Original Article

Imaging Spectrum in Patients with Nontraumatic Ankle Pain

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Abstract

Background: Ankle pain is a disabling clinical complaint with substantial negative impact on patients' quality of life. The etiology of foot/ankle pain is multifactorial. Despite careful and detailed clinical history and accurate physical examination, reaching an accurate diagnosis is often difficult because nontraumatic ankle pain has a broad-spectrum etiology. Imaging plays a vital role in the etiology of ankle pain. **Materials and Methods:** This was a prospective study done in collaboration between department of orthopedics and radiodiagnosis and imaging on 43 patients from August 2018 to December 2019. Plain radiography of the ankle joint with anteroposterior and lateral views was done in every patient. Further investigations were advised using the American College of Radiology Appropriateness criteria scale for chronic ankle pain. **Results:** The most common causes of nontraumatic ankle pain were tendinosis of Achilles 6 (13.9%) including calcific tendinitis, tenosynovitis of other tendons 4 (9.3%), and benign bone tumors 4 (9.3%). Overall imaging was able to pick probable etiology in 34 out of 43 patients. No possible cause could be found in nine cases. **Conclusion:** Radiological imaging, especially cross-sectional imaging, is an asset for diagnosing etiology of ankle pain. Orthopedicians should not hesitate in referring patients with ankle pain to the radiology department.

Keywords: Ankle pain, computed tomography, magnetic resonance imaging, ultrasonography

Introduction

Ankle is composed of true ankle joint and subtalar joint. The true ankle joint is composed of three bones, seen from the front: tibia medially, fibula laterally, and talus inferiorly. Subtalar joint is composed of calcaneum inferiorly and talus superiorly. Ankle pain is a disabling clinical complaint with substantial negative impact on patients' quality of life. Despite careful and detailed clinical history and accurate physical examination, reaching an accurate diagnosis is often difficult because nontraumatic ankle pain has a broad-spectrum etiology.

Ankle pain can be associated with swelling, stiffness, redness, and intense dull ache, which occurs upon weight-bearing and ankle motion.[1-3] The etiology of foot/ankle pain is multifactorial, and poor footwear choices may also play a key role in its development.[4-6] Wearing shoes that are too small[6] or shoes that lack support and sound structure (high heels, sandals, and slippers) has been associated with foot pain, especially when no cause could be found on imaging. Conventional radiography is the first modality used to evaluate any bony abnormalities. It is the most commonly used modality because of its wide availability and low cost. However, proper assessment of ligamentous, tendinous, and cartilaginous lesions is not possible with radiography.[7] High soft tissue resolution, nonionizing, noninvasive nature, and multiplanar capabilities of magnetic resonance imaging (MRI) make it an investigation of choice for nontraumatic ankle pain. It is also useful for guiding treatment decisions and determining response to therapy.[8] Ultrasonography and computed tomography (CT) also are the useful tools in the diagnosis of specific conditions. CT is particularly sensitive for picking stress fractures, bone tumors, tarsal coalition, and bony abnormalities in arthritis. Ultrasound is useful for assessing tendons, nerve entrapment, synovitis, and Morton's neuroma.

Materials and Methods

Our study was a prospective study done in collaboration between department of orthopedics and radiodiagnosis and

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imaging on 43 patients from August 2018 to December 2019. Plain radiography of ankle joint with anteroposterior and lateral views was done in every patient. Further investigations were advised only if radiograph did not reveal any definitive

Figure 1: Dorsoplantar radiograph of the foot showing sclerosis of the second metatarsal head with fragmentation suggestive of Freiberg infarction

Figure 2: Lateral radiograph showing evidence of a well-defined lytic lesion with sclerotic margins and narrow zone of transition in calcaneum in proven case of simple bone tumor

Figure 3: Sagittal computed tomography image revealing evidence of fat attenuation lesion in calcaneum suggestive of intraosseous lipoma

