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## Clinical Appropriateness Guidelines

# Advanced Imaging

# Appropriate Use Criteria: Imaging of the Extremities

### Proprietary

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## Description and Application of the Guidelines

The Carelon Clinical Appropriateness Guidelines (hereinafter “the Carelon Clinical Appropriateness Guidelines” or the “Guidelines”) are designed to assist providers in making the most appropriate treatment decision for a specific clinical condition for an individual. The Guidelines establish objective and evidence-based criteria for medical necessity determinations, where possible, that can be used in support of the following:

- To establish criteria for when services are medically necessary
- To assist the practitioner as an educational tool
- To encourage standardization of medical practice patterns
- To curtail the performance of inappropriate and/or duplicate services
- To address patient safety concerns
- To enhance the quality of health care
- To promote the most efficient and cost-effective use of services

The Carelon guideline development process complies with applicable accreditation and legal standards, including the requirement that the Guidelines be developed with involvement from appropriate providers with current clinical expertise relevant to the Guidelines under review and be based on the most up-to-date clinical principles and best practices. Resources reviewed include widely used treatment guidelines, randomized controlled trials or prospective cohort studies, and large systematic reviews or meta-analyses. Carelon reviews all of its Guidelines at least annually.

Carelon makes its Guidelines publicly available on its website. Copies of the Guidelines are also available upon oral or written request. Additional details, such as summaries of evidence, a list of the sources of evidence, and an explanation of the rationale that supports the adoption of the Guidelines, are included in each guideline document.

Although the Guidelines are publicly available, Carelon considers the Guidelines to be important, proprietary information of Carelon, which cannot be sold, assigned, leased, licensed, reproduced or distributed without the written consent of Carelon. Use of the Guidelines by any external AI entity without the express written permission of Carelon is prohibited.

Carelon applies objective and evidence-based criteria, and takes individual circumstances and the local delivery system into account when determining the medical appropriateness of health care services. The Carelon Guidelines are just guidelines for the provision of specialty health services. These criteria are designed to guide both providers and reviewers to the most appropriate services based on a patient’s unique circumstances. In all cases, clinical judgment consistent with the standards of good medical practice should be used when applying the Guidelines. Guideline determinations are made based on the information provided at the time of the request. It is expected that medical necessity decisions may change as new information is provided or based on unique aspects of the patient’s condition. The treating clinician has final authority and responsibility for treatment decisions regarding the care of the patient and for justifying and demonstrating the existence of medical necessity for the requested service. The Guidelines are not a substitute for the experience and judgment of a physician or other health care professionals. Any clinician seeking to apply or consult the Guidelines is expected to use independent medical judgment in the context of individual clinical circumstances to determine any patient’s care or treatment.

The Guidelines do not address coverage, benefit or other plan specific issues. Applicable federal and state coverage mandates take precedence over these clinical guidelines, and in the case of reviews for Medicare Advantage Plans, the Guidelines are only applied where there are not fully established CMS criteria. If requested by a health plan, Carelon will review requests based on health plan medical policy/guidelines in lieu of the Carelon Guidelines. Pharmaceuticals, radiotracers, or medical devices used in any of the diagnostic or therapeutic interventions listed in the Guidelines must be FDA approved or conditionally approved for the intended use. However, use of an FDA-approved or conditionally approved product does not constitute medical necessity or guarantee reimbursement by the respective health plan.

The Guidelines may also be used by the health plan or by Carelon for purposes of provider education, or to review the medical necessity of services by any provider who has been notified of the need for medical necessity review, due to billing practices or claims that are not consistent with other providers in terms of frequency or some other manner.

# General Clinical Guideline

## Clinical Appropriateness Framework

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Critical to any finding of clinical appropriateness under the guidelines for a specific diagnostic or therapeutic intervention are the following elements:

- Prior to any intervention, it is essential that the clinician confirm the diagnosis or establish its pretest likelihood based on a complete evaluation of the patient. This includes a history and physical examination and, where applicable, a review of relevant laboratory studies, diagnostic testing, and response to prior therapeutic intervention.
- The anticipated benefit of the recommended intervention is likely to outweigh any potential harms, including from delay or decreased access to services that may result (net benefit).
- Widely used treatment guidelines and/or current clinical literature and/or standards of medical practice should support that the recommended intervention offers the greatest net benefit among competing alternatives.
- There exists a reasonable likelihood that the intervention will change management and/or lead to an improved outcome for the patient.

Providers may be required to submit clinical documentation in support of a request for services. Such documentation must a) accurately reflect the clinical situation at the time of the requested service, and b) sufficiently document the ordering provider's clinical intent.

If these elements are not established with respect to a given request, the determination of appropriateness will most likely require a peer-to-peer conversation to understand the individual and unique facts that would justify a finding of clinical appropriateness. During the peer-to-peer conversation, factors such as patient acuity and setting of service may also be taken into account to the extent permitted by law.

## Simultaneous Ordering of Multiple Diagnostic or Therapeutic Interventions

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Requests for multiple diagnostic or therapeutic interventions at the same time will often require a peer-to-peer conversation to understand the individual circumstances that support the medical necessity of performing all interventions simultaneously. This is based on the fact that appropriateness of additional intervention is often dependent on the outcome of the initial intervention.

Additionally, either of the following may apply:

- Current literature and/or standards of medical practice support that one of the requested diagnostic or therapeutic interventions is more appropriate in the clinical situation presented; or
- One of the diagnostic or therapeutic interventions requested is more likely to improve patient outcomes based on current literature and/or standards of medical practice.

## Repeat Diagnostic Intervention

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In general, repeated testing of the same anatomic location for the same indication should be limited to evaluation following an intervention, or when there is a change in clinical status such that additional testing is required to determine next steps in management. At times, it may be necessary to repeat a test using different techniques or protocols to clarify a finding or result of the original study.

Repeated testing for the same indication using the same or similar technology may be subject to additional review or require peer-to-peer conversation in the following scenarios:

- Repeated diagnostic testing at the same facility due to technical issues
- Repeated diagnostic testing requested at a different facility due to provider preference or quality concerns

- Repeated diagnostic testing of the same anatomic area based on persistent symptoms with no clinical change, treatment, or intervention since the previous study
- Repeated diagnostic testing of the same anatomic area by different providers for the same member over a short period of time

## **Repeat Therapeutic Intervention**

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In general, repeated therapeutic intervention in the same anatomic area is considered appropriate when the prior intervention proved effective or beneficial and the expected duration of relief has lapsed. A repeat intervention requested prior to the expected duration of relief is not appropriate unless it can be confirmed that the prior intervention was never administered. Requests for ongoing services may depend on completion of previously authorized services in situations where a patient's response to authorized services is relevant to a determination of clinical appropriateness.

# Imaging of the Extremities

## General Information/Overview

### Scope

These guidelines address advanced imaging of the extremities in both adult and pediatric populations. For interpretation of the Guidelines, and where not otherwise noted, “adult” refers to persons age 19 and older, and “pediatric” refers to persons age 18 and younger. Where separate indications exist, they are specified as **Adult** or **Pediatric**. Where not specified, indications and prerequisite information apply to persons of all ages.

See the Coding section for a list of modalities included in these guidelines.

### Technology Considerations

**Advanced imaging** is an umbrella term that refers to anatomy-based (structural), physiology-based (functional), and hybrid imaging methods that offer greater spatial and/or contrast resolution relative to conventional imaging methods in radiology such as radiography or ultrasound. Examples of advanced structural imaging include computed tomography (CT) and magnetic resonance imaging (MRI) and some technique variants. Advanced functional imaging includes positron emission tomography (PET) as well as those MRI/CT technique variants that create image contrast based on a physiological parameter (for example, functional magnetic resonance imaging (fMRI)). Hybrid advanced imaging techniques optimize diagnostic accuracy by coupling structural and functional approaches (such as PET-CT or PET-MRI).

In general, conventional radiographs should be obtained prior to advanced imaging. **Computed tomography (CT)** is often the preferred modality for evaluation of displaced fractures and subluxations, whereas stress fractures and some incomplete and non-displaced fractures may be better imaged with **magnetic resonance imaging (MRI)**. Tendons and ligamentous structures are better imaged using MRI. Use of contrast is at the discretion of both the ordering and imaging physicians. Implanted surgical hardware, including joint prostheses, may produce sufficient local artifact to preclude adequate imaging through the region containing hardware.

