American College of Radiology
ACR Appropriateness Criteria®
Chronic Elbow Pain

Variant: 1 Chronic elbow pain. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography elbow	Usually Appropriate	☢
US elbow	Usually Not Appropriate	O
MR arthrography elbow	Usually Not Appropriate	O
MRI elbow without and with IV contrast	Usually Not Appropriate	O
MRI elbow without IV contrast	Usually Not Appropriate	O
CT arthrography elbow	Usually Not Appropriate	☢☢
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢
CT elbow without IV contrast	Usually Not Appropriate	☢☢
3-phase bone scan elbow	Usually Not Appropriate	☢☢☢

Variant: 2 Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
MR arthrography elbow	Usually Appropriate	O
MRI elbow without IV contrast	Usually Appropriate	O
CT arthrography elbow	Usually Appropriate	☢☢
CT elbow without IV contrast	Usually Appropriate	☢☢
US elbow	Usually Not Appropriate	O
MRI elbow without and with IV contrast	Usually Not Appropriate	O
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢
3-phase bone scan elbow	Usually Not Appropriate	☢☢☢

Variant: 3 Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
MRI elbow without IV contrast	Usually Appropriate	O
CT elbow without IV contrast	Usually Appropriate	☢☢
3-phase bone scan elbow	May Be Appropriate (Disagreement)	☢☢☢
US elbow	Usually Not Appropriate	O
MR arthrography elbow	Usually Not Appropriate	O
MRI elbow without and with IV contrast	Usually Not Appropriate	O
CT arthrography elbow	Usually Not Appropriate	☢☢
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢

Variant: 4 **Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
US elbow	Usually Appropriate	O
MRI elbow without IV contrast	Usually Appropriate	O
MR arthrography elbow	Usually Not Appropriate	O
MRI elbow without and with IV contrast	Usually Not Appropriate	O
CT arthrography elbow	Usually Not Appropriate	☢☢
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢
CT elbow without IV contrast	Usually Not Appropriate	☢☢
3-phase bone scan elbow	Usually Not Appropriate	☢☢☢

Variant: 5 **Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
US elbow	Usually Appropriate	O
MR arthrography elbow	Usually Appropriate	O
MRI elbow without IV contrast	Usually Appropriate	O
CT arthrography elbow	Usually Appropriate	☢☢
Radiography elbow stress views	May Be Appropriate	☢
MRI elbow without and with IV contrast	Usually Not Appropriate	O
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢
CT elbow without IV contrast	Usually Not Appropriate	☢☢
3-phase bone scan elbow	Usually Not Appropriate	☢☢☢

Variant: 6 **Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
US elbow	Usually Appropriate	O
MRI elbow without IV contrast	Usually Appropriate	O
CT elbow without IV contrast	May Be Appropriate	☢☢
MR arthrography elbow	Usually Not Appropriate	O
MRI elbow without and with IV contrast	Usually Not Appropriate	O
CT arthrography elbow	Usually Not Appropriate	☢☢
CT elbow with IV contrast	Usually Not Appropriate	☢☢
CT elbow without and with IV contrast	Usually Not Appropriate	☢☢
3-phase bone scan elbow	Usually Not Appropriate	☢☢☢

Panel Members

Jonelle M. Thomas, MD, MPH[a]; Eric Y. Chang, MD[b]; Alice S. Ha, MD, MS[c]; Roger J. Bartolotta, MD[d]; Matthew D. Bucknor,

MD[e]; Jamie T. Caracciolo, MD, MBA[f]; Karen C. Chen, MD[g]; Jonathan Flug, MD, MBA[h]; Manickam Kumaravel, MD[i]; Noah M. Raizman, MD[j]; Andrew B. Ross, MD, MPH[k]; Matthew L. Silvis, MD[l]; Devaki Shilpa Surasi, MD[m]; Francesca D. Beaman, MD[n].

Summary of Literature Review

Introduction/Background

Chronic elbow pain is a common patient complaint in the primary care setting. Patients may report symptoms of swelling, pain, restricted range of motion, stiffness, and numbness or tingling [1]. There is a wide differential diagnosis for chronic elbow pain, including osseous, soft tissue, cartilaginous, and nerve-related abnormalities. Epicondylalgia, caused by tendinosis of the common extensor tendon laterally ("tennis elbow") or medially the common flexor tendon ("golfer's elbow"), is the most common cause of chronic elbow pain, estimated to occur in 1% to 3% of the population [2]. Epicondylalgia is associated with lost workdays and a significant economic burden [3]. Both occupational and recreational causes play a role in development of epicondylalgia as well as other causes of chronic elbow pain, including biceps tendinopathy, osteochondral injuries, collateral ligament tears, and cubital tunnel syndrome.

