Resonance Arthrography. *J Bone Joint Surg A.* 2012;94(181):1643-1648. doi:10.2106/JBJS.K.01342.
5. Steinbach LS, Palmer WE, and Schweitzer ME. Special Focus Session MR Arthrography1. *RadioGraphics.* 2002;22(5):1223-1246.
6. Redmond JM, Chen AW, and Domb BG. Greater Trochanteric Pain Syndrome. *J Am Acad Orthop Surg*. 2016;24(4):231-240. doi:10.5435/JAAOS-D-14-00406.
7. Center for Devices and Radiological Health. Metal-on-Metal Hip Implants - Information for Orthopaedic Surgeons. U S Food and Drug Administration Home Page.
8. Ross AB, Lee KS, Chang EY, et al. ACR Appropriateness Criteria® Acute Hip Pain-Suspected Fracture. Available at https://acsearch.acr.org/docs/3082587/Narrative/. American College of Radiology. Revised 2018.
9. Weissman BN, Palestro CJ, Appel M, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Imaging After Total Hip Arthroplasty. *Am Coll Radiol (ACR);* Date of Origin: 1998. Last Review: 2023. https://acsearch.acr.org/docs/3094200/Narrative/.
10. Jawetz ST, Fox MG, Blankenbaker DG, et al. ACR Appropriateness Criteria® Chronic Hip Pain. Available at https://acsearch.acr.org/docs/69425/Narrative/. American College of Radiology. Revised 2022.
11. Murphey MD, Roberts CC, Bencardino JT, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Osteonecrosis of the Hip. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2022. https://acsearch.acr.org/docs/69420/Narrative/ .
12. Bencardino JT, Stone TJ, Roberts CC, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69435/Narrative/.
13. Verberne SJ, Raijmakers PG, and Temmerman OP. The Accuracy of Imaging Techniques in the Assessment of Periprosthetic Hip Infection. A Systematic Review and Meta-Analysis. *J Bone Joint Surg Am*. 2016;98(19):1638-45. doi:10.2106/JBJS.15.00898.
14. Shin AY, Morin WD, Gorman JD, et al. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. *Am J Sports Med*. 1996;24:168-76. doi:10.1177/036354659602400209.
15. Slocum KA, Gorman JD, Puckett ML, et al. Resolution of abnormal MR signal intensity in patients with stress fractures of the femoral neck. *AJR Am J Roentgenol*. 1997;168:1295-9. doi:10.2214/ajr.168.5.9129429.
16. Lee EY, Margherita AJ, Gierada DS, et al. MRI of Piriformis Syndrome. *American Journal of Roentgenology*. 2004;183:63-64. doi:10.2214/ajr.183.1.1830063.
17. Jankiewicz JJ, Hennrikus WL, and Houkom JA. The appearance of the piriformis muscle syndrome in computed tomography and magnetic resonance imaging: a case report and review of the literature. *Clin Orthop.* 1991;262:205-09.
18. Rossi P, Cardinali P, Serrao M, et al.. Magnetic resonance imaging findings in piriformis syndrome: a case report. *Arch Phys Med Rehabil.* 2001;82(4):519-21. doi:10.1053/apmr.2001.21971.
19. Heer ST, Callander JW, Kraeutler MJ, Mei-Dan O, Mulcahey MK. Hamstring Injuries. *The Journal of Bone and Joint Surgery.* 2019;101(9):843-853. doi:10.2106/jbjs.18.00261.
20. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022. https://acsearch.acr.org/docs/3094201/Narrative/.

21. Margo K, Drezner J, Motzkin D. Evaluation and management of hip pain: an algorithmic approach. *J Fam Pract*. 2003 Aug;52(8):607-17.
22. Chamberlain R. Hip Pain in Adults: Evaluation and Differential Diagnosis. *Am Fam Physician*. 2021 Jan 15;103(2):81-89. Erratum in: *Am Fam Physician*. 2021 Mar 1;103(5):263.
23. Gómez-Hoyos J, Martin RL, Martin HD. Current Concepts Review: Evaluation and Management of Posterior Hip Pain. *J Am Acad Orthop Surg*. 2018 Sep 1;26(17):597-609.
24. Verrill MM, Hall MN, Loven B. FPIN's clinical inquiries. Evaluation of hip pain in older adults. *Am Fam Physician*. 2012 Aug 15;86(4):1-2.
25. Trigg SD, Schroeder JD, Hulsopple C. Femoroacetabular Impingement Syndrome. *Curr Sports Med Rep*. 2020;19(9):360-366. doi:10.1249/JSR.0000000000000748 .
26. Schmaranzer F, Kheterpal AB, Bredella MA. Best Practices: Hip Femoroacetabular Impingement. *AJR Am J Roentgenol*. 2021 Mar;216(3):585-598.
27. Chan BY, Allen H, Davis KW, Blankenbaker DG. MR Imaging of the hip: Avoiding pitfalls, identifying normal variants. *Appl Radiol*. 2018; 47(12):8-14.
28. Register B, Pennock AT, Ho CP, Strickland CD, Lawand A, Philippon MJ. Prevalence of abnormal hip findings in asymptomatic participants: a prospective, blinded study. *Am J Sports Med*. 2012 Dec;40(12):2720-4.
29. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
30. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
31. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
32. Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, Rosenthal MB, Colla CH, Sequist TD. Cascades of Care After Incidental Findings in a US National Survey of Physicians. *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325
33. Battaglia PJ, D'Angelo K, Kettner NW. Posterior, Lateral, and Anterior Hip Pain Due to Musculoskeletal Origin: A Narrative Literature Review of History, Physical Examination, and Diagnostic Imaging. *J Chiropr Med*. 2016 Dec;15(4):281-293.
34. Vahedi H, Aalirezaie A, Azboy I, Daryoush T, Shahi A, Parvizi J. Acetabular Labral Tears Are Common in Asymptomatic Contralateral Hips With Femoroacetabular Impingement. *Clin Orthop Relat Res*. 2019 May;477(5):974-979.
35. Frank JM, Harris JD, Erickson BJ, Slikker W 3rd, Bush-Joseph CA, Salata MJ, Nho SJ. Prevalence of Femoroacetabular Impingement Imaging Findings in Asymptomatic Volunteers: A Systematic Review. *Arthroscopy*. 2015 Jun;31(6):1199-204.
36. Anzillotti G, Iacomella A, Grancagnolo M, Bertolino EM, Marcacci M, Sconza C, Kon E, Di Matteo B. Conservative vs. Surgical Management for Femoro-Acetabular Impingement: A Systematic Review of Clinical Evidence. *J Clin Med*. 2022 Oct 2;11(19):5852.
37. Lustenberger DP, Ng VY, Best TM, Ellis TJ. Efficacy of treatment of trochanteric bursitis: a systematic review. *Clin J Sport Med*. 2011 Sep;21(5):447-53
38. Aaron DL, Patel A, Kayiaros S, Calfee R. Four common types of bursitis: diagnosis and management. *J Am Acad Orthop Surg*. 2011 Jun;19(6):359-67