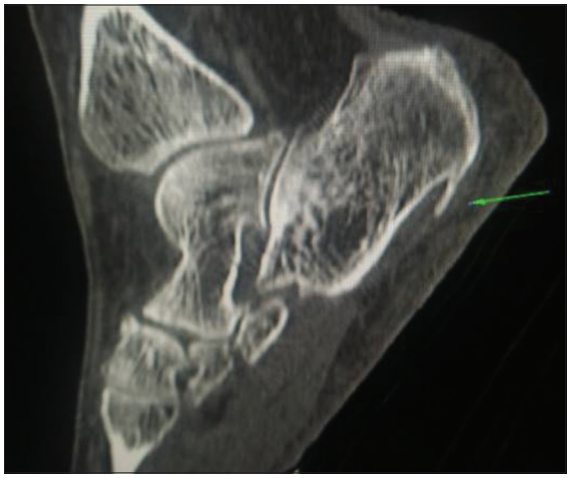

Figure 4: Sagittal computed tomography image revealing evidence of calcaneal spur

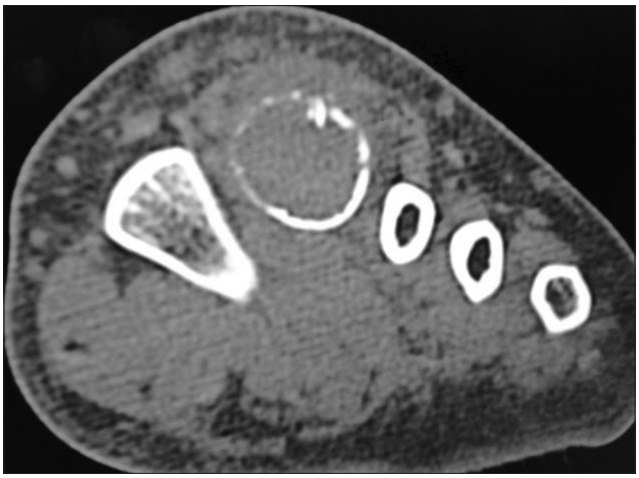

Figure 5: Axial computed tomography revealing evidence of well-defined lytic lesion in the second metatarsal in proven case of enchondroma

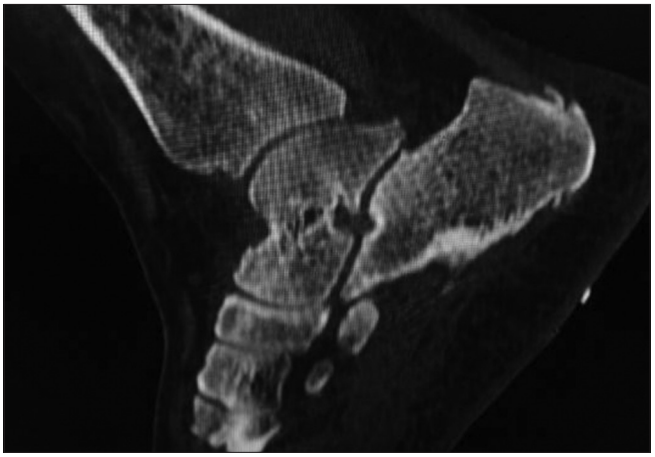

Figure 6: Sagittal computed tomography revealing evidence of calcification in Achilles tendon suggestive calcific tendinitis with tiny calcaneal spur

diagnosis. Further investigations were advised using the American College of Radiology Appropriateness Criteria Scale for chronic ankle pain. CT was done in patients with suspected accessory bone, bone tumor, etc., with Kilovolt (KV) of 130 and mA of 70; MRI was done in patients with suspected tendon, ligamentous, soft tissue abnormality, or stress fracture. MRI was done on a 3.0 Tesla scanner Magnetom Avanto (Siemens Medical System) with a standard

