Extraarticular Lateral Ankle Impingement

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Learning objectives

- Describe the anatomy of the lateral ankle,
- Identify MRI findings of extraarticular lateral ankle impingement,
- Discuss the clinical importance of the lateral ankle impingement.

Background

Anatomy of the hindfoot:

The foot can be divided into three anatomical sections called the hindfoot, midfoot, and forefoot. The hindfoot consists of the talus and the calcaneus. On the upper surface of the calcaneus there are three smooth facets, posterior, middle, and anterior, which articulate with corresponding facets on the lower surface of the talus to form the subtalar joint. Of these three talocalcaneal facets, the posterior is the largest, covering almost the entire width of the calcaneal body. The middle and posterior facets are separated from each other by a deep groove, which together with a corresponding groove on the talus, forms a channel between the two bones called the sinus tarsi.

The lateral wall of calcaneus is nearly flat, except for a small ridge called the peroneal tubercle. The medial wall has a shelf-like projection, the sustentaculum tali. This shelf carries the middle talocalcaneal facet on its upper surface. The undersurface of the shelf has a groove for the flexor hallucis longus tendon. The subtalar joint is bound together by several talocalcaneal ligaments. In addition, it is supported by portions of the medial and lateral ligaments of the ankle, which span both the ankle and the subtalar joint.

Extraarticular lateral hindfoot impingement:

Ankle impingement syndromes result in chronic, painful movement restriction at the tibiotalar joint secondary to soft tissue or osseous abnormalities. In addition to ankle impingement syndromes extraarticular soft-tissue and osseous impingement occur lateral to the ankle joint. It is termed "lateral hindfoot impingement" or "extraarticular lateral ankle impingement". It can be divided into talocalcaneal impingement, subfibular impingement and combined talocalcaneal-subfibular impingements. Talocalcaneal impingement occurs between the lateral talus and calcaneus and subfibular impingement occurs between the calcaneus and the fibula. There are several causes of lateral hindfoot impingement (Table 1 on page 3).
Lateral hindfoot impingement is characteristically not related to an acute injury, but to chronic hindfoot valgus malalignment which is often due to posterior tibial tendon insufficiency, as this tendon is crucial in maintaining the longitudinal arch of the foot. Clinical presentation of the cases varies on the basis of the cause of flatfoot and hindfoot valgus (Table 2 on page 4). Patients may have decreased range of motion at the ankle, hindfoot, midfoot or forefoot, and lateral ankle pain on palpation. Contracture and tightness of the achilles tendon may also be present. Patients may also experience subluxation or dislocation of the peroneal tendons, causing a popping sensation at the posterior margin of the lateral malleolus. This instability is not related to the lateral impingement, but rather is caused by severe hindfoot valgus malalignment, and resultant overactivity of the unopposed peroneus brevis in the presence of posterior tibial tendon insufficiency.

Progressive deformity, secondary osteoarthrosis of the subtalar, talonavicular, and calcaneocuboid articulations contribute to pain symptoms in cases with extraarticular lateral ankle impingement. Therefore, detection of impingement with MRI at an early stage is important.

The purpose of this exhibit is to review the causes and the imaging findings of the extraarticular lateral ankle impingement.

Images for this section:

<table>
<thead>
<tr>
<th>Table-1: Causes of the lateral hindfoot impingement as a sequela of flatfoot deformity and hindfoot valgus</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Posterior tibial tendon deficiency</td>
</tr>
<tr>
<td>• Congenital flatfoot</td>
</tr>
<tr>
<td>• Healed intraarticular calcaneal fractures</td>
</tr>
<tr>
<td>• Neuropathic arthropathy (diabetes)</td>
</tr>
<tr>
<td>• Inflammatory arthritides</td>
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**Table 1:** Causes of the lateral hind foot impingement.
Table 2: Clinical presentation on the basis of the cause of flatfoot and hindfoot valgus.

<p>| | | |</p>
<table>
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<tbody>
<tr>
<td><strong>PTT dysfunction</strong></td>
<td>Medial ankle pain in early stages, lateral ankle pain and</td>
<td>impingement in long-standing cases</td>
</tr>
<tr>
<td><strong>Rigid flatfoot deformity</strong> (regardless of the initial cause)</td>
<td>Decreased range of motion at the midfoot and hindfoot,</td>
<td>decreased ankle dorsiflexion</td>
</tr>
<tr>
<td><strong>Lateral hindfoot impingement</strong></td>
<td>Lateral ankle pain (osteoarthrosis and progressive deformity of the subtalar, talonavicular and calcaneocuboid joints contribute to pain symptoms)</td>
<td></td>
</tr>
</tbody>
</table>
Findings and procedure details

Conventional weight-bearing ankle radiographs are useful to assess the plantar arch and hindfoot valgus (Fig. 1 on page 6). In cases with advanced lateral hindfoot valgus, osseous impingement occurs with direct contact between the talus and calcaneus or between the lateral calcaneus and the fibula. Opposing sclerosis and cystic changes may also be seen (Fig. 2 on page 7).

