

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

**Clinical Condition:** Chronic Elbow Pain

**Variant 1:** Initial evaluation for chronic elbow pain. First test.

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
X-ray elbow	9		Min
MRI elbow without contrast	1		None
MR arthrography elbow	1		None
CT elbow without contrast	1		Min
CT arthrography elbow	1		Min
US elbow	1		None
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<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.	None
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. See comments regarding contrast in text under "Anticipated Exceptions."	None
CT elbow without contrast	8		Min
CT arthrography elbow	8	If double contrast is used, dose of less than 0.5 cc of contrast should be used.	Min
US elbow	6	With appropriate expertise.	None
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

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**Clinical Condition:****Chronic Elbow Pain****Variant 3:****Suspect occult injury; eg, osteochondral injury; radiographs nondiagnostic.**

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow without contrast	9		None
CT elbow without contrast	2		Min
MR arthrography elbow	2		None
CT arthrography elbow	2		Min
NUC Tc-99m bone scan elbow	2		Med
US elbow	1		None
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 4:****Suspect unstable osteochondral injury; 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.	None
MR arthrography elbow	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions. See comments regarding contrast in text under "Anticipated Exceptions."	None
CT arthrography elbow	8	If MR is contraindicated or not available.	Min
CT elbow without contrast	2		Min
US elbow	1		None
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 5:****Suspect mass; radiographs nondiagnostic.**

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
MRI elbow with contrast	9	See comments regarding contrast in text under "Anticipated Exceptions."	None
US elbow	5	An alternative to MRI if expertise is available.	None
NUC Tc-99m bone scan elbow	2		Med
CT elbow without and with contrast	2		Min
CT arthrography elbow	1		Min
MR arthrography elbow	1		None
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**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		None
US elbow	8	An alternative to MRI if expertise is available.	None
MR arthrography elbow	2		None
CT elbow without contrast	1		Min
CT arthrography elbow	1		Min
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most 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 comments regarding contrast in text under "Anticipated Exceptions."	None
MRI elbow without contrast	9	Either routine MRI or MR arthrogram is appropriate. Depends on availability, expertise, and local conditions.	None
US elbow	6	An alternative to MRI if expertise is available.	None
CT arthrography elbow	5		Min
CT elbow without contrast	2		Min
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most 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		None
US elbow	8	An alternative to MRI if expertise is available.	None
MR arthrography elbow	1		None
CT elbow without contrast	1		Min
CT arthrography elbow	1		Min
NUC Tc-99m bone scan elbow	1		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

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**Clinical Condition:****Chronic Elbow Pain****Variant 9:****Suspect nerve abnormality; radiographs nondiagnostic.**

<b>Radiologic Procedure</b>	<b>Rating</b>	<b>Comments</b>	<b><a href="#">RRL*</a></b>
MRI elbow without contrast	9		None
US elbow	8	An alternative to MRI if expertise is available. Dynamic US is ideal for assessing ulnar nerve dislocation and snapping triceps syndrome.	None
MR arthrography elbow	1		None
CT elbow without contrast	1		Min
CT arthrography elbow	1		Min
NUC Tc-99m bone scan elbow	1		Med
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

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# CHRONIC ELBOW PAIN

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## **Summary of Literature Review**

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, calcification 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 imaging modalities such as 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 ultrasound 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 osteochondral fracture, osteochondritis dissecans, and osteocartilaginous intra-articular body (IAB). CT, as well as CT arthrography with single-contrast (iodinated contrast or air) and double-contrast (iodinated contrast and air) techniques have been used for detecting an osteochondral lesion or IAB [1]. 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 [2-4]. 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 [5]. Both CT and MRI can assess for osteochondral fragment stability [6]. MRI following direct intra-articular contrast administration is preferred to routine MRI for diagnosing IAB and may also play a role in improving diagnosis of stability of an osteochondral lesion [7,8]. While US may show osteochondral abnormalities in some situations [9], 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 [10]. Osteoid osteomas may produce synovitis if intra-articular and can be identified with MRI, CT, or bone scan [11]. Primary bone tumors are characterized with radiography and MRI before and after intravenous gadolinium administration. While the extent of osseous metastatic disease is assessed with bone scan, MRI will evaluate local extent.

### **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 [2-5,12-28]. 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 [29-34].

Radiographs can be useful to identify heterotopic calcification (ossification) of the ulnar collateral ligament [35]. 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 [9], this finding is optimally evaluated with a combination of radiographs and coronal MRI [36]. MR arthrography has been advocated to distinguish complete

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tears from partial tears of the medial collateral ligament [22,37], and it improves detection of ulnar collateral ligament tears [28].

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 [25]. Epicondylitis—caused by tendon degeneration and tear of the common extensor tendon laterally (“tennis elbow”) or common flexor tendon medially (in pitchers, golfers, and tennis players)—is a common clinical diagnosis, and imaging is usually not necessary [13]. MRI or US may be useful for confirming the diagnosis in refractory cases and to exclude associated tendon and ligament tear [5,16,20,24,29].

Bicipitoradial and interosseous bursitis around the distal biceps tendon is a source of elbow pain that can be assessed with MRI or US [34,38]. MRI also demonstrates the effects of the bursa on adjacent structures, including the posterior interosseous and median nerves [38]. 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 [39]. Axial T1-weighted images have been shown to depict the size and shape of the nerve, and axial T2-weighted or STIR images may show increased signal in the presence of neuritis [40], and both are more sensitive than conventional nerve conduction studies [41]. 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% [42]. 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 [40,43,44]. US is ideal for dynamic assessment of ulnar nerve subluxation and dislocation, as well as for confirmation of snapping triceps syndrome [30,45,46]. Radial nerve and median nerve entrapment syndromes may also be evaluated with MRI [5,13,26,40].

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 [47].

In the setting of rheumatoid arthritis, US can be used to detect joint effusion, synovitis, and erosions [48].

## Summary

Initial evaluation of chronic elbow pain should begin with radiography. Chondral and osteochondral abnormalities can be further evaluated with MRI or CT, although the addition of arthrography is helpful. 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), also known as nephrogenic fibrosing dermopathy) was first identified in 1997 and has recently generated substantial concern among radiologists, referring doctors and lay people. Until the last few years, gadolinium-based MR contrast agents were widely believed to be almost universally well tolerated, extremely safe and non-nephrotoxic, even when used in patients with impaired renal function. All available experience suggests that these agents remain generally very safe, but recently some patients with renal failure who have been exposed to gadolinium contrast agents (the percentage is unclear) have developed NSF [49-51], a syndrome that can be fatal. Further studies are necessary to determine what the exact relationships are between gadolinium-containing contrast agents, their specific components and stoichiometry, patient renal function and NSF. Current theory links the development of NSF to the administration of relatively high doses (eg, >0.2mM/kg) and to agents in which the gadolinium is least strongly chelated. The FDA has recently issued a “black box” warning concerning these contrast agents ([http://www.fda.gov/cder/drug/InfoSheets/HCP/gcca\\_200705HCP.pdf](http://www.fda.gov/cder/drug/InfoSheets/HCP/gcca_200705HCP.pdf)).

This warning recommends that, until further information is available, gadolinium contrast agents should not be administered to patients with either acute or significant chronic kidney disease (estimated GFR <30 mL/min/1.73m<sup>2</sup>), recent liver or kidney transplant or hepato-renal syndrome, unless a risk-benefit assessment suggests that the benefit of administration in the particular patient clearly outweighs the potential risk(s) [50].

## 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

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estimate population total radiation risk associated with an imaging procedure. 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	Effective Dose Estimate Range
None	0
Minimal	< 0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

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