Disadvantages of CT include exposure to ionizing radiation and risks associated with infusion of iodinated contrast media, including allergic reactions or renal compromise. The presence of implantable devices such as pacemakers or defibrillators, a potential need for sedation in pediatric patients, and claustrophobia are the main limitations of MRI. Infusion of gadolinium may also confer an unacceptable risk in persons with advanced renal disease.

**CT arthrography** and **MR arthrography** are diagnostic tests performed by injecting contrast into the joint space prior to imaging. Injection is generally performed under fluoroscopic or ultrasound guidance. They are often preferable to standard CT or MRI for indications where visualization of the joint space integrity is needed.

### Definitions

**Phases of the care continuum are broadly defined as follows:**

- **Screening** – testing in the absence of signs or symptoms of disease
- **Diagnosis** – testing based on a reasonable suspicion of a particular condition or disorder, usually due to the presence of signs or symptoms
- **Management** – testing to direct therapy of an established condition, which may include preoperative or postoperative imaging, or imaging performed to evaluate the response to nonsurgical intervention
- **Surveillance** – periodic assessment following completion of therapy, or for monitoring known disease that is stable or asymptomatic

**Indeterminate lesion** is a focal mass or mass-like finding identified on prior imaging that has not been confidently diagnosed as either benign or malignant based on imaging appearance and/or biopsy

**Cannot be performed or is nondiagnostic** applies when the test:

- Is positive or indeterminate for clinically significant pathology when the information provided about the abnormality by the test is not sufficient to direct subsequent management
- Is negative when the negative likelihood ratio of the test is both insufficient to confidently exclude the absence of suspected disease and unable to direct subsequent management. This typically applies in scenarios with moderate to high clinical pretest probability with negative testing or low pretest probability with clear evidence for net benefit
- Has been previously nondiagnostic because of a persistent clinical factor (e.g., body habitus, immobility) that is very likely to make retesting nondiagnostic as well
- Cannot be performed due to a medical contraindication (e.g., contrast nephrotoxicity, allergy, or in highly radiation sensitive populations such as pediatrics and pregnancy) or reasonable unavailability related to lack of local expertise or service availability.

**General prerequisites for extremity imaging:**

- **Conservative management**<sup>1</sup> – a combination of strategies to reduce inflammation, alleviate pain, and correct underlying dysfunction, including physical therapy **AND** at least **ONE** complementary conservative treatment strategy.
  - **Physical therapy requirement** includes **ANY** of the following:
    - Physical therapy rendered by a qualified provider of physical therapy services
    - Supervised home treatment program that includes **ALL** of the following:
      - Participation in a patient-specific or tailored program
      - Initial active instruction by physician or allied health provider with redemonstration of patient ability to perform exercises
      - Compliance (documented or by clinician attestation on follow-up evaluation)
    - Exception to the physical therapy requirement in unusual circumstances (for instance, intractable pain so severe that physical therapy is not possible) when clearly documented in the medical record
  - **Complementary conservative treatment requirement** includes **ANY** of the following:
    - Prescription strength anti-inflammatory medications and analgesics<sup>2</sup>
    - Adjunctive medications such as nerve membrane stabilizers or muscle relaxants<sup>2</sup>
    - Intra-articular corticosteroid injection(s)<sup>2</sup>
    - Alternative therapies such as acupuncture, chiropractic manipulation, massage therapy, activity modification, and/or a trial period of rest (e.g. from the aggravating/contributing factors) where applicable
  - **Exception to specified duration of conservative management** may be made in certain circumstances (for example, worsening of symptoms during a course of conservative management) when clearly documented in the medical record, or when the duration period is substantiated by documentation of serial evaluation

<sup>1</sup> Additional condition or procedure specific requirements may apply and can be found in the respective sections of the guideline.

<sup>2</sup> In the absence of contraindications

## Clinical Indications

The following section includes indications for which advanced imaging of the extremities is considered medically necessary, along with prerequisite information and supporting evidence where available. Indications, diagnoses, or imaging modalities not specifically addressed are considered not medically necessary.

**General prerequisites for extremity imaging include conservative management, as defined above.**

Documentation of compliance with a plan of therapy that includes elements of conservative management may be required. Exceptions may be considered on a case-by-case basis.

## Congenital and Developmental Conditions

### Congenital or developmental anomalies of the extremity (Pediatric only)

Advanced imaging is considered medically necessary for diagnosis and management when radiographs are nondiagnostic or not sufficient to guide treatment.

#### IMAGING STUDY

- For acetabular dysplasia or developmental dysplasia of the hip (DDH), initial evaluation with hip ultrasound is required in infants with a corrected age of 4 months or less
- CT upper extremity; CT lower extremity
- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)

### Tarsal coalition

Advanced imaging is considered medically necessary for diagnosis and management when radiographs are nondiagnostic or not sufficient to guide treatment.

#### IMAGING STUDY

- CT lower extremity
- MRI lower extremity (joint or non-joint)

#### Rationale

Tarsal coalition refers to fusion—osseous, cartilaginous or fibrous—of the tarsal bones, typically talocalcaneal or calcaneonavicular (90%)<sup>1</sup> and is an important cause of foot pain, especially in adolescents; it is responsible for foot pain in up to 13% of cases.<sup>1</sup> Radiographs are commonly the initial diagnostic imaging study<sup>2,3</sup> and have reasonable sensitivity (~80%) and high specificity (~97%)<sup>1,2</sup> for establishing the diagnosis of bony disease. Radiographs are also useful to exclude other causes of foot pain which can mimic the presentation of tarsal coalition, especially acutely. When radiographs are nondiagnostic or not sufficient to guide treatment, CT or MRI can be used to further delineate the extent of disease and to identify occult disease or associated abnormalities.<sup>1</sup>

## Infection

### Soft tissue infection

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Localization of known or suspected abscess, to direct surgical treatment
- Known or suspected fasciitis
- Other soft tissue infection not responsive to treatment

#### IMAGING STUDY

- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)
- CT upper or lower extremity as an alternative to MRI for known or suspected abscess
- CT upper or lower extremity when MRI cannot be performed for indications other than abscess

## Osteomyelitis

Advanced imaging is considered medically necessary for **EITHER** of the following scenarios:

- Suspected osteomyelitis, when radiographs are nondiagnostic
- Clinical suspicion for treatment failure or disease progression

### IMAGING STUDY

- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint) (preferred)
- CT upper or lower extremity when MRI cannot be performed
- FDG-PET for chronic osteomyelitis when MRI is nondiagnostic

### Rationale

Though radiographs often do not show abnormalities associated with osteomyelitis in the first two weeks of the infection, they can detect other pathologies that may contribute to the patient's symptoms. The information provided by radiographs generally complements that provided by other modalities, so radiographs should be performed even when other imaging is planned.

Radiographs are the appropriate initial imaging study in osteomyelitis because they can demonstrate findings suggestive of the diagnosis, but can also exclude or provide information to suggest other diagnoses. Abnormal radiographs are helpful, but the diagnosis cannot be excluded on the basis of negative radiographs. The sensitivity and specificity of CT are not well established, but the sensitivity is known to be lower than that of MRI. For this reason, the utility of CT is limited to specific situations. For example, CT can be used to detect bony sequestra, and has an important role in determining operative therapy.<sup>4</sup>

Overall, CT has a limited role in the diagnosis of osteomyelitis, and should be used only when imaging is being done to assess the extent of bone destruction, to direct a biopsy, or when MRI is contraindicated. For early detection of osteomyelitis, MRI is superior to other imaging modalities. The sensitivity and specificity for MRI are 78%-90% and 60%-90%, respectively. This compares to sensitivity and specificity of 67% and 50% for CT, and 14%-54% and 68%-70% for radiography.<sup>5</sup>

The American College of Radiology Appropriateness Criteria rate radiographs as "usually appropriate" for initial evaluation of suspected osteomyelitis. CT, MRI, and ultrasound are all rated as "usually not appropriate" regardless of whether the studies are performed with IV contrast. For evaluation of suspected osteomyelitis following radiographs, MRI without and with IV contrast is preferred, with a comment that radiographs and MRI are both indicated and complementary. MRI without contrast is generally appropriate if contrast is contraindicated, and CT with IV contrast is generally appropriate if MRI is contraindicated.<sup>4</sup>

## Septic arthritis

Advanced imaging is considered medically necessary when radiograph, ultrasound, or arthrocentesis is nondiagnostic or not sufficient to guide treatment.

