American College of Radiology
ACR Appropriateness Criteria®
Chronic Foot Pain

Variant 1:   **Chronic foot pain. Unknown etiology. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography foot	Usually Appropriate	☢
US foot	Usually Not Appropriate	O
MRI foot without and with IV contrast	Usually Not Appropriate	O
MRI foot without IV contrast	Usually Not Appropriate	O
CT foot with IV contrast	Usually Not Appropriate	☢
CT foot without and with IV contrast	Usually Not Appropriate	☢
CT foot without IV contrast	Usually Not Appropriate	☢
Bone scan foot	Usually Not Appropriate	☢☢☢

Variant 2:   **Persistent posttraumatic foot pain. Radiographs negative or equivocal. Clinical concern includes complex regional pain syndrome type I. Next imaging study.**

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

Variant 3:   **Chronic metatarsalgia including plantar great toe pain. Radiographs negative or equivocal. Clinical concern includes sesamoiditis, Morton's neuroma, intermetatarsal bursitis, chronic plantar plate injury, or Freiberg's infraction. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI foot without IV contrast	Usually Appropriate	O
US foot	May Be Appropriate	O
MRI foot without and with IV contrast	May Be Appropriate	O
CT foot without IV contrast	May Be Appropriate	☢
Bone scan foot	May Be Appropriate	☢☢☢
CT foot with IV contrast	Usually Not Appropriate	☢
CT foot without and with IV contrast	Usually Not Appropriate	☢

Variant 4:   Chronic plantar heel pain. Radiographs negative or equivocal. Clinical concern includes plantar fasciitis or plantar fascia tear. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
US foot	Usually Appropriate	O
MRI foot without IV contrast	Usually Appropriate	O
MRI foot without and with IV contrast	Usually Not Appropriate	O
CT foot with IV contrast	Usually Not Appropriate	☢
CT foot without and with IV contrast	Usually Not Appropriate	☢
CT foot without IV contrast	Usually Not Appropriate	☢
Bone scan with SPECT or SPECT/CT foot	Usually Not Appropriate	☢☢☢

Variant 5:   Nonradiating chronic midfoot pain of suspected osseous origin. Radiographs negative or equivocal. Clinical concern includes occult fracture, or painful accessory ossicles. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
MRI foot without IV contrast	Usually Appropriate	O
CT foot without IV contrast	Usually Appropriate	☢
Bone scan foot	May Be Appropriate	☢☢☢
US foot	Usually Not Appropriate	O
MRI foot without and with IV contrast	Usually Not Appropriate	O
CT foot with IV contrast	Usually Not Appropriate	☢
CT foot without and with IV contrast	Usually Not Appropriate	☢

Variant 6:   Chronic foot pain. Entrapment syndromes. Radiographs negative or equivocal. Clinical concern includes Baxter's neuropathy. Next imaging study.

Procedure	Appropriateness Category	Relative Radiation Level
US foot	Usually Appropriate	O
MRI foot without IV contrast	Usually Appropriate	O
MRI foot without and with IV contrast	Usually Not Appropriate (Disagreement)	O
CT foot with IV contrast	Usually Not Appropriate	☢
CT foot without and with IV contrast	Usually Not Appropriate	☢
CT foot without IV contrast	Usually Not Appropriate	☢
Bone scan with SPECT or SPECT/CT foot	Usually Not Appropriate	☢☢☢

CHRONIC FOOT PAIN

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Summary of Literature Review

Introduction/Background

Chronic foot pain is a frequent clinical complaint with approximately 14% to 42% of adults in the United States reporting foot problems, often with significant impact on mobility, difficulty performing daily activities, and increased risk of falling, particularly in older individuals [1,2]. Randomized controlled trials have demonstrated a significant improvement in health-related quality of life with effective treatment of foot pain [3]. Estimating the prevalence of chronic foot pain is challenging, because there is no consensus regarding the definition of chronic pain in the literature. The International Association for the Study of Pain defines chronic pain as any pain persisting past the normal healing time, suggesting 3 months in case of chronic pain of benign causes.

