Transient osteoporosis of the foot

Transient osteoporosis is a rare cause of pain in the foot. There is a broad differential diagnosis. A multidisciplinary assessment by both an orthopaedic surgeon and rheumatologist with review of the imaging by a radiologist is useful, as this condition is a diagnosis of exclusion.

Transient osteoporosis is an uncommon cause of pain involving the weight-bearing joints of the lower limb. The first description was by Curtiss and Kincaid (1959) as a disease causing transitory demineralization of the hip. The term transient osteoporosis was coined by Hunder and Kelly (1968). Wilson et al (1988) suggested transient osteoporosis be replaced by the term transient bone marrow oedema because of the magnetic resonance imaging findings in these conditions. Regional migratory osteoporosis was first described by Duncan et al (1967) as a rare migratory and recurrent type of transient osteoporosis.

Case series of transient osteoporosis, transient bone marrow oedema and regional migratory osteoporosis are reported in the literature to describe similar entities. These conditions are uncommon, self-limiting, have an unknown aetiology and are characterized clinically by pain without a history of trauma. The conditions affect the axial skeleton and lower limbs but never the upper limbs. The most commonly involved sites are the hip, then the knee and rarely the foot. Early recognition of this syndrome is difficult because it is a diagnosis of exclusion.

The stimulus for this review was a group of patients presenting with foot pain of unknown cause. This is a review of transient osteoporosis of the foot with case illustrations.

Case presentation

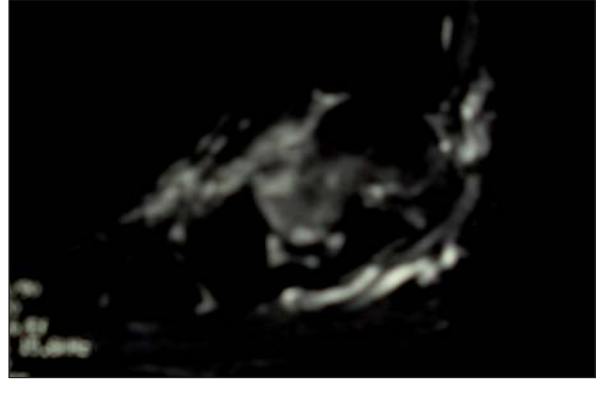
Between April 2004 and September 2007 ten patients with foot pain of unknown cause were referred. The medical records and radiological investigations were retrospectively reviewed. In this series there were six females and four males with an average age of 53 years (range 44–63 years). Five of the six females were postmenopausal. There were six left and four right feet involved. All patients had a history of acute onset of foot pain. Inflammatory markers and initial radiographs (*Figure 1*) were normal.

On magnetic resonance imaging scan the involved bones of the foot were the talus in seven patients (*Figure 2*), the navicular in one patient (*Figure 3*) and the cuneiforms in two patients.

The diagnosis of transient osteoporosis of the foot was made following an examination by both an orthopaedic surgeon and rheumatologist with review of the imaging by a radiologist. The specific points to note in the history are acute onset of pain without a traumatic incident. The pain gradually worsens in severity over the first 3 months and can make weight bearing difficult. The examination findings are tenderness at the site of the joint involved with minor swelling or effusion. Inflammatory markers and serum blood tests are normal. The affected bone may show regional osteopenia on radiographs and increased radionuclide uptake on bone scans. The magnetic resonance imaging findings are of non-specific marrow oedema with a pattern of decreased signal intensity on T1-weighted images and increased signal intensity on T2-weighted images. The marrow oedema is transient and resolves on follow-up imaging examinations.

Figure 1. Normal radiograph of the foot.

Figure 2. Transient osteoporosis of the talus.



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All patients had symptomatic resolution with conservative treatment at an average of 5 months (range 3–8 months). All the patients were allowed to weight bear as tolerated and none of the patients showed evidence of bone collapse on follow up radiographs. Two patients developed knee pain during the time of review and magnetic resonance imaging scans showed involvement of the medial femoral condyle (*Figure 4*) in one patient and the lateral femoral condyle (*Figure 5*) in the other. These two patients were treated conservatively and their knee symptoms also resolved.

Differential diagnosis

Transient osteoporosis is a diagnosis of exclusion and the differential diagnoses are broad. Classic osteonecrosis of the foot occurs in typical locations, most commonly the talus, as a consequence of talar neck fractures. Kohler's disease is an osteonecrosis of the tarsal navicular bone in children. A form of this osteonecrosis has been described in adults and is called Mueller–Weiss syndrome. Finally, osteonecrosis is also frequently seen in the second metatarsal head, known as Freiberg disease. Other entities that can cause soft tissue and bone marrow oedema on magnetic resonance imaging include bone infections, degenerative osteoarthritis, osteochondral lesions, neoplastic infiltration and enthesopathies such as plantar fasciitis. Bone contusion, stress responses and stress fatigue or insufficiency fractures are diagnosed based on predisposing factors. These fractures predominantly involve the second metatarsal, the calcaneus, and less frequently the navicular bone and talus. Before a stress fracture, a stress response can occur and the magnetic resonance imaging findings can be similar to those of transient osteoporosis (Stafford et al, 1989).

Altered biomechanics and mechanical overload can cause changes in bone marrow oedema. Schweitzer and White (1996) detected bone marrow oedema 2 weeks after patients began using foot pads designed to cause overpronation of the foot and Lazzarini et al (1997) showed this in joggers who run more than 80 km per week. Neuroarthropathy is characterized by bone fragmentation, cortical and periosteal thickening, joint effusion and soft tissue swelling. Seabold et al (1990) have shown that in some circumstances the marrow changes of neuropathic arthropathy are similar to osteomyelitis. Pain syndromes such as reflex sympathetic dystrophy also cause soft tissue oedema and may be difficult to differentiate clinically and radiologically. The relationship between transient osteoporosis and reflex sympathetic dystrophy remains controversial. The similar magnetic resonance imaging presentation of many of the causes of bone marrow oedema discussed above proves the importance of the clinical history in the diagnosis of transient osteoporosis.

Figure 3. Transient osteoporosis of the navicular.

Terminology

The terms transient osteoporosis, transient bone marrow oedema and regional migratory osteoporosis are used interchangeably in the literature to describe similar entities. Naides et al (1985) have suggested that they are likely to be part of the same spectrum of disease. Cahir and Toms (2008) reviewed the world literature using the terms transient osteoporosis, transient bone marrow

Figure 4. Transient osteoporosis of the medial femoral condyle of the right knee.

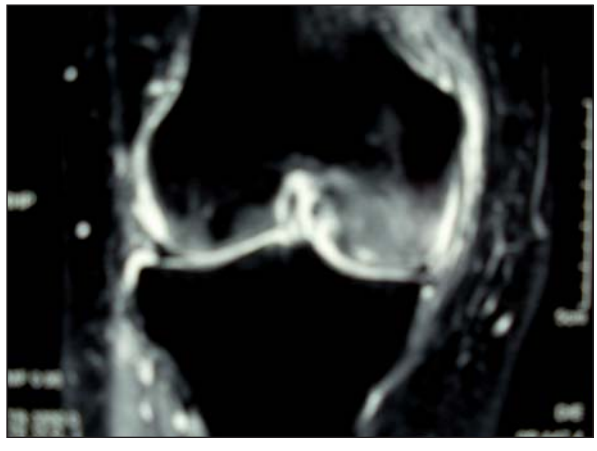
