

**American College of Radiology  
ACR Appropriateness Criteria®**

**Clinical Condition:**      Chronic Elbow Pain

**Variant 1:**                      Evaluation for chronic elbow pain. First test.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
X-ray elbow	9		☼
MRI elbow without contrast	1		O
MR arthrography elbow	1		O
CT elbow without contrast	1		☼
CT arthrography elbow	1		☼
US elbow	1		O
Tc-99m bone scan elbow	1		☼ ☼ ☼
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 2:**                      Suspect intra-articular osteocartilaginous body; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. If effusion is present, without contrast is preferred.	O
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. See statement regarding contrast in text under “Anticipated Exceptions.”	O
CT elbow without contrast	8		☼
CT arthrography elbow	8	If double contrast is used, dose should be less than 0.5 cc.	☼
US elbow	6	With appropriate expertise.	O
Tc-99m bone scan elbow	1		☼ ☼ ☼
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

**Clinical Condition:**      **Chronic Elbow Pain**

**Variant 3:**                      **Suspect occult injury (eg, osteochondral injury); radiographs nondiagnostic.**

<b>Radiologic Procedure</b>	<b>Rating</b>	<b>Comments</b>	<b><u>RRL*</u></b>
MRI elbow without contrast	9		O
CT elbow without contrast	2		☢
MR arthrography elbow	2		O
CT arthrography elbow	2		☢
Tc-99m bone scan elbow	2		☢ ☢ ☢
US elbow	1		O
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 4:**                      **Suspect unstable osteochondral injury; radiographs nondiagnostic.**

<b>Radiologic Procedure</b>	<b>Rating</b>	<b>Comments</b>	<b><u>RRL*</u></b>
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions.	O
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. See statement regarding contrast in text under “Anticipated Exceptions.”	O
CT arthrography elbow	8	If MR is contraindicated or not available.	☢
CT elbow without contrast	2		☢
US elbow	1		O
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 5:**                      **Suspect soft-tissue mass; radiographs nondiagnostic.**

<b>Radiologic Procedure</b>	<b>Rating</b>	<b>Comments</b>	<b><u>RRL*</u></b>
MRI elbow without and with contrast	9	Contrast may not be necessary in all cases. See statement regarding contrast in text under “Anticipated Exceptions.”	O
US elbow	5	With appropriate expertise.	O
Tc-99m bone scan elbow	2		☢ ☢ ☢
CT elbow without and with contrast	2		☢
CT arthrography elbow	1		☢
MR arthrography elbow	1		O
<b><u>Rating Scale:</u> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>			<b>*Relative Radiation Level</b>

**Clinical Condition:** Chronic Elbow Pain**Variant 6:** Suspect chronic epicondylitis; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without contrast	9		O
US elbow	8	An alternative to MRI if expertise is available.	O
MR arthrography elbow	2		O
CT elbow without contrast	1		☢
CT arthrography elbow	1		☢
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Variant 7:** Suspect collateral ligament tear; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. See statement regarding contrast in text under “Anticipated Exceptions.”	O
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions.	O
US elbow	6	With appropriate expertise.	O
CT arthrography elbow	5		☢
CT elbow without contrast	2		☢
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Variant 8:** Suspect biceps tendon tear and/or bursitis; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without contrast	9		O
US elbow	8	An alternative to MRI if expertise is available.	O
MR arthrography elbow	1		O
CT elbow without contrast	1		☢
CT arthrography elbow	1		☢
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Clinical Condition:** Chronic Elbow Pain

**Variant 9:** Suspect nerve abnormality; radiographs nondiagnostic.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without contrast	9		O
US elbow	8	An alternative to MRI if expertise is available. Dynamic US is ideal for assessing ulnar nerve dislocation and snapping triceps syndrome.	O
MR arthrography elbow	1		O
CT elbow without contrast	1		☢
CT arthrography elbow	1		☢
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Variant 10:** Elbow stiffness; suspect heterotopic ossification/osteophytosis by radiograph. Next test.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
CT elbow without contrast	9		☢
MRI elbow without contrast	5		O
US elbow	1		O
MR arthrography elbow	1		O
CT arthrography elbow	1		☢
Tc-99m bone scan elbow	1		☢ ☢ ☢
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