### IMAGING STUDY

- MRI upper or lower extremity (joint) – preferred
- CT upper or lower extremity when MRI cannot be performed

### Rationale

The diagnosis of septic arthritis is established by joint aspiration and culture of the synovial fluid. Initial evaluation for septic joint should include radiography (to outline anatomic detail, evaluate for radiodense foreign bodies or soft-tissue gas, and exclude alternate diagnoses such as fracture, degenerative changes, or tumor).<sup>4,6</sup> Additional imaging with CT or MRI may be utilized for further evaluation in children, high-risk adults, and for preoperative planning for confirmed septic arthritis. In children, MRI may also be useful to evaluate for associated osteomyelitis or cartilage involvement. The American College of Radiology recommends MRI to further clarify and stage conditions diagnosed clinically and/or suggested by other imaging

modalities, including, but not limited to, the following: inflammatory, infectious, neuropathic, degenerative, crystal-induced, or post-traumatic arthritis.<sup>7</sup> Compared to other advanced imaging modalities, MRI is generally preferred for septic arthritis for its ability to assess soft tissue infection, osteomyelitis, and abscess.<sup>4,6</sup> MRI is highly sensitive for the diagnosis of septic arthritis, although it still lacks specificity as it cannot reliably distinguish inflamed from infected joints.<sup>8</sup> CT may be utilized when MRI is contraindicated.

## Inflammatory Conditions

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### Capitellar osteochondritis

Advanced imaging is considered medically necessary following nondiagnostic radiographs.

#### IMAGING STUDY

- MRI upper extremity (joint)
- CT upper extremity when MRI cannot be performed

### Juvenile idiopathic arthritis (Pediatric only)

*Also see Spine Imaging guidelines*

Advanced imaging of the extremity is considered medically necessary for management of established juvenile idiopathic arthritis when radiographs are insufficient to determine appropriate course of therapy, particularly intra-articular therapy.

#### IMAGING STUDY

- MRI upper extremity (joint); MRI lower extremity (joint)
- CT upper or lower extremity when MRI cannot be performed or is nondiagnostic

#### Rationale

Juvenile idiopathic arthritis (JIA), the most common rheumatic disease of children and adolescents, is an umbrella term that encompasses all forms of arthritis that begin before age 16, persist for more than 6 weeks, and are of unknown etiology. Examples of JIA include oligoarthritis, polyarthritis, systemic arthritis, psoriatic arthritis, and enthesitis-related arthritis. JIA is the most common childhood rheumatic entity with a prevalence of 0.6 to 1.9 in 1000 children.<sup>9</sup>

JIA is primarily a clinical diagnosis. General practitioners should base diagnosis of JIA (and differential diagnosis) primarily on history and clinical examination.

When there is clinical diagnostic doubt, conventional radiographs (CR), ultrasound, or MRI can be used to improve the certainty of a diagnosis of JIA above clinical features alone.<sup>10</sup> MRI is the most sensitive noninvasive imaging modality to evaluate for inflammation of the joints, tendons, and entheses, and is the only modality that can depict bone marrow edema. Currently, MRI with contrast is the most sensitive tool for determining active synovitis.<sup>9</sup>

When the imaging modalities were directly compared, MRI and ultrasound detected more joint damage than CR, but primarily at the hip (MRI vs CR detection rate, mean [range] 1.54-fold [1.08–2.0-fold]; ultrasound vs CR detection rate, mean 2.29-fold), and at the wrist (MRI vs CR detection rate, 1.36-fold [1.0–2.0-fold]).<sup>10</sup>

Imaging studies help identify children with a high likelihood of early erosive joint damage, providing an opportunity to implement aggressive therapy at an early stage in an attempt to reduce morbidity.<sup>9</sup>

### Myositis

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Clinically suspected myositis, for imaging confirmation or localization for biopsy
- Monitoring response to therapy

#### IMAGING STUDY

- MRI upper extremity (non-joint); MRI lower extremity (non-joint)
- CT upper or lower extremity when MRI cannot be performed

*Note: Bilateral imaging may be appropriate to assess optimal site for biopsy when symptoms are generalized (not localized to one site).*

## Plantar fasciitis and fibromatosis

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation for plantar fasciitis following a failure of at least 6 months of treatment, including at least two of the following: mechanical de-weighting, foot orthosis, night splints, taping, or manual therapy
- Evaluation for plantar fibromatosis when ultrasound cannot be performed or is nondiagnostic and following a failure of at least 3 months of conservative management including corticosteroid injections

### IMAGING STUDY

- MRI lower extremity (joint or non-joint)
- CT lower extremity when MRI cannot be performed

## Trauma and Fracture

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### Acute traumatic injuries –not otherwise specified

*This indication applies to traumatic injuries not addressed elsewhere in the Extremity Imaging guidelines. See pain indications or specific ligament/tendon indications for subacute or chronic injuries.*

Advanced imaging is considered medically necessary when radiographs are nondiagnostic or not sufficient to establish a diagnosis and direct management.

### IMAGING STUDY

- CT upper extremity; CT lower extremity
- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)

### Rationale

Radiography is the standard modality used to screen for osseous injuries in the setting of trauma. Trauma guidelines state that CT is not indicated for routine evaluation of common extremity fractures, but may be valuable in pre-operative planning, including for intra-articular and other complicated fractures. Further, while MRI is valuable in assessment of some bone, bone marrow, cartilage, and soft tissue injuries, it is rarely indicated in the acute setting.<sup>11</sup>

### Fracture

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Detection of occult fracture following nondiagnostic radiographs at high-risk/weight bearing sites:
  - Upper extremity:
    - Scaphoid
    - Lunate
  - Lower extremity:
    - Femoral neck, proximal femur
    - Tibia (anterior tibial cortex; tibial plateau; medial malleolus)
    - Patella

- Talus
  - Navicular
  - Metatarsal base (second and fifth digits)
  - Great toe sesamoid
  - Calcaneus (in individuals when imaging will direct the timing of return to vigorous athletic activity)
- Following radiographs demonstrating or suggesting a supracondylar, intra-articular, or Salter-Harris (growth plate) fractures (including tibial plateau fracture)
  - To assess fracture healing for delayed union or nonunion when radiographs are nondiagnostic

### IMAGING STUDY

- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)
- CT upper or lower extremity for supracondylar, intra-articular, or Salter-Harris fractures
- CT upper or lower extremity for detection of occult fracture when MRI cannot be performed
- CT upper extremity for delayed union or nonunion of the scaphoid as an alternative to MRI

### Rationale

Though MRI is often more sensitive than radiography in detecting occult fractures, radiography remains the initial study of choice for clinically suspected fractures with good specificity (greater than 88%) but limited sensitivity (less than 56%).<sup>12</sup> CT is often the preferred modality for evaluation of displaced fractures and subluxations, whereas stress fractures and some incomplete and non-displaced fractures may be better imaged with MRI.

While many types of stress fractures are diagnosed clinically and managed conservatively,<sup>13</sup> high-risk fracture sites are susceptible to nonunion. Early diagnosis is important, as these fractures may require prolonged immobilization or surgical intervention.<sup>13</sup> There is consensus among multiple high-quality evidence-based guidelines that advanced imaging (most commonly MRI) is indicated in patients with suspected stress or fragility fracture when initial and/or follow-up radiography is negative. MRI has a high diagnostic yield in this patient population—especially for elderly patients—and establishing the diagnosis frequently changes management.

