

National Imaging Associates, Inc.*	
Clinical guidelines UPPER EXTREMITY MRI (Hand, Wrist, Arm, Elbow, Long bone, or Shoulder MRI)	Original Date: September 1997
CPT Codes: 73218, 73219, 73220, 73221, 73222, 73223, +0698T	Last Revised Date: May March 20221
Guideline Number: NIA_CG_057-3	Implementation Date: January 20232

INDICATIONS FOR UPPER EXTREMITY MRI (HAND, WRIST, ARM, ELBOW or SHOULDER) (Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI.

Joint specific provocative orthopedic examination ~~(see Table 1)~~

Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging.

- Shoulder¹⁻⁴ ~~(Bencardino, 2013; Jain, 2017; Loh, 2016, Somerville, 2017)~~
 - Any positive test listed
 - Rotator cuff weakness⁵ ~~(van Kampen, 2014)~~
 - Bear hug test
 - Belly press test
 - Drop arm test
 - Full can test
 - Hornblower's sign
 - ~~Internal rotation lag sign~~
 - ~~Supraspinatus test~~ (aka Empty Can Test) when positive because of weakness
 -
- Elbow^{6, 7} ~~(Kane 2014, Karbach 2017)~~

* National Imaging Associates, Inc. (NIA) is a subsidiary of Magellan Healthcare, Inc.

- Any positive test listed
 - Valgus stress
 - Varus stress
 - Posterolateral rotatory drawer test
 - Milking maneuver
 - Push-up test
 - Popeye sign
 -
- Wrist^{8,9} ~~(Pandey, 2014; Ruston, 2013)~~
 - Any positive test listed
 - Watson test (scaphoid shift test)
 - Scapholunate ballottement test
 - Reagan test (lunotriquetral ballottement test)
 - Snuff box pain (after initial x-ray)

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed^{10, 11}

~~(Park, 2010; Pieters, 2020)~~

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician-supervised exercise**), of at least four (4) weeks, OR
- With progression or worsening of symptoms during the course of conservative treatment.

~~Other Specific Shoulder Conditions which are approvable after active conservative therapy (above) and x-ray:~~

~~Shoulder Impingement—Hawkin’s, Neer’s, Painful arc, Load and shift, and Yocum tests~~

- ~~Non-Traumatic Shoulder Instability—Sulcus, Surprise, Anterior or Posterior draw, Apprehension, Anterior slide, Clunk, Crank, Empty can, HERI (hyperextension internal rotation) tests~~
- ~~Glenoid labral tear (i.e., SLAP lesion)—Apprehension, Relocation, Surprise, Jobe’s, O’Brien’s, Superior labral, Anterior slide, Jerk, Compression rotation, Crank tests~~

Shoulder Dislocations^{12, 13}

~~(Galvin, 2017; Kilocyne, 2017)~~

- Recurrent
- First time in any of the situations below that increase the risk or repeated dislocation
 - Glenoid or humeral bone loss on x-ray
 - 14-35 year-old competitive contact sport athlete

Extremity Mass

- Mass or lesion after non-diagnostic x-ray or ultrasound¹⁴ ~~(Murphey, 2018)~~
 - If superficial, then ultrasound is the initial study

- If deep, then x-ray is the initial study

Known Cancer of the Extremity¹⁵⁻¹⁹

~~(Bestic, 2019; Fitzgerald, 2015; Holzapfel, 2015; Kircher, 2012; NCCN, 2019)~~

- Cancer staging
- Cancer restaging
- Signs or symptoms of recurrence

Infection of Bone or Joint²⁰⁻²²

~~(Beaman, 2017; Dodwell, 2013; Glaudemans, 2019)~~

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
 - Signs and symptoms of joint or bone infection include:
 - Pain and swelling
 - Decrease range of motion
 - Fever
 - Laboratory findings of infection include:
 - Elevated ESR or CRP
 - Elevated white blood cell count
 - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone or deep infection is suspected
 - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell²³ ~~(Bowers, 2020)~~

Osteonecrosis (e.g., Avascular necrosis (AVN))²⁴⁻²⁶

~~(Felten, 2019; Murphey, 2014; 2016)~~

- Abnormal x-ray
- Normal x-rays but symptomatic and high-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse ~~(Fukushima, 2010)~~,²⁷ sickle cell anemia²⁸ ~~(Wali, 2011)~~)

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis)^{29, 30}

~~(Colebatch, 2013; Narvaez, 2010)~~

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- Follow-up to determine treatment efficacy in the following:
 - Early rheumatoid arthritis
 - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory

Bone Fracture or Ligament Injury

- Suspected stress or insufficiency fracture with a negative initial x-ray³¹⁻³³ (~~Bencardino, 2017; Sadineni, 2015; Yin, 2010~~)
 - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray³⁴ (~~Fayad, 2005~~)
- Intraarticular fractures that may require surgery
- Suspected scaphoid fracture with negative x-rays
- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion (~~Morshed, 2014~~).³⁵
- Clinical suspicion based on mechanism of injury and physical findings and x-ray completed
 - TFCC (triangular fibrocartilage complex) injury^{36, 37} (~~Barlow, 2016; Ng, 2017~~)
 - SLAP (superior labral anterior to posterior complex) lesions⁴ (~~Somerville, 2017~~)

Note: Imaging approvable in the setting of known trauma; otherwise, active conservative therapy is recommended (see background).

Occult wrist ganglion, after indeterminate ultrasound

(~~Meena, 2014~~)

- ~~Clinical suspicion and failed 4 weeks conservative treatment including all of the below:~~
 - ~~Activity modification~~
 - ~~Rest, ice, or heat~~
 - ~~Splinting or orthotics~~
 - ~~Medication~~

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray completed³⁸⁻⁴¹

(~~Smith, 2012; Taljanovic, 2019; Van Dijk, 2010; Van Bergen, 2016~~)

- Clinical suspicion based on mechanism of injury and physical findings
- Loose bodies or synovial chondromatosis seen on x-ray or ultrasound
 - In the setting of joint pain⁴² (~~Rajani, 2016~~)

Foreign Body⁴³

(~~Laya, 2017~~)

- Indeterminate x-ray and ultrasound

Tendon or Muscle Rupture after x-ray⁴⁴⁻⁴⁶

(~~Garras, 2012; Peck, 2017; Wilkins, 2012~~)

- Clinical suspicion based on mechanism of injury and physical findings (i.e., Popeye, Hook, Yergasons sign)

Peripheral Nerve Entrapment (e.g., carpal tunnel)⁴⁷⁻⁵¹

(~~Domkundwar, 2017; Dong, 2012; Donovan, 2010; Meyer, 2018; Tos, 2015~~)

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
 - Activity modification
 - Rest, ice, or heat
 - Splinting or orthotics
 - Medication

Brachial Plexopathy^{52, 53}

~~(Mansukhani, 2013; Vijayasarithi, 2016)~~

- If mechanism of injury or EMG/NCV studies are suggestive
- Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications
- Joint prosthesis loosening or dysfunction, x-rays non-diagnostic^{54, 55} ~~(Fritz, 2014; 2015)~~