Women are more commonly affected, and forefoot conditions are more frequent. Persistent pain for more than 6 years has been reported in 51% of women between 70 to 75 years of age [4]. Because of the wide range of causes of chronic foot pain, assessment of these patients with imaging studies in addition to a dedicated clinical examination is often needed [1].

The guidelines of the American College of Foot and Ankle Surgeons divide heel pain into plantar heel pain, usually related to pathology of the plantar fascia, and posterior heel pain, usually related to pathology of the Achilles tendon, and treatment options vary from nonoperative treatments to surgical procedures [5].

Chronic foot pain in children, symptoms related to soft-tissue or bone neoplasms and pain related to infectious conditions, inflammatory arthropathies, or other systemic diseases are beyond the scope of this document. Evaluation of patients with neuropathic foot or Charcot arthropathy is addressed in the ACR Appropriateness Criteria® topic on "Suspected Osteomyelitis of the Foot in Patients with Diabetes Mellitus" [6]. Posttraumatic entities affecting the ankle, including instability, arthrosis, osteochondral defects, osteonecrosis, and tendinopathies, are discussed in ACR Appropriateness Criteria® topic on "Chronic Ankle Pain" [7]. Infectious and inflammatory arthropathies are discussed in ACR Appropriateness Criteria® topics on "Suspected Osteomyelitis, Septic Arthritis, or Soft Tissue Infection (Excluding Spine and Diabetic Foot)" [8] and "Chronic Extremity Joint Pain–Suspected Inflammatory Arthritis" [9]. Acute traumatic injuries of the foot including Lisfranc injuries are discussed in ACR Appropriateness Criteria® topic on "Acute Trauma to the Foot" [10].

Initial Imaging Definition

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 (ie, only one procedure will be ordered to provide the clinical information to effectively manage the patient's care)

OR

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

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Discussion of Procedures by Variant

Variant 1: Chronic foot pain. Unknown etiology. Initial imaging.

Bone Scan Foot
There is no relevant literature to support the use of nuclear medicine studies as the first imaging study in the evaluation of chronic foot pain.

CT Foot
There is no relevant literature to support the use of CT as the first imaging study in the evaluation of chronic foot pain.

MRI Foot
There is no relevant literature to support the use of MRI as the first imaging study in the evaluation of chronic foot pain.

Radiography Foot
Conventional radiography can be useful to distinguish among different causes of chronic foot pain and is usually the first imaging study in evaluating patients with chronic foot pain.

The value of radiographs in the diagnosis of tarsal coalitions has been extensively demonstrated. Overall sensitivities range from 80% to 100% and specificities range from 97% to 98% have been reported for radiographs in the diagnosis of calcaneonavicular coalitions. Most calcaneonavicular coalitions are easily detected on lateral and oblique radiographs of the foot and confirmed on sagittal CT or MRI scans [11]. Talocalcaneal or subtalar coalition may be overlooked on standard foot radiographs due to overlapping structures; however, secondary signs on the lateral view could suggest a subtalar coalition. An overall sensitivity of 100% and a specificity of 88% have been found for radiographs in the diagnosis of talocalcaneal coalitions [12]. CT and MRI remain the most reliable methods for diagnosing subtalar coalitions.

Radiographs are usually performed initially in the clinical setting of a suspected stress fracture. A systematic review by Wright et al [13] reported sensitivities ranging from 12% to 56% and specificities ranging from 88% to 96% for radiographs in the detection of lower-extremity stress fractures.

Radiographs are useful to assess several causes of forefoot pain. Radiographs represent the first imaging study usually performed to evaluate the first metatarsal sesamoids and may be useful to diagnose sesamoid dislocation, osteoarthritis, or to distinguish between bipartite versus fractured sesamoid. Differentiation between a bipartite versus a fractured sesamoid and diagnosis of other conditions affecting the sesamoids remains difficult to assess with radiographs [12]. Radiographs are insensitive to diagnose Morton's neuroma but are useful to exclude other causes of webspace pain such as osteoarthritis, Freiberg's infraction, and stress fractures. Splaying of the metatarsals or soft-tissue density may be demonstrated but are not diagnostic [14].