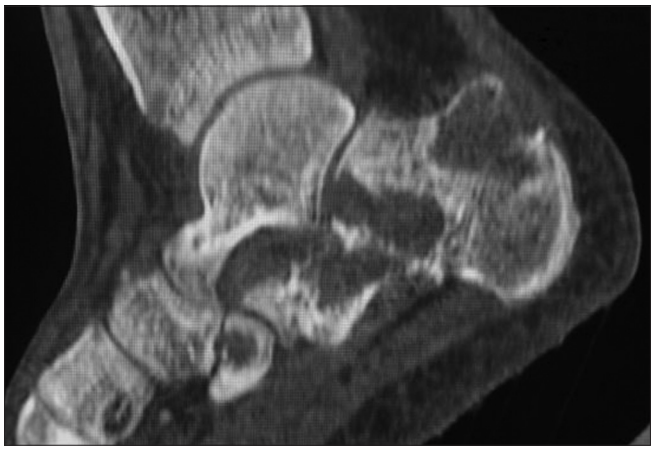

Figure 7: Sagittal computed tomography revealing evidence of multiple lytic lesions in calcaneum, cuneiform, cuboid in case of Langerhans cell histiocytosis

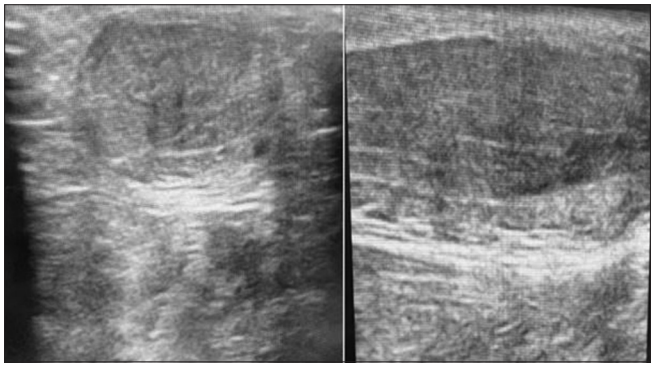

Figure 9: Axial and sagittal ultrasound revealing evidence enlarged and heterogeneous Achilles tendon

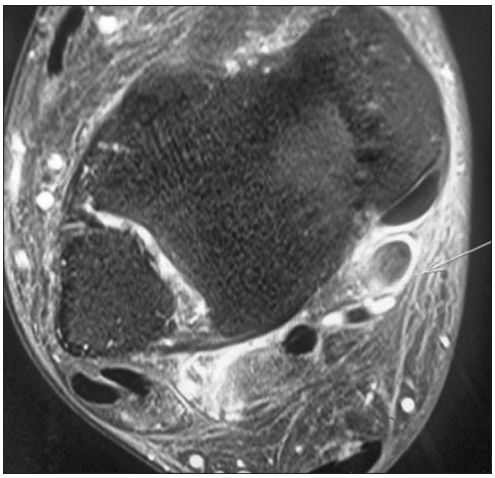

Figure 11: Axial magnetic resonance imaging revealing evidence of enlarged and hyperintense flexor digitorum tendon with associated fluid

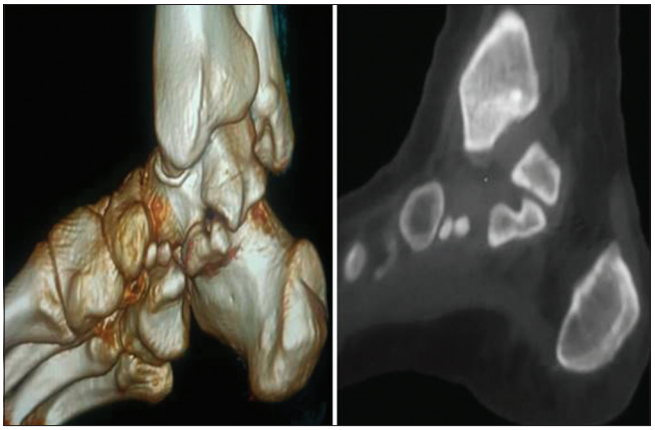

Figure 8: Volume rendered image and sagittal computed tomography revealing evidence of os navicularis

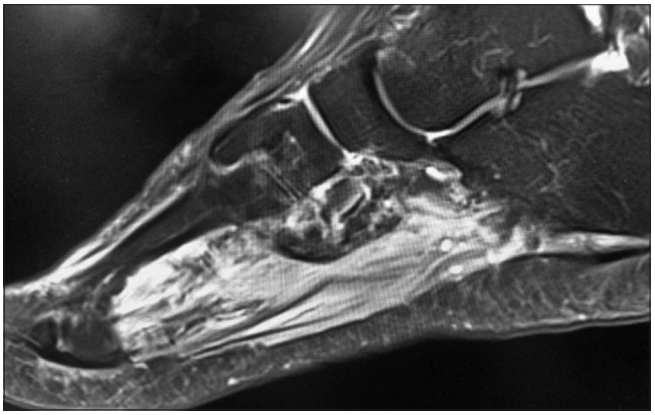

Figure 10: Sagittal short inversion-time inversion recovery magnetic resonance imaging revealing evidence of hyperintense sole muscles in a case of polymyositis