Table 1: Positive Orthopedic Joint Tests, Upper Extremity

ELBOW

~~Moving valgus stress test~~

~~Hook test~~

~~Passive forearm pronation~~

~~Biceps squeeze test~~

~~Biceps Aponeurosis (BA) flex test~~

~~Table top relocation test~~

SHOULDER

~~Drop Arm Test~~

~~External rotation lag sign 0 and 90 degrees~~

~~Full can test~~

~~Hook test~~

~~Hornblower test~~

~~Internal rotation lag sign~~

~~• Lift off test~~

~~• Popeye sign~~

WRIST

Snuff box pain (after initial x-ray)

Derby relocation test

Ulnar foveal sign/test

Press test

- Ulnocarpal stress test (if concern for TFCC tear)

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI can positively influence clinicians' diagnoses and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy** (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

Rotator Cuff Tears – 3.0 Tesla MRI has been found valuable for the detection of partial thickness rotator cuff tendon tears and small rotator cuff tendon tears. It is especially useful in detecting the partial tears due to increased spatial resolution. Increased spatial resolution results in precise measurements of rotator cuff tendon tears in all 3 planes, and it also reduces acquisition time which reduces motion artifacts. 3.0 Tesla makes it possible to adequately evaluate tendon edges and avoid underestimation of tears. MRI is less invasive than MR arthrography, and it is faster and less expensive. MRI may be useful in the selection of patients that may benefit from arthroscopy.

MRI and Occult Fractures – Magnetic resonance imaging may help to detect occult fractures of the elbow when posttraumatic elbow effusions are shown on radiographs without any findings of fracture. Effusions may be visualized on radiographs as fat pads, which can be elevated by

the presence of fluid in the joint caused by an acute fracture. MRI may be useful when effusions are shown on radiographs without a visualized fracture, but there is a clinical suspicion of a lateral condylar or radial head fracture.

MRI and Avascular Necrosis – Sports, such as racquetball and gymnastics, may cause repeated microtrauma due to the compressive forces between the radial head and capitellum. Focal avascular necrosis and osteochondritis dissecans of the capitellum may result. MRI can be used to evaluate the extent of subchondral necrosis and chondral abnormalities. The images may also help detect intraarticular loose bodies.

MRI and Acute Osseous Trauma – Many elbow injuries result from repetitive microtrauma rather than acute trauma, and the injuries are sometimes hard to diagnose. Non-displaced fractures are not always evident on plain radiographs. When fracture is suspected, MRI may improve diagnostic specificity and accuracy. T1-weighted images can delineate morphologic features of the fracture.

MRI and Brachial Plexus — MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

Adhesive Capsulitis a.k.a. Frozen Shoulder⁵⁶⁻⁵⁸ ~~(Ramirez, 2019; Redler, 2019; Small, 2018)~~ — MRI is the preferred modality for imaging after a failure of improvement with active conservative therapy. Affected patients have impaired range of shoulder motion with forward flexion, abduction, and external and internal rotation which may be associated with pain. Clinically, it can be distinguished from rotator cuff pathology, where passive range of motion is preserved, or neoplasm which may also have associated fever or weight loss. Treatment is with a combination of intracapsular steroid injection and active conservative care. Anti-inflammatory medications are also given to facilitate active treatment. When nonsurgical management, including anti-inflammatory medication, active care (physical therapy, a supervised home exercise program or manipulations), and injections, have failed to provide relief of symptoms by 9 to 12 months, surgical intervention is indicated, but this represents the minority of patients.

Shoulder Impingement, Non-Traumatic Shoulder Instability, and Glenoid Labral tears — require active conservative therapy and x-ray (orthopedic signs listed below):

- **Shoulder Impingement—Hawkin’s, Neer’s, Painful arc, Load and shift, and Yocum tests**
- **Non-Traumatic Shoulder Instability—Sulcus, Surprise, Anterior or Posterior draw, Apprehension, Anterior slide, Clunk, Crank, Empty can, HERI (hyperextension-internal rotation) tests**
- **Glenoid labral tear (i.e., SLAP lesion)—Apprehension, Relocation, Surprise, Jobe’s, O’Brien’s, Superior labral, Anterior slide, Jerk, Compression rotation, Crank tests**

The American Academy of Pediatrics “Choosing Wisely” Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. “History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient. If you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered ~~(AAP, 2018)~~.”⁵⁹

POLICY HISTORY

Date	Summary
<u>March 2022</u>	<ul style="list-style-type: none"> • <u>Simplified orthopedic sign section to include only the most robust signs and removed Table 1.</u> • <u>Clarified the Supraspinatus Test.</u> • <u>Moved the section recommending active conservative care for shoulder impingement, non traumatic shoulder instability and glenoid labral tears to the background information section.</u> • <u>Removed occult wrist ganglion section</u> • <u>Added Snuff box pain after initial x-ray to wrist section and Popeye sign to Elbow section</u>
November 2021	<ul style="list-style-type: none"> • Added +0698T
May 2021	<ul style="list-style-type: none"> • Additional signs for rotator cuff tear that are considered useful • Removed signs for impingement, shoulder instability and glenoid labral tear since active conservative therapy should be done first • Added section about impingement, nontraumatic shoulder instability and glenoid labral tear requiring active conservative therapy • Added information for the following: shoulder dislocation; suspected bone infection in the setting of ulcers and neuropathy; brachial plexopathy; treatment for rheumatoid arthritis
May 2020	<ul style="list-style-type: none"> • Expanded the list of orthopedic signs and Added note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging.

	<ul style="list-style-type: none"> • Added information about adhesive capsulitis • Clarified that if an MR Arthrogram fits approvable criteria, approve as MRI. • Revised the information about an evaluation of an extremity mass.
May 2019	<ul style="list-style-type: none"> • Added initial statement about approvals: ‘Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time’. • Expanded Extremity mass indications including peripheral lymphadenopathy; and mass with increased risk for malignancy • Added indications for foreign body and peripheral nerve entrapment • Modified Known Cancer indication to be more broad – ‘cancer staging, cancer restaging, signs or symptoms of recurrence’ • Expanded sections for bone fracture and infection of bone or joint to include list of signs or symptoms and laboratory findings (elevated ESR or CRP, elevated white blood cell count, positive joint aspiration)

REFERENCES

American Academy of Pediatrics (AAP) Section on Orthopaedics and the Pediatric Orthopaedic Society of North America. Choosing Wisely®. <http://www.choosingwisely.org/clinician-lists/aap-posna-mri-or-ct-for-musculoskeletal-conditions-in-children/>. Released February 12, 2018.

American College of Radiology (ACR). ACR Appropriateness Criteria®. <https://acsearch.acr.org/list>. Published 2017.

Arnander M, Tennent D. Clinical assessment of the glenoid labrum. *Shoulder Elbow*. 2014;6(4):291-299.