Though radiography is typically insensitive in the diagnosis of fasciitis, it should be the initial imaging study in patients with a painful heel. Evidence supports the use of weightbearing radiographs in this instance [5]. The combination of thickened plantar fascia and fat pad abnormalities on radiographs has a sensitivity of 85% and a specificity of 95% for plantar fasciitis [15].

US Foot
Ultrasound (US) is usually not indicated as the first imaging study in the evaluation of chronic foot pain, but may be performed when there is a high clinical suspicion of pathologic conditions of the Achilles tendon, plantar fascia, and other conditions such as tarsal tunnel syndrome, Morton's neuroma, plantar plate tears, and intermetatarsal bursitis.

Variant 2: Persistent posttraumatic foot pain. Radiographs negative or equivocal. Clinical concern includes complex regional pain syndrome type I. Next imaging study.

3-Phase Bone Scan Foot
A 3-phase bone scan may be useful in cases of suspected complex regional pain syndrome (CRPS) type I reflex sympathetic dystrophy, and several imaging findings have been described. There is some variation in the literature regarding the diagnostic capabilities of 3-phase bone scan in the diagnosis of CRPS type I. Some authors have found 3-phase bone scan to have higher sensitivity (100%) and negative predictive value (NPV; 100%) when compared to MRI and conventional radiography, and therefore, it may be useful to rule-out disease [16]. A meta-analysis by Cappello et al [17] demonstrated a pooled sensitivity, specificity, NPV, and positive predictive value (PPV) of 78%,

88%, 88%, and 84%, respectively. There is no relevant literature to support the routine clinical use of nuclear medicine studies in the evaluation of CRPS type II.

CT Foot
There is no relevant literature to support the use of CT in the evaluation of suspected CRPS.

MRI Foot
CRPS is subdivided into type I and type II. CRPS type I encompasses reflex sympathetic dystrophy and similar conditions without a nerve injury, whereas CRPS type II occurs after a nerve injury [18]. Several findings have been described on MRI in patients with early and advanced CRPS type I reflex sympathetic dystrophy [19,20]. In general, MRI has been found to be a specific but nonsensitive method in the diagnosis of CRPS type I. In a study by Schürmann et al [19], contrast-enhanced MRI was found to have a sensitivity of 13% to 43% and a specificity of 78% to 98%, resulting in low PPV and moderate NPV, suggesting that MRI cannot be used as a screening test. In contrast, Schweitzer et al [20] demonstrated higher sensitivity (87%) and PPV (100%) for contrast-enhanced MRI. A meta-analysis by Cappello et al [17] reported pooled specificity, sensitivity, NPV, and PPV for MRI in the diagnosis of CRPS type I of 91%, 35%, 51%, and 64%, respectively. Although there is paucity in the literature regarding MRI in the diagnosis of CRPS type II, given its capability to directly visualize and characterize the nerves and to detect signs of muscle denervation, MRI may be useful in cases of CRPS type II [21].

US Foot
A few studies addressing the role of US in the diagnosis of CRPS type I reflex sympathetic dystrophy have been published. There is evidence showing that patients who have CRPS type I affecting the lower extremity have increased power Doppler flow compared with asymptomatic control subjects with a sensitivity of 73% and specificity of 92% [22]. Although there is no relevant literature to support the routine clinical use of US in the diagnosis of CRPS type II, high-resolution US may have a role giving its increasing use in nerve assessment [23].

Variant 3: Chronic metatarsalgia including plantar great toe pain. Radiographs negative or equivocal. Clinical concern includes sesamoiditis, Morton's neuroma, intermetatarsal bursitis, chronic plantar plate injury, or Freiberg's infraction. Next imaging study.

