

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

**Clinical Condition:**                      **Chronic Foot Pain**

**Variant 1:**                                      **20-year-old male suspected to have Reiter's disease. Now complains of heel pain and swollen toes.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot AP lateral and oblique	9		Min
MRI foot	2		None
CT foot	2		Min
X-ray foot AP and lateral	2		Min
NUC bone scan targeted	2		Med
US foot	2		None
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 2:**                                      **Pain and tenderness over the navicular tuberosity unresponsive to conservative therapy. Plain radiographs showed accessory navicular.**

Radiologic Procedure	Rating	Comments	RRL*
MRI foot	9		None
NUC bone scan targeted	3		Med
CT foot	2		Min
US foot	2		None
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 3:**                                      **Pain and tenderness over head of second metatarsal. Rule out Freiberg's disease.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot AP lateral with or without oblique	9		Min
MRI foot	2		None
CT foot	2		Min
NUC bone scan targeted	2		Med
US foot	2		None
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

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**Clinical Condition:****Chronic Foot Pain****Variant 4:****Athlete with pain and tenderness over tarsal navicular; plain radiographs are unremarkable.**

Radiologic Procedure	Rating	Comments	RRL*
MRI foot	9		None
CT foot	6	Especially for follow-up of healing fractures.	Min
NUC bone scan targeted	2	If MRI cannot be performed.	Med
US foot	2		None
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 5:****To rule out reflex sympathetic dystrophy.**

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot AP lateral and oblique	9		Min
NUC bone scan targeted	8	If plain films are not diagnostic.	Med
US foot	2		None
X-ray foot AP and lateral	2		Min
MRI foot	2		None
CT foot	2		Min
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 6:****Child or adolescent with painful rigid flat foot. Rule out tarsal coalition.**

Radiologic Procedure	Rating	Comments	RRL*
CT foot	9		Min
X-ray foot AP lateral and oblique and Harris-Beath view	9		Min
NUC bone scan targeted	2		Med
X-ray foot AP and lateral	2		Min
US foot	2		None
MRI foot	2		None
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**Clinical Condition:****Chronic Foot Pain****Variant 7:**

Middle aged woman with burning pain and paresthesias along the plantar surface of the foot and toes. Clinically, the patient is suspected of having tarsal tunnel syndrome.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot AP lateral and oblique	9		Min
MRI foot	9		None
US foot	8	Can be used in place of MRI, with the proper expertise.	None
CT foot	2		Min
NUC bone scan targeted	2		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 8:**

Patient is complaining of pain in the 3-4 web space with radiation to the toes. Morton's neuroma is clinically suspected.

Radiologic Procedure	Rating	Comments	RRL*
MRI foot	9		None
X-ray foot AP and lateral	9		Min
US foot	9	Can be used in place of MRI, with the proper expertise.	None
CT foot	2		Min
NUC bone scan targeted	2		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

**Variant 9:**

Young athlete presenting with localized pain at the plantar aspect of the heel. Plantar fasciitis is suspected clinically.

Radiologic Procedure	Rating	Comments	RRL*
X-ray foot AP and lateral	9		Min
MRI foot	9		None
US foot	8	Can be used in place of MRI, with the proper expertise.	None
CT foot	2		Min
NUC bone scan targeted	2		Med
<b>Rating Scale:</b> 1=Least appropriate, 9=Most appropriate			<b>*Relative Radiation Level</b>

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# CHRONIC FOOT PAIN

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## **Summary of Literature Review**

Many conditions can affect the foot and cause chronic foot pain. Some of these conditions and techniques to image them are reviewed here.