Knee (MS-25)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Knee (MS-25)

MS.KN.0025.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Knee Pain	Yes	• MRI Knee without contrast (CPT® 73721) **OR** • US Knee (CPT® 76881 or CPT® 76882)	
Symptomatic Loose Bodies	No	• MRI Knee without contrast (CPT® 73721) **OR** • CT Knee with contrast (arthrogram) (CPT® 73701) if MRI cannot be performed	
Tendonitis	Yes	• MRI Knee without contrast (CPT® 73721) **OR** • US Knee (CPT® 76881 or CPT® 76882)	
Complex Knee Fracture	No	• MRI Knee without contrast (CPT® 73721) **OR** • CT Knee without contrast (CPT® 73700)	See: **Fractures (MS-5)**

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Meniscus Tear	Yes*	• MRI Knee without contrast (CPT® 73721) **OR** • CT Knee with contrast (arthrogram) (CPT® 73701) if MRI cannot be performed *Conservative treatment is not required if at least 2 of following 4 criteria are met: 1) Positive McMurray's, positive Thessaly, or positive Apley's Compression Test 2) twisting or acute injury of the knee 3) locked knee/inability to fully extend the knee on exam in comparison to the opposite knee 4) knee effusion	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
		• MRI Knee without contrast (CPT® 73721) for clinical suspicion of a symptomatic degenerative meniscus tear in an individual with osteoarthritis following conservative treatment	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Ligament Tear	Yes*	• MRI Knee without contrast (CPT® 73721) *Conservative treatment is not required if any of the following signs are positive in comparison to the opposite knee: • Anterior drawer • Lachman • Pivot shift • Posterior drawer • Posterior sag • Valgus stress • Varus stress	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Knee Joint Dislocation	No	• Following significant trauma to evaluate for ligament and vascular injury: ◦ MRI Knee without contrast (CPT® 73721) AND EITHER ◦ MR Angiography lower extremity without and with contrast (CPT® 73725) **OR** ◦ CT Angiography lower extremity without and with contrast (CPT® 73706)	
Patellar Dislocation/ Subluxation	No	• MRI Knee without contrast (CPT® 73721) **OR** CT Knee without contrast (CPT® 73700) when there is an acute knee injury, consideration of surgery, **AND** concern for osteochondral fracture or loose osteochondral fracture fragment	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Recurrent Patellar Instability	Yes	• MRI Knee without contrast (CPT® 73721) **OR** CT Knee without contrast (CPT® 73700) if consideration for surgery	
Patellofemoral Pain Syndrome/ Anterior Knee Pain/ Tracking Disorder	Yes	• MRI Knee without contrast (CPT® 73721) **OR** CT Knee without contrast (CPT® 73700) if consideration for surgery	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Suspected Osteochondral Injury	No	• If plain x-rays are negative and an osteochondral fracture is still suspected: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ MRI Knee with contrast (arthrogram) (CPT® 73722) **OR** ◦ CT Knee with contrast (arthrogram) (CPT® 73701)	See: **Chondral/ Osteochondral Lesions (MS-13)** for other osteochondral injury scenarios.
Avascular Necrosis (AVN) of the Distal Femur	No	• See: **AVN (MS-4.1)**	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Baker's Cyst (Popliteal Cyst)	Yes	• US Knee (CPT® 76881 or CPT® 76882) is the initial imaging study • MRI Knee without contrast (CPT® 73721) for preoperative planning	See also: **Acute Limb Swelling (PVD-12)** in the Peripheral Vascular Disease Imaging Guidelines
Plica (Symptomatic Synovial Plica/ Medial Synovial Shelf)	Yes	• MRI Knee without contrast (CPT® 73721)	
Hemarthrosis (Traumatic)	*See comments	*See specific trauma-related section (e.g. ligament tear, suspected osteochondral injury, patellar dislocation)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Hemarthrosis **(Non-traumatic or spontaneous)**[23,24]	No	• MRI Knee without contrast (CPT® 73721)	
Complete Rupture of the Distal Quadriceps Tendon or Patellar Ligament/ Tendon	No	• For preoperative planning: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ US Knee (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ US Knee (CPT® 76881 or CPT® 76882)	MRI is NOT needed for muscle belly strains/ muscle tears.
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ US Knee (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative	Yes	• In symptomatic individuals following surgery for meniscus tears and reconstruction of the anterior cruciate ligament: ◦ MRI Knee with contrast (arthrogram) (CPT® 73722) **OR** ◦ MRI Knee without contrast (CPT® 73721) • In symptomatic individuals following surgery for fracture/dislocation: ◦ CT Knee without contrast (CPT® 73700)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Post-Operative Knee Replacement Surgery	No*	• For suspected aseptic loosening when recent plain x-ray is nondiagnostic: ◦ CT Knee without contrast (CPT® 73700) **OR** ◦ MRI Knee without contrast (CPT® 73721) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ MRI Knee without and with contrast (CPT® 73723) **OR** ◦ CT Knee with contrast (CPT® 73701) **OR** ◦ US Knee (CPT® 76881 or CPT® 76882)	See also: **Post-Operative Joint Replacement Surgery (MS-16)**

