Fracture of the Medial Tubercle of the Posterior Process of the Talus: Magnetic Resonance Imaging Appearance with Clinical Follow-Up

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Abstract Fractures of the medial tubercle of the posterior process of the talus are rare injuries. They are often misdiagnosed, resulting in increased morbidity and symptoms of chronic ankle pain and instability. When undetected, these fractures may become displaced, with potential additional injuries such as to the flexor hallucis longus tendon which may become interposed between the fracture fragments. We report a case of a clinically unsuspected fracture of the medial tubercle of the posterior process of the talus seen on magnetic resonance imaging, treated conservatively, with interval satisfactory healing of the fracture at 6 weeks follow-up.

Keywords magnetic resonance imaging · ankle · talus · fracture · trauma

Introduction

The posterior talar process is comprised of medial and lateral tubercles which serve as attachments for the posterior talotibial and talofibular ligaments, respectively. Fractures

of the medial tubercle of the posterior process of the talus are very rare with few cases reported in the literature [1, 2]. We report a case of such a fracture which was diagnosed by magnetic resonance imaging (MRI) and treated successfully in a conservative fashion.

Case report

The patient is a 36-year-old female who “missed a step” while descending the stairs in her home, impacted heavily on her right ankle and sustained a supination injury. She rested, iced, and elevated the affected side and used oral anti-inflammatories as needed for approximately 3 weeks. At 3 weeks she was still feeling discomfort within the ankle, in particular when carrying her twin sons.

On presentation to the clinic at 4-weeks post-injury, she described medial ankle pain deep to the medial malleolus and along the course of the posterior tibial tendon. It was sharp in character and at its worst 8 out of 10 on the visual analogue scale but typically 4 to 5 out of 10. This discomfort was exacerbated by resisted inversion and a unilateral heel raise. There was no obvious injury to bone reported on her radiographs (anteroposterior, lateral, and oblique views) performed at an outside institution so an MRI was ordered to assess the soft tissues and diagnose any subtle injury within the ankle joint.

MR imaging was performed on a 1.5T MR scanner (General Electric, Milwaukee, WI, USA). The foot was placed in a neutral position in a quadrature phased array knee coil. Sequences included: sagittal fast short tau inversion recovery (STIR) (TR/TE 5367/17, FOV 160 mm, ETL 7, slice thickness 3.4 mm, 0 gap, TI 150, matrix 256×192, 2 NEX), axial proton density (TR/TE 4917/26, FOV 140 mm, ETL 7, slice thickness 3.5 mm, matrix 516×256, 2 NEX), coronal proton density (TR/TE 3650/28, FOV 110 mm, ETL 9, slice thickness 4 mm 0 gap, matrix 512×384, 2 NEX), and sagittal proton density

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(TR/TE 4000/26, FOV 150 mm, ETL 9, slice thickness 3 mm, 0 gap, matrix 512×384, 2 NEX).

Sagittal fast inversion recovery image demonstrated focal intense bone marrow edema pattern in the far medial tubercle of the posterior process of the talus (Fig. 1). Routine fast spin echo proton density images further disclosed a discrete low signal intensity fracture line within the medial tubercle without distraction or displacement (Fig. 2).

Standing radiographs were performed 2 weeks after the MR imaging examination and did not demonstrate any abnormality. Specifically, the medial tubercle was not displaced (Fig. 3).

The patient was treated conservatively with a non-weightbearing fiberglass cast for a period of 2 weeks followed by a cam boot for 4 weeks. The first 2 weeks in the cam boot involved her being entirely non-weightbearing and the subsequent 2 weeks involved a gradual increase in weightbearing followed by weaning from the boot. Patient had a follow-up MR examination 6 weeks after the initial injury. Selected images from that examination using similar standard ankle pulse sequence parameters as outlined above demonstrate interval healing of the fracture with progressive osseous union (Figs. 4 and 5). The patient then commenced on a specific and aggressive physical therapy regimen to address ankle strength, balance, and proprioception.

The patient has since returned to her full activities and is pain-free.

Discussion

Fractures of the posterior process of the talus are potentially very important as the undersurface of this portion of the talus constitutes approximately 25% of the posterior articular facet of the subtalar joint [3]. Cases of fractures of the medial tubercle of the talus are very rare in the literature but have typically been cited to occur as a consequence of a pronation-

Fig. 1. Sagittal fast inversion recovery image through the far medial aspect of the ankle demonstrates bone marrow edema pattern in the medial tubercle of the posterior process of the talus with a hypointense fracture line (arrow)

Fig. 2. Axial proton density MR image shows the fracture line (arrow) but it is more difficult to prospectively observe compared with the sagittal and coronal sequences, as it is at the far posteromedial margin of the bone and there are multiple regional soft tissue structures here somewhat confounding visual inspection

dosiflexion injury [1]. They have been most often treated conservatively if diagnosed early. This is often not the case with conventional anteroposterior, oblique, and lateral radiographs of the ankle and thus surgery has been performed in

Fig. 3. Anteroposterior view of the ankle obtained 2 weeks after the initial MR examination demonstrates no obvious fracture line

Fig. 4. Sagittal proton density MR image obtained 6 weeks after the initial MR exam demonstrates osseous incorporation of the fracture with a less conspicuous fracture line (arrow)

many cases of this type of injury. We have reported the successful conservative treatment of a stress fracture of the medial tubercle of the posterior process diagnosed with MR imaging.