Barlow SJ. A non-surgical intervention for triangular fibrocartilage complex tears. *Physiother Res Int*. 2016 Dec; 21(4):271-276.

Beaman FD, Von Herrmann PF, Kransdorf MJ, et al. ACR Appropriateness Criteria®—Suspected osteomyelitis, septic arthritis, or soft tissue infection (excluding spine and diabetic foot). *J Am Coll Radiol*. 2017; 14(5 Suppl):S326-S337.

Bencardino JT, Gyftopoulos S, Palmer WE. Imaging in anterior glenohumeral instability. *Radiology*. 2013 Nov; 269(2).

Bencardino JT, Stone TJ, et al. ACR Appropriateness Criteria Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. *J Am Coll Radiol*. 2017 May; 14(5S):S293-S306.

Bestic JM, Wessell DE, Beaman FD, et al. American College of Radiology ACR Appropriateness Criteria®—Primary Bone Tumors. <https://acsearch.acr.org/docs/69421/Narrative/>. Revised 2019.

Biermann JS, Chow W, Adkins DR, et al. National Comprehensive Cancer Network (NCCN) Guidelines: Version 1.2014. *Bone Cancer*. http://www.nccn.org/professionals/physician_gls/pdf/bone.pdf. Published 2014.

Bowers S, Franco E. Chronic wounds: Evaluation and management. *Am Fam Physician*. 2020 Feb; 101(3):159-66.

Buck FM, Jost B, Hodler J. Shoulder arthroplasty. *Eur Radiol*. 2008; 18(12):2937-2948. doi: 10.5167/uzh-11349.

Chuang TY, Adams CR, Burkhart SS. Use of preoperative three-dimensional computed tomography to quantify glenoid bone loss in shoulder. *Arthroscopy*. 2008; 24(4):376-382. doi: 10.1016/j.arthro.2007.10.008.

Colebatch AN, Edwards CJ, Østergaard M, et al. EULAR recommendations for the use of imaging

of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis*. 2013; 72:804-814. <http://ard.bmj.com/content/72/6/804>.

Consigliere P, Haddo O, Levy O, et al. Subacromial impingement syndrome: Management challenges. *Orthop Res Rev*. 2018 Oct 23; 10:83-91. doi:10.2147/ORR.S157864.

Dodwell ER. Osteomyelitis and septic arthritis in children: current concepts. *Curr Opin Pediatrics*. 2013 Feb; 25(1):58-63.

Domkundwar S, Autkar G, Khadilkar SV, et. al. Ultrasound and EMG—NCV study (electromyography and nerve conduction velocity) correlation in diagnosis of nerve pathologies. *J Ultrasound*. 2017 Jun; 20(2):111-122.

Dommett RM, Redaniel MT, Stevens MC, et al. Features of cancer in teenagers and young adults in primary care: A population-based nested case-control study. *Br J Cancer*. 2013 Jun 11; 108(11):2329-33.

Dong Q, Jacobsen JA, Jamadar DA, et al. Entrapment neuropathies in the upper and lower limbs: Anatomy and MRI features. *Radiol Res Practice*. 2012:230679.

Donovan A, Rosenberg ZS, Cavalcanti CF. MR imaging of entrapment neuropathies of the lower extremity. *Radiographics*. 2010; 30(4).

Eljabu W, Klinger HM, von Knoch M. The natural course of shoulder instability and treatment trends: a systematic review. *J Orthop Traumatol*. 2017;18(1):1-8.

Fayad LM, Kawamoto S, et al. Distinction of long bone stress fractures from pathologic fractures of cross-sectional imaging: How successful are we? *Am J Roentgenol*. 2005; 185:915-924.

Felten R, Pemin P, Caillard S, et al. Avascular osteonecrosis in kidney transplant recipients: Risk factors in a recent cohort study and evaluation of the role of secondary hyperparathyroidism. *PLOS ONE*. February 22, 2019.

Fitzgerald JJ, Roberts CC, Daffner RH, et al. American College of Radiology ACR Appropriateness Criteria®—Follow-up of Malignant or Aggressive Musculoskeletal Tumors. <https://acsearch.acr.org/docs/69428/Narrative/>. Published 2015.

Fritz J, Lurie B, Miller TT, et al. MR imaging of hip arthroplasty implants, *RadioGraphics*. 2014; 34(4):E106-E132. <http://pubs.rsna.org/doi/abs/10.1148/rg.344140010>.

Fritz J, Lurie B, Potter HG. MR imaging of knee arthroplasty implants. *Radiographics*. 2015 Aug; 35(5).

~~Fukushima W, Fujioka M, Kubo T, et al. Nationwide epidemiologic survey of idiopathic osteonecrosis of the femoral head. *Clin Orthop Relat Res*. 2010 Oct; 468(10):2715-24. Epub 2010 Mar 12.~~

~~Gaddey HL, Riegel AM. Unexplained lymphadenopathy: Evaluation and differential diagnosis. *Am Fam Physician*. 2016 Dec 1; 94(11):896-903.~~

~~Galvin J, Ernat JJ, Waterman BR, et al. The epidemiology and natural history of anterior shoulder instability. *Curr Rev Musculoskel Med*. 2017 Dec; 10(4):411-424.~~

~~Garras DN, Raikin SM, Bhat SB, et al. MRI is unnecessary for diagnosing acute achilles tendon ruptures: Clinical diagnostic criteria. *Clin Orthop Relat Res*. 2012 Aug; 470(8):2268-2273.~~

~~Glaudemans AWJM, Jutte PC, et al. Consensus document for the diagnosis of peripheral bone infection in adults: A joint paper by the EANM, EBJIS, and ESR (with ESCMID endorsement). *Eur J Nucl Med Mol Imaging*. 2019; 46(4):957-970.~~

~~Holzapfel K, Regler J, Baum T, et. al. Local staging of soft tissue sarcoma: Emphasis on assessment of neurovascular encasement—value of MR Imaging in 174 confirmed cases. *Radiology*. 2015 May; 275(2):501-9. Epub 2015 Jan 14.~~

~~Jain NB, Luz J, Higgins LD, et al. The diagnostic accuracy of special tests for rotator cuff tear: The ROW cohort study. *Am J Phys Med Rehabil*. 2017 Mar; 96(3):176-183.~~

~~Kane SF, Lynch JH, Taylor JC. Evaluation of Elbow Pain in Adults. *Am Fam Physician*. 2014 Apr 15; 89(8):649-657.~~

~~Karbach LE, Elfar J. Elbow instability: Anatomy, biomechanics, diagnostic maneuvers, and testing. *J Hand Surg Am*. 2017 Feb; 42(2):118-126.~~

~~Kekatpure AL, Sun JH, Sim GB, et al. Rapidly destructive arthrosis of the shoulder joints: Radiographic, magnetic resonance imaging, and histopathologic findings. [Published online ahead of print December 26, 2014]. *J Shoulder Elbow Surg*. June 2015; 24(6):922-927.~~