Bone Scan Foot
Planar bone scintigraphy has low anatomic resolution and has been shown to be a nonspecific technique to assess the hallucal sesamoids [24]. However, bone scintigraphy with single-photon emission computed tomography (SPECT)/CT increases contrast resolution and anatomic localization of foci with increased osteoblastic activity [25]. Bone scintigraphy may demonstrate increased uptake in pathologic conditions affecting the first metatarsal sesamoids not evident on radiographs. A less dramatic uptake is noted in stress fractures, which may be helpful to differentiate between them and acute fractures [26]. When an indeterminate linear lucency is visualized on radiographs, a negative bone scintigraphy suggests sesamoid bipartition [12]. Other conditions that may present positive findings on Tc-99m-methylene diphosphonate (MDP) bone scintigraphy include sesamoiditis, inflammatory or deposition arthropathies, osteoarthritis, and osteonecrosis [39]. In Freiberg's infraction, a photopenic center with a hyperactive collar may be identified on early stages on high-resolution Tc-99m-MDP bone scintigraphy [27].

CT Foot
CT may be useful to confirm suspected sesamoid stress fractures on radiographs and to distinguish between a stress fracture and a bipartite sesamoid with more precision than conventional radiography [28]. CT is also useful to evaluate nonunion of sesamoid fractures in symptomatic patients with persistent bone marrow edema on MRI. Abnormalities in sesamoid position, which may be present in turf toe, hallux valgus, or osteoarthritis can also be assessed with CT [29]. CT is considered a useful and reliable method to determine the extent of necrosis in Freiberg's infraction, which represents the main determining factor in the outcome [30]. There is no evidence in the literature supporting the routine use of contrast-enhanced CT imaging in the diagnosis of any of the conditions discussed above. Given the use of conventional arthrography in the detection of plantar plate tears, CT arthrography could presumably be of use in this setting [31].

MRI Foot
MRI is useful in the diagnosis of several conditions affecting the hallucal sesamoid bones, including fractures, acute and chronic stress related changes, and avascular necrosis, and a variety of MRI findings have been described in the literature [12]. Contrast administration is not routinely performed in the assessment of noninfectious and/or

nontumoral conditions affecting the hallucal sesamoids; however, it could be useful to distinguish between sesamoiditis and avascular necrosis [32,33].

The most commonly used imaging techniques in the diagnosis of Morton's neuroma are MRI and US. It has been shown that MRI has a significant effect in the diagnostic and therapeutic decisions made by orthopedic surgeons thanks to an increase in their confidence levels and change in treatment [34]. MRI is believed to be a sensitive and reliable method to evaluate patients with metatarsalgia and Morton's neuroma with a sensitivity of 87%, specificity of 100%, accuracy of 89%, PPV of 100%, and NPV of 60% in surgically treated patients [35]. In a meta-analysis, MRI had a pooled sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio of 93%, 68%, 1.89, and 0.19, respectively [36]. Increased fluid within the intermetatarsal bursa, which suggests bursitis, is well demonstrated on MRI [37]. Although the use of gadolinium does not seem essential to detect Morton's neuromas [38], it may facilitate its detection because of the improved soft-tissue contrast [32,39].

MRI is widely accepted as the imaging study of choice for diagnosis of plantar plate tears. In a prospective study, Sung et al [40] found high accuracy (96%), sensitivity (95%), specificity (100%), PPV (100%), and NPV (67%) for MRI with surgical correlation. In this study, moderate concordance was found between tear severity on MRI and surgery with greater concordance at higher severity. A meta-analysis showed higher diagnostic accuracy for MRI than US for the detection of plantar plate tears with sensitivity and specificity for MRI of 95% and 54%, respectively [41]. MR arthrography improves visualization of pericapsular structures when compared to conventional MRI and therefore is useful in the diagnosis and characterization of plantar plate tears and abnormalities of related structures [42,43].