CT is more sensitive than radiography for identifying cystic and sclerotic changes at the osseous impingement sites (Fig. 3 on page 7).

The measurement of the hinfoot valgus angle performed on the most posterior coronal image that includes both tibia and calcaneus, taking care not to use an image through the calcaneal sustentaculum tali as that would increase the angle. Medial calcaneal wall is selected for MR measurements. Normal angle is between 0-6 degrees. Hindfoot valgus on MRI has been graded as mild (7-16°), moderate (17-26°) and severe (>26°) (Fig. 4 on page 8). As the MR images are not obtained during weight-bearing, the measurement of the hindfoot valgus angle may underestimate the functional malalignment.

The most common MRI findings of talocalcaneal impingement are cystic changes, sclerosis, and edema in the posterior subtalar joint and in the lateral process of the talus and the lateral calcaneus (Table 3 on page 5). Imaging features of subfibular impingement often include extensive lateral soft-tissue thickening between the fibula and the calcaneus. Entrapment and thickening of the calcaneofibular ligament may also be seen (Fig. 5 on page 9, Fig. 6 on page 10). MRI features of lateral hindfoot impingement are more commonly seen in patients with advanced posterior tibial tendon tears and with greater MR hindfoot valgus angle.

Differential diagnosis of the imaging findings of the extraarticular lateral ankle impingement should include sinus tarsi syndrome, inflammatory arthropathies (such as rheumatoid arthritis) and calcaneal intraosseous ganglion formation or prominence of vascular structures.

Images for this section:
Table 3: MR imaging findings of lateral hindfoot impingement.

<table>
<thead>
<tr>
<th>Talocalcaneal impingement</th>
<th>Subfibular impingement</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Cystic changes</td>
<td>▪ Lateral soft-tissue thickening between the fibula and the calcaneus</td>
</tr>
<tr>
<td>✓ Sclerosis</td>
<td>▪ Entrapment and thickening of the calcaneofibular ligament</td>
</tr>
<tr>
<td>✓ Bone marrow edema</td>
<td>▪ Fibular tip marrow edema</td>
</tr>
<tr>
<td>(In the posterior subtalar joint, lateral process of the talus and lateral calcaneus)</td>
<td>▪ Contact between fibula and calcaneus</td>
</tr>
<tr>
<td></td>
<td>▪ Formation of a neocalcaneal facet</td>
</tr>
<tr>
<td></td>
<td>▪ Peroneal tendon subluxation</td>
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</tbody>
</table>

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**Fig. 1:** Weight bearing radiograph shows direct contact between the talus and the calcaneus and sclerotic changes (arrows).

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**Fig. 2:** A,B; Sagittal fat saturated T2-wd images shows marrow edema of opposing lateral talar process and calcaneus. C; Coronal proton density fat saturated image shows subchondral cystic changes in posterior subtalar facet in a case with talocalcaneal impingement.

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Fig. 3: Coronal CT image shows calcaneal facet articulating with distal fibula (red arrow). Lateral subluxation of calcaneus and subchondral changes in posterior subtalar facet (yellow arrow) are compatible with combined talocalcaneal and subfibular impingement on the left side in a case with old calcaneal fracture.

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Fig. 4: Illustration shows lateral hindfoot impingement (A; normal, B; talocalcaneal impingement with hindfoot valgus, C; combined talocalcaneal and subfibular impingement with progressive hindfoot valgus. Angle between the medial calcaneal cortex and the long axis of the tibia, measured just posterior to the sustentaculum at the level of the posterior talus and tibia.

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**Fig. 5:** A; Sagittal T2-wd fat saturated image shows abnormal contact between calcaneus and talus with opposing bone marrow edema and cystic changes in a case with lateral hindfoot impingement. B; coronal fat saturated PD image shows thickened calcaneofibular ligament, due to entrapment between the fibula and the calcaneus (PTF: posterior talofibular ligament, PT: peroneal tendons, red arrow; thickened calcaneofibular ligament).

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Fig. 6: A; Due to hindfoot valgus, soft tissue edema and impingement is seen between the fibula and the calcaneus (yellow arrows) without prominent bony changes (red arrow; peroneal tendons). B; Malalignment results dislocation of peroneal tendons (arrow). Peroneal tendon dislocation is not related to lateral ankle impingement.

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Conclusion

Knowledge of the imaging findings of the extraarticular lateral ankle impingement syndromes is essential for making early and correct diagnosis in combination with the clinical findings. MRI can also aid in differentiating the other causes for lateral ankle pain in valgus foot such as lateral malleolar bursitis and distal fibular stress fracture.

Calcaneal osteotomy is often necessary to correct hindfoot valgus and lateral hindfoot impingement. Early detection of the impingement is also beneficial for successful surgical results.

Personal information

References