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
		• Following plain x-ray for suspected periprosthetic fracture: ◦ CT Knee without contrast (CPT® 73700) **OR** ◦ MRI Knee without contrast (CPT® 73721) • For suspected osteolysis or component instability, rotation, or wear: ◦ CT Knee without contrast (CPT® 73700) **OR** ◦ MRI Knee without contrast (CPT® 73721) • For suspected periprosthetic soft tissue abnormality unrelated to infection (e.g., tendinopathy, arthrofibrosis, patellar clunk syndrome, impingement of nerves or	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
		other soft tissue) *requires conservative treatment: ◦ MRI Knee without contrast (CPT® 73721) **OR** ◦ US Knee (CPT® 76881 or CPT® 76882)	

Evidence Discussion (MS-25)

v2.0.2025

For most patients with a knee complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. It has been reported that approximately 30 – 40 percent of middle-aged patients and an even higher percentage of older patients have asymptomatic meniscus tears. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of knee conditions are also recommended by the American College of Radiology Appropriate Use Criteria. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many knee conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. However, for some knee conditions (e.g. loose bodies, suspected tendon tear, particular issues after knee replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many knee conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

References (MS-25)

v2.0.2025

1. Harrison BK, Abell BE, Gibson TW. The Thessaly test for detection of meniscal tears: validation of a new physical examination technique for primary care medicine. *Clin J Sport Med*. 2009;19:9-12. doi:10.1097/JSM.0b013e31818f1689.
2. Landewé RBM, Günther KP, Lukas C, et al. EULAR/EFFORT recommendations for the diagnosis and initial management of patients with acute or recent onset swelling of the knee. *Ann Rheum Dis*. 2010;69:12-19. doi:10.1136/ard.2008.104406.
3. Johnson MW. Acute knee effusions: a systematic approach to diagnosis. *Am Fam Physician*. 2000;61(8):2391-2400. https://www.aafp.org/afp/2000/0415/p2391.html.
4. Sung-Jae Kim, Byoung-Yoon Hwang, Choi DH, et al. *J Bone Joint Surg A*. 2012;94(16):e118 1-7.
5. Kannus P, Järvinen M. Nonoperative treatment of acute knee ligament injuries. A review with special reference to indications and methods. *Sports Med.*1990;9(4):244-260. doi:10.2165/00007256-199009040-00005.
6. Manek NJ and Lane NE. Osteoarthritis: Current concepts in diagnosis and management. *Am Fam Physician*. 2000;61(6):1795-1804. https://www.aafp.org/afp/2000/0315/p1795.html.
7. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:84, 541-545.
8. Lee IS, Choi JA, Kim TK, et al. Reliability analysis of 16-MDCT in preoperative evaluation of total knee arthroplasty and comparison with intraoperative measurements. *Am J Roentgenol*. 2006;186(6):1778-1782. doi:10.2214/AJR.05.1191.
9. Morrissey RT, Weinstein SL (Eds.). *Lovell and Winter's Pediatric Orthopaedics*. 6th Ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2005:1413.
10. Woolson ST, Harris AHS, Wagner DW, et al; Component alignment during total knee arthroplasty with use of standard or custom instrumentation: A Randomized Clinical Trial Using Computed Tomography for Postoperative Alignment Measurement. *Journal of Bone and Joint Surgery*. 2014;96:366-372. doi:10.2106/JBJS.L.01722.
11. Vance K, Meredick R, Schweitzer ME, et al. Magnetic resonance imaging of the postoperative meniscus. *Arthroscopy*. 2009;25:522-30. doi:10.1016/j.arthro.2008.08.013.
12. Magee T, Shapiro M, and Williams D. Prevalence of meniscal radial tears of the knee revealed by MRI after surgery. *Am J Roentgenol.* 2004;184:931-936. doi:10.2214/ajr.182.4.1820931.
13. Meyers AB, Haims AH, Menn K, et al. Imaging of anterior cruciate ligament repair and its complications. *Am J Roentgenol.* 2010;194:476-484. doi:10.2214/AJR.09.3200.
14. Tuite, MJ, Kransdorf MJ, Beaman FD, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Acute Trauma to the Knee. *Am Coll Radiol (ACR);* Date of Origin: 1998. Revised: 2019. https://acsearch.acr.org/docs/69419/Narrative.
15. Bennett DL, Nelson JW, Weissman BN, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Nontraumatic Knee Pain. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2018. https://acsearch.acr.org/docs/69432/Narrative/.
16. Zoga AC, Weissman BN, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Soft-Tissue Masses. *Am Coll Radiol (ACR);* Date of Origin: 1995. Revised: 2017. https://acsearch.acr.org/docs/69434/Narrative/.
17. Walker EA, Fox MG, Blankenbaker DG, et. al. ACR Appropriateness Criteria® Imaging After Total Knee Arthroplasty. Available at: https://acsearch.acr.org/docs/69430/Narrative/. American College of Radiology. Revised 2023.
18. Kurosaka M, Yagi M, Yoshiya S, Muratsu H, Mizuno K. Efficacy of the axially loaded pivot shift test for the diagnosis of a meniscal tear. *Int Orthop*. 1999;23:271-274. doi:10.1007/s002640050369.
19. Fowler PJ, Lubliner JA. The predictive value of five clinical signs in the evaluation of meniscal pathology. *Arthroscopy*. 1989;5(3):184-186. doi:10.1016/0749-8063(89)90168-0.
20. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine

and Diabetic Foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022. https://acsearch.acr.org/docs/3094201/Narrative/.

21. Pauyo T, Park JP, Bozzo I, Bernstein M. Patellofemoral instability part I: evaluation and nonsurgical treatment. *J Am Acad Orthop Surg*. 2022;30:e1431-e1442. doi:10.5435/JAAOS-D-22-00254.
22. Sasho T, Ogino S, Tsuruoka H, et al. Spontaneous Recurrent Hemarthrosis of the Knee in the Elderly: Arthroscopic Treatment and Etiology. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. 2008; 24(9):1027-1033.
23. van Vulpen LFD, Holstein K, Martinoli C. Joint disease in haemophilia: Pathophysiology, pain and imaging. *Haemophilia*. 2018;24 Suppl 6:44-49. doi:10.1111/hae.13449.
24. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
25. Englund M, Guermazi A, Gale D, et al. Incidental meniscal findings on knee MRI in middle-aged and elderly persons. *N Engl J Med*. 2008;359(11):1108-1115.
26. Deshpande BR, Losina E, Smith SR, Martin SD, Wright RJ, Katz JN. Association of MRI findings and expert diagnosis of symptomatic meniscal tear among middle-aged and older adults with knee pain. *BMC Musculoskelet Disord*. 2016 Apr 11;17:154.
27. Ryzewicz M, Peterson B, Siparsky PN, Bartz RL. The diagnosis of meniscus tears: the role of MRI and clinical examination. *Clin Orthop Relat Res*. 2007;455:123-133.
28. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
29. Bunt CW, Jonas CE, Chang JG. Knee Pain in Adults and Adolescents: The Initial Evaluation. *Am Fam Physician*. 2018 Nov 1;98(9):576-585.
30. Fox MG, Chang EY, Amini B, et. al. ACR Appropriateness Criteria® Chronic Knee Pain. Available at https://acsearch.acr.org/docs/69432/Narrative/. American College of Radiology. Revised 2018.
31. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
32. Song YD, Jain NP, Kim SJ, Kwon SK, Chang MJ, Chang CB, Kim TK. Is Knee Magnetic Resonance Imaging Overutilized in Current Practice? *Knee Surg Relat Res*. 2015 Jun;27(2):95-100.
33. Sherman SL, Gulbrandsen TR, Lewis HA, Gregory MH, Capito NM, Gray AD, Bal BS. Overuse of Magnetic Resonance Imaging in the Diagnosis and Treatment of Moderate to Severe Osteoarthritis. *Iowa Orthop J*. 2018;38:33-37. PMID: 30104922; PMCID: PMC6047403.
34. Petron DJ, Greis PE, Aoki SK, Black S, Krete D, Sohagia KB, Burks R. Use of knee magnetic resonance imaging by primary care physicians in patients aged 40 years and older. *Sports Health*. 2010;2(5):385-390. doi:10.1177/1941738110377420 .
35. Khaund R, Flynn SH. Iliotibial band syndrome: a common source of knee pain. *Am Fam Physician*. 2005 Apr 15;71(8):1545-50.