Posterior talar fractures have been most often cited to occur as an avulsion injury secondary to a pronation-dorsiflexion force which causes tension at the insertion of the posterior talotibial ligament [1]. This type of avulsion injury was originally described by Cedell in 1974 and most cases have been attributed to this indirect effect [2, 4–7]. However, the injury may also occur as a result of direct trauma [8]. In fact, one group did hypothesize that high energy injuries resulting in fractures of the medial tubercle are very different to sporting avulsion fractures [6]. They believed that in this form of injury, the medial tubercle is likely to be significantly displaced with potential interposition of the flexor hallucis longus tendon. At the time of their article all previous case reports had described sporting avulsion fractures involving small fracture fragments [3, 9].

Some authors have advocated the use of oblique radiographs to improve conspicuity of these injuries and increase sensitivity of diagnosis [10]. These authors examined ten ankle specimens with a simulated fracture of the medial tubercle of the posterior process of the talus in varying planes and in varying angles of external rotation in order to increase the sensitivity of oblique views to diagnose this injury [10]. They found that conventional X-ray series i.e. true AP and lateral views (0° and 90° of external rotation) of the ankle joint were unable to detect the fracture in any of the specimens. Their conclusion was that two oblique views at 45° and 70° of external rotation could identify the fractures of the posteromedial tubercle at all planes and recommended these views before opting for more sophisticated imaging techniques such as computed tomography or MRI. Despite somewhat improved visualization of the

medial tubercle of the posterior process of the talus with oblique views, nondisplaced fractures remain difficult to see. Moreover, these injuries are often clinically unsuspected; therefore, knowing prospectively in what patients to obtain these additional views is unknown.

This is the first reported case, to our knowledge, of the MR depiction of a fracture of the medial tubercle of the posterior process of the talus. At least one water sensitive pulse sequence is recommended when performing MRI of the foot and ankle to visualize the bone marrow edema pattern occurring with these fractures, making them more conspicuous to identify. Despite this, these fractures still may be missed as there are multiple structures at the posteromedial aspect of the ankle, and one can be misled by volume averaging with the adjacent osseous contour of the talus or sustentaculum. Meticulous inspection of all corners, margins, and recesses of the hindfoot should be performed in all cases where there is a history of trauma, as these fractures can be subtle and can occur at the far peripheral margins of the bone.

Additional pulse sequences to further identify and visualize the regional anatomy and a discrete fracture plane is suggested such as T1-weighted images; in the case presented here, high resolution fast spin echo proton density sequences were used to visualize the fracture. The posterior process of the talus assumes a somewhat oblique, downward sloping morphology, with the fracture plane often occurring in a somewhat horizontal fashion. Therefore, if one is faced with significant motion artifact on MR images, possibly due to patient discomfort, meticulous inspection of the orthogonal planes (eg. sagittal and coronal) are suggested to better identify the fracture line with resultant increased diagnostic yield likely.

Treatment of this injury has involved surgery in the majority of the few cases reported with conservative

Fig. 5. Axial MR image from the same exam (6 weeks after the initial MRI examination) shows no obvious fracture line

treatment successful in one case. In the largest case series, Kim et al. reported on five patients who had sustained such a fracture of the medial tubercle of the posterior process of the talus while participating in sporting activities [5]. Two of the five patients were diagnosed acutely and treated successfully with immobilization limited weightbearing. The remaining three patients were not diagnosed acutely and went on to have delayed operative excision for persistent posteromedial ankle pain. Their results suggested that prompt diagnosis and appropriate management yielded reliably good outcomes while untreated avulsion fractures had a poor outcome until surgical excision was performed.

Of note, one case report did highlight the potential for interposition of the flexor hallucis longus (FHL) between the fracture fragments thus prohibiting successful reduction [6]. The authors described rotation of an avulsed medial tubercle fracture fragment, by the deltoid ligament, with resultant interposition of the nearby FHL. This led to an inability to reduce the fracture using a closed technique. MR imaging can clearly define the relationship of the fracture to the FHL providing further prognostic information in addition to the primary diagnosis.

One limitation of this study is the absence of continued imaging follow-up to document the fracture to complete healing without complication; however, the initial follow-up examination at 6 weeks did demonstrate satisfactory healing of the fracture and the patient demonstrated clinical improvement with appropriate therapy at this time.

Summary/conclusion

We present the MR appearance of a fracture of the medial tubercle of the posterior process of the talus. We advocate the use of MR imaging of the ankle in patients with significant hindfoot pain and/or instability following a traumatic incident as hindfoot fractures are often poorly

seen on standard weightbearing radiographs. Meticulous inspection of the cortical margins of the bones of the hindfoot is recommended with focal attention to often subtle and peripherally located areas of bone marrow edema pattern, as they can suggest the presence of small, yet clinically significant, fractures.

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