Tibialis posterior tendon abnormalities in feet with accessory navicular bone and flatfoot

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To assess tibialis posterior tendon (TPT) pathology, we investigated 27 feet with the accessory navicular bone and 22 normal feet by MRI. We found two major anatomical differences in the feet with the accessory navicular bone; the TPT directly inserted in the accessory navicular bone, without any continuity to the sole of the foot or with a slip, less than 1 mm in thickness, and there was a mass with the density of fibrocartilage tissue, between the tendon and the bone in 20/27 feet. These abnormalities were not detected in the control group. 3 patients in the study group were operated on and the MRI findings were confirmed. These findings suggest that patients with the accessory navicular bone and flatfoot should be examined by MRI for insertion abnormalities of the TPT.

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The accessory navicular bone is one of the supernumerary bones which may be normally present in the foot (O'Rahilly 1953). The relationship between the accessory navicular bone and the flatfoot that sometimes accompanies it, is not clear (Grogan et al. 1989). Kidner (1929, 1933) thought that the accessory navicular bone alters the pull of the tibialis posterior tendon (TPT), and leads to flatfoot, but other studies have refuted this theory and suggest that the accessory navicular bone serves as an irritant that does not affect the normal mechanics of the foot (Sullivan and Miller 1979, Strayhorn and Puhl 1982).

However, it is well known that dysfunction of the TPT, from tenosynovitis to complete rupture, may result in flatfoot (Funk et al. 1986, Jahss 1992, Narvaez et al. 1997). We investigated the TPT by MRI in 27 feet with the accessory navicular bone and flat feet.

Patients and methods

The study group included 27 feet of 16 patients (age range 10–57 years, 11 men). 11 patients had bilateral disease. All had radiographically and clinically documented flatfeet with a type II or III accessory navicular bone (Miller et al. 1995). All feet were examined by MRI. The study protocol included axial and sagittal T2-weighted (TR/TE 2200/70) spin echo (SE) axial and coronal T1-weighted (600/15) SE and axial frequency-selective fat-saturated T2-weighted (60/10) gradient echo (GRE) (Flip angle 40°) sequences. Slice thickness was 3 mm in T1 and GRE and 4mm in T2 images. MRI studies were performed on a 1.0 T scanner (Magnetom SP, Erlanger, Germany).

11 cases, without the accessory navicular and flatfoot who were age- and gender-matched, were also assessed as a control group.

The symptoms of 13 patients in the study group responded well to shoe modifications and anti-inflammatory medication or else no treatment was necessary. 3 patients underwent operation (1 foot in each), by excision of the accessory navicular bone and rerouting the TPT.

Results

There were two major differences between the groups in the MRI findings: first, the TPT directly inserted in the accessory navicular, without any continuity with the sole of the foot or with a slip,

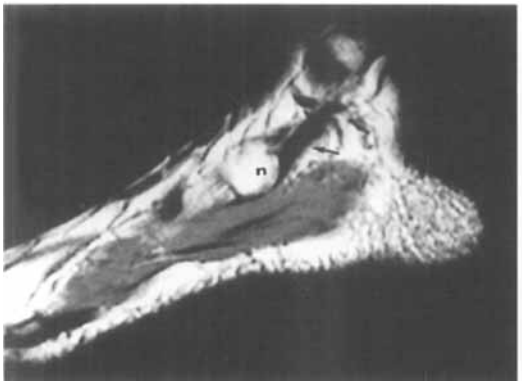

Figure 1. T2-weighted MRI images showing tibialis posterior tendon (arrow) continuity under the accessory navicular. n: navicular bone

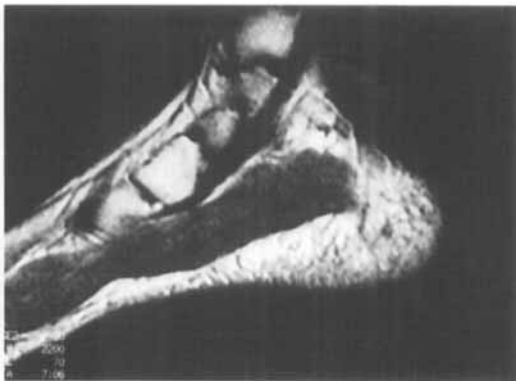

Figure 2. T2-weighted MRI images of a normal foot. Note the tendon continuity under the navicular bone.

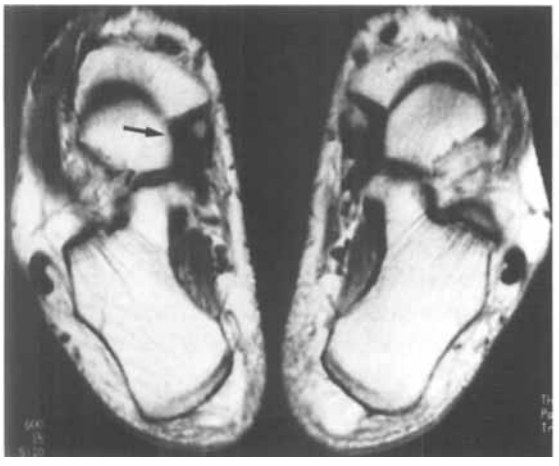

Figure 3. T1-weighted images showing the mass, just lateral to the tendon attachment area (arrow).

