

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

Clinical Condition: Chronic Ankle Pain

Variant 1: Chronic ankle pain of any origin—best initial study.

Radiologic Procedure	Rating	Comments	RRL*
X-ray ankle AP lateral and mortise views	9		Min
X-ray ankle stress films-with manual stressing	2		Min
X-ray ankle stress films—using biomechanical device	2		Min
X-ray ankle stress films—manual stress while under general anesthesia	2		Min
NUC bone scan targeted	2		Med
US ankle	2		None
MRI ankle	2		None
CT ankle	2		Min
X-ray arthrography ankle	2		Min
CT arthrography ankle	2		Min
MR arthrography ankle	2		None
X-ray tenography ankle	2		Min
INV injection of anesthetic ankle	2		IP
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 2: Suspected osteochondral injury, ankle radiographs normal. Next study.

Radiologic Procedure	Rating	Comments	RRL*
MRI ankle	9		None
X-ray ankle stress films—using biomechanical device	2		Min
X-ray tenography ankle	2		Min
CT ankle	2	If MRI not available.	Min
NUC bone scan targeted	2		Med
MR arthrography ankle	2		None
X-ray arthrography ankle	2		Min
X-ray ankle stress films-with manual stressing	2		Min
US ankle	2		None
CT arthrography ankle	2		Min
INV injection of anesthetic ankle	2		IP
X-ray ankle stress films—manual stress while under general anesthesia	2		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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Clinical Condition:**Chronic Ankle Pain****Variant 3:****Suspected tendinopathy, ankle radiographs normal. Next study.**

Radiologic Procedure	Rating	Comments	RRL*
MRI ankle	9		None
US ankle	6	Only if experienced examiner available.	None
X-ray tenography ankle	2		Min
X-ray arthrography ankle	2		Min
MR arthrography ankle	2		None
INV injection of anesthetic ankle	2		IP
X-ray ankle stress films-with manual stressing	2		Min
NUC bone scan targeted	2		Med
X-ray ankle stress films–manual stress while under general anesthesia	2		Min
X-ray ankle stress films–using biomechanical device	2		Min
CT ankle	2		Min
CT arthrography ankle	2		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 4:**Suspected ankle instability, ankle radiographs normal. Next study.**

Radiologic Procedure	Rating	Comments	RRL*
MRI ankle	3		None
CT arthrography ankle	2		Min
INV injection of anesthetic ankle	2		IP
X-ray ankle stress films-with manual stressing	2		Min
X-ray tenography ankle	2		Min
X-ray arthrography ankle	2		Min
MR arthrography ankle	2		None
X-ray ankle stress films–using biomechanical device	2		Min
CT ankle	2		Min
X-ray ankle stress films–manual stress while under general anesthesia	2		Min
NUC bone scan targeted	2		Med
US ankle	2		None
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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Clinical Condition:**Chronic Ankle Pain****Variant 5:****Pain of uncertain etiology, ankle radiographs normal. Next study.**

Radiologic Procedure	Rating	Comments	RRL*
MRI ankle	6	If patient needs an imaging study, it should be MRI.	None
INV injection of anesthetic ankle	5	Depending on clinical implication and severity of pain.	IP
MR arthrography ankle	2		None
US ankle	2		None
X-ray ankle stress films—manual stress while under general anesthesia	2		Min
X-ray ankle stress films-with manual stressing	2		Min
X-ray ankle stress films—using biomechanical device	2		Min
CT arthrography ankle	2		Min
X-ray arthrography ankle	2		Min
X-ray tenography ankle	2		Min
NUC bone scan targeted	2		Med
CT ankle	2		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

Variant 6:**Multiple sites of DJD by ankle radiographs, operative candidate. Next study.**

Radiologic Procedure	Rating	Comments	RRL*
INV injection of anesthetic ankle	6		IP
X-ray tenography ankle	2		Min
X-ray arthrography ankle	2		Min
X-ray ankle stress films-with manual stressing	2		Min
MR arthrography ankle	2		None
US ankle	2		None
X-ray ankle stress films—manual stress while under general anesthesia	2		Min
CT arthrography ankle	2		Min
NUC bone scan targeted	2		Med
MRI ankle	2		None
CT ankle	2		Min
X-ray ankle stress films—using biomechanical device	2		Min
Rating Scale: 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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Clinical Condition:**Chronic Ankle Pain****Variant 7:****Suspected ankle impingement syndrome, initial ankle radiographs normal. Next study.**