MRI may be helpful to diagnose Freiberg's infraction and several nonspecific findings have been described in early and chronic stages [32,44]. There is no evidence in the literature supporting the routine use of contrast in the setting of avascular necrosis [45].

US Foot
There is limited information available in the literature regarding the use of US in the diagnosis of sesamoiditis. US has been shown to be useful in diagnosing tears of the sesamoid phalangeal ligament in the setting of turf toe [46].

Morton's neuroma and fluid-filled intermetatarsal bursae can be demonstrated on US. High-resolution US can approach the sensitivity of MRI in detecting Morton's neuromas. Similar to MRI, US is considered a reliable method to evaluate patients with Morton's neuroma. US has the advantage of allowing clinical correlation during examination. High sensitivities for US and MRI (83%–96% and 82%–96%, respectively) with no significant differences between the two modalities were found in a meta-analysis [36]. Other authors have found higher diagnostic capabilities of US over MRI in the diagnosis of Morton's neuroma with pooled sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio of 90%, 88%, 2.77, and 0.16 for US and 93%, 68%, 1.89, and 0.19 for MRI [47].

MRI is generally better, but US is also useful in the diagnosis of plantar plate tears. In a cadaveric study, an accuracy, sensitivity, and specificity of 79%, 78%, and 80%, respectively, were found for US [48]. With MRI as the reference standard, Gregg et al [49] showed a sensitivity, specificity, PPV, NPV, and accuracy of 91%, 44%, 93%, 35%, and 85%, respectively, for US in the detection of metatarsophalangeal plantar plate tears in symptomatic subjects. A meta-analysis showed higher diagnostic accuracy for MRI than US for the detection of plantar plate tears. In this meta-analysis the sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio were 93%, 33%, 1.2, and 0.35, respectively, for US [41].

Variant 4: Chronic plantar heel pain. Radiographs negative or equivocal. Clinical concern includes plantar fasciitis or plantar fascia tear. Next imaging study.
Bone Scan Foot with SPECT or SPECT/CT
SPECT/CT has been found to be of use when investigating heel pain with increased specificity when compared to bone scintigraphy alone, because of the improved anatomic localization of metabolic activity. Despite the anatomic and functional advantages of SPECT/CT, MRI and high-frequency US remain the most frequently used imaging modalities in patients with heel pain [50]. A characteristic pattern of abnormal uptake on 3-phase bone scintigraphy has been proven helpful to differentiate plantar fasciitis from calcaneal stress or avulsion fractures [51]. There is no relevant literature to support the routine use of nuclear medicine studies to diagnose plantar fascial tears.

CT Foot

There is no relevant literature to support the routine use of CT in the evaluation of a patient with clinical suspicion of pathology of the plantar fascia.

MRI Foot

MRI allows accurate characterization of the plantar fascia and adjacent soft-tissues and bones, and several imaging findings have been described in patients with plantar fasciitis and partial or complete tears of the plantar fascia on MRI [52]. Given that, some of the findings in patients with plantar fasciitis are nonspecific; these findings can also be seen in asymptomatic patients. MRI should always be correlated with clinical symptoms to avoid overcalling plantar fasciitis. Although no significant differences have been found in plantar fascia thickness on US and MRI, MRI is currently considered the most sensitive imaging study in the diagnosis of plantar fasciitis [53]. There is no relevant literature supporting the routine use of contrast in the diagnosis of plantar fasciitis or tears.

US Foot

US has shown good sensitivity (80%) and specificity (88%) in the diagnosis of plantar fasciitis when compared to MRI [54]. A diagnostic accuracy of 69% for abnormal focal echogenicity within the plantar fascia, 60% for edema around the plantar fascia, 78% for perifascial edema, 69% for rupture of the plantar fascia, and 56% for an associated calcaneal spur have been found for US, using MRI as the reference standard [55]. Kapoor et al [56] showed higher sensitivity and specificity of US elastography when compared to US in the detection of plantar fasciitis (95% and 100% versus 66% and 75%, respectively), using MRI as the reference standard. US has been shown to be useful in the diagnosis of complete and partial tears of the plantar fascia [57]. Some authors regard US to be superior to MRI in differentiating true fiber interruption and tearing of the plantar fascia from edema [58].