Ankle (MS-26)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Ankle (MS-26)

MS.AL.0026.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Ankle Pain	Yes	• MRI Ankle without contrast (CPT® 73721) **OR** • US Ankle (CPT® 76881 or CPT® 76882)	
Symptomatic Loose Bodies	No	• MRI Ankle without contrast (CPT® 73721)	
Complex Fracture	No	• MRI Ankle without contrast (CPT® 73721) **OR** • CT Ankle without contrast (CPT® 73700)	
Ankle Sprain, Including Avulsion Fracture	Yes	• MRI Ankle Without Contrast (CPT® 73721) **OR** • CT Ankle without contrast (CPT® 73700)	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
High Ankle Sprain (Syndesmosis Injury)	No	• MRI Ankle without contrast (CPT® 73721) **OR** • CT Ankle without contrast (CPT® 73700)	
Suspected Osteochondral Injury	No	• If plain x-rays are negative and an osteochondral fracture is still suspected, ONE of the following: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ CT Ankle without contrast (CPT® 73700)	See: **Chondral/ Osteochondral Lesions (MS-13)** for other osteochondral injury scenarios
Avascular Necrosis (AVN) of the Talus	No	• See:**AVN (MS-4.1)**	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced Imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Anterior Impingement **Anterior-Lateral Impingement** **Posterior Impingement (e.g., Os Trigonum Syndrome)**	Yes	• MRI Ankle with contrast (arthrogram) (CPT® 73722) **OR** • CT Ankle with contrast (arthrogram) (CPT® 73701) **OR** • MRI Ankle without contrast (CPT® 73721)	
Tendonitis	Yes	• For suspected posterior tibial dysfunction, peroneal tendon or subluxation, Achilles tendonitis: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882)	
Complete Rupture of Achilles Tendon	No	• For preoperative evaluation: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Complete Rupture -Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882)	
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/ muscle tears.
Instability	Yes	• For preoperative evaluation: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ MRI Ankle with contrast (arthrogram) (CPT® 73722)	
Charcot Ankle	Yes	• MRI Ankle without contrast (CPT® 73721)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Post-Operative	Yes	• In symptomatic individuals following surgery for ligament/tendon injuries, one of the following: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882) • For symptomatic individuals following surgery for complex fractures: ◦ CT Ankle without contrast (CPT® 73700)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced Imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Post-Operative Ankle Replacement Surgery	No	• For suspected aseptic loosening or periprosthetic fracture when recent plain x-ray is nondiagnostic: ◦ CT Ankle without contrast (CPT® 73700) • For suspected infection with negative or inconclusive joint aspiration culture: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ MRI Ankle without and with contrast (CPT® 73723) **OR** ◦ CT Ankle with contrast (CPT® 73701) **OR** ◦ US Ankle (CPT® 76881 or CPT® 76882)	See: **Post-Operative Joint Replacement Surgery (MS-16)**

One Study/Area Only

In foot and ankle advanced imaging, studies are frequently ordered of both areas. This is unnecessary since ankle MRI will image from above the ankle to the mid-metatarsal area. **Only one CPT® code should be reported**.

Evidence Discussion (MS-26)

v2.0.2025

For most patients with an ankle complaint, a diagnosis can be made based on a detailed history, physical examination and plain radiographs. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of ankle conditions are also recommended by the American College of Radiology Appropriate Use Criteria. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many ankle conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. However, for some ankle conditions (e.g. loose bodies, suspected tendon tear, issues after ankle replacement surgery), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many ankle conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-26)

v2.0.2025

1. Donovan A, Rosenberg ZS. MRI of ankle and lateral hindfoot impingement syndromes. *AJR*. 2010;195: 595-604.
2. Wolfe MW, Uhl TL, and McClusky LC. Management of ankle sprains. *Am Fam Physician* 2001;63(1):93-104. https://www.aafp.org/afp/2001/0101/p93.html.
3. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:593-596; 606-609; 683.
4. Bergkvist D, Astrom I, Josefsson PO, et al. Acute Achilles Tendon Rupture: A Questionnaire Follow-up of 487 Patients. *J Bone Joint Surg Am.* 2012;94(13):1229-1233. doi:10.2106/JBJS.J.01601.
5. Hartgerink P, Fessell DP, Jacobson JA, et al. Full- versus partial-thickness Achilles tendon tears: sonographic accuracy and characterization in 26 cases with surgical correlation. *Radiology* 2001;220:406-412. doi: 10.1148/radiology.220.2.r01au41406.
6. Jones MP, Riaz JK, Smith RLC. Surgical Interventions for Treating Acute Achlles Tendon Rupture: Key Findings from a Recent Cochrane Review. *J Bone Joint Surg Am.* 2012;94(12):e88 1-6. doi:10.2106/jbjs.j.01829.
7. Vaseenon T, Amendola A. Update on anterior ankle impingement. *Current Reviews in Musculoskeletal Medicine*. 2012;5:140-150. doi:10.1007/s12178-012-9117-z.
8. Talusan PG, Toy J, Perez J, Milewski MD, et al. Anterior ankle impingement: diagnosis and treatment. *J Am Acad Orthop Surg*. 2014;22:333-339. doi:10.5435/JAAOS-22-05-333.
9. Nault ML, Kocher MS, Micheli LJ. Os Trigonum Syndrome. *J Am Acad Orthop Surg*. 2014;22:545-553. doi:10.5435/JAAOS-22-09-545.
10. Peace KAL, Jillier JC, Hulme A, et al. MRI features of posterior ankle impingement syndrome in ballet dancers: a review 25 cases. *Clinical Radiology*. 2004;59:1025-1033. doi:10.1016/j.crad.2004.02.010.
11. J Kane and R Zell. Achilles Tendon Rupture. Physician Resource Center. *American Orthopaedic Foot & Ankle Society*. Last reviewed July 2015.
12. Garras DN, et al. MRI is Unnecessary for Diagnosing Acute Achilles Tendon Ruptures. *Clinical Orthopaedics and Related Research*. 2012;470:2268–2273 Retrospective Analysis with finding. doi:10.1007/s11999-012-2355-y.
13. Smith SE, Chang EY, Ha AS, et al. ACR Appropriateness Criteria® Acute Trauma to the Ankle. Available at https://acsearch.acr.org/docs/69436/Narrative/. American College of Radiology. Revised 2020.
14. Chang EY, Tadros AS, Amini B, et al. ACR Appropriateness Criteria® Chronic Ankle Pain. Available at https://acsearch.acr.org/docs/69422/Narrative/. American College of Radiology. Revised 2017.
15. Dodd A, Daniels TR. Charcot Neuroarthropathy of the Foot and Ankle. *J Bone Joint Surg Am.* 2018;100:696-711. doi:10.2106/JBJS.17.00785.
16. Beaman FD, von Herrmann PF, Kransdorf MJ, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). *Am Coll Radiol (ACR)*; Date of Origin: 2016. Revised: 2022. https://acsearch.acr.org/docs/3094201/Narrative/.
17. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
18. Deu RS, Coslick AM, Dreher G. Tendinopathies of the Foot and Ankle. *Am Fam Physician*. 2022 May 1;105(5):479-486.
19. Tiemstra JD. Update on acute ankle sprains. *Am Fam Physician*. 2012 Jun 15;85(12):1170-6.
20. Tocci SL, Madom IA, Bradley MP, Langer PR, DiGiovanni CW. The diagnostic value of MRI in foot and ankle surgery. *Foot Ankle Int*. 2007 Feb;28(2):166-8.
21. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
22. de Ga K, Noblett D, Bateni C. Ankle MRI and preceding radiographs: an evaluation of physician ordering practices. *Skeletal Radiol*. 2022;51(12):2263-2268. doi:10.1007/s00256-022-04084-8.
23. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.

24. Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, Rosenthal MB, Colla CH, Sequist TD. Cascades of Care After Incidental Findings in a US National Survey of Physicians. *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325.
25. Noto AM, Cheung Y, Rosenberg ZS, Norman A, Leeds NE: MR imaging of the ankle: normal variants. *Radiology*. 1989;170(1 Pt 1):121-124. doi:10.1148/radiology.170.1.2909084.
26. Rosenberg ZS, Bencardino J, Mellado JM: Normal variants and pitfalls in magnetic resonance imaging of the ankle and foot. *Top Magn Reson Imaging*. 9:262–272, 1998.
27. Papaliodis DN, Vanushkina MA, Richardson NG, DiPreta JA. The foot and ankle examination. *Med Clin North Am*. 2014 Mar;98(2):181-204.

Foot (MS-27)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

Foot (MS-27)

MS.FT.0027.C
v2.0.2025

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
General Foot Pain	Yes	• MRI Foot without contrast (CPT® 73718)	
Complex Fractures	No	• CT Foot without contrast (CPT® 73700)	
Plantar Plate Disorders, Including Turf Toe Injuries	Yes	• MRI Foot without contrast (CPT® 73718)	
Sesamoid Disorders	Yes	• MRI Foot without contrast (CPT® 73718) **OR** • CT Foot without contrast (CPT® 73700)	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Lisfranc Tarsometatarsal Fracture or Dislocation	No	• MRI Foot without contrast (CPT® 73718) **OR** • CT Foot without contrast (CPT® 73700)	
Tarsal Navicular Stress/Occult Fracture	No	• MRI Foot without contrast (CPT® 73718) • CT Foot without contrast (CPT® 73700) for follow-up of healing fractures	See also: **Suspected Occult/ Stress/ In-sufficiency Fracture/ Stress Reaction and Shin Splints (MS-5.2)**

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Avascular Necrosis (AVN) of the Tarsal Navicular (Kohler Disease) or Metatarsal Head (Frieberg's Infraction)	No	• See: **AVN (MS-4.1)**	
Tendonitis	Yes	• MRI Foot without contrast (CPT® 73718) **OR** • US Foot (CPT® 76881 or CPT® 76882)	
Complete Rupture – Tear of a Specific Named Tendon	No	• For preoperative planning: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882)	

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Partial Tendon Rupture	No	• For a suspected partial tendon rupture of a specific named tendon not otherwise specified: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882)	MRI is *NOT* needed for muscle belly strains/muscle tears.
Morton's Neuroma	Yes	• For preoperative planning: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ MRI Foot without and with contrast (CPT® 73720) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882)	
Plantar Fasciitis	Yes*	• For preoperative planning: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882)	*Provider-directed conservative treatment must be for 6 months or more.

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Suspected Plantar Fascia Rupture or Tear	Yes	• MRI Foot without contrast (CPT® 73718) **OR** • US Foot (CPT® 76881 or CPT® 76882)	
Diabetic Foot Infection	No	• For suspected osteomyelitis or soft tissue infection as a complement to plain x-ray (both plain x-ray and advanced imaging are indicated): ◦ MRI Foot without and with contrast (CPT® 73720) **OR** ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ CT Foot without contrast (CPT® 73700) **OR** ◦ CT Foot with contrast (CPT® 73701)[13]	See also: **Infection-General (MS 9.1)**