~~Kilcoyne KG, Parada SA et al. Prevention and management of post-instability glenohumeral arthropathy. *World J Orthop*. 2017 Mar 18; 8(3):229-241.~~

~~Kircher MF, Willman JK. Molecular body imaging: MR imaging, CT, and US. Part II. Applications. *Radiology*. 2012; 264(2):349.~~

~~Laya BF, Restrepo R, Lee EY. Practical imaging evaluation of foreign bodies in children: An update. *Radiol Clin North Am*. 2017 Jul; 55(4):845-867.~~

~~Lee YJ, Sadigh S, Mankad K, et al. The imaging of osteomyelitis. *Quant Imaging Med Surg*. 2016~~

~~Apr; 6(2):184–198.~~

~~Loh B, Lim JBT, Tan AHC. Is clinical evaluation alone sufficient for the diagnosis of a Bankart lesion without the use of magnetic resonance imaging? *Ann Transl Med*. 2016 Nov; 4(21):419.~~

~~Magee T. Utility of pre- and post-MR arthrogram imaging of the shoulder: effect on patient care. *Br J Radiol*. 2016; 89:1062.~~

~~Mansukhani KA. Electrodiagnosis in traumatic brachial plexus injury. *Ann Indian Acad Neurol*. 2013 Jan-Mar; 16(1):19–25. doi:10.4103/0972-2327.~~

~~Mathew CJ, Lintner DM. Superior Labral Anterior to Posterior Tear Management in Athletes. *Open Orthop J*. 2018;12:303–313. Published 2018 Jul 31.~~

~~Meena S, Gupta A. Dorsal wrist ganglion: Current review of literature. *J Clin Orthop Trauma*. 2014 Jun; 5(2):59–64.~~

~~Meyer P, Lintingre P-F, Pesquer L, et al. The median nerve at the carpal tunnel and elsewhere. *J Belgian Society Radiol*. 2018; 102(1):17.~~

~~Mohseni S, Shojaiepard A, Khorgami Z, et al. Peripheral lymphadenopathy: Approach and diagnostic tools. *Iran J Med Sci*. 2014 Mar; 39(2 Suppl):158–170.~~

~~Morshed S. Current Options for Determining Fracture Union. *Adv Med*. 2014; 2014:708574.~~

~~Mullan CP, Madan R, Trotman Dickenson B, et al. Radiology of chest wall masses. *AJR*. 2011;197(3).~~

~~Murphey MD, Foreman KL, Klassen_Fischer MK, et al. From the radiologic pathology archives imaging of osteonecrosis: Radiologic-pathologic correlation. *RadioGraphics*. 2014 Jul 14; 34(4).~~

~~Murphey MD, Roberts CC, Bencardino JT, et al. American College of Radiology ACR Appropriateness Criteria® Osteonecrosis of the Hip. *J Am Coll Radiol*. 2016; 13:147–155.~~

~~Murphey MD, Wessell DE, et al. ACR Appropriateness Criteria® Soft Tissue Masses. *J Am Coll Radiol*. 2018 May; 15(5 Suppl):S189–S197.~~

~~Narvaez J, Narvaez J, et al. MR Imaging of Early Rheumatoid Arthritis. *Radiographics*. 2010 Jan 1; 30(1).~~

~~National Comprehensive Cancer Network (NCCN). Imaging guidelines. 2019. https://www.nccn.org/professionals/physician_gls/default.aspx.~~

~~Nazarian LN, Jacobson JA, Benson CB, et al. Imaging algorithms for evaluating suspected rotator~~

cuff disease: Society of Radiologists in Ultrasound consensus conference statement. [Published online ahead of print February 11, 2013]. *Radiology*. 2013; 267(2):589-595. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3632808/>.

Ng AW, Chu CM, Lo WN, et al. Assessment of capsular laxity in patients with recurrent anterior shoulder dislocation using MRI. *AJR Am J Roentgenol*. 2009; 192(6):1690-1695. doi: 10.2214/AJR.08.1544.

Ng AW, Griffith JF, Fung CS, et al. MR imaging of the traumatic triangular fibrocartilaginous complex tear. *Quant Imaging Med Surg*. 2017; 7(4):443-460. <http://doi.org/10.21037/qims.2017.07.01>.

Pandey T, Slaughter AJ, Reynolds KA, et al. Clinical orthopedic examination findings in the upper extremity: Correlation with imaging studies and diagnostic efficacy. *RadioGraphics*. 2014; 34:E24-E40.

Park JY, Park HK, et al. Prospective evaluation of the effectiveness of a home-based program of isometric strengthening exercises: 12-month follow-up. *Clin Orthop Surg*. 2010;2(3):173.

Peck J, Gustafson KE, Bahner DP. Diagnosis of achilles tendon rupture with ultrasound in the emergency department setting. *Int J Academ Med*. 2017; 3(3):205-207.

Pieters L, Lewis J, et al. An update of systematic reviews examining the effectiveness of conservative physical therapy interventions for subacromial shoulder pain. *J Orthop Sports Phys Ther*. 2020 Feb 29; 50(3):131-141.

Rajani R, Quinn R. Synovial chondromatosis. *OrthoInfo*. 2016 Dec. <https://orthoinfo.aaos.org/en/diseases-conditions/synovial-chondromatosis>

Ramirez J. Adhesive capsulitis: Diagnosis and management. *Am Fam Physician*. 2019 Mar 1; 99(5):297-300.

Redler LH, Dennis MS. Treatment of adhesive capsulitis of the shoulder. *J Am Acad Orthop Surg*. 2019 Jun 15; 27(12):e544-e554.

Rhee RB, Chan KK, Lieu JG, et al. MR and CT arthrography of the shoulder. *Semin Musculoskelet Radiol*. 2012 Feb; 16(1):3-14. Epub 2012 Mar 23.

Roberts CC, Weissman BN, Appel M, et al. American College of Radiology ACR Appropriateness Criteria®—Metastatic Bone Disease. <https://acsearch.acr.org/docs/69431/Narrative/>. Published 2012.

Roderick MR, Shah R, et al. Chronic recurrent multifocal osteomyelitis (CRMO)—Advancing the diagnosis. *Pediatr Rheumatol*. 2016; 14:47.