### CHOICE OF IMAGING STUDY

MRI is the advanced imaging modality of choice for diagnosis of presumed hip fracture not apparent on initial radiographs.<sup>14</sup> For suspected hip fracture, MR imaging is the imaging study of choice when there is doubt regarding the diagnosis. If MR is not available or not feasible, CT can be considered.<sup>15</sup>

A 2016 systematic review of imaging modalities in lower extremity stress fractures found greater sensitivity for MRI (68%-99%) than CT (32%-38%) and comparable but wide-ranging specificities (4%-97% for MRI, 88%-98% for CT). In assessing the data, the authors conclude that “MRI was identified as the most sensitive and specific imaging test for diagnosing stress fractures of the lower extremity.”<sup>12</sup>

## Tumor/Neoplasm

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See *Oncologic Imaging guidelines for management of an established malignancy*.

### Brachial plexus mass

Advanced imaging is considered medically necessary to further characterize a brachial plexus mass identified on clinical exam or prior imaging, or when suspected by electromyography.

### IMAGING STUDY

- MRI upper extremity (non-joint)
- CT upper extremity when MRI cannot be performed or is nondiagnostic

## Indeterminate bone lesion

Advanced imaging is considered medically necessary for further characterization following nondiagnostic radiographs.

### IMAGING STUDY

- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint) (preferred)
- CT upper extremity; CT lower extremity

## Morton's neuroma

Advanced imaging is considered medically necessary for presurgical planning when ultrasound cannot be performed or is nondiagnostic, and failure of at least 6 weeks of conservative management, including a focused steroid injection and use of foot orthoses.

### IMAGING STUDY

- MRI lower extremity (joint or non-joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

## Pigmented villonodular synovitis

Advanced imaging is considered medically necessary when the results of imaging are essential to establish a diagnosis or direct management.

### IMAGING STUDY

- MRI upper extremity (joint); MRI lower extremity (joint)
- CT upper or lower extremity when MRI cannot be performed or is nondiagnostic

### Rationale

Pigmented villonodular synovitis exists in both diffuse and localized forms. Radiographic findings are nonspecific, and radiographs may be normal in up to approximately 20% of cases. In localized disease, a soft tissue mass may be evident. In diffuse disease, there may be a joint effusion as well as erosive changes. Radiographic changes including osteopenia, joint space narrowing, and degenerative changes may less commonly be present. CT arthrography and MR arthrography reveal synovial thickening with nodular projections into the joint.<sup>16</sup>

The extent of disease is better demonstrated with MR arthrography than with CT arthrography. However, CT is ideal for demonstrating bony erosion and subchondral cystic change. The CT appearance of pigmented villonodular synovitis is less well described than its appearance on MR arthrography. Because the clinical and radiographic findings, particularly in diffuse disease, are nonspecific, MR is typically the study chosen as a follow-up to radiography.<sup>16</sup>

## Soft tissue mass – not otherwise specified

Advanced imaging is considered medically necessary in **ANY** of the following scenarios:

- Superficial or palpable non-popliteal mass, following nondiagnostic radiograph or ultrasound
- Superficial or palpable popliteal (posterior knee) mass, following nondiagnostic radiographs and ultrasound
- Soft tissue evaluation when prominent or unexplained calcifications are seen on radiograph

### IMAGING STUDY

- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)
- CT upper or lower extremity when MRI cannot be performed or is nondiagnostic

## Rationale

According to the American College of Radiology Appropriateness Criteria, “Initial imaging assessment of a suspected musculoskeletal soft tissue mass should almost invariably begin with radiographic evaluation and is advocated by ESMO-EURACAN. Radiographs remain the modality best suited for the initial assessment of a suspected soft tissue mass and are the initial study of choice for orthopedic oncologists.”<sup>17</sup> Plain radiography provides useful information about the relationship between the mass and the joint, any regional bone or joint abnormalities, and may define characteristic patterns of ossification or calcification within the mass or demonstrate internal fat. Ultrasound also provides useful information and can fully characterize superficial lesions such as lipomas, sebaceous or Baker’s cysts.

The initial evaluation for suspected popliteal (Baker’s) cyst should include an ultrasound and plain radiographs. Plain radiography provides limited information about the popliteal cyst, but may provide additional information on joint and bone abnormalities such as loose bodies in the cyst or the general findings of osteoarthritis and inflammatory arthritis. Ultrasound, however, is preferred and considered invaluable for evaluation of a Baker’s cyst as it is readily available, noninvasive, involves no exposure to radiation, and allows assessment of the cyst including size, extent, and relation to surrounding tissue. In the clinical scenario where plain radiograph and ultrasound are nondiagnostic for a Baker’s cyst, an MRI may be useful. As ultrasound is not sensitive for intra-articular lesions, an MRI can confirm the cystic, unilocular nature of a benign popliteal cyst, evaluate its relationship to anatomic structures in the joint and surrounding tissue, and delineate associated intra-articular pathologies.<sup>18</sup>

Among patients presenting for primary care evaluation of a soft tissue mass, a benign cause is found in 95% of cases.<sup>19</sup> Radiographic findings are often nonspecific. However, there are some radiographic findings that are characteristic of certain masses. Examples include phleboliths, which are suggestive of hemangiomas, as well as trabecular bone adjacent to a soft tissue mass, which—when combined with a history of trauma—suggests myositis ossificans. The radiographic findings may help direct next steps in evaluation of the mass, such as a clinical situation where the most appropriate next study is CT. For most soft tissue masses, MRI is the more appropriate follow-up study.<sup>17</sup> “CT has become a useful technique for the evaluation of patients who cannot undergo MRI and is the modality of choice in this scenario.”<sup>17</sup>

## Conditions of the Upper Extremity

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### Adhesive capsulitis (Adult only)

Advanced imaging is considered medically necessary when **BOTH** of the following criteria are met:

- Nondiagnostic radiographs
- Manipulation under anesthesia or arthroscopic lysis of adhesions is planned

#### IMAGING STUDY

- MRI upper extremity (joint)
- CT upper extremity

#### Rationale

There is no agreement on the imaging features of adhesive capsulitis. A single high-quality evidence-based guideline suggests that imaging is not initially indicated but that MRI may be considered prior to manipulation.<sup>20</sup>

### Biceps or triceps tendon rupture

Advanced imaging is considered medically necessary for clinically suspected biceps/triceps tendon rupture, to establish a diagnosis or direct management.

#### IMAGING STUDY

- MRI upper extremity (joint)

### Brachial plexopathy

Advanced imaging is considered medically necessary for diagnosis and management.

**IMAGING STUDY**

- MRI upper extremity (non-joint)
- CT upper extremity when MRI cannot be performed

**Entrapment neuropathy (excluding carpal and cubital tunnel)**

Advanced imaging is considered medically necessary when **BOTH** of the following criteria are met:

- The diagnosis is confirmed by electromyography
- Failure of conservative management, unless objective weakness on exam

**IMAGING STUDY**

- MRI upper extremity (joint)
- CT upper extremity when MRI cannot be performed or is nondiagnostic

**Labral tear – shoulder**

Advanced imaging is considered medically necessary for suspected labral tear in **ANY** of the following scenarios:

- History of shoulder dislocation or recurrent subluxation, with persistent pain and/or instability
- Acute trauma with either evidence of suprascapular nerve entrapment or radiographic suspicion of a bony Bankart lesion (anteroinferior glenoid fracture)
- Pain with at least one physical exam finding of SLAP tear, nondiagnostic radiograph and failure of at least 6 weeks of conservative management

**IMAGING STUDY**

- MRI upper extremity (joint)
- CT upper extremity when MRI cannot be performed or is nondiagnostic

**Rationale**

Most literature suggests that radiographs should be the initial imaging study in patients with shoulder pain; radiographs can evaluate for concurrent bony or calcific pathology which may explain symptomatology, and may obviate additional imaging or be complementary to subsequent imaging studies.<sup>21</sup> In general, MR arthrogram is more accurate than MRI in diagnosing and excluding labral tears. CT and MR arthrogram have comparable diagnostic accuracy in evaluation of superior labral anterior to posterior (SLAP) tears, Bankart lesions, and humeral head/Hill-Sachs fractures. CT arthrogram may have slightly better diagnostic accuracy for glenoid rim fractures and anterior labral periosteal sleeve avulsion fractures. In the absence of intra-articular contrast, CT should only be performed for this indication when there is a contraindication to MRI.

