Treatment of posterior ankle pain by excision of a bipartite talar fragment

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We describe five adolescent patients aged between 13 and 16 years with bipartite ossification of the posteromedial aspect of the talus. All presented without a history of trauma.

All the ankles had a similar radiological appearance. Clinically, some restriction of movement was noted in three ankles and two subtalar joints. In addition, pain was noted over the posteromedial aspect of the ankle in three patients. In each patient the bipartite fragment was excised through a posteromedial approach to the ankle. Complete resolution was achieved at six months in three patients, with the remaining two describing exercise-induced symptoms. In one of these this precluded participation in sport.

Despite numerous anatomical variations within the tarsus, a case series of a bipartite talus has not previously been reported. This anatomical variation should be recognised to avoid misinterpretation as post-traumatic or other pathological processes. In the presence of recalcitrant symptoms excision is an option, but this is not universally successful in abolishing symptoms.

The talus is the second largest of the six tarsal bones. It occupies an integral position between the bimalleolar fork and the upper parts of the tarsus, with up to 80% of its surface covered by articular cartilage. It has no tendinous attachments and is held in position by anchorage to strong ligamentous attachments. Anatomically, it is subdivided into three well-defined parts, namely, the head, the neck and the body.

The body comprises five surfaces: superior, lateral, medial, posterior and inferior. The superior surface is pulley-shaped and smooth. Immediately posteriorly lies the smooth trochlear surface, allowing for articulation with the tibia. The posterior surface is narrow and comprises the posterolateral and posteromedial tubercles flanking the sulcus or an oblique groove which accommodates the tendon of flexor hallucis longus (FHL). The posterior process lies lateral to the groove to which the posterior talofibular ligament is attached. As an accessory ossicle the os trigonum (Fig. 1) may be found attached to the posterolateral tubercle. Accessory articular surfaces may also be present in continuity with the posterior calcaneal surface.

Rosenmuller was the first to describe the os trigonum in 1804. It occurs in between 2.7% and 8% of ankles, and is a persistent separation of the lateral tubercle from the remainder of the posterior aspect of the talus. It has been postulated that this separation may be a result of repeated trauma during development, although this remains unproven. At birth the developmental centre of the os trigonum is cartilaginous and it appears to ossify between the ages of eight and 11 years.

An elongated posterolateral tubercle is known as a Stieda process (Fig. 2). This ossicle has three surfaces, anterior, posterior and inferior. The anterior surface may articulate with the posterolateral surface of the talus or is attached by pseudarthrosis. The inferior surface articulates with the os calcis. Rarely, this tubercle may be very large and may extend posteriorly over the os calcis giving rise to a talocalcaneal coalition.

There have been no reports of unossified posteromedial aspects of the talus giving rise to a bipartite talus. The surface of such an ossicle has been defined as having a smooth, regular edge with no evidence of a fracture or arthritic changes present. The cortex should be well formed with a cartilage-covered surface.

It is generally accepted that the talus originates from a single ossification centre which appears at the seventh month of gestation. There are historical reports which suggest that it originates from two centres of ossification.
However, no further reports have verified these findings. We present a series of five adolescents whose clinical findings support the suggestion of two ossific centres occurring in the talus.

**Patients and Methods**

We retrospectively studied five patients (Table I) who presented over a period of five years with pain on standing and exercise-induced symptoms. All were initially treated conservatively which included immobilisation, rest and splinting for a minimum of three months. In four patients, there was no history of injury, but the fifth patient, a 16-year-old male with a history of a sprain of the right ankle, complained of posteromedial ankle pain and impingement. However, the sprain had occurred several months after the onset of symptoms in the posterior ankle. In this patient the pain was exacerbated by postero-medial compression and dorsiflexion of the ankle. When the symptoms became more severe, he was treated by limited weight-bearing in a CAM walker orthosis (DJO LLC, Vista, California) for three weeks without improvement before referral.

The radiological appearance was similar in all five patients. A large posterior bone mass, larger than an os trigonum and adjacent to the postero-medial tubercle, appeared on the lateral radiograph of the ankle as an isolated fragment with a double-density shadow. Additionally, there was slight flattening of the body of the talus on all the lateral radiographs. None had the appearance of a typical os trigonum, in which the posterior margin of the talus is well defined (Fig. 3).

CT was used in all the patients to clarify the size of the bipartite fragment. The appearances were similar, with a large separate unossified postero-medial fragment in each case (Fig. 4). The fragment extended forward to the medial body of the talus obliquely, and included 20% to 25% of the posterior facet of the subtalar joint.