~~Ruston J, Konan S, Rubinraut E, et al. Diagnostic accuracy of clinical examination and magnetic resonance imaging for common articular wrist pathology. *Acta Orthop Belg*. 2013; 79:375–380.~~

~~Sadineni RT, Psumarthy A, Bellapa NC, et al. Imaging patterns in MRI in recent bone injuries following negative or inconclusive plain radiographs. *J Clin Diagn Res*. 2015 Oct; 9(10):TC10–TC13.~~

~~Scalcione LR, Gimber LH, Ho AM, et al. Spectrum of carpal dislocations and fracture-dislocations: Imaging and management. *Am J Roentgenol*. 2014; 203:541–550.~~

~~Sinha S, Peach AH. Diagnosis and management of soft tissue sarcoma. *BMJ*. 2010; 341:c7170.~~

~~Small KM, Adler RS, Shah SH, et al. American College of Radiology ACR Appropriateness Criteria® – Shoulder Pain: Atraumatic. *JACR*. 2018 Nov; 15(Suppl 11):S388–S402.
<https://acsearch.acr.org/docs/3101482/Narrative/>. Published 2017.~~

~~Smith TO, Drew BT, Toms AP, et al. Accuracy of magnetic resonance imaging, magnetic resonance arthrography and computed tomography for the detection of chondral lesions of the knee. *Knee Surg Sports Traumatol Arthrosc*. 2012 Dec; 20(12):2367–79.~~

~~Somerville LE, Wilits K, Johnson AM, et. al. Clinical assessment of physical examination maneuvers for superior labral anterior to posterior lesions. *Surg J (NY)*. 2017 Oct; 3(4):e154–e162.~~

~~Subhawong TK, Fishman EK, Swart JE, et al. Soft-tissue masses and masslike conditions: What does CT add to diagnosis and management? *AJR Am J Roentgenol*. 2010 Jun; 194(6):1559–1567.~~

~~Sudol Szopinska I, Cwikla JB. Current imaging techniques in rheumatology: MRI, scintigraphy and PET. *Pol J Radiol*. 2013 Jul-Sep; 78(3):48–56.~~

~~Taljanovic MS, Chang EY, Ha AS, et al. American College of Radiology Appropriateness Criteria® – Acute Trauma to the Knee. Revised 2019.
<https://acsearch.acr.org/docs/69419/Narrative/>.~~

~~Tos P, Crosio A, Pugliese P, et. el. Painful scar neuropathy: principles of diagnosis and treatment. *Plast Aesthet Res*. 2015; 2:156–64.~~

~~Turan A, Celtikci P, Tufan A, et al. Basic radiological assessment of synovial diseases: A pictorial essay. *Eur J Rheumatol*. 2017 Jun; 4(2):166–74.~~

~~Van Bergen CJA, Van den Ende KIM, Ten Brinke B, et al. Osteochondritis dissecans of the capitellum in adolescents. *World J Orthop*. 2016 Feb 18; 7(2):102–108.~~

~~Van Dijk CN, Reilingh ML, Zengerink M, et al. Osteochondral defects in the ankle: Why painful?~~

~~Knee Surg Sports Traumatol Arthrosc. 2010 May; 18(5):570–580.~~

~~Van Kampen DA, van den Berg T. The diagnostic value of the combination of patient characteristics, history, and clinical shoulder tests for the diagnosis of rotator cuff tear. *J Orthop Surg Res.* 2014; 9:70.~~

~~Vijayasarathi A, Chokshi C. MRI of the brachial Plexus: A practical review. *Applied Radiology.* 2016 May; 9:18.~~

~~Von Mehren M, Randall RL, Benjamin RS, et al. National Comprehensive Cancer Network (NCCN) Guidelines: Version 2.2014. *Soft Tissue Sarcoma.* http://www.nccn.org/professionals/physician_gls/pdf/sarcoma.pdf. Published 2014.~~

~~Wali Y, Almaskan S. Avascular necrosis of the hip in sickle cell disease in oman. Is it serious enough to warrant bone marrow transplantation? *Sultan Qaboos Univ Med J.* 2011 Feb; 11(1):127–128.~~

~~Wenham CYJ, Grainger AJ, Coaghan PG. The role of imaging modalities in the diagnosis, differential diagnosis and clinical assessment of peripheral joint osteoarthritis. *Osteoarthritis Cartilage.* 2014; 22(2014):1692e1702.~~

~~Wilkins R, Bisson LJ. Operative versus nonoperative management of acute Achilles tendon ruptures: A quantitative systematic review of randomized controlled trials. *Am J Sports Med.* 2012;40(9):2154–2160. doi:10.1177/0363546512453293~~

~~Yin ZG, Zhang JB, Kan SL, et al. Diagnosing Suspected Scaphoid Fractures: A Systematic Review and Meta-analysis. *Clin Orthop Relat Res.* 2010; 468(3):723–734. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2816764/>~~

~~Zoga AC, Weissman BN, Kransdorf MJ, et al. American College of Radiology ACR Appropriateness Criteria®—Soft Tissue Masses. <https://acsearch.acr.org/docs/69434/Narrative/>. Published 2017.~~

Reviewed / Approved by NIA Clinical Guideline Committee

GENERAL INFORMATION

~~It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.~~

Disclaimer: Magellan Healthcare service authorization policies do not constitute medical advice and are not intended to govern or otherwise influence the practice of medicine. These policies are not meant to supplant your normal procedures, evaluation, diagnosis, treatment and/or care plans for your patients. Your professional judgement must be exercised and followed in all respects with regard to the treatment and care of your patients. These policies apply to all Magellan Healthcare subsidiaries including, but not limited to, National Imaging Associates (“Magellan”). The policies constitute only the reimbursement and coverage guidelines of Magellan. Coverage for services varies for individual members in accordance with the terms and conditions of applicable Certificates of Coverage, Summary Plan Descriptions, or contracts with governing regulatory agencies. Magellan reserves the right to review and update the guidelines at its sole discretion. Notice of such changes, if necessary, shall be provided in accordance with the terms and conditions of provider agreements and any applicable laws or regulations.

1. Bencardino JT, Gyftopoulos S, Palmer WE. Imaging in anterior glenohumeral instability. *Radiology*. Nov 2013;269(2):323-37. doi:10.1148/radiology.13121926
2. Jain NB, Luz J, Higgins LD, et al. The Diagnostic Accuracy of Special Tests for Rotator Cuff Tear: The ROW Cohort Study. *Am J Phys Med Rehabil*. Mar 2017;96(3):176-183. doi:10.1097/phm.0000000000000566
3. Loh B, Lim JB, Tan AH. Is clinical evaluation alone sufficient for the diagnosis of a Bankart lesion without the use of magnetic resonance imaging? *Ann Transl Med*. Nov 2016;4(21):419. doi:10.21037/atm.2016.11.22
4. Somerville LE, Willits K, Johnson AM, et al. Clinical Assessment of Physical Examination Maneuvers for Superior Labral Anterior to Posterior Lesions. *Surg J (N Y)*. Oct 2017;3(4):e154-e162. doi:10.1055/s-0037-1606829
5. van Kampen DA, van den Berg T, van der Woude HJ, et al. The diagnostic value of the combination of patient characteristics, history, and clinical shoulder tests for the diagnosis of rotator cuff tear. *J Orthop Surg Res*. Aug 7 2014;9:70. doi:10.1186/s13018-014-0070-y
6. Kane SF, Lynch JH, Taylor JC. Evaluation of elbow pain in adults. *Am Fam Physician*. Apr 15 2014;89(8):649-57.
7. Karbach LE, Elfar J. Elbow Instability: Anatomy, Biomechanics, Diagnostic Maneuvers, and Testing. *J Hand Surg Am*. Feb 2017;42(2):118-126. doi:10.1016/j.jhsa.2016.11.025
8. Pandey T, Slaughter AJ, Reynolds KA, Jambhekar K, David RM, Hasan SA. Clinical orthopedic examination findings in the upper extremity: correlation with imaging studies and diagnostic efficacy. *Radiographics*. Mar-Apr 2014;34(2):e24-40. doi:10.1148/rg.342125061