In a meta-analysis comparing MR arthrogram (N = 2013) to MRI (N=1498) in patients with suspected SLAP tears, MR arthrogram was superior to MRI in the detection of SLAP lesions. MR arthrogram had higher sensitivity (87% vs 76%), specificity (92% vs 87%), positive likelihood ratio (10.28 vs 5.89), and negative likelihood ratio (0.14 vs 0.28) than MRI.<sup>22</sup>

In nontraumatic cases, there is agreement that imaging is not initially indicated prior to 4 weeks of conservative care. Clinical tests such as O'Brien, Neer, and Yergason tests are used to diagnose labral lesions. Since most SLAP tears are associated with other pathology, the provider should identify other shoulder conditions, if any, and follow appropriate surgical indications. Indications for surgical treatment of SLAP tears are not standardized and remain somewhat controversial. Expert opinion, including the American Academy of Orthopedic Surgeons, recommends initial conservative care for SLAP tears. In general, conservative management should last a minimum of 6 to 12 weeks. Early surgery should be considered only when there is evidence of symptomatic suprascapular nerve compression.<sup>23</sup>

**Ligament and tendon injuries – wrist**

Advanced imaging is considered medically necessary following nondiagnostic radiographs in **ANY** of the following scenarios:

- Suspected scapholunate ligament tear
- Suspected triangular fibrocartilage complex (TFCC) tear with instability on exam
- Suspected TFCC tear without instability, following failure of at least 6 weeks conservative management

### IMAGING STUDY

- MRI upper extremity (joint)
- CT when MRI cannot be performed or is nondiagnostic

### Rationale

In comparing CT arthrography and MRI (without arthrography), dorsal segment tears were only detected with CT arthrography. For palmar tears, the sensitivity and specificity of CT arthrography were 100% and 77%, respectively, compared to 60% sensitivity and 77% specificity for MRI. For central segment tears, the sensitivity and specificity of CT arthrography were 86% and 50%, respectively, compared to 79% sensitivity and 25% specificity for MRI. In addition, inter-observer agreement was better for CT arthrography ( $k = 0.37-0.78$ ) compared to MRI ( $k = -0.33-0.10$ ).<sup>24</sup>

MRI is preferable to CT for evaluation of internal derangements of the joints and related tendinous, ligamentous, and cartilaginous structures. However, both MR arthrography and CT arthrography are appropriate. In the absence of arthrography, CT should only be used for this indication when there is a contraindication to MRI.

### Rotator cuff tear

Advanced imaging is considered medically necessary for diagnosis of new or recurrent tear when **ALL** of the following apply:

- Radiographs or ultrasound are nondiagnostic
- At least one positive sign to support the diagnosis of rotator cuff tear has been demonstrated
- **EITHER** of the following:
  - At least one positive sign of a complete rotator cuff tear
  - Failure of at least 6 weeks of conservative management

### IMAGING STUDY

- MRI upper extremity (joint)
- CT upper extremity when MRI cannot be performed or is nondiagnostic

### Rationale

Rotator cuff tears usually occur as a result of trauma, and are rare in the young (age < 35 years) but common in older people, in whom the trauma may be minimal, and tears may be asymptomatic. Radiography is a useful initial screening modality for acute shoulder pain of all causes<sup>25</sup> and is recommended as the initial imaging modality by multiple high-quality evidence-based and practice based guidelines.<sup>20,26</sup>

There is consensus among multiple high-quality evidence-based guidelines that imaging is generally not indicated for suspected atraumatic rotator cuff tear unless the patient has failed a 4 to 6 week course of conservative care or has red flags/high risk features. Imaging is not indicated in patients with full or limited movement and nontraumatic shoulder pain of less than 4 weeks duration.<sup>20</sup> MRI or ultrasound may be considered when shoulder pain is refractory to 4 to 6 weeks of an appropriate shoulder rehabilitation program and the diagnosis has not been identified through clinical exam.<sup>26</sup> In the absence of red flag symptoms, X-rays and imaging are not indicated in the first 4 to 5 weeks for an injured worker presenting with suspected rotator cuff syndrome.<sup>27</sup>

High-risk features, for which early intervention confers a better prognosis, include infection, neoplasm, high-impact trauma, and specific clinical features suggestive of a full-thickness rotator cuff tear.<sup>23,28</sup>

According to Handoll et al., imaging is not indicated for shoulder pain in the primary care setting unless there is a suspicion of serious pathology. Imaging and surgical intervention should only be considered after conservative treatment has failed.<sup>29</sup>

## Ulnar collateral ligament tear (elbow or thumb)

*Ulnar collateral ligament tear at the thumb is also known as gamekeeper's thumb.*

Advanced imaging is considered medically necessary for diagnosis and management

### IMAGING STUDY

- MRI upper extremity (joint)
- MRI upper extremity (non-joint)

## Conditions of the Lower Extremity

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### Labral tear and femoral acetabular impingement – hip

Advanced imaging is considered medically necessary for suspected labral tear with **ALL** of the following:

- Hip pain, **OR** positive impingement on exam
- Radiographs are nondiagnostic (without severe osteoarthritis) or normal
- Failure of at least 6 weeks of conservative management

### IMAGING STUDY

- MRI lower extremity (joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

### Rationale

Consensus among high-quality evidence-based guidelines is that imaging may be indicated when radiographs are negative or equivocal. Recommendations about choice of imaging study are inconsistent.

- MR arthrography or CT arthrography is appropriate in patients with chronic hip pain when a labral tear is suspected and radiographs are negative, equivocal, or nondiagnostic.<sup>30</sup>
- MRI is useful in detecting musculotendinous pathology such as iliopsoas tendinopathy. Although MRI is not used widely to detect intra-articular injury, some investigators report high accuracy (89%-95%) in detecting labral tears. Currently, the most common imaging procedure used to confirm the diagnosis of intra-articular pathology, such as labral tears or chondral lesions, is MR arthrography.<sup>31</sup>
- A systematic review of 29 studies (13 MRI [10 @ 1.5T], 16 MR arthrography [13 @ 1.5T]) assessing the diagnostic accuracy of MRI or MR arthrography for labral tear in 872 patients found that both conventional MRI and MR arthrography provide acceptable ability in detecting acetabular labral tears in adults. The sensitivity of MR arthrography was greater than conventional MRI in detecting an acetabular labral tear when one was present, but conventional MRI had a higher specificity than MR arthrography in detecting a negative result when no labral tear was evident. The authors conclude that "both MRI and MR arthrography may be useful adjuncts in the diagnosis of acetabular labral tears in adults, but MR arthrography appears to be superior to conventional MRI based on the current evidence."<sup>32</sup>

### Legg-Calve-Perthes disease (Pediatric only)

*Refers to osteonecrosis of bony epiphysis in femoral heads, usually in patients age 4 to 10*

Advanced imaging is considered medically necessary for diagnosis and management when radiographs are nondiagnostic.

### IMAGING STUDY

- MRI lower extremity (joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

## Ligament tear – knee

Advanced imaging is considered medically necessary following nondiagnostic radiographs (without severe osteoarthritis) in **ANY** of the following scenarios :

- Failure of at least 4 weeks of conservative management
- Preoperative evaluation when **ANY** of the following physical examination tests are positive:
  - Anterior or posterior drawer sign
  - Lachman
  - Medial or lateral stress
  - Pivot shift test
- Following a ligament repair, when there are new symptoms

### IMAGING STUDY

- MRI lower extremity (joint)
- CT lower extremity when MRI cannot be performed

## Ligament and tendon injury and rupture – foot and ankle

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Suspected full-thickness ligament or tendon rupture
- Radiographs or ultrasound are nondiagnostic, and patient has completed a period of protected weight-bearing, immobilization or strapping, of at least 4 weeks duration

### IMAGING STUDY

- MRI lower extremity (joint or non-joint)

## Lisfranc injury

Advanced imaging is considered medically necessary following nondiagnostic radiographs when the results of imaging are essential to establish a diagnosis or direct management.