Imaging plays an important role in assessment of chronic elbow pain. Electromyography assists in the workup related to nerve symptoms. Management for epicondylalgia and osteoarthritis includes conservative measures such as rest, activity modification, analgesia, physical therapy, and corticosteroid injections. Surgery may be indicated for more severe or refractory cases and cases of collateral ligament injury, biceps injury, cubital tunnel syndrome, or osteochondral abnormalities.

Special Imaging Considerations

Stress radiographs to detect medial joint line opening and/or asymmetry to the contralateral elbow are available to evaluate valgus instability of the elbow.

Initial Imaging Definition

Initial imaging is defined as imaging at the beginning of the care episode for the medical condition defined by the variant. More than one procedure can be considered usually appropriate in the initial imaging evaluation when:

- There are procedures that are equivalent alternatives (i.e., only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

- There are complementary procedures (i.e., more than one procedure is ordered as a set or simultaneously wherein each procedure provides unique clinical information to effectively manage the patient's care).

Discussion of Procedures by Variant

Variant 1: Chronic elbow pain. Initial imaging.

Variant 1: Chronic elbow pain. Initial imaging.

A. 3-phase bone scan elbow

There is limited evidence to support the use of 3-phase bone scan as the initial imaging study for the evaluation of chronic elbow pain.

Variant 1: Chronic elbow pain. Initial imaging.
B. CT arthrography elbow

There is limited evidence to support the use of CT arthrography elbow as the initial imaging study for the evaluation of chronic elbow pain.

Variant 1: Chronic elbow pain. Initial imaging.
C. CT elbow

There is limited evidence to support the use of CT elbow as the initial imaging study for the evaluation of chronic elbow pain.

Variant 1: Chronic elbow pain. Initial imaging.
D. MR arthrography elbow

There is limited evidence to support the use of MR arthrography elbow as the initial imaging study for the evaluation of chronic elbow pain.

Variant 1: Chronic elbow pain. Initial imaging.
E. MRI elbow

There is limited evidence to support the use of MRI elbow as the initial imaging study for the evaluation of chronic elbow pain.

Variant 1: Chronic elbow pain. Initial imaging.
F. Radiography elbow

Radiographs are beneficial as the initial imaging for chronic elbow pain. Radiographs may show intra-articular bodies, heterotopic ossification, osteochondral lesion, soft tissue calcification, occult fracture, or osteoarthritis. Radiographs complement subsequent MRI elbow examination [4]. Radiographs have been shown to aide the diagnosis of valgus instability [5] and ulnar collateral ligament (UCL) injury [6]. Comparison with the asymptomatic side is often useful [7].

Variant 1: Chronic elbow pain. Initial imaging.
G. US elbow

There is limited evidence to support the use of ultrasound (US) elbow as the initial imaging study for the evaluation of chronic elbow pain.

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.
A. 3-phase bone scan elbow

There is limited evidence to support the routine use of 3-phase bone scan elbow for evaluation of osteochondral bodies, osteochondral lesions, or synovial abnormalities. However, the early phase

of a 3-phase bone scan can identify the inflammatory component of heterotopic ossification. The delayed images demonstrate increased tracer uptake due to bone formation [8,9].

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

B. CT arthrography elbow

CT arthrography elbow is useful in the assessment of heterotopic ossification, loose bodies, and osteoarthritis. CT elbow has a sensitivity and specificity of 93% and 66% for detection of loose bodies [10]. It has a reported accuracy of 79% for the detection of loose bodies and 76% for osteophytes [10]. However, small intra-articular bodies may be obscured by contrast. CT arthrography is helpful for evaluation of osteochondral lesion stability [11].

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

C. CT elbow

CT elbow is useful in the assessment of heterotopic ossification, loose bodies, and osteophytosis. CT elbow has a sensitivity and specificity of 93% and 66% for the detection of loose bodies [10]. CT elbow without intravenous (IV) contrast is less useful than CT arthrography elbow for the assessment of osteochondral lesion stability.