9. Ruston J, Konan S, Rubinraut E, Sorene E. Diagnostic accuracy of clinical examination and magnetic resonance imaging for common articular wrist pathology. *Acta Orthop Belg.* Aug 2013;79(4):375-80.
10. Park JY, Park HK, Choi JH, et al. Prospective evaluation of the effectiveness of a home-based program of isometric strengthening exercises: 12-month follow-up. *Clin Orthop Surg.* Sep 2010;2(3):173-8. doi:10.4055/cios.2010.2.3.173
11. Pieters L, Lewis J, Kuppens K, et al. An Update of Systematic Reviews Examining the Effectiveness of Conservative Physical Therapy Interventions for Subacromial Shoulder Pain. *J Orthop Sports Phys Ther.* Mar 2020;50(3):131-141. doi:10.2519/jospt.2020.8498
12. Galvin JW, Ernat JJ, Waterman BR, Stadecker MJ, Parada SA. The Epidemiology and Natural History of Anterior Shoulder Instability. *Curr Rev Musculoskelet Med.* Dec 2017;10(4):411-424. doi:10.1007/s12178-017-9432-5
13. Waterman BR, Kilcoyne KG, Parada SA, Eichinger JK. Prevention and management of post-instability glenohumeral arthropathy. *World J Orthop.* Mar 18 2017;8(3):229-241. doi:10.5312/wjo.v8.i3.229
14. Kransdorf MJ, Murphey MD, Wessell DE, et al. ACR Appropriateness Criteria(®) Soft-Tissue Masses. *J Am Coll Radiol.* May 2018;15(5s):S189-s197. doi:10.1016/j.jacr.2018.03.012
15. American College of Radiology. ACR Appropriateness Criteria® Primary Bone Tumors. American College of Radiology. Updated 2019. Accessed November 22, 2021. <https://acsearch.acr.org/docs/69421/Narrative/>
16. American College of Radiology. ACR Appropriateness Criteria® Follow-up of Malignant or Aggressive Musculoskeletal Tumors. American College of Radiology. Updated 2015. Accessed November 22, 2021. <https://acsearch.acr.org/docs/69428/Narrative/>
17. Holzapfel K, Regler J, Baum T, et al. Local Staging of Soft-Tissue Sarcoma: Emphasis on Assessment of Neurovascular Encasement-Value of MR Imaging in 174 Confirmed Cases. *Radiology.* May 2015;275(2):501-9. doi:10.1148/radiol.14140510
18. Kircher MF, Willmann JK. Molecular body imaging: MR imaging, CT, and US. Part II. Applications. *Radiology.* Aug 2012;264(2):349-68. doi:10.1148/radiol.12111703
19. NCCN Imaging Appropriate Use Criteria™. National Comprehensive Cancer Network (NCCN). Updated 2021. Accessed November 4, 2021. <https://www.nccn.org/professionals/imaging/default.aspx>
20. Beaman FD, von Herrmann PF, Kransdorf MJ, et al. ACR Appropriateness Criteria(®) Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot). *J Am Coll Radiol.* May 2017;14(5s):S326-s337. doi:10.1016/j.jacr.2017.02.008
21. Dodwell ER. Osteomyelitis and septic arthritis in children: current concepts. *Curr Opin Pediatr.* Feb 2013;25(1):58-63. doi:10.1097/MOP.0b013e32835c2b42
22. Glaudemans A, Jutte PC, Cataldo MA, et al. Consensus document for the diagnosis of peripheral bone infection in adults: a joint paper by the EANM, EBJIS, and ESR (with ESCMID endorsement). *Eur J Nucl Med Mol Imaging.* Apr 2019;46(4):957-970. doi:10.1007/s00259-019-4262-x
23. Bowers S, Franco E. Chronic Wounds: Evaluation and Management. *Am Fam Physician.* Feb 1 2020;101(3):159-166.
24. Felten R, Perrin P, Caillard S, Moulin B, Javier RM. Avascular osteonecrosis in kidney transplant recipients: Risk factors in a recent cohort study and evaluation of the role of

secondary hyperparathyroidism. *PLoS One*. 2019;14(2):e0212931.

doi:10.1371/journal.pone.0212931

25. Murphey MD, Foreman KL, Klassen-Fischer MK, Fox MG, Chung EM, Kransdorf MJ. From the radiologic pathology archives imaging of osteonecrosis: radiologic-pathologic correlation.

Radiographics. Jul-Aug 2014;34(4):1003-28. doi:10.1148/rg.344140019

26. Murphey MD, Roberts CC, Bencardino JT, et al. ACR Appropriateness Criteria Osteonecrosis of the Hip. *J Am Coll Radiol*. Feb 2016;13(2):147-55. doi:10.1016/j.jacr.2015.10.033

27. Fukushima W, Fujioka M, Kubo T, Tamakoshi A, Nagai M, Hirota Y. Nationwide epidemiologic survey of idiopathic osteonecrosis of the femoral head. *Clin Orthop Relat Res*. Oct 2010;468(10):2715-24. doi:10.1007/s11999-010-1292-x

28. Wali Y, Almaskari S. Avascular Necrosis of the Hip in Sickle Cell Disease in Oman: Is it serious enough to warrant bone marrow transplantation? *Sultan Qaboos Univ Med J*. Feb 2011;11(1):127-8.

29. Colebatch AN, Edwards CJ, Østergaard M, et al. EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis*. Jun 2013;72(6):804-14. doi:10.1136/annrheumdis-2012-203158

30. Narváez JA, Narváez J, De Lama E, De Albert M. MR imaging of early rheumatoid arthritis.

Radiographics. Jan 2010;30(1):143-63; discussion 163-5. doi:10.1148/rg.301095089

31. Bencardino JT, Stone TJ, Roberts CC, et al. ACR Appropriateness Criteria(®) Stress (Fatigue/Insufficiency) Fracture, Including Sacrum, Excluding Other Vertebrae. *J Am Coll Radiol*. May 2017;14(5s):S293-s306. doi:10.1016/j.jacr.2017.02.035

32. Sadineni RT, Pasumarthy A, Bellapa NC, Velicheti S. Imaging Patterns in MRI in Recent Bone Injuries Following Negative or Inconclusive Plain Radiographs. *J Clin Diagn Res*. Oct 2015;9(10):Tc10-3. doi:10.7860/jcdr/2015/15451.6685

33. Yin ZG, Zhang JB, Kan SL, Wang XG. Diagnosing suspected scaphoid fractures: a systematic review and meta-analysis. *Clin Orthop Relat Res*. Mar 2010;468(3):723-34. doi:10.1007/s11999-009-1081-6