### **Tarsal Coalition**

Tarsal coalition is a congenital abnormality resulting from fibrous, cartilaginous, or osseous union of two or more tarsal bones. Calcaneonavicular and middle-facet talocalcaneal coalitions are the most common. In about half the patients the coalition is bilateral. Calcaneonavicular coalition is easily detected on oblique radiographs of the foot and confirmed by computed tomography (CT). Talocalcaneal (subtalar) coalition is often associated with severe valgus deformity of the hind foot, rigid painful flat foot, and restricted subtalar motion. It is frequently overlooked on standard foot radiographs because of overlapping structures; however, secondary signs on the lateral view could be suggestive of a subtalar coalition. These signs include talar beaking, flattening and broadening of the lateral talar process, positive C-sign, and narrowing of the posterior talocalcaneal joint [1]. A well-penetrated axial view (Harris-Beath view) can demonstrate the posterior and middle subtalar joints [2,3].

CT of the subtalar joint is usually diagnostic [3,4]. Magnetic resonance imaging (MRI) has been shown to be effective in depicting all types of coalition [5]. Inversion-recovery MR images may reveal bone marrow edema along the margins of the abnormal articulation, which is an important clue to the diagnosis [6].

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### **Reflex Sympathetic Dystrophy (RSD) Syndrome**

Reflex sympathetic dystrophy (RSD), also called complex regional pain syndrome type I (CRPS I), is characterized clinically by pain, tenderness, swelling, diminished motor function, and vasomotor instability [7]. Conditions associated with RSD of the foot include fractures and other trauma, central nervous system (CNS) and spinal disorders, and peripheral nerve injury. RSD has also been described in children; the patients are predominantly girls [8]. Early diagnosis favorably affects outcome [7]. Diffuse osteopenia of the involved part is seen in 69% of patients with RSD [9]. The osteopenia patterns are not pathognomonic and can be seen as a result of disuse [10]. Three-phase radionuclide scans have been used to diagnose RSD [9,11,12]. Holder et al [13] reported characteristic delayed bone scan pattern consisting of diffuse increased tracer throughout the foot, with juxta-articular accentuation of tracer uptake. Overall sensitivity in this study was 100%, specificity 80%, positive predictive value 54%, and negative predictive value 100%. There are no specific findings on MRI in patients with RSD [14,15]. Using power Doppler sonography, patients with RSD of the lower extremity have increased power Doppler flow compared with asymptomatic control subjects [16].

### **Stress Fractures**

[Also see the ACR Appropriateness Criteria<sup>®</sup> on Stress/Insufficiency Fracture, Including Sacrum, Excluding Other Vertebrae]. Stress injuries can be categorized into three types: stress reactions, fatigue fractures, and insufficiency fractures. A stress reaction occurs when microfractures are healing and a complete fracture has not yet developed [17]. Activities producing fatigue fractures in the feet include running, marching, and dancing. The second and third metatarsals as well as the calcaneus are the most common sites for stress fractures and stress reactions [18-20].

Stress fractures have also been described, less frequently, in the tarsal navicular, first metatarsal, and medial sesamoid bones of the great toe. In the early phase, plain radiography may be entirely normal, but with time a fracture line can be identified and only one cortex may be involved; a hint of periosteal reaction with some endosteal new bone may develop. It may take 3-4 weeks for changes to occur in the metaphyseal area of bone and 4-6 weeks for them to occur in the diaphysis [15-19]. During the healing phase, both periosteal and endosteal new bone are incorporated in the cortex, resulting in a fusiform expansion of the cortex. Occasionally more than one stress fracture is present in the same foot [21]. Most of the navicular fractures are oriented in the sagittal plane and occur in the central

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third of the bone. Some are partial fractures involving only the dorsal portion of the navicular [22,23]. Participation in strenuous exercise is not essential for such fractures to develop [24].

Initially plain radiographs can be negative, and the panel believes that the best next test is MRI.

### **Avascular Necrosis of the Metatarsal Head (Freiberg's Disease)**

This disease is characterized by pain, tenderness, swelling, and limitation of motion in the affected metatarsophalangeal (MP) joint [25]. The disease is usually detected in adolescents, and adolescent girls predominate about three or four to one. Radiographic changes are characteristic, and they show increased density of the metatarsal head, and flattening, collapse, cystic changes, and widening of the MP joint. The second metatarsal is most commonly affected, although the third and fourth can also be occasionally involved [26].