Radiologic Procedure	Rating	Comments	RRL*
MRI ankle	8		None
MR arthrography ankle	8		None
INV injection of anesthetic ankle	4		IP
CT arthrography ankle	4		Min
NUC bone scan targeted	2		Med
US ankle	2		None
X-ray arthrography ankle	2		Min
CT ankle	2		Min
<u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate			*Relative Radiation Level

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CHRONIC ANKLE PAIN

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Summary of Literature Review

Most research on imaging for chronic ankle pain has focused on the accuracy of one imaging method for specific conditions such as tendinopathy. Only a few studies have compared imaging methods for a specific condition. There have been no studies comparing imaging methods for assessing chronic ankle pain of uncertain etiology.

For assessing chronic ankle pain, there are multiple imaging options, including stress radiography, radionuclide bone scanning, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), and injection procedures. Injection procedures include arthrography, CT arthrography, MR arthrography, and diagnostic injection with anesthetics. There have been no studies specifically addressing the value of radiographs in assessing chronic ankle pain. However, radiographs are routinely obtained as the first option to exclude arthritis, infection, fracture, or neoplasm.

Ankle instability has traditionally been imaged using radiographs obtained with varus, valgus, or anterior stress on the ankle [1]. However, recent studies have questioned the value of stress radiographs. Even with a mechanical stress device, there is overlap between stable and unstable ankles [2]. Patients may have successful surgery for clinically unstable ankles even if the stress radiographs are normal [3,4]. McCaskie et al [5] found that stress radiographs obtained preoperatively were not as accurate as intraoperative stress films while the patient is under general anesthesia. Chandnani et al [6] found that MR arthrography was significantly more accurate than stress radiography in detecting chronic tears of the ankle ligaments. A review of eight prospective clinical series using stress radiography for assessment of chronic

instability concluded that “the large variability in talar tilt and anterior draw values in both injured and noninjured ankles precludes their routine use” [7]. More recently, a comparison of stress radiography and stress radiostereometry for assessing syndesmotic injuries in a cadaver model concluded that stress radiography is not reliable for assessing these injuries [8]. However another study reported that both stress radiography and MRI were both accurate in diagnosing the extent of both lateral ligament and syndesmosis injuries [9]. The accuracy of MRI for diagnosing tibiofibular syndesmotic injuries was also confirmed in a study comparing routine radiography and MRI with ankle arthroscopy [10]. When compared to stress radiography, MRI offers the additional advantage of evaluating for injuries associated with or mimicking lateral instability such as tenosynovitis, tendon injury, and osteochondral lesions [11].

Radionuclide bone scanning, CT, and MRI have been used to assess the ankle joint for osteochondral injuries. Two studies reported that ankle CT is useful in assessing persistent ankle pain after trauma. Meyer et al [12] used CT to evaluate 31 consecutive patients with chronic ankle pain after an injury. Thirteen of these 31 patients had normal radiographs but had occult intra-articular or juxta-articular fractures noted on CT. In the study by Zinman et al [13], four of 32 osteochondral lesions of the talus were occult by radiographs but identified on direct coronal CT scanning. Loomer et al [14] reviewed 92 patients with talar osteochondral lesions. Although they did not report the accuracy for occult lesions alone, only 66% of the osteochondral lesions were seen on radiographs, but the sensitivity was 99% with bone scanning and 98% with CT. There have been no reports on the accuracy of CT arthrography for detecting osteochondral fractures in the ankle. However, case reports suggest that CT arthrography can help detect intra-articular loose bodies [15] and assess the stability of osteochondritis dissecans [16].

MRI can be used to assess osteochondritis dissecans of the talus with a high accuracy in determining lesion stability [17,18]. In a multimodality study, 17 cases of occult osteochondral fractures were found in 30 patients with normal radiographs and posttraumatic chronic ankle pain [19]. MRI detected all occult osteochondral injuries, bone scanning missed one, and CT missed four [19]. Radiography has also been shown to be unreliable for detecting osteochondritis dissecans of the tibial plafond [20]. The accuracy of MRI and its ability to stage osteochondritis dissecans of the talar dome have also been assessed in a study of 54 patients who had operative confirmation of the presence and stage of their lesions [21]. MRI may also have a role in monitoring the healing of an osteochondral lesion after surgery [22].