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

D. MR arthrography elbow

MRI arthrography elbow is useful for detection of intra-articular bodies, with a reported sensitivity of 100% and a specificity of 67% [12]. MR arthrography elbow also plays an important role in evaluation of osteochondral lesion stability [13,14]. MRI may also show the presence of enlarged synovial plica, which can result in symptoms of locking and/or pain with extension [15]. However, MR arthrography elbow is limited in the detection of cartilage abnormalities. Accuracy is reported as 45% for the radius, 64% for the capitellum, 18% for the ulna, and 27% for the trochlea [16].

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

E. MRI elbow

MRI elbow may detect loose bodies, and this is enhanced in the presence of joint fluid. Thus, T2-weighted images are recommended for the evaluation of loose bodies in the elbow [17]. MRI may also show the presence of enlarged plica, which can result in symptoms of locking and/or pain with extension [15]. MRI is often suggested as the initial study to assess for osteochondral lesion [12,17]. MRI is less sensitive than radiographs in the detection of heterotopic ossification/calcification [18]. Similar to MR arthrography, MRI elbow is limited in the evaluation of cartilage defects [16].

Variant 2: Chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion. Suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. Radiographs normal or nonspecific. Next imaging study.

F. US elbow

Although US may demonstrate early-stage osteochondral lesions and medial epicondylar fragmentation [10], the details of an osteochondral lesion are better defined by CT arthrography or MR arthrography. Because of shadowing, evaluation of heterotopic ossification and loose bodies is limited on US.

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

A. 3-phase bone scan elbow

Bone scan is extremely sensitive for detection of stress fractures and trauma related fractures [19-21]. Radiopharmaceutical uptake occurs in areas of active bone turnover, and thus, imaging may be positive in the presymptomatic stage of stress injuries [20].

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

B. CT arthrography elbow

There is limited evidence to the support the use of CT arthrography elbow for the detection of occult fractures following radiographs.

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

C. CT elbow

CT elbow is helpful in identifying complex fracture patterns, the origin of dislocated fragments, and positions of displaced fragments [22]. However, it has poor sensitivity in the detection of early stress fractures [20].

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

D. MR arthrography elbow

There is limited evidence to the support the use of MR arthrography elbow for the detection of occult fractures following radiographs.

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

E. MRI elbow

MRI is as sensitive as 3-phase bone scan for detection of stress fractures [20]. MRI findings include bone marrow edema and/or periosteal fluid at the site of abnormality [20]. MRI elbow has the advantage of demonstrating associated soft tissue injuries.

Variant 3: Chronic elbow pain. Suspect occult stress fracture or other bone abnormality. Radiographs normal or nonspecific. Next imaging study.

F. US elbow

US can demonstrate a lipohemarthrosis in children with occult elbow fractures [23]. However, poor penetration of sound through the bone limits characterization of fractures.

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
A. 3-phase bone scan elbow

Although there is limited evidence to support the routine use of 3-phase bone scan in this setting, bone scans can detect chronic epicondylalgia [24].

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
B. CT arthrography elbow

There is limited evidence to the support the use of CT arthrography elbow for the detection of tendon tears or chronic epicondylalgia.

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
C. CT elbow

There is limited evidence to the support the use of CT elbow for detection of tendon tears or chronic epicondylalgia.

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
D. MR arthrography elbow

MR arthrography does not add additional information compared with noncontrast MRI for the diagnosis of biceps tendon tear or chronic epicondylalgia [25].

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
E. MRI elbow

MRI has high inter- and intraobserver reliability for the diagnosis of epicondylalgia [26]. It also has a sensitivity of 90% to 100% and a specificity of 83% to 100% [27]. The most specific findings of medial epicondylalgia include intermediate to high T2 signal or high T2 signal within the common flexor tendon and paratendinous soft tissue edema [28]. MRI has the benefit of demonstrating associated findings in epicondylalgia, including radial collateral and lateral UCL injuries [26]. MRI may also facilitate surgical planning [29].

MRI is useful for the diagnosis of biceps tendon injury. Sensitivity and specificity are reported at 92.4% and 100%, respectively, in detecting distal biceps tendon ruptures and 59.1% and 100%, respectively for partial tears [30].