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition **(Individual's condition)**	**Conservative Treatment** **(Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?)** **(Yes or No)**	**Advanced imaging** **(The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)**	**Comments** **(Additional comments related to the condition.)**
Tarsal Tunnel Syndrome including Baxter's Neuropathy	Yes	• For preoperative planning if mass/lesion is suspected as etiology of entrapment: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882)	
Tarsal Coalition	Yes	• For preoperative planning: ◦ MRI Ankle without contrast (CPT® 73721) **OR** ◦ CT Ankle without contrast (CPT® 73700)	
Sinus Tarsi Syndrome	Yes	• MRI Ankle without contrast (CPT® 73721) if diagnosis is unclear or for preoperative evaluation	
Charcot Foot	Yes	• MRI Foot without contrast (CPT® 73718) **OR** • MRI Foot without and with contrast (CPT® 73720)	
CRPS Type I	Yes	• Triple phase bone scan (CPT® 78315) OR • MRI Foot without contrast (CPT® 73718)	

After an initial plain x-ray has been obtained, and results are available to the provider, the following advanced imaging is indicated (as described in General Guidelines [MS-1.0])			
Condition (Individual's condition)	**Conservative Treatment** (Is failure of 6 weeks of provider-directed conservative treatment within the past 12 weeks with clinical re-evaluation required?) (Yes or No)	**Advanced imaging** (The appropriate advanced imaging indicated for this condition. In some scenarios, advanced imaging may not be indicated.)	**Comments** (Additional comments related to the condition.)
Post-Operative	Yes	• In symptomatic individuals following surgery for conditions including the tendons, ligaments, and plantar plate, ONE of the following: ◦ MRI Foot without contrast (CPT® 73718) **OR** ◦ US Foot (CPT® 76881 or CPT® 76882) • In symptomatic individuals following surgery for complex fractures, sesamoid fractures, and subtalar arthrodesis: ◦ CT Foot without contrast (CPT® 73700)	

One Study/Area Only

In foot and ankle advanced imaging, studies are frequently ordered of both areas. This is unnecessary since ankle MRI will image from above the ankle to the mid- metatarsal area. **Only one CPT® code should be reported.**

Evidence Discussion (MS-27)

v2.0.2025

A diagnosis can be made for most patients with a foot complaint based on a detailed history, physical examination and plain x-rays. Advanced imaging is typically not necessary for the initial evaluation. Multiple articles have shown advanced imaging can often demonstrate abnormalities that have no relevance to the patient's symptoms. Advanced imaging incidental findings can possibly lead to overtreatment with referral to specialists and possibly unnecessary surgery. Ganguli et. al. reported incidental findings on screening and diagnostic tests are common and may trigger cascades of further testing and treatment. Also reported was that such cascades of care come with substantial potential for harm (including patient anxiety and additional treatment risks) in addition to monetary costs and inconvenience.

Plain x-rays are valuable as initial imaging as they can determine the necessity of advanced imaging, what specific advanced imaging study is warranted and if contrast is needed. As x-rays often have a larger field of view than MRI or CT, they have the potential to identify more proximal or distal pathology in an extremity. Initial plain x-rays for the evaluation of foot conditions are also recommended by the American College of Radiology Appropriate Use Criteria. It is also noteworthy that when MRI is necessary, radiographs are considered an essential, initial complementary study for the reading of musculoskeletal MRIs.

Treatment for many foot conditions does not rely on advanced imaging results and most patients will improve within a few weeks or months with conservative care. Plantar fasciitis may take up to 12 months of non-operative treatment, however, MRI imaging is rarely needed for treatment planning. It should be noted though, for some foot conditions (e.g. Lisfranc injuries, suspected tendon tear, diabetic foot infections), conservative care would not be necessary prior to advanced imaging.

In addition to overtreatment and possibly unnecessary surgery due to incidental findings, risks of advanced imaging include but are not limited to radiation exposure, implanted device complications, metallic foreign body complications and contrast complications.

For many foot conditions, initial plain x-rays and an initial course of conservative care can provide a significant clinical benefit that would outweigh the clinical harm from perhaps briefly delaying advanced imaging if needed. A course of conservative care or plain x-ray findings many times may obviate the need for advanced imaging which possess their own set of significant risks.

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924

References (MS-27)