**Operative technique.** Operative treatment was performed in each patient in an identical manner. A curved skin incision posterior to the medial malleolus was used. The neuro-vascular bundle was retracted anteriorly, and the tendon of FHL posteriorly. No tenosynovitis of the FHL was noted in any patient. The fragment was lying immediately lateral to FHL and was easily identified. Its full lateral extent was not initially apparent. A small periosteal elevator was first inserted into the posteromedial corner of the partition to define its plane which was followed by a 1 cm osteotome to mobilise the fragment. Once loosened, the fragment was levered laterally and grasped with a small rongeur before being twisted from its pedicle to separate it for removal. The size of the fragments was similar in all cases, being 2.0 cm to 2.5 cm in length and 1.0 cm to 1.5 cm in width. Approxim-
mately 20% to 25% of the articular surface of the subtalar joint was involved with the bipartite fragment and subsequently removed during surgery.

**Post-operative treatment.** A posterior splint was used initially and no weight-bearing was allowed for two weeks, after which a removable boot was used. Active and passive range-of-motion exercises were encouraged three times daily. Physiotherapy was not used routinely unless recovery of the ankle movement had not been achieved by four weeks. The patients were encouraged to start passive maximum plantar flexion and dorsiflexion stretching exercises as soon as these were comfortable. A return to full activity was encouraged with no restrictions by six weeks.

**Results**

There were no complications after surgery. Three patients reported improved function and the ability to participate in sporting activities pain free and with no further symptoms. One patient was unable to return to sporting activity which involved running, but his overall symptoms were improved. One continued to experience some pain after walking and exercise. Overall, all were satisfied with the outcome.

**Discussion**

The forefoot ossifies before the hind foot, during the third to fifth prenatal months in a general sequence from a distal to proximal. In the hind foot the calcaneum is the first bone to ossify at approximately five months or at a crown-rump length of 180 mm. The calcaneum occasionally appears to have two centres of ossification. The talus is ossified by the eighth foetal month and commonly follows on from the calcaneum. However, the ossification centre may not always be present at birth. The cuboid is the last tarsal element to show prenatal ossification. At birth, the primary centres of the calcaneum, talus and cuboid are present.

Numerous accessory bones in the foot have been described with approximately 22% of children under the age of 16 years of age having one or more accessory bones as seen on radiography.

The tarsal bones are characterised by numerous variations which may simulate pathological conditions. In the absence of complete knowledge these may be misinterpreted as fractures, osteochondritis, osteonecrosis, metabolic disorders or other pathological processes.

The distinction between traumatic and non-traumatic division of bones or multipartition may be difficult. The best known example of bipartition in the tarsus is that of the medial cuneiform with prenatal instances of this condition recorded.

The talus ossifies from one major centre which appears in the seventh month of gestation. It does not develop in a uniform direction since the talar body increases more rapidly in height than length and the width of the posterior

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**Fig. 3**

Lateral radiograph of the ankle, showing an isolated large well-defined posterior bone fragment (arrow).

**Fig. 4a**

Sagittal (a) and coronal (b) CT scans showing the separate posteromedial fragment of the talus.
talar segment increases slightly more rapidly than the length. Between eight and 11 years of age, separate centres of ossification appear between the medial and lateral tubercles, usually fusing rapidly to comprise the main body within 12 months.10

Early reports by Bennett6 and Turner7 indicated the presence of a possible discrete ossicle found just posterior to the main body of the talus. They went on to suggest that this may represent a secondary centre of ossification of the talus. Weinstein and Bonfiglio16 excised a fragment measuring 2.5 cm by 2 cm, which covered the entire posterior talocalcaneal surface as well as part of the upper surface of the talus. They described this fragment as a possible separation of the cartilage between the main body of the talus after repeated minor trauma or an unrecalled traumatic episode resulting in a pseudarthrosis.

In our series of patients a traumatic nature was excluded both clinically and radiologically, which led to the conclusion that the presence of these accessory bones in the talus could be explained only in terms of an anomaly of ossification. Endocrine factors must also be excluded when bony anomalies present since hypothyroid epiphyseal dysgenesis is characterised by multiple foci of bipartition in the hands and feet.17 Our patients did not have an endocrinopathy, neither there a family history of tarsal anomalies. Commonly, divisions of bones are acquired secondary to trauma though some may have a hereditary basis.

Two of our five patients still had pain induced by exercise. This may be related to the size of the fragments excised which were larger than a typical os trigonum. Brodsky and Khalil18 reported follow-up to a maximum of seven years in dancers in whom the os trigonum was excised successfully for talar compression syndrome without further symptoms.

In our series we believe the excised fragments represented a posteromedial secondary centre of ossification of the main body of the talus which had failed to unite. During the period of follow-up of 1.5 to five years no patient complained of instability of the subtalar joint, and avascular necrosis or arthritis was not found. However, we do not know if there will be any long-term consequences from the removal of a large proportion of the subtalar articulation. Our patients were satisfied with the outcome although one was unable to return to full sporting activities.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References