### IMAGING STUDY

- MRI lower extremity (joint or non-joint)
- CT lower extremity

## Meniscal tear/injury

Advanced imaging is considered medically necessary following nondiagnostic radiographs (without severe osteoarthritis) in **ANY** of the following scenarios:

- Symptoms of locking, catching, or instability **AND** at least **ONE** physical exam finding of meniscal tear:
  - Joint swelling or effusion
  - Positive McMurray or Apley test
  - Joint line tenderness
  - Reduced range of motion
- Knee pain with failure of at least 6 weeks of conservative management
- Following meniscal repair, when there are new symptoms

## IMAGING STUDY

- MRI lower extremity (joint)
- CT lower extremity when MRI cannot be performed

### Rationale

Radiographs are usually the initial imaging modality for both acute knee injury as well as for chronic knee pain, as presence of bony pathology may alter management (for example, detection of severe osteoarthritis may preclude meniscal repair). In patients with negative or nondiagnostic radiographs and findings suggestive of internal derangement, an MRI is the most appropriate imaging study.<sup>33</sup> Strong evidence suggests that MRI can provide confirmation of injury and assist in identifying concomitant knee pathology such as other ligament, meniscal, or articular cartilage injury.<sup>34</sup> MRI is considered the gold standard for detection of internal derangement of the knee, with multiple meta-analyses demonstrating high sensitivity and specificity for both medial and lateral meniscal injuries [REF 51, 52].

The use of CT for evaluation of internal knee pathology has been looked at prospectively in 2 separate trials. Heffernan et al. found that multidetector CT imaging had very high sensitivity and specificity for anterior cruciate ligament (ACL) tears (87.5%-100%, with a specificity of 100%); however, CT had low sensitivity for other soft tissue injuries of the knee.<sup>35</sup> In a second prospective study, the overall accuracy rates for diagnosing a meniscal tear were 82%-88% with MR arthrography and 74%-76% with CT arthrography. The authors concluded that CT arthrography was moderately accurate in the diagnosis of meniscal tears and can be used as an alternative procedure when MR arthrography cannot be completed.<sup>36</sup> An older retrospective study confirmed that multidetector CT can detect an intact ACL and posterior cruciate ligament with good specificity, accuracy, and negative predictive value, but assessment of torn ligaments is unreliable.<sup>37</sup> In general, spiral CT arthrography is an alternative for assessing internal derangements of the knee when MRI is unavailable or contraindicated.<sup>38</sup>

## Slipped capital femoral epiphysis (Pediatric only)

*Note: Atraumatic fracture through the physeal plate is typically seen in overweight teenagers*

Advanced imaging is considered medically necessary for diagnosis following nondiagnostic radiographs.

### IMAGING STUDY

- MRI lower extremity (joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

## Tarsal tunnel

Advanced imaging is considered medically necessary when **BOTH** of the following requirements are met:

- Following confirmation by electromyography and nerve conduction study
- Failure of at least 4 weeks of conservative management

### IMAGING STUDY

- MRI lower extremity (joint or non-joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

## Miscellaneous Conditions

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### Avascular necrosis

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Diagnosis following nondiagnostic radiographs
- Management of established avascular necrosis

### IMAGING STUDY

- MRI upper extremity (joint); MRI lower extremity (joint or non-joint)
- CT upper or lower extremity when MRI cannot be performed or is nondiagnostic

### Rationale

Avascular necrosis or osteonecrosis is a form of ischemic bone necrosis due to vascular insufficiency. In 60%-75% of cases, avascular necrosis is associated with sickle cell disease, steroid use, alcoholism, chemoradiation, or metabolic bone disease.<sup>38</sup> Accurate grading is important for treatment as more advanced stages tend to require surgical intervention whereas medical treatments are favored in earlier stages. When initial radiographs demonstrate avascular necrosis and additional information is needed to guide treatment, MRI without IV contrast is usually appropriate.<sup>33</sup> Consensus among high-quality evidence-based guidelines also suggests that additional MRI imaging for avascular necrosis is also indicated in high-risk patients when radiographs are normal or inconclusive. Bone scan or CT may be substituted when MRI is not available.<sup>38</sup>

Few studies have directly compared the accuracy of MRI and CT in the diagnosis of avascular necrosis, and most of these studies focus on the hip. Those findings are likely applicable to other joints as the disease process is similar. While consensus favors MRI, and MRI has the added benefit of not using ionizing radiation, CT may be more sensitive in detecting subchondral fractures than MRI (MRI had a relative sensitivity of 38% compared to CT for subchondral fracture detection).<sup>39</sup>

## Hemarthrosis

Advanced imaging is considered medically necessary following arthrocentesis (except where contraindicated) when imaging is required to guide management.

### IMAGING STUDY

- CT upper extremity; CT lower extremity
- MRI upper extremity (joint); MRI lower extremity (joint)

### Rationale

Both CT and MRI may be useful in the evaluation of hemarthrosis. In the setting of trauma, CT may be useful to detect an underlying fracture. Both of these modalities can be useful in evaluating the extent of hemophilic pseudotumor. To evaluate changes of hemophilic arthropathy in early stages of the disease, when treatment may be most beneficial, MRI is preferable.<sup>40</sup>

## Intra-articular loose body

Advanced imaging is considered medically necessary for diagnosis in patients with mechanical symptoms **AND** when radiographs are nondiagnostic.

### IMAGING STUDY

- CT upper extremity; CT lower extremity
- MRI upper extremity (joint); MRI lower extremity (joint)

### Rationale

Both CT arthrography and MRI showed excellent sensitivity (92%-100%) but lower specificity (15%-77%) for detecting posteriorly located loose bodies in the elbow. Neither MRI nor CT arthrography showed adequate sensitivity (46%-91%) or specificity (13%-73%) for evaluating anterior loose bodies. Overall, the sensitivity (80%-100%) and specificity (20%-70%) of MRI and CT arthrography were similar to those of radiography, which had a sensitivity of 84% and specificity of 71%.<sup>41</sup>

In both primary and secondary synovial chondromatosis, radiographs reveal multiple intraarticular calcifications. They tend to be more numerous and more uniform in size, shape, and distribution in primary synovial chondromatosis. CT is the optimal modality to characterize these loose bodies. The appearance of the loose bodies is more variable on MRI, with differences depending on the degree of calcification. However, MRI delineates the extent of disease well.<sup>42</sup>

## Neuropathic osteoarthropathy (Charcot joint) (Adult only)

Advanced imaging is considered medically necessary for diagnosis and management following nondiagnostic radiographs.

**IMAGING STUDY**

- CT upper extremity; CT lower extremity
- MRI upper extremity (joint); MRI lower extremity (joint or non-joint)

**Rationale**

The early radiographic findings are similar to those of osteoarthritis. In more advanced disease, additional changes include subluxation, subchondral bone loss or fragmentation, sclerosis, osteophytosis, and intraarticular bone fragments.

The decision to perform CT or MRI is dependent upon the specific clinical concerns. For evaluation of subluxation and cortical or subcortical bone, CT may be preferable. If there is concern for underlying infection, MRI may be preferred.

**Osteochondral lesion (including osteochondritis dissecans, transient dislocation of patella)**

Advanced imaging is considered medically necessary following nondiagnostic radiographs.

**IMAGING STUDY**

- MRI upper extremity (joint); MRI lower extremity (joint)
- CT upper or lower extremity when MRI cannot be performed or is nondiagnostic

**Rationale**

MR arthrography is reportedly more accurate than standard MRI, both for the detection of loose bodies and for determining the stability of osteochondral lesions. When direct arthrography is done, a lesion is considered to be unstable if there is insinuation of contrast between the lesion and its parent bone.<sup>43</sup>

**Paget disease**

Advanced imaging is considered medically necessary to evaluate for malignant transformation of Pagetoid lesions

**IMAGING STUDY**

- CT upper extremity; CT lower extremity
- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)

**Rationale**

Paget disease of bone is a metabolic bone disease characterized by non-inflammatory osteoclastic activity followed by osteoblastic activity.<sup>44</sup> The disease can be mono- or polyostotic. CT or MRI may be indicated when malignant transformation of a Pagetoid lesion is suspected based on suspicious imaging or clinical findings.