v2.0.2025

1. Griffin LY. *Essentials of Musculoskeletal Care.* 3rd edition. Rosemont, IL: American Academy of Orthopaedic Surgeons; 2005:619-622;667-671;681-684;697-699;700-702.
2. Needell S, Cutler J. Morton neuroma imaging. eMedicine, April 11, 2011
3. Morton's Neuroma. MDGuidelines™.
4. Berquist TH. *Radiology of the Foot and Ankle.* 2nd Ed. Philadelphia, Lippincott, 2000, pp.155-156.
5. Bouche R. Sinus Tarsi Syndrome. What is Sinus Tarsi Syndrome, Testing and Treatment. http://www.aapsm.org/sinus_tarsi_syndrome.html.
6. D Resnick. Internal Derangements of Joints 2006: Imaging-Arthroscopic Correlation. Washington, DC.Oct.31-Nov. 4, 2006.
7. Doty JF, Coughlin MJ. Metatarsophalangeal joint instability of the lesser toes and plantar plate deficiency. *J Am Acad Orthop Surg*. 2014;22(4):235-245. doi:10.5435/JAAOS-22-04-235.
8. Lareau CR, Sawyer GA, Wang JH, et al. Plantar and medial heel pain: diagnosis and management. *J Am Acad Orthop Surg*. 2014;22:372-380. doi:10.5435/JAAOS-22-06-372.
9. Sung, W, Weil L Jr, Weill LS Sr, et al. Diagnosis of plantar plate injury by magnetic resonance imaging with reference to Intraoperative findings. *Journal of Foot Ankle Surgery.* 2012;51(5):570-574. doi:10.1053/j.jfas.2012.05.009.
10. Gorbachova T, Chang EY, Ha AS, et al. ACR Appropriateness Criteria® Acute Trauma to the Foot. Available at https://acsearch.acr.org/docs/70546/Narrative/. American College of Radiology. Revised 2019.
11. Tafur M, Bencardino JT, Roberts CC, et al. ACR Appropriateness Criteria® Chronic Foot Pain. Available at https://acsearch.acr.org/docs/69424/Narrative/. American College of Radiology. Revised 2020.
12. Bencardino JT, Stone TJ, Roberts CC, et. al. Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. *Am Coll Radiol (ACR);* Revised: 2016. https://acsearch.acr.org/docs/69435/Narrative/.
13. Walker EA, Beaman FD, Wessell DE, et al. ACR Appropriateness Criteria® Suspected Osteomyelitis of the Foot in Patients with Diabetes Mellitus. Available at https://acsearch.acr.org/docs/69340/Narrative/. American College of Radiology. Revised 2019.
14. Thomas JL, Christensen JC, Kravitz SR, et al. The Diagnosis and Treatment of Heel Pain: A Clinical Practice Guideline - Revision 2010. *J Foot Ankle Surg*. 2010;49:S1-S19. doi: 10.1053/j.jfas.2010.01.001.
15. Goff JD, Crawford R. Diagnosis and Treatment of Plantar Fasciitis. *Am Fam Physician*. 2011 Sep;84(6):676-682. https://www.aafp.org/afp/2011/0915/p676.html.
16. Baxter D, Pfeffer G. Treatment of chronic heel pain by surgical release of the first branch of the lateral plantar nerve. *Clin Orthop.* 1992;279:229–236.
17. Schepsis A, Leach R, Gorzyca J. Plantar fasciitis: etiology, treatment, surgical results, and review of the literature. *Clin Orthop* 1991;266:185–196.
18. Neufeld SK, Cerato R. Plantar fasciitis: evaluation and treatment. *J Am Acad Orthop Surg.* 2008;16:338-46. doi:10.5435/00124635-200806000-00006.
19. Dodd A, Daniels TR. Charcot Neuroarthropathy of the Foot and Ankle. *J Bone Joint Surg Am.* 2018;100:696-711. doi:10.2106/JBJS.17.00785.
20. Deu RS, Coslick AM, Dreher G. Tendinopathies of the Foot and Ankle. *Am Fam Physician*. 2022 May 1;105(5):479-486.
21. Tocci SL, Madom IA, Bradley MP, Langer PR, DiGiovanni CW. The diagnostic value of MRI in foot and ankle surgery. *Foot Ankle Int*. 2007 Feb;28(2):166-8.
22. Papaliodis DN, Vanushkina MA, Richardson NG, DiPreta JA. The foot and ankle examination. *Med Clin North Am*. 2014 Mar;98(2):181-204.
23. Trojian T, Tucker AK. Plantar Fasciitis. *Am Fam Physician*. 2019 Jun 15;99(12):744-750.
24. Joong MA, El-Khoury GY. Radiologic evaluation of chronic foot pain. *Am Fam Physician*. 2007 Oct 1;76(7):975-83.

25. Pompan DC. Appropriate use of MRI for evaluating common musculoskeletal conditions. *Am Fam Physician*. 2011 Apr 15;83(8):883-4.
26. Aparisi Gómez, M., Aparisi, F., Bartoloni, A. et al. Anatomical variation in the ankle and foot: from incidental finding to inductor of pathology. Part I: ankle and hindfoot. *Insights Imaging.* 10, 74 (2019).
27. Rosenberg ZS, Bencardino J, Mellado JM: Normal variants and pitfalls in magnetic resonance imaging of the ankle and foot. *Top Magn Reson Imaging.* 9:262–272, 1998.
28. Becker BA, Childress MA. Common Foot Problems: Over-the-Counter Treatments and Home Care. *Am Fam Physician*. 2018 Sep 1;98(5):298-303.
29. Taljanovic MS, Hunter TB, Fitzpatrick KA, Krupinski EA, Pope TL. Musculoskeletal magnetic resonance imaging: importance of radiography. *Skeletal Radiol*. 2003 Jul;32(7):403-11.
30. Watson RE, Yu L. Safety Considerations in MRI and CT. *Continuum (Minneap Minn)*. 2023 Feb 1;29(1):27-53.
31. Ganguli I, Simpkin AL, Lupo C, Weissman A, Mainor AJ, Orav EJ, Rosenthal MB, Colla CH, Sequist TD. Cascades of Care After Incidental Findings in a US National Survey of Physicians. *JAMA Netw Open*. 2019 Nov 1;2(11):e1916768. doi: 10.1001/jamanetworkopen.2019.16768]. *JAMA Netw Open*. 2019;2(10):e1913325. Published 2019 Oct 2. doi:10.1001/jamanetworkopen.2019.13325.

This section intentionally left blank (MS-28)

Guideline Page

400 Buckwalter Place Boulevard, Bluffton, SC 29910 (800) 918-8924