Variant 4: Chronic elbow pain. Suspect chronic epicondylalgia or tendon tear. Refractory to empirical treatment. Radiographs normal or nonspecific. Next imaging study.
F. US elbow

US elbow has moderate agreement with MR elbow for the diagnosis and grading of common extensor tendon tears. US sensitivity, specificity, and accuracy are reported at 64.25%, 85.19%, and

72.73%, respectively [31]. Recently, sonoelastography has shown more promising outcomes for detection of medial epicondylalgia with a sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of 95.2%, 92%, 93.5%, 90.9%, and 95.8%, respectively [32]. Another new technique, superb microvascular imaging, can be used to detect subtle low blood flow. The combination of superb microvascular imaging with conventional US performed best for the diagnosis of epicondylalgia, with sensitivity of 94%, specificity of 98%, accuracy of 96% [33].

US is also useful for detection of biceps tendon abnormalities. It performs similar to slightly better than MRI for the diagnosis of distal biceps brachii tendon tear [34]. Reports show 95% sensitivity, 71% specificity, and 91% accuracy for the diagnosis of complete versus partial distal biceps tendon tears with US [35].

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
A. 3-phase bone scan elbow

There is limited evidence to support the routine use of 3-phase bone scan for the diagnosis of collateral ligament injury following radiographs.

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
B. CT arthrography elbow

CT arthrography has a sensitivity of 86%. The sensitivity for full-thickness tears and partial tears is reported at 100% and 71%, respectively. The overall specificity is 91% [36].

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
C. CT elbow

There is limited evidence to support the routine use of CT elbow for the diagnosis of collateral ligament injury following radiographs.

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
D. MR arthrography elbow

MR arthrography elbow is accurate for the diagnosis of collateral ligament injuries [37]. At 3T, it is more accurate than noncontrast MRI [38]. The reported sensitivity, specificity, and accuracy for UCL tears are 81%, 91%, and 88%, respectively [39]. MR arthrography may also assist in differentiation between partial and complete UCL tear [40,41]. Presence of soft tissue and bone marrow edema occurs more often in symptomatic patients [42]. Additionally, a more distal ligamentous insertion of the UCL (T sign) has recently been suggested to result from repetitive overhead activity and injury rather than representing a normal anatomic variant [42].

In patients with posterolateral rotatory instability, MR arthrography can assess the integrity of the ulnar band of the radial collateral ligament [43] and demonstrate radiocapitellar incongruity [44].

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
E. MRI elbow

A 3T MR arthrography is more accurate than noncontrast MRI elbow for detection of collateral ligament injuries [38].

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
F. Radiography elbow stress views

Measurement of medial joint space opening on stress radiographs correlates with severity of UCL injury in throwing athletes [6]. Additionally, medial joint vacuum phenomenon on valgus stress radiographs is specific for UCL injury [45]. However, radiographs do not directly provide information on the location of collateral ligament injury or associated soft tissue injuries as can be done on MR arthrography.

Variant 5: Chronic elbow pain. Suspect collateral ligament tear. Radiographs normal or nonspecific. Next imaging study.
G. US elbow

For full-thickness UCL tears, conventional US has a sensitivity of 79%, a specificity of 98%, and an accuracy of 95% (38). For partial thickness UCL tears, conventional US has a sensitivity of 77%, a specificity of 94%, and an accuracy of 90% (38). Stress US can accurately detect UCL tears when there is medial joint gapping [46,47]. The sensitivity and specificity of valgus stress US for all UCL tears is 96% and 81%, respectively [36].

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.
A. 3-phase bone scan elbow

There is limited evidence to support the routine use of 3-phase bone scan elbow for nerve abnormalities at the elbow following radiographs.

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.
B. CT arthrography elbow

There is limited evidence to support the routine use of CT arthrography elbow for nerve abnormalities at the elbow following radiographs.

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.
C. CT elbow

CT axial images in flexion and extension can demonstrate recurrent ulnar nerve dislocation because of a snapping of the medial head of the triceps [47].

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.
D. MR arthrography elbow

There is limited evidence to support the routine use of MR arthrography elbow for nerve abnormalities following radiographs.

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.

E. MRI elbow

T2-weighted MR neurography is the reference standard for imaging ulnar nerve entrapment (UNE) [48-50]. Most common findings include high signal intensity and nerve enlargement [50]. Diagnostic confidence can be increased with the use of diffusion-tensor imaging [49,51]. Diffusion-tensor imaging and tractography also provide quantitative information in 3-D perspective [47,49]. However, 3T MRI has only fair-to-moderate agreement for localization of compression points in UNE [52,53]. Radial nerve, median nerve, and other entrapment syndromes can also be evaluated with MRI [54,55].