**Variant 11:** Suspect osseous tumor per radiographs. Next test.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without and with contrast	9		O
CT elbow with or without contrast	5		☢
US elbow	1		O
MR arthrography elbow	1		O
CT arthrography elbow	1		☢
Tc-99m bone scan elbow	1	If multifocal disease suspected.	☢ ☢ ☢
<b><u>Rating Scale:</u></b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			<b>*Relative Radiation Level</b>

## CHRONIC ELBOW PAIN

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### **Summary of Literature Review**

#### **Introduction**

Chronic elbow pain may be caused by a variety of osseous abnormalities, soft-tissue abnormalities, or both. Exclusion of an osseous abnormality with radiographs may be helpful when conservative therapy is planned. In some cases, radiographs may reveal the cause of the problem (eg, intra-articular osteocartilaginous body, osteophytes, heterotopic ossification, or calcification in and around the joint in the form of hydroxyapatite deposition or calcium pyrophosphate crystal deposition). When the etiology of the chronic pain is uncertain and the patient has failed appropriate conservative therapeutic trials, (eg, anti-inflammatory medication, physical therapy, and/or corticosteroid injection), other imaging studies may be considered. While computed tomography (CT) and ultrasound (US) may be used for specific indications, magnetic resonance imaging (MRI) can be used to display most abnormalities in the elbow. The success of US varies, depending on the training and experience of the person performing the examination, as well as the US equipment. Imaging choices will be considered for a variety of clinical conditions.

#### **Osteochondral Lesion or Intra-articular Body**

Radiographs are required before other imaging studies and may be diagnostic for fracture, osteochondritis dissecans, and osteocartilaginous intra-articular body (IAB). CT and CT arthrography with single-contrast (iodinated contrast or air) and double-contrast (iodinated contrast and air) techniques are superior to radiography for detecting a chondral or osteochondral lesion or IAB [1,2]. All of these studies have limitations; a small IAB may be obscured by contrast or confused with air bubbles (double-contrast arthrography). A CT air arthrogram can avoid confusion of air bubbles with IABs. MRI has been advocated as the initial study for suspected osteochondral fracture or IAB [3-5]. Regardless of method, detection of an IAB is limited by its size and location within the elbow joint, although detection is enhanced by the presence of joint effusion [6]. Both CT and MRI can assess for osteochondral fragment stability [7]. MRI following direct intra-articular contrast administration is preferred to routine MRI for diagnosing an IAB and may also play a role in improving diagnosis of stability of an osteochondral lesion [8,9]. While US may show osteochondral abnormalities in some situations [10], MRI offers a more comprehensive evaluation of them.

#### **Other Osseous Abnormalities**

There are a number of other osseous abnormalities about the elbow that may cause chronic elbow pain. Initial evaluation should begin with radiography. Both traumatic and stress fractures may be identified with MRI and bone scan [11]. CT is superior to radiography in the preoperative assessment of osteophytosis or heterotopic ossification in the patient with symptomatic stiff elbow [2,12]. Primary bone tumors are characterized with radiography, CT, and MRI before and after intravenous gadolinium administration. While the whole-body extent of osseous metastatic disease is assessed with bone scan, MRI will evaluate local extent.

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## **Tendon, Ligament, Muscle, Nerve, or Other Soft-Tissue Abnormality**

MRI may provide important diagnostic information for evaluating the elbow in many different conditions, including collateral ligament injury, epicondylitis, injury to the biceps and triceps tendons, and abnormality of the ulnar, radial, or median nerve, and for evaluating masses about the elbow joint [3-6,13-29]. There is a lack of studies showing the sensitivity and specificity of MRI in many of these conditions; most of the studies demonstrate MRI findings in patients either known or highly likely to have a specific condition. US has been shown to be helpful for diagnosing abnormalities of the distal biceps tendon, flexor and extensor tendons, and ligaments, providing an alternative to MRI [30-35].

Radiographs can be useful to identify heterotopic calcification (ossification) of the ulnar collateral ligament [36]. This finding may be associated with partial or complete tears of that structure. Avulsion of the ulnar collateral ligament at the insertion site on the ulna is a source of chronic medial elbow pain in the throwing athlete. While US has been shown to detect medial epicondylar fragmentation of the humerus in throwing athletes [10], this finding is optimally evaluated with a combination of radiographs and coronal MRI [37]. MR arthrography has been advocated to distinguish complete tears from partial tears of the ulnar collateral ligament [23,29,38].