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Ankle tendon pathology has been studied using tenography, CT, MRI, and US. Tenography uniquely demonstrates the configuration of the tendon sheath and can identify tenosynovial irregularity and focal stenosis. Gilula et al [23] found that five patients with tenographic evidence of moderate to severe tenosynovitis failed conservative treatment but that three patients with normal or minimally abnormal tenograms responded to conservative treatment. However, Jaffee et al [24] reported a series of 111 patients who had tenography and injection of anesthetic and corticosteroid. They found that 47% of patients who had been previously refractory to treatment had prolonged relief after injection. The degree of tenosynovitis on tenography did not correlate with the therapeutic response. Resnick and Goergen [25] found peroneal stenosing tenosynovitis in ten patients with prior calcaneal fractures.

Both CT and MRI can be used to identify tendon pathology [26,27]. The greater tissue contrast of MRI and its sensitivity to fluid allow easier and more specific diagnosis of chronic tendinitis and partial and complete tendon tears. Rosenberg et al [28] found a slightly lower accuracy for CT than MRI in distinguishing an intact from a torn ankle tendon. However, MRI was significantly more accurate than CT in staging the severity of the tendon injury [28]. Conti et al [29] found that MRI staging was more accurate in predicting patient outcome after tendon reconstruction than intraoperative staging. MRI is also useful for diagnosing injuries of the superior peroneal retinaculum [6].

Imaging can also be used to diagnose ankle impingement syndromes which can occur in the anterolateral, anterior, anteromedial, posteromedial, and posterior aspects of the ankle joint [30-40]. In one study, CT arthrography was found to be accurate in diagnosing anterolateral impingement syndrome when compared to arthroscopy [34]. Studies on the accuracy of MRI in diagnosing anterolateral impingement syndrome have drawn different conclusions. While one study found considerable overlap in the MRI findings of patients with anterolateral impingement and control individuals [32], another found that MRI was useful when an ankle effusion was present [39], and a third found no overlap in the MRI appearance of patients with anterolateral impingement and control ankles [35]. There are only limited reports on the use of MRI for the other forms of ankle impingement syndrome, so its accuracy in these conditions is not well established [30,33,36,37]. MR arthrography has been found to be an accurate method for assessing both anterolateral and anteromedial impingement with the advantage of joint capsule distention by intra-articular contrast injection [37,38].

Recently, US has been used in assessing ankle tendon pathology [41-43]. Although a limitation of US is the dependence on operator skill, several studies have

reported a high degree of accuracy. In one series in which 54 tendons were examined by US and surgery, the sensitivity and specificity of US for tendon tears were 100% and 88%, respectively [44]. In another series with surgical correlation, Rockett et al [45] found that the sensitivity and specificity for detection of ankle tendon pathology were 100% and 89.9% for US and 23.4% and 100% for MRI. However, the sensitivity of MRI for tendon pathology in this study was much lower than the 92%-95% previously reported [28,46]. Sonography of posterior tibial tendinopathy was found to have a sensitivity of 80% and specificity of 90% when MRI was used as the gold standard [47]. A unique advantage of sonography when compared to CT and MRI is the ability to perform dynamic imaging for conditions such as subluxation of the peroneal tendons [48] and identify causes of tendon impingement [49].

Injection procedures include CT arthrography, MR arthrography, and tenography as discussed above, as well as conventional arthrography and diagnostic injections with anesthetic. Dory [50] performed arthrograms to assess the ankle ligaments in 61 patients with chronic ankle instability and noted 20 true-positive, one false-positive, and four false-negative arthrograms in 25 patients who underwent surgery. Ankle arthrography is also useful to diagnose adhesive capsulitis after ankle trauma [51-53]. The importance of post-traumatic adhesive capsulitis has not been determined.

Although anesthetic injection has been shown to be useful in assessment of hindfoot pain [54], the value of this technique has not been studied in the ankle joint itself. Resnick and Goergen [25] did report that Xylocaine injection into the peroneal tendon sheaths of ten patients helped to confirm that the patients' pain was due to tendon pathology.

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. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document.

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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
*RRL assignments are not included for some examinations. The RRL assignments for the IP (in progress) exams will be available in future releases.	

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An 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 exams 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.