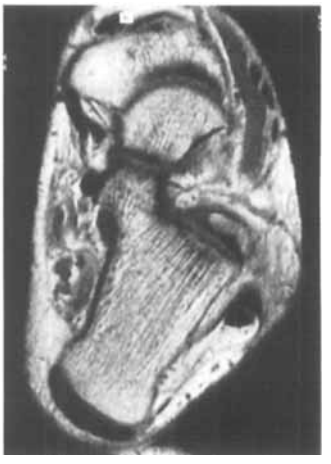

Figure 4. T1-weighted MRI images of the normal foot. Compare with Figure 3.

less than 1mm in thickness, in 20/27 feet of the study group (Figure 1). In these cases, there was a new tendon, originating from the lateral part of the accessory navicular. On the other hand, this insertion anomaly was not detected in any cases in the control group and, in all cases, the TPT had continuity with the sole of the foot, and was at least 4mm in thickness (Figure 2).

The other difference between the groups was the presence of a mass with the density of fibrocartilage tissue, between the tendon and the bone in 20 feet of the study group (Figure 3), instead of the normal fatty tissue found in all cases in the control group (Figure 4).

MRI studies also revealed osteonecrosis of the accessory navicular bone in 2 feet in the study group, with a minimal increase of the fluid in the joint between the accessory navicular bone and the navicular bone. Peritendonal fluid in the tendon was also detected in 2 feet in the study group and 1 foot in the control group. These 3 patients had a history of recent ankle sprain.

Operative findings

In all 3 cases, there was no continuity of the TPT under the navicular bone. The main trunk of the TPT ended at the accessory navicular and a thin slip of tissue was observed between the TPT and the other tendon originating from the accessory navicular bone. Macroscopically, this tissue did not possess the characteristics of a normal tendon tissue. Before and after the excision of the acces-

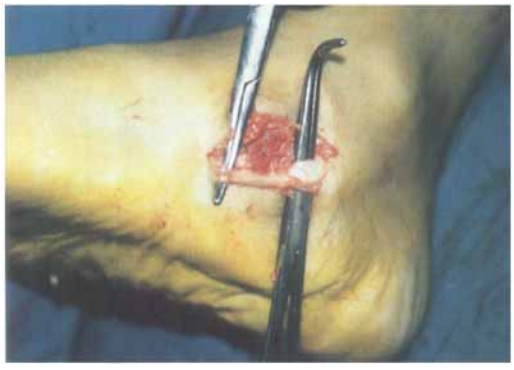

Figure 5. Main tendon and distal slip.

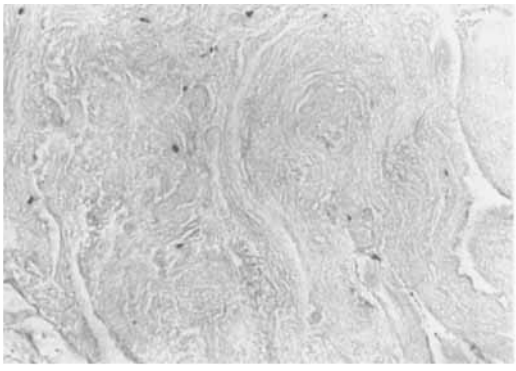

Figure 6. Histologic examination of the excised part showed hypocellular tendinous tissue characterized by extensive degenerative areas (HE ×100).

sory navicular, when the TPT was pulled in the direction of the pull of the TPT, no contraction was observed either in this thin slip or in the other portion of the TPT under the sole of the foot (Figure 5). This slip was excised as was the AN, and the main trunk of the TPT was sutured to the tendon under the sole of the foot. Microscopic evaluation of the excised part showed hypocellular tendinous tissue with degenerative areas (Figure 6).

Discussion

The accessory navicular bone may occur in up to 14% of the population, but seldom becomes symptomatic (Grogan et al. 1989). The association between the accessory navicular bone and flatfoot is not clear. Our MRI findings indicate that there exists an insertion anomaly of the TPT in patients with the accessory navicular bone and flatfeet. This condition, in our opinion, mimics TPT dysfunction, since the TPT has no supinator function without its distal attachments. With the loss of this function, the gastrocnemius-soleus complex acts at the talonavicular joint and when this happens, the passive structures of the longitudinal arc give way and flatfoot results (Funk et al 1986, Narvaez et al. 1997).

Although our operative findings are limited to only 3 patients, the MRI findings were confirmed. When traction was applied to the TPT during the operation, no contraction was observed in the distal part, although some slips of the tendon were connecting them. Histologic studies also proved that this part did not have the properties of a healthy tendon. This variation has not been mentioned in textbooks of anatomy (Williams and Warwick 1980, Sarrafian 1983). A review of the literature revealed that only Zadek (1926) had pointed out that the TPT did not pass beyond the accessory navicular, in cases with flatfoot.

Some authors have mentioned tenosynovitis or tenderness of the TPT in cases with an accessory navicular bone (Burman and Lapidus 1931, Mygind 1953, Strayhorn and Puhl 1982, Lawson et al. 1984, Grogan et al. 1989, Chen et al. 1997, Dyal et al. 1997). So far as we know, only Miller et al. (1995) have performed an MRI study with special reference to the TPT. They had found that edema surrounded the TPT and slight thickening of the tendon in one of their 5 patients with the accessory navicular bone.

The other previously unreported finding in our study is the presence of fibrocartilage tissue between the tendon and the bone, resembling the characteristic features of resistant fibrocartilage (Williams and Warwick 1980, Stevens and Lowe 1997). This is probably due to insufficient function of the TPT, resulting in friction between the tendon and the bone because they come closer in the pronated foot.

Two procedures have been described for surgical treatment of accessory navicular: excision of the accessory navicular and rerouting the TPT to the inner part of the navicular (Kidner 1929, 1933), or simple excision of the accessory navicular (Chater 1962, Macnicol and Voutsinas 1984). Good results have been reported in each. By per-

forming an excision, the irritative effect of the accessory navicular is avoided and relief of pain is achieved, but the TPT insufficiency persists. By taking into account the results of our study, we conclude that the patients with an accessory navicular and flatfoot should be examined by MRI for the insertion abnormalities of the TPT.

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