With use of appropriate pulse sequences, MRI is an effective tool in the preoperative diagnosis of posterolateral rotatory instability. This includes assessment of the ulnar band of the lateral collateral ligament [26]. Epicondylitis — caused by tendon degeneration and tear of the common extensor tendon laterally (“tennis elbow”) or the common flexor tendon medially (in pitchers, golfers, and tennis players) — is a common clinical diagnosis, and imaging is usually not necessary [14]. MRI or US may be useful for confirming the diagnosis in refractory cases and to exclude associated tendon and ligament tear [6,17,21,25,30,39,40].

Bicipitoradial and interosseous bursitis around the distal biceps tendon is a source of elbow pain that can be assessed with MRI or US [35,41]. MRI also demonstrates the effects of the bursa on adjacent structures, including the posterior interosseous and median nerves [41]. MRI effectively characterizes a soft-tissue mass, showing its extent and differentiating between intra-articular mass, lymph node (as in cat scratch disease), pseudomass from tendon tear, and other soft-tissue masses.

The ulnar nerve is particularly vulnerable to trauma from a direct blow in the region of its superficial location in the restricted space of the cubital tunnel. Anatomic variations of the cubital tunnel retinaculum may contribute to ulnar neuropathy [42]. Axial T1-weighted MR images have been shown to depict the size and shape of the nerve, and axial T2-weighted or short tau inversion recovery (STIR) images may show increased signal in the presence of neuritis [43], and both are more sensitive than conventional nerve conduction studies [44]. US may also show ulnar nerve enlargement, and when added to electrodiagnostic tests, increases sensitivity for the diagnosis of ulnar neuropathy at the elbow from 78%-98% [45]. A snapping of the medial head of the triceps can cause recurrent dislocation of the ulnar nerve. This diagnosis can be confirmed with MRI or CT using axial images with the elbow in flexion and extension [43,46,47]. US is ideal for dynamic assessment of ulnar nerve subluxation and dislocation, as well as for confirmation of snapping triceps syndrome [31,48,49]. Radial nerve and median nerve entrapment syndromes may also be evaluated with MRI [6,14,27,43].

Chronic elbow pain may also be caused by a number of joint-related processes, such as inflammatory arthritis (and chronic infection), as well as other synovial proliferative disorders. Evaluation begins with radiography to assess for joint distention and erosions. MRI can also show erosions, and is effective in characterizing synovitis (low signal suggests hemosiderin) and the extent and activity of disease [50]. In the setting of rheumatoid arthritis, US can also be used to detect joint effusion, synovitis, and erosions [51].

## **Summary**

- Initial evaluation of chronic elbow pain should begin with radiography.
- Chondral and osteochondral abnormalities can be further evaluated with MRI or CT. The addition of arthrography is helpful, especially for detecting intra-articular bodies.
- Radiographically occult bone abnormalities can be detected with MRI.
- Soft-tissue abnormalities (tendon, ligament, nerve, joint recess) are well-demonstrated with MRI or US.
- Dynamic assessment with US is effective for diagnosing nerve or muscle subluxation.

## Anticipated Exceptions

Nephrogenic systemic fibrosis (NSF) is a disorder with a scleroderma-like presentation and a spectrum of manifestations that can range from limited clinical sequelae to fatality. It appears to be related to both underlying severe renal dysfunction and the administration of gadolinium-based contrast agents. It has occurred primarily in patients on dialysis, rarely in patients with very limited glomerular filtration rate (GFR) (ie, <30 mL/min/1.73m<sup>2</sup>), and almost never in other patients. There is growing literature regarding NSF. Although some controversy and lack of clarity remain, there is a consensus that it is advisable to avoid all gadolinium-based contrast agents in dialysis-dependent patients unless the possible benefits clearly outweigh the risk, and to limit the type and amount in patients with estimated GFR rates <30 mL/min/1.73m<sup>2</sup>. For more information, please see the [ACR Manual on Contrast Media](#) [52].

## 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, both because of 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 to 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 (eg, region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies”.		

## Supporting Documents

- [ACR Appropriateness Criteria® Overview](#)
- [Procedure Information](#)
- [Evidence Table](#)

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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.