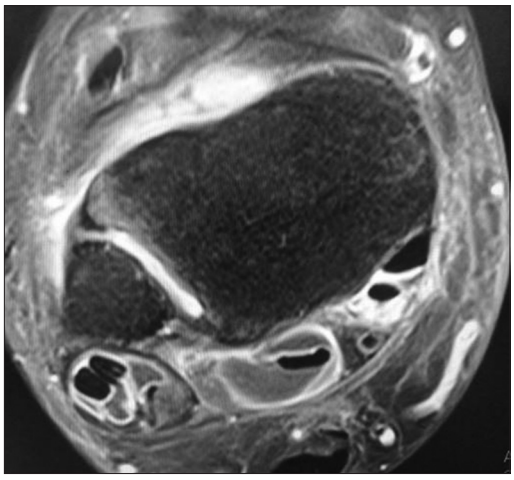

Figure 12: Axial magnetic resonance imaging revealing evidence of multiple collections around flexor and peroneal tendons with joint effusion in a case of tuberculosis

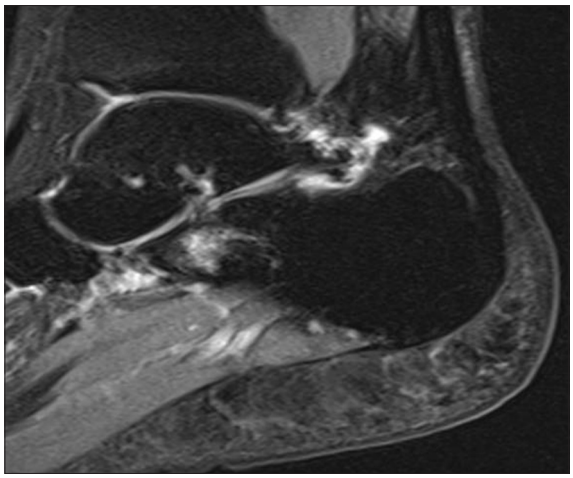

Figure 13: Sagittal Magnetic Resonance Imaging revealing evidence of fluid around steida process with surrounding inflammation in posterior ankle impingement

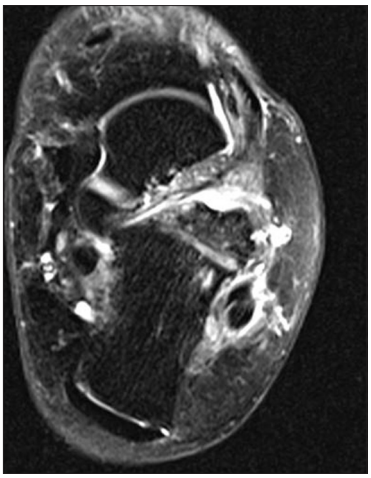

Figure 14: Axial Magnetic Resonance Imaging revealing evidence of fluid and inflammation around peroneal tendons in case of peroneal tenosynovitis

Figure 15: Sagittal T1-weighted and short inversion-time inversion recovery magnetic resonance imaging showing evidence of subchondral cysts, edema, and ankle effusion in osteoarthritis