Variant 6: Chronic elbow pain. Suspect nerve abnormality. Radiographs normal or nonspecific. Next imaging study.

F. US elbow

US elbow is another option for evaluation of UNE. Assessment of cross-sectional area/nerve thickness has high accuracy rates [48,56-58]. US also accurately demonstrates hourglass constriction of the nerve [59]. Dynamic US is helpful in demonstrating nerve dislocation in ulnar nerve neuropathy and snapping triceps syndrome [59-62].

Shear-wave elastography is a newer method used for the diagnosis of ulnar neuropathy at the elbow. Values of 100% specificity, sensitivity, and both positive and negative predictive value have been reported [63,64].

Summary of Highlights

- **Variant 1**: Radiography elbow is usually appropriate for the initial imaging of chronic elbow pain.
- **Variant 2**: In the setting of chronic elbow pain with mechanical symptoms such as locking, clicking, or limited range of motion with normal or nonspecific radiographs, MR arthrography elbow or MRI elbow without IV contrast or CT arthrography elbow or CT elbow without IV contrast is usually appropriate as the next imaging study for suspect intra-articular pathology such as osteocartilaginous body, osteochondral lesion, or synovial abnormality. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care).
- **Variant 3**: In the setting of chronic elbow pain with normal or nonspecific radiographs, MRI elbow without IV contrast or CT elbow without IV contrast is usually appropriate as the next imaging study for suspected occult stress fracture or other bone abnormality. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care). Although the panel did not agree on recommending 3-phase bone scan elbow, because there is insufficient medical literature to conclude whether these patients would benefit from the procedure, its use may be appropriate.
- **Variant 4**: In the setting of chronic elbow pain with normal or nonspecific radiographs, US elbow or MRI elbow without IV contrast is usually appropriate as the next imaging study for suspected chronic epicondylalgia or tendon tear including refractory to empirical treatment. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care).
- **Variant 5**: In the setting of chronic elbow pain with normal or nonspecific radiographs, US elbow or MRI elbow without IV contrast or MRI elbow without IV contrast or CT arthrography

elbow is usually appropriate as the next imaging study for suspected collateral ligament tear. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care).

- **Variant 6**: In the setting of chronic elbow pain with normal or nonspecific radiographs, US elbow or MRI elbow without IV contrast is usually appropriate as the next imaging study for suspected nerve abnormalities. These procedures are equivalent alternatives (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care).

Supporting Documents

The evidence table, literature search, and appendix for this topic are available at https://acsearch.acr.org/list. The appendix includes the strength of evidence assessment and the final rating round tabulations for each recommendation.

For additional information on the Appropriateness Criteria methodology and other supporting documents, please go to the ACR website at https://www.acr.org/Clinical-Resources/Clinical-Tools-and-Reference/Appropriateness-Criteria.

Appropriateness Category Names and Definitions

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	5	The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.
Usually Not Appropriate	1, 2, or 3	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure.

Patients in the pediatric age group are at inherently higher risk from exposure, because of both organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared with those specified for adults (see Table below). Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® Radiation Dose Assessment Introduction document.

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

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The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

[a]Penn State Milton S. Hershey Medical Center, Hershey, Pennsylvania. [b]Panel Chair, VA San Diego Healthcare System, San Diego, California. [c]Panel Vice-Chair, University of Washington, Seattle, Washington. [d]Weill Cornell Medical College, New York, New York. [e]University of California San Francisco, San Francisco, California. [f]Moffitt Cancer Center and University of South Florida Morsani College of Medicine, Tampa, Florida; MSK-RADS Committee. [g]VA San Diego Healthcare System, San Diego, California. [h]Mayo Clinic Arizona, Phoenix, Arizona. [i]University of Texas Health Science Center, Houston, Texas; Committee on Emergency Radiology-GSER. [j]The Centers for Advanced Orthopaedics, George Washington University, Washington, DC and Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland; American Academy of Orthopaedic Surgeons. [k]University of Wisconsin School of Medicine & Public Health, Madison, Wisconsin. [l]Penn

State Milton S. Hershey Medical Center, Hershey, Pennsylvania, Primary care physician. [m]The University of Texas MD Anderson Cancer Center, Houston, Texas; Commission on Nuclear Medicine and Molecular Imaging. [n]Specialty Chair, University of Kentucky, Lexington, Kentucky.