**Pain, unspecified**

*Applies to conditions not otherwise referenced in the Extremity guidelines*

**Non-specific hip pain, including limping child (Pediatric only)**

Advanced imaging is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of a limp in patients under 5 years of age, following nondiagnostic radiographs and ultrasound
- In patients age 5 years or older, following nondiagnostic radiographs and a failure of conservative management

**IMAGING STUDY**

- MRI lower extremity (joint)

- CT lower extremity when MRI cannot be performed or is nondiagnostic

### Lower extremity pain, not otherwise specified

*Applies when focused history and physical exam have not provided a likely diagnosis.*

Advanced imaging is considered medically necessary for persistent pain when **BOTH** of the following criteria are met:

- Radiographs are nondiagnostic (without severe osteoarthritis) or normal
- Failure of at least 6 weeks of conservative management

#### IMAGING STUDY

- MRI lower extremity (joint or non-joint)
- CT lower extremity when MRI cannot be performed or is nondiagnostic

#### Rationale

A focused history and physical examination will often provide a more specific clinical diagnosis. When imaging is needed, professional society guidance indicates that radiographs are usually appropriate as the first-line imaging modality. If advanced imaging is needed following radiographs, the most appropriate advanced imaging study depends on the suspected diagnosis.

<sup>45</sup>

### Upper extremity pain, not otherwise specified

*Applies when focused history and physical exam have not provided a likely diagnosis.*

Advanced imaging is considered medically necessary for persistent pain when **BOTH** of the following criteria are met:

- Radiographs are nondiagnostic (without severe osteoarthritis) or normal
- Failure of at least 6 weeks of conservative management

#### IMAGING STUDY

- MRI upper extremity (joint or non-joint)
- CT upper extremity when MRI cannot be performed or is nondiagnostic

#### Rationale

A focused history and physical may lead to a diagnosis in about 70% of cases. When imaging is needed, radiographs are the first-line modality and should include postero-anterior and lateral views. If the diagnosis remains in doubt after radiography, further imaging is indicated. The appropriate study depends upon the primary clinical concerns, among advanced imaging modalities, CT can evaluate for fractures and articular subluxations that are radiographically occult, and MRI is preferred for evaluation of soft tissue injuries.<sup>46</sup>

## Procedural Imaging

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### Shoulder arthroplasty, presurgical planning

*Advanced imaging is not indicated for robotic-assisted shoulder arthroplasty.*

*Note: Appropriateness of imaging is dependent on appropriateness of the technique. Please refer to the health plan medical policy/guidelines and federal/state coverage mandates applicable to these techniques which supersede Carelon guidelines.*

Advanced imaging is considered medically necessary for evaluation in **ANY** of the following scenarios:

- For preoperative assessment of bone stock and bone version prior to shoulder arthroplasty

- For assessment of rotator cuff status to determine the surgical approach

## IMAGING STUDY

- MRI upper extremity (joint) for assessment of rotator cuff status
- CT upper extremity for preoperative assessment of bone stock and bone version

## Knee arthroplasty, presurgical planning

*Advanced imaging is not indicated for conventional total knee arthroplasty*

*Note: Appropriateness of imaging is dependent on appropriateness of the technique. Please refer to the health plan medical policy/guidelines and federal/state coverage mandates applicable to these techniques which supersede Carelon guidelines.*

Advanced imaging may be medically necessary for knee arthroplasty with patient specific instrumentation or robotic assisted navigation when at least **ONE** of the following criteria are met:

- Existing hardware precludes use of medullary guides
- Radiographs demonstrate post-traumatic diaphyseal deformity of the femur or tibia that precludes use of an external guide

## IMAGING STUDY

- CT lower extremity
- MRI lower extremity (joint)

## Rationale

Studies evaluating patient-specific instrumentation have found limited evidence for improved mechanical alignment relative to conventional total knee replacement. A large systematic review of 8 randomized control trials and 8 cohort studies concluded that patient-specific instrumentation does not improve the accuracy of alignment of the components in total knee replacement compared with conventional instrumentation.<sup>47</sup> A separate systematic review looked at 2739 knees and found more misalignment in the patient-specific instrumentation group than in the conventional total knee replacement group and no difference in rotational alignment.<sup>48</sup>

The American Academy of Orthopaedic Surgeons (AAOS) evidence-based guideline on surgical management of osteoarthritis of the knee recommends against using intraoperative navigation in total knee arthroplasty because there is no difference in outcomes or complications, citing strong evidence. They further state that, "New surgical navigation methods will need randomized controlled trials to determine their effectiveness."<sup>49</sup>

Robotic assisted arthroplasty is a new surgical navigation method. The method employs a haptic assistive robotic arm to restrict cutting movements within volumes defined from the 3D surgical plan established by preoperative CT.<sup>50</sup> Similar to other forms of surgical assisted arthroplasty, CT is therefore integral to the procedure and the appropriateness of the CT follows the appropriateness of the procedure.

A systematic review and network meta-analysis of 34 randomized controlled trials (7289 patients and 7424 knees) found that there was higher radiological accuracy for computer-assisted and robotic-assisted surgery when compared to conventional knee arthroplasty, but no differences were found in clinical outcomes.<sup>51</sup> A systematic overview of ten meta-analyses compared robotic-assisted versus conventional UKA and TKA. In UKA, one meta-analysis found improved clinical scores with robotic-assisted UKA, one found reduced complication rates, three found extended operation times with robotic-assisted UKA, and three found improved component positioning and alignment. In TKA, two studies found improved clinical scores and two found extended surgery times with robotic-assisted surgery, while five found improved component positioning and alignment. None of the included meta-analyses reported differences in survivorship when comparing conventional and robotic-assisted knee arthroplasty. The authors further noted, "six of the ten meta-analyses were of 'critically low quality,' calling for caution when interpreting results."<sup>52</sup>

A randomized controlled trial of 1406 patients followed patients for a minimum of ten years after knee arthroplasty. 700 patients (750 knees) received robotic-assisted TKA and 706 patients (766 knees) received conventional knee arthroplasty. In terms of functional outcome scores, aseptic loosening, overall survivorship, and complications, the authors found no significant differences between conventional knee arthroplasty and robotic-assisted arthroplasty. Similar findings were seen in other RCTs.<sup>53, 54</sup>

The body of randomized evidence specific to MAKO is limited. For MAKO-assisted TKA, a 2021 prospective randomized controlled trial found that there is some reduction in systemic inflammatory markers at 7 days postoperatively, compared to conventional knee arthroplasty. No significant reductions were noted at 6 hours, 1 day, 2 days, or 28 days, however, and therefore the significance of this transient reduction is unclear.<sup>55</sup> No randomized data has been identified regarding the effect of MAKO-assisted TKA on patient-centered outcomes, compared to conventional knee arthroplasty.

For MAKO assisted UKA, a 2016 randomized controlled trial was done to evaluate robotic-assisted unicompartmental knee arthroplasty compared to conventional unicompartmental knee arthroplasty, with implant positioning as the primary endpoint. This study demonstrated increased accuracy of implant positioning but did not address patient-centered outcomes. A multiyear exploratory study found no significant differences in numerous patient-reported outcomes including UCLA score, Oxford Knee Score, American knee score, and several others.<sup>56</sup> There were also no differences in revision and complication rates. Only reintervention rate was significant at a single timepoint and based on an absolute difference of 4 cases. The authors concluded that “Larger multicentre studies, combined with registry data, in the future should provide sufficient data on large enough numbers of patients to allow robust sub-group analyses to determine which patients benefit most from the technology.”<sup>50</sup>

The body of non-randomized data on MAKO/robotic assist is also inconsistent. Some authors find short term and immediate post operative improvements in pain scores and function, but the findings are not consistent and may not exceed the minimum clinically important difference.<sup>57-62</sup>

Follow-up data beyond a year is limited. The limited availability of randomized data and inconsistent non-randomized data supports the conclusion from numerous systematic reviews (including those specific to MAKO)<sup>52, 59, 63-72</sup> that further well designed mid and long term outcome studies are needed to establish the efficacy of this technology relative to conventional arthroplasty.

## Perioperative Imaging (including delayed hardware failure), not otherwise specified

*Includes conditions not otherwise referenced in the Extremity Imaging guidelines. Advanced imaging is not indicated for conventional hip arthroplasty or robotic-assisted hip arthroplasty.*

*Note: Appropriateness of imaging is dependent on appropriateness of the technique. Please refer to the health plan medical policy/guidelines and federal/state coverage mandates applicable to these techniques which supersede Cargon guidelines.*

Advanced imaging is considered medically necessary following nondiagnostic radiographs or ultrasound.