Variant 5: Nonradiating chronic midfoot pain of suspected osseous origin. Radiographs negative or equivocal. Clinical concern includes occult fracture, or painful accessory ossicles. Next imaging study.

Bone Scan Foot

Bone scintigraphy is a sensitive but not specific technique to detect occult fractures because of its capability to detect increased osteoblastic activity. Although bone scans may reveal focal uptake at the site of a radiographically occult fracture, given the anatomical complexity of the foot particularly the midfoot, precise localization may be limited [59]. SPECT/CT may improve the diagnosis of patients with suspected fractures because of the more precise anatomical localization [60].

Symptomatic accessory navicular bones were initially studied with Tc-99m-MDP bone scans and were reported to show increased radiotracer uptake at the synchondrosis, apparently due to the chronic stress reaction [61]. A negative bone scan can exclude the presence of a symptomatic accessory ossicle, but positive findings lack specificity [62]. Isotope bone scans, when combined with CT, may be positive in cases of painful accessory ossicles but remain relatively insensitive for some soft-tissue pathology [63].

CT Foot

CT is useful for the detection of radiographically occult fractures. Almeida et al [64] reported visualization of Chopart fractures on CT and/or MRI in one-third of cases initially not diagnosed on radiographs. CT also has utility in the diagnosis of occult fractures involving the subtalar joint as demonstrated in the study by Choi et al [65]. CT is a primary imaging technique in patients with high-energy polytrauma and complex fractures, because radiographs have only poor to moderate sensitivity in this clinical setting [66]. More recently, dual-energy CT has been reported as a useful technique in the detection of bone marrow edema, with excellent performance in the appendicular skeleton, with a sensitivity of 98% and specificity of 93% [67]. This could potentially aid in the detection of radiographically occult fractures.

CT may be useful to confirm the presence of an accessory ossicle, os fragmentation or fracture, intra-articular bodies, or osteochondral abnormalities. In contrast to conventional radiographs, CT offers multiplanar capability allowing detailed characterization of the ossicle and the synchondrosis. Assessment of associated soft-tissue pathology or bone marrow edema on CT is limited when compared to MRI [68].

There is no relevant literature supporting the routine use of contrast-enhanced CT images in the diagnosis of occult fractures or symptomatic accessory ossicles, besides a possible use of CT arthrography to demonstrate disruption of the synchondrosis in the setting of os trigonum syndrome [69].

MRI Foot

MRI allows the visualization of bone marrow edema patterns, which improves the detection of fractures in cases of negative or inconclusive radiographs [70]. The utility of MRI in the detection of radiographically occult Chopart fractures has been demonstrated by Almeida et al [64]. Baker et al [71] analyzed 31 occult fractures involving the ankle and foot in hockey players, finding five occult fractures in the foot, all of which involved the navicular bone. Pierre-Jerome et al [72] found 79% of cuboid fractures in the diabetic population that were radiographically occult using MRI. MRI is also useful in the detection of occult fractures involving the fifth metatarsal bone (Jones fracture) and the subtalar joint [65,73]. There is no evidence in the literature supporting the routine use of contrast in the diagnosis of occult fractures.

MRI has replaced bone scans in the evaluation of symptomatic accessory ossicles. MRI allows optimal visualization of the bone marrow within the ossicle and visualization of the synchondrosis. Accessory ossicles may also be associated with tendon pathology, which is also well assessed on MRI [74]. MRI allows clear demonstration of the findings often associated with posterior ankle impingement syndrome [75]. Contrast administration is not routinely performed when assessing symptomatic accessory ossicles on MRI; however, contrast within a disrupted synchondrosis may be demonstrated on MR arthrography studies [69].