34. Fayad LM, Kawamoto S, Kamel IR, et al. Distinction of long bone stress fractures from pathologic fractures on cross-sectional imaging: how successful are we? *AJR Am J Roentgenol*. Oct 2005;185(4):915-24. doi:10.2214/ajr.04.0950

35. Morshed S. Current Options for Determining Fracture Union. *Adv Med*. 2014;2014:708574. doi:10.1155/2014/708574

36. Barlow SJ. A Non-surgical Intervention for Triangular Fibrocartilage Complex Tears. *Physiother Res Int*. Dec 2016;21(4):271-276. doi:10.1002/pri.1672

37. Ng AWH, Griffith JF, Fung CSY, et al. MR imaging of the traumatic triangular fibrocartilaginous complex tear. *Quant Imaging Med Surg*. Aug 2017;7(4):443-460. doi:10.21037/qims.2017.07.01

38. Smith TO, Drew BT, Toms AP, Donell ST, Hing CB. Accuracy of magnetic resonance imaging, magnetic resonance arthrography and computed tomography for the detection of chondral lesions of the knee. *Knee Surg Sports Traumatol Arthrosc*. Dec 2012;20(12):2367-79. doi:10.1007/s00167-012-1905-x

39. American College of Radiology. ACR Appropriateness Criteria® Acute Trauma to the Knee. American College of Radiology (ACR). Updated 2019. Accessed November 22, 2021.

<https://acsearch.acr.org/docs/69419/Narrative/>

40. van Dijk CN, Reilingh ML, Zengerink M, van Bergen CJ. Osteochondral defects in the ankle: why painful? *Knee Surg Sports Traumatol Arthrosc*. May 2010;18(5):570-80. doi:10.1007/s00167-010-1064-x
41. van Bergen CJ, van den Ende KI, Ten Brinke B, Eygendaal D. Osteochondritis dissecans of the capitellum in adolescents. *World J Orthop*. Feb 18 2016;7(2):102-8. doi:10.5312/wjo.v7.i2.102
42. Rajani R, Quinn RH, Fischer SJ. Synovial Chondromatosis. American Academy of Orthopaedic Surgeons (AAOS). Updated December 2016. Accessed November 22, 2021. <https://orthoinfo.aaos.org/en/diseases--conditions/synovial-chondromatosis>
43. Laya BF, Restrepo R, Lee EY. Practical Imaging Evaluation of Foreign Bodies in Children: An Update. *Radiol Clin North Am*. Jul 2017;55(4):845-867. doi:10.1016/j.rcl.2017.02.012
44. Garras DN, Raikin SM, Bhat SB, Taweel N, Karanjia H. MRI is unnecessary for diagnosing acute Achilles tendon ruptures: clinical diagnostic criteria. *Clin Orthop Relat Res*. Aug 2012;470(8):2268-73. doi:10.1007/s11999-012-2355-y
45. Peck J, Gustafson K, Bahner D. Diagnosis of Achilles tendon rupture with ultrasound in the emergency department setting. Images in Academic Medicine: Republication. *Int J Academ Med*. May 1, 2017 2017;3(3):205-207. doi:10.4103/ijam.ijam_16_17
46. Wilkins R, Bisson LJ. Operative versus nonoperative management of acute Achilles tendon ruptures: a quantitative systematic review of randomized controlled trials. *Am J Sports Med*. Sep 2012;40(9):2154-60. doi:10.1177/0363546512453293
47. Domkundwar S, Autkar G, Khadilkar SV, Virarkar M. Ultrasound and EMG-NCV study (electromyography and nerve conduction velocity) correlation in diagnosis of nerve pathologies. *J Ultrasound*. Jun 2017;20(2):111-122. doi:10.1007/s40477-016-0232-3
48. Dong Q, Jacobson JA, Jamadar DA, et al. Entrapment neuropathies in the upper and lower limbs: anatomy and MRI features. *Radiol Res Pract*. 2012;2012:230679. doi:10.1155/2012/230679
49. Donovan A, Rosenberg ZS, Cavalcanti CF. MR imaging of entrapment neuropathies of the lower extremity. Part 2. The knee, leg, ankle, and foot. *Radiographics*. Jul-Aug 2010;30(4):1001-19. doi:10.1148/rg.304095188
50. Meyer P, Lintingre PF, Pesquer L, Poussange N, Silvestre A, Dallaudière B. The Median Nerve at the Carpal Tunnel ... and Elsewhere. *J Belg Soc Radiol*. Jan 31 2018;102(1):17. doi:10.5334/jbsr.1354
51. Tos P, Crosio A, Pugliese P, Adani R, Toia F, Artiaco S. Painful scar neuropathy: principles of diagnosis and treatment. *Plastic and Aesthetic Research*. 2015;2:156-164. doi:10.4103/2347-9264.160878
52. Mansukhani KA. Electrodiagnosis in traumatic brachial plexus injury. *Ann Indian Acad Neurol*. Jan 2013;16(1):19-25. doi:10.4103/0972-2327.107682
53. Vijayarathi A, Chokshi FH. MRI of the brachial plexus: A practical review. *Appl Radiol*. 2016;45(4):9-18.
54. Fritz J, Lurie B, Potter HG. MR Imaging of Knee Arthroplasty Implants. *Radiographics*. Sep-Oct 2015;35(5):1483-501. doi:10.1148/rg.2015140216
55. Fritz J, Lurie B, Miller TT, Potter HG. MR imaging of hip arthroplasty implants. *Radiographics*. Jul-Aug 2014;34(4):E106-32. doi:10.1148/rg.344140010

56. Ramirez J. Adhesive Capsulitis: Diagnosis and Management. *Am Fam Physician*. Mar 1 2019;99(5):297-300.
57. Redler LH, Dennis ER. Treatment of Adhesive Capsulitis of the Shoulder. *J Am Acad Orthop Surg*. Jun 15 2019;27(12):e544-e554. doi:10.5435/jaaos-d-17-00606
58. Small KM, Adler RS, Shah SH, et al. ACR Appropriateness Criteria(®) Shoulder Pain-Atraumatic. *J Am Coll Radiol*. Nov 2018;15(11s):S388-s402. doi:10.1016/j.jacr.2018.09.032
59. American Academy of Pediatrics. Five things physicians and patients should question: Do not order advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. Choosing Wisely Initiative ABIM Foundation. Updated February 12, 2018. Accessed November 22, 2021. <https://www.choosingwisely.org/clinician-lists/aap-posna-mri-or-ct-for-musculoskeletal-conditions-in-children/>