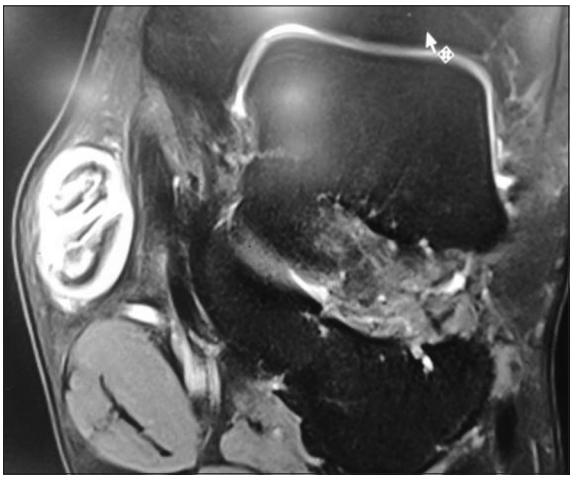

Figure 16: Coronal magnetic resonance imaging revealing evidence of enhancing mass within subcutaneous tissue on the medial side

extremity coil. T1-weighted (repetition time [ms]/echo time [ms] = 600/20) and T2-weighted (2000/20, 80) MRI, short inversion-time inversion recovery with inversion time of 150 ms, two-dimensional (2D) or 3D gradient-echo sequences for cartilage abnormalities were obtained with an 18-cm field of view, a 256 × 256 acquisition matrix, 1–3 signal averages, and 5-mm section thickness with 3-mm interval. Ultrasound was done using a 12 Hz frequency probe on GE Logiq S8 machine.

- Inclusion criteria
  1. Patients with nontraumatic ankle pain.
- Exclusion criteria
  1. Patients with history of trauma
  2. Patients with fracture on radiographs
  3. Patients with operative history
  4. Patients with contraindications to MRI.

Statistical analysis

Categorical values were presented with absolute and relative frequencies (%) and continuous values with mean.

Results

Of 43 patients, 23 were male and 20 were female. The age range of the patients was 12–63 years, with a mean age of 37 years. Radiography was able to give probable diagnosis in two patients, including one case of Freiberg infarction [Figure 1] and one case of simple bone cyst [Figure 2], and presumptive diagnosis in three patients, including one case of intraosseous lipoma, one case of osteomyelitis, and one case of enchondroma. Computerized radiography gave probable diagnosis in 10 patients, including two cases of calcific tendinitis of Achilles, two cases of calcaneal spur, one case each of intraosseous lipoma, enchondroma, painful accessory bone, Langerhans cell histiocytosis in the form of multiple lytic lesions, metatarsal osteomyelitis, and advanced osteoarthritis [Figures 3-8]. Ultrasound was helpful in definite diagnosis in two cases of peroneal tenosynovitis and two cases of tendinosis of Achilles tendon [Figure 9]. MRI was helpful in achieving final diagnosis in

Figure 17: Axial T1-weighted magnetic resonance imaging revealing evidence of fibrous ankylosis between cuboid and medial cuneiform

18 patients [Figures 10-17]. Overall imaging was able to pick probable etiology in 34 out of 43 patients. No possible cause could be found in nine cases.

The most common causes of nontraumatic ankle pain were 6 (13.9%) cases of tendinosis of Achilles including calcific tendinitis, 4 (9.3%) cases of tenosynovitis of other tendons, and 4 (9.3%) cases of benign bone tumors. We found tenosynovitis of peroneal tendons in two cases; one case of posterior tibial and one case of flexor digitorum tenosynovitis. Bone tumors responsible for ankle pain in our study include enchondroma, simple bone cyst, intraosseous lipoma, and osteoid osteoma. We had three cases of ankle impingement, two cases of calcaneal spur, two cases of osteoarthritis, one case each of painful accessory bone, sinus tarsi syndrome, metatarsal osteomyelitis, Langerhans cell histiocytosis, tuberculosis, navicular osteonecrosis (Kohler's disease), plantar fasciitis, tarsal coalition, polymyositis, soft tissue tumor, Freiberg infarction, talar avascular necrosis, and pigmented villonodular synovitis (PVNS) Table 1.

Final confirmation of diagnosis in bone tumors, osteomyelitis, and Langerhans cell histiocytosis, except intraosseous lipoma, was done through histopathology. Soft tissue tumor was found to be spindle cell carcinoma on histopathology.