### IMAGING STUDY

- CT upper or lower extremity
- MRI upper extremity (joint or non-joint); MRI lower extremity (joint or non-joint)

### Rationale

#### ROBOTIC-ASSISTED HIP ARTHROPLASTY

Robotic assisted arthroplasty is a new surgical navigation method. The method employs a haptic assistive robotic arm to restrict cutting movements within volumes defined from the 3D surgical plan established by preoperative CT.<sup>50</sup> Similar to other forms of surgical assisted arthroplasty, CT is therefore integral to the procedure and the appropriateness of the CT follows the appropriateness of the procedure.

The body of non-randomized data on MAKO/robotic assist is also inconsistent. Some authors find short term and immediate post operative improvements in pain scores and function, but the findings are not consistent and may not exceed the minimum clinically important difference.<sup>73</sup>

The body of evidence related specifically to robotic-assisted hip arthroplasty is limited. A systematic review to 2020 finds low level evidence for an improved Harris hip score in patients having rTHA compared to those having a conventional arthroplasty; however, no long-term data is available.<sup>74</sup> A second systematic review to 2021 finds no significant difference in functional outcomes or complication rates when comparing robotic THA to manual THA.<sup>75</sup> Both systematic reviews note significant heterogeneity in the data.

Follow-up data beyond a year is limited. The limited availability of randomized data and inconsistent non-randomized data supports with the conclusion from numerous systematic reviews (including those specific to MAKO)<sup>76</sup> that further well designed mid and long term outcome studies are needed to establish the efficacy of this technology relative to conventional arthroplasty.

## References

## Codes

The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes.

Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

### CPT/HCPCS

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73200	CT upper extremity, without contrast
73201	CT upper extremity, with contrast
73202	CT upper extremity, without contrast, followed by re-imaging with contrast
73218	MRI upper extremity non-joint, without contrast
73219	MRI upper extremity non-joint, with contrast
73220	MRI upper extremity non-joint, without contrast, followed by re-imaging with contrast
73221	MRI upper extremity any joint, without contrast
73222	MRI upper extremity any joint, with contrast
73223	MRI upper extremity any joint, without contrast, followed by re-imaging with contrast
73700	CT lower extremity, without contrast
73701	CT lower extremity, with contrast
73702	CT lower extremity, without contrast, followed by re-imaging with contrast
73718	MRI lower extremity non-joint, without contrast
73719	MRI lower extremity non-joint, with contrast
73720	MRI lower extremity non-joint, without contrast, followed by re-imaging with contrast
73721	MRI lower extremity any joint, without contrast
73722	MRI lower extremity any joint, with contrast
73723	MRI lower extremity any joint, without contrast, followed by re-imaging with contrast
78811	PET imaging, limited area
78812	PET imaging, skull to mid-thigh
78813	PET imaging, whole body
78814	PET imaging, with concurrently acquired CT for attenuation correction and anatomic localization; limited area
78815	PET imaging, with concurrently acquired CT for attenuation correction and anatomic localization; skull base to mid-thigh
78816	PET imaging, with concurrently acquired CT for attenuation correction and anatomic localization; whole body
G0235	PET imaging, any site, not otherwise specified
S8085	Fluorine-18 fluorodeoxyglucose (f-18 fdg) imaging using dual-head coincidence detection system (non-dedicated PET scan)

### ICD-10 Diagnosis

Refer to the ICD-10 CM manual

## History

Status	Review Date	Effective Date	Action
Revised	01/29/2026	09/19/2026	Independent Multispecialty Physician Panel (IMPP) review. Revised indications: Osteomyelitis, Ligament and tendon injuries- wrist, Ligament tear-knee, Meniscal tear/injury, Avascular necrosis, and Knee arthroplasty, presurgical planning.
Revised	01/30/2025	11/15/2025 except for Healthy Blue LA Medicaid, BCBS OH Medicaid; 01/01/2026 for Regence	IMPP review. Revised the following indications: Septic arthritis, Myositis, Fracture, Soft tissue mass, Labral tear- shoulder, Ligament and tendon injuries- wrist, Labral tear and femoral acetabular impingement- hip, Meniscal tear/injury. Lower extremity pain, and Upper extremity pain.
Revised	01/23/2024	10/20/2024 except for Healthy Blue LA Medicaid	IMPP review. Revised definitions and these indications: Soft tissue infection, Osteomyelitis, Septic arthritis, Fracture, Rotator cuff tear, and Paget disease.
Updated	01/23/2024	Unchanged	Expanded guideline rationale. Added required language per new Medicare regulations.
Revised	01/24/2023	09/10/2023	IMPP review. Revised indications: Traumatic injuries – acute/not otherwise specified, Fracture, and Shoulder arthroplasty, presurgical planning.
Revised	11/11/2021	09/11/2022	IMPP review. Revised general prerequisites for extremity imaging and these indications: Plantar fasciitis and fibromatosis, Fracture, Rotator cuff tear, Chronic anterior knee pain (including chondromalacia patella and patellofemoral pain syndrome), Shoulder arthroplasty, presurgical planning, and Perioperative Imaging (including delayed hardware failure), not otherwise specified.
Revised	12/03/2020	09/12/2021	IMPP review. Revised definitions, general prerequisites for extremity imaging, and these indications: Soft tissue infection, Osteomyelitis or septic arthritis, picondylitis, Myositis, Plantar fasciitis, Tenosynovitis – long head of biceps, Fracture, Brachial plexus mass, Morton's neuroma, Adhesive capsulitis, Labral tear—shoulder, Ligament and tendon injuries- upper extremity, not listed elsewhere, Rotator cuff tear, Triangular fibrocartilage complex tear, Ulnar collateral ligament tear (elbow or thumb), Labral tear and femoral acetabular impingement—hip, Ligament tear—knee, Ligament and tendon injury and rupture- foot and ankle, Avascular necrosis, Chronic anterior knee pain (including Chondromalacia patella and patellofemoral pain syndrome), Intra-articular loose body, Osteochondral lesion (including osteochondritis dissecans, transient dislocation of patella), Entrapment neuropathy (excluding carpal and cubital tunnel), Lower extremity pain, not otherwise specified, Upper extremity pain, not otherwise specified, Reverse shoulder arthroplasty, Knee arthroplasty, presurgical planning, Perioperative Imaging (including delayed hardware failure), not otherwise specified.
Revised	-	03/14/2021	Added HCPCS codes G0235 and S8085.
Reaffirmed	07/08/2020	Unchanged	IMPP review. Guideline reaffirmed.
Revised	01/28/2019	09/28/2019	IMPP review. Revised general prerequisites for extremity imaging and these indications: Congenital or developmental anomalies, Meniscal tear/injury, Soft tissue infection, Osteomyelitis or septic arthritis, Upper extremity pain, Capitellar osteochondritis, Fracture, Traumatic injuries—acute/not otherwise specified, Intraarticular loose body, Indeterminate bone lesion, Soft tissue mass—not otherwise specified, Labral tear—shoulder, Rotator cuff tear (adult), Labral tear—hip, Ligament tear—knee, Lisfranc injury, Meniscal tear/injury, Avascular necrosis, Paget's disease, Perioperative imaging.

Status	Review Date	Effective Date	Action
Restructured	09/12/2018	01/01/2019	IMPP review. Advanced Imaging guidelines redesigned and reorganized to a condition-based structure. Incorporated AIM guidelines for pediatric imaging.
Revised	07/11/2018	03/09/2019	IMPP review. Renamed the Administrative Guidelines to “General Clinical Guideline.” Retitled Pretest Requirements to “Clinical Appropriateness Framework” to summarize the components of a decision to pursue diagnostic testing. Revised to expand applicability beyond diagnostic imaging, retitled Ordering of Multiple Studies to “Ordering of Multiple Diagnostic or Therapeutic Interventions” and replaced imaging-specific terms with “diagnostic or therapeutic intervention.” Repeated Imaging split into two subsections, “repeat diagnostic testing” and “repeat therapeutic intervention.”
Reaffirmed	09/22/2017	03/12/2018	Annual review.
Revised	07/26/2016	10/31/2016	IMPP review.
Created	-	03/30/2005	Original effective date.

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