ADDITIONAL RESOURCES

1. Arnander M, Tennent D. Clinical assessment of the glenoid labrum. *Shoulder Elbow*. Oct 2014;6(4):291-9. doi:10.1177/1758573214546156
2. NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines): Bone Cancer Version 2.2022. National Comprehensive Cancer Network (NCCN). Updated October 8, 2021. Accessed November 23, 2021. https://www.nccn.org/professionals/physician_gls/pdf/bone.pdf
3. Buck FM, Jost B, Hodler J. Shoulder arthroplasty. *Eur Radiol*. Dec 2008;18(12):2937-48. doi:10.1007/s00330-008-1093-8
4. Chuang TY, Adams CR, Burkhart SS. Use of preoperative three-dimensional computed tomography to quantify glenoid bone loss in shoulder instability. *Arthroscopy*. Apr 2008;24(4):376-82. doi:10.1016/j.arthro.2007.10.008
5. Consigliere P, Haddo O, Levy O, Sforza G. Subacromial impingement syndrome: management challenges. *Orthop Res Rev*. 2018;10:83-91. doi:10.2147/orr.S157864
6. Dommett RM, Redaniel MT, Stevens MC, Hamilton W, Martin RM. Features of cancer in teenagers and young adults in primary care: a population-based nested case-control study. *Br J Cancer*. Jun 11 2013;108(11):2329-33. doi:10.1038/bjc.2013.191
7. Eljabu W, Klinger HM, von Knoch M. The natural course of shoulder instability and treatment trends: a systematic review. *J Orthop Traumatol*. Mar 2017;18(1):1-8. doi:10.1007/s10195-016-0424-9
8. Gaddey HL, Riegel AM. Unexplained Lymphadenopathy: Evaluation and Differential Diagnosis. *Am Fam Physician*. Dec 1 2016;94(11):896-903.
9. Kekatpure AL, Sun JH, Sim GB, Chun JM, Jeon IH. Rapidly destructive arthrosis of the shoulder joints: radiographic, magnetic resonance imaging, and histopathologic findings. *J Shoulder Elbow Surg*. Jun 2015;24(6):922-7. doi:10.1016/j.jse.2014.10.020
10. Lee YJ, Sadigh S, Mankad K, Kapse N, Rajeswaran G. The imaging of osteomyelitis. *Quant Imaging Med Surg*. Apr 2016;6(2):184-98. doi:10.21037/qims.2016.04.01
11. Magee T. Utility of pre- and post-MR arthrogram imaging of the shoulder: effect on patient care. *Br J Radiol*. Jun 2016;89(1062):20160028. doi:10.1259/bjr.20160028

12. Mathew CJ, Lintner DM. Superior Labral Anterior to Posterior Tear Management in Athletes. *Open Orthop J*. 2018;12:303-313. doi:10.2174/1874325001812010303
13. Mohseni S, Shojaiefard A, Khorgami Z, Alinejad S, Ghorbani A, Ghafouri A. Peripheral lymphadenopathy: approach and diagnostic tools. *Iran J Med Sci*. Mar 2014;39(2 Suppl):158-70.
14. Mullan CP, Madan R, Trotman-Dickenson B, Qian X, Jacobson FL, Hunsaker A. Radiology of chest wall masses. *AJR Am J Roentgenol*. Sep 2011;197(3):W460-70. doi:10.2214/ajr.10.7259
15. Nazarian LN, Jacobson JA, Benson CB, et al. Imaging algorithms for evaluating suspected rotator cuff disease: Society of Radiologists in Ultrasound consensus conference statement. *Radiology*. May 2013;267(2):589-95. doi:10.1148/radiol.13121947
16. Ng AW, Chu CM, Lo WN, Lai YM, Kam CK. Assessment of capsular laxity in patients with recurrent anterior shoulder dislocation using MRI. *AJR Am J Roentgenol*. Jun 2009;192(6):1690-5. doi:10.2214/ajr.08.1544
17. Rhee RB, Chan KK, Lieu JG, Kim BS, Steinbach LS. MR and CT arthrography of the shoulder. *Semin Musculoskelet Radiol*. Feb 2012;16(1):3-14. doi:10.1055/s-0032-1304297
18. Roberts CC, Daffner RH, Weissman BN, et al. ACR appropriateness criteria on metastatic bone disease. *J Am Coll Radiol*. Jun 2010;7(6):400-9. doi:10.1016/j.jacr.2010.02.015
19. Roderick MR, Shah R, Rogers V, Finn A, Ramanan AV. Chronic recurrent multifocal osteomyelitis (CRMO) - advancing the diagnosis. *Pediatr Rheumatol Online J*. Aug 30 2016;14(1):47. doi:10.1186/s12969-016-0109-1
20. Scalcione LR, Gimber LH, Ho AM, Johnston SS, Sheppard JE, Taljanovic MS. Spectrum of carpal dislocations and fracture-dislocations: imaging and management. *AJR Am J Roentgenol*. Sep 2014;203(3):541-50. doi:10.2214/ajr.13.11680
21. Sinha S, Peach AH. Diagnosis and management of soft tissue sarcoma. *Bmj*. Dec 29 2010;341:c7170. doi:10.1136/bmj.c7170
22. Subhawong TK, Fishman EK, Swart JE, Carrino JA, Attar S, Fayad LM. Soft-tissue masses and masslike conditions: what does CT add to diagnosis and management? *AJR Am J Roentgenol*. Jun 2010;194(6):1559-67. doi:10.2214/ajr.09.3736
23. Sudół-Szopińska I, Cwikła JB. Current imaging techniques in rheumatology: MRI, scintigraphy and PET. *Pol J Radiol*. Jul 2013;78(3):48-56. doi:10.12659/pjr.889138
24. Turan A, Çeltikçi P, Tufan A, Öztürk MA. Basic radiological assessment of synovial diseases: a pictorial essay. *Eur J Rheumatol*. Jun 2017;4(2):166-174. doi:10.5152/eurjrheum.2015.0032
25. NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines): Soft Tissue Sarcoma Version 2.2021. National Comprehensive Cancer Network (NCCN). Updated April 28, 2021. Accessed November 23, 2021. https://www.nccn.org/professionals/physician_gls/pdf/sarcoma.pdf
26. Wenham CY, Grainger AJ, Conaghan PG. The role of imaging modalities in the diagnosis, differential diagnosis and clinical assessment of peripheral joint osteoarthritis. *Osteoarthritis Cartilage*. Oct 2014;22(10):1692-702. doi:10.1016/j.joca.2014.06.005

Reviewed / Approved by NIA Clinical Guideline Committee

|

|

GENERAL INFORMATION

It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.

Disclaimer: Magellan Healthcare service authorization policies do not constitute medical advice and are not intended to govern or otherwise influence the practice of medicine. These policies are not meant to supplant your normal procedures, evaluation, diagnosis, treatment and/or care plans for your patients. Your professional judgement must be exercised and followed in all respects with regard to the treatment and care of your patients. These policies apply to all Magellan Healthcare subsidiaries including, but not limited to, National Imaging Associates (“Magellan”). The policies constitute only the reimbursement and coverage guidelines of Magellan. Coverage for services varies for individual members in accordance with the terms and conditions of applicable Certificates of Coverage, Summary Plan Descriptions, or contracts with governing regulatory agencies. Magellan reserves the right to review and update the guidelines at its sole discretion. Notice of such changes, if necessary, shall be provided in accordance with the terms and conditions of provider agreements and any applicable laws or regulations.