Table 1: Etiology of nontraumatic ankle pain

Etiology	Frequency (%)
Achilles tendinopathy	6 (13.90)
Tenosynovitis	4 (9.30)
Benign bone tumors	4 (9.30)
Ankle impingement	3 (6.90)
Calcaneal spur	2 (4.60)
Osteoarthritis	2 (4.60)
Painful accessory bone	1 (2.30)
Sinus tarsi syndrome	1 (2.30)
Metatarsal osteomyelitis	1 (2.30)
Langerhans cell histiocytosis	1 (2.30)
Tuberculosis	1 (2.30)
Navicular osteonecrosis	1 (2.30)
Plantar fasciitis	1 (2.30)
Tarsal coalition	1 (2.30)
Polymyositis	1 (2.30)
Soft tissue tumor	1 (2.30)
Freiberg infarction	1 (2.30)
Pigmented villonodular synovitis	1 (2.30)
Talar avascular necrosis	1 (2.30)
Idiopathic	9 (20.90)

Discussion

Achilles tendon pathology was the most common cause of ankle pain in our study. Achilles tendon injuries may be classified as noninsertional or insertional.[9,10] The former group includes diffuse acute and chronic peritendinosis, tendinosis, and a rupture of 2–6 cm above the insertion of the tendon on the calcaneus.[11] The latter group includes insertional Achilles tendinosis, which may be associated with Haglund deformity of the calcaneus. Tenosynovitis affecting peroneal tendon, flexor digitorum, and posterior tibial tendon accounted for four cases of ankle pain. On ultrasound, affected tendon appears bulky with surrounding fluid. MRI characteristics of peroneal tenosynovitis include fluid within the common tendon sheath with preserved morphology of tendon.[12] Acute tenosynovitis is related to overuse and is usually encountered in young, athletic individuals. At MRI, fluid is seen within the tendon sheath.[13] Bone tumors are a known cause of bone pain. Three patients had posterior impingement as cause of pain. Posterior ankle impingement caused by a prominent talar trigonal process, either a prominent posterior process of the talus (Stieda's process) or discrete separate os trigonum, is an often underrecognized cause of hindfoot pain.[14] Two patients had osteoarthritis of ankle joint. Radiographic findings include joint space narrowing, osteophyte formation, subchondral sclerosis, and cyst formation.[8] Calcaneal spurs act as foreign bodies leading to the irritation of adjacent surrounding structures causing ankle pain. We had one case of accessory navicular bone. Potentially painful normal variants, such as accessory tarsal navicular and os trigonum, have been described with chronic foot pain.[15,16] We had one case of fibrous ankylosis between navicular and medial cuneiform. Tarsal coalition is deformity that results from abnormal bridging across two or more tarsal bones.[8] We had one case of Freiberg infarction of second metatarsal head. Freiberg's disease is characterized by pain, tenderness, swelling, and limitation of motion in the affected metatarsophalangeal joint.[17] One patient had plantar fasciitis. Plantar fasciitis is most likely related to repetitive trauma and mechanical stress, which produce microtears and inflammation of the fascia and perifascial soft tissues. Plantar fasciitis is common in runners and obese patients.[18,19] Inflammation of the plantar fascia can produce heel pain even in the absence of a traumatic event.[18] We had one case of talar osteonecrosis and Kohler's disease. Osteonecrosis of the

ankle and foot typically occurs in the talus as a consequence of talar neck fractures with vascular compromise of the bone at the level of the sinus tarsi.[20] Kohler disease manifests radiographically as sclerosis, irregularity, and fragmentation of the bone.[21] We had one case of polymyositis and one case of chronic metatarsal osteomyelitis. Both patients were diabetic. Polymyositis is characterized by the inflammation of muscles with increased signal intensity of muscles on the fluid sensitive sequences. Chronic osteomyelitis is characterized by sequestra formation, cloacae, and cortical thickening. PVNS presents with joint pain and swelling of long duration, and most are slowly progressive.[22] About nine cases have no cause on imaging. However, poor choice of shoes that do not provide sufficient support has been known to cause ankle pain.

Conclusion

Radiological imaging, especially cross-sectional imaging, is an asset for diagnosing etiology of ankle pain. MRI is the most valuable tool in ankle pain due to its high soft tissue resolution, nonionizing, noninvasive nature, and multiplanar capabilities. Orthopedicians should not hesitate in referring patients with ankle pain to the radiology department.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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