### **Painful Accessory Bones**

Potentially painful normal variants such as accessory navicular and os trigonum have been described [27-29].

The mechanism of pain in the presence of an accessory navicular has been attributed to traumatic or degenerative changes at the synchondrosis or to soft-tissue inflammation. Symptomatic accessory navicular bones have been studied with radionuclide bone scans and MRI. Symptomatic lesions are reported to show increased radiotracer uptake or marrow edema across the synchondrosis [30,31].

For a painful os trigonum, selective arthrography of the synchondrosis followed by local anesthetic injection localizes the source of pain [32,33].

### **Neoplasm**

Neoplasm is another cause of chronic foot pain, and (diagnostically) these lesions in the foot can be approached like other neoplasms in the musculoskeletal system (see the ACR Appropriateness Criteria<sup>®</sup>; on Soft Tissue Masses and Bone Tumors).

### **Arthritis**

All the common forms of arthritis affect the feet and can cause chronic foot pain. Most of the arthritides are best evaluated with plain radiography [34]. Charcot changes are still best detected and followed by plain radiography also [35]. There is now evidence that gadolinium-enhanced MRI can be helpful in detecting early rheumatoid arthritis [36,37].

Chronic heel pain can be caused by calcaneal stress fractures, tarsal tunnel syndrome, and plantar fasciitis. When the heel pain is bilateral, the seronegative arthritides warrant consideration.

### **Plantar Fasciitis**

Plantar fasciitis is the most common cause of plantar heel pain. It may occur in isolation or as a manifestation of a systemic disease such as the seronegative spondyloarthropathies, rheumatoid arthritis, gout, or systemic lupus erythematosus (SLE) [27]. In athletes, plantar fasciitis is a common cause of foot pain and it is attributed to mechanical stresses, presumably due to repetitive trauma causing microtearing of the plantar fascia at its origin as well as fascial and perifascial inflammation. Plantar fasciitis is also common in obese patients and in patients with flat feet. Typically plain radiography is not productive, but bone scintigraphy and MRI have been shown to be helpful in arriving at a diagnosis [27-29,38,39]. Ultrasonography has been shown by Cardinal et al [40] to be effective in differentiating normal plantar fascia from those involved with plantar fasciitis.

### **Tarsal Tunnel Syndrome**

This syndrome is a compressive neuropathy of the posterior tibial nerve or one of its branches. Patients typically complain of poorly localized burning pain and paresthesias along the plantar surface of the foot and toes [41,42]. Inflammatory processes or mass lesions in the tarsal tunnel are described as the cause for this syndrome in most of patients with this syndrome. Such lesions are best imaged by MRI [41-43].

### **Interdigital (Morton's) Neuroma**

This is a nonneoplastic perineural fibrous proliferation involving a plantar digital nerve. Clinical symptoms include pain in the involved web space that often radiates to the toes. Morton's neuroma is frequently asymptomatic [44]. These neuromas are seen more often in women and typically involve the three-four or less commonly the two-three intermetatarsal space. They are best detected on MRI using T1-weighted or T1-weighted, fat-suppressed images with gadolinium enhancement and T2-weighted images [45-46]. The diagnosis of Morton's neuroma at MRI becomes relevant only when transverse diameter of the lesion is 5 mm or more and can be correlated with the clinical findings [47,48]. High-resolution ultrasound has been used successfully to diagnose Morton's neuromas [49].

### **Tendinopathies**

Tendinopathies, ranging from tendinosis to complete tear, in and around the foot can result in significant foot pain and disabilities. The most commonly affected tendons are the Achilles tendon, posterior tibial tendon,

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and peroneal tendons. Tendon dysfunction is best imaged with MRI and ultrasound [50-55].

### Hallux Valgus

Hallux valgus is a common foot disorder resulting in significant morbidity. Preoperative radiographic evaluation and measurements as well as postoperative follow-up are best evaluated on the weight-bearing PA and lateral radiographs of the feet [56-58].

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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.