US Foot

Although not routinely performed, previous studies have demonstrated the role of US in the detection of occult foot fractures. On US, these can be seen as cortical irregularities and are frequently associated with soft-tissue injury in the acute or subacute setting. Wang et al [76] demonstrated 24 cases of radiographically occult ankle and foot fractures in 268 patients. Of these, foot fractures were found most frequently in the calcaneus and metatarsals, and less frequently in the navicular, cuboid, and cuneiform bones.

On US, several findings have been reported in cases of painful accessory ossicles, including patients with posterior ankle impingement syndrome; however, optimal characterization of the synchondrosis is difficult on US [62]. High-resolution US offers some advantages over other imaging modalities because it allows dynamic exploration of the foot with further assessment of stability of the synchondrosis and tendon tears when present as well as direct clinical correlation and comparative evaluation with the asymptomatic foot [77]. Power Doppler US has proven useful in identifying increased blood supply in the setting of ankle impingement [78,79].

Variant 6: Chronic foot pain. Entrapment syndromes. Radiographs negative or equivocal. Clinical concern includes Baxter's neuropathy. Next imaging study.

Bone Scan Foot with SPECT/CT

There is no relevant literature supporting the use of nuclear medicine studies in the diagnosis of Baxter's neuropathy.

CT Foot

There is no relevant literature supporting the use of CT, either with or without contrast in the diagnosis of Baxter's neuropathy.

MRI Foot

Compression of the inferior calcaneal nerve or Baxter's neuropathy manifests as denervation changes of the abductor digiti minimi muscle. Because of its ability to demonstrate signal intensity changes in the presence of muscle denervation, MRI has been shown to be useful in the diagnosis of patients with Baxter's neuropathy and in the exclusion of other causes of foot pain [23]. However, fatty atrophy of the abductor digiti minimi muscle is not a specific sign of Baxter's neuropathy and can be found in 4% of asymptomatic subjects [80]. Contrast administration is not routinely performed in the initial assessment of neuropathic syndromes.

US Foot

Compression of the inferior calcaneal nerve or Baxter's neuropathy due to calcaneal enthesophytes, plantar fasciitis, or varices can result in heel pain. This nerve is best seen anterior to the calcaneus on MRI and US [23]. Presley et al [81] studied the visualization of the inferior calcaneal nerve on high-resolution US in a cadaveric foot, suggesting a possible role of high-resolution US in diagnostic and therapeutic injections around the inferior calcaneal nerve.

Summary of Recommendations

- **Variant 1:** Radiography foot is usually appropriate for the initial imaging of chronic foot pain of unknown etiology.

- **Variant 2:** MRI foot without IV contrast or 3-phase bone scan foot is usually appropriate as the next imaging study after negative or equivocal radiographs in patients with persistent posttraumatic foot pain when clinical concern includes CRPS type I. Bone scan may be useful to exclude this condition, and enhanced MRI may assist in the diagnosis.

- **Variant 3:** MRI foot without IV contrast is usually appropriate as the next imaging study after negative or equivocal radiographs in patients with chronic metatarsalgia, including plantar great toe pain, when clinical concern includes sesamoiditis, Morton's neuroma, intermetatarsal bursitis, chronic plantar plate injury, or Freiberg's infraction.

- **Variant 4:** MRI foot without IV contrast or US foot is usually appropriate as the next imaging study after negative or equivocal radiographs in patients with chronic plantar heel pain when clinical concern includes plantar fasciitis or plantar fascia tear.

- **Variant 5:** MRI foot without IV contrast or CT foot without IV contrast is usually appropriate as the next imaging study after negative or equivocal radiographs in patients with nonradiating chronic midfoot pain of suspected osseous origin when clinical concern includes occult fracture or painful accessory ossicles.

- **Variant 6**: MRI foot without IV contrast or US foot is usually appropriate as the next imaging study after negative or equivocal radiographs in patients with chronic foot pain resulting from entrapment syndromes when clinical concern includes Baxter's neuropathy.

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 go to www.acr.org/ac.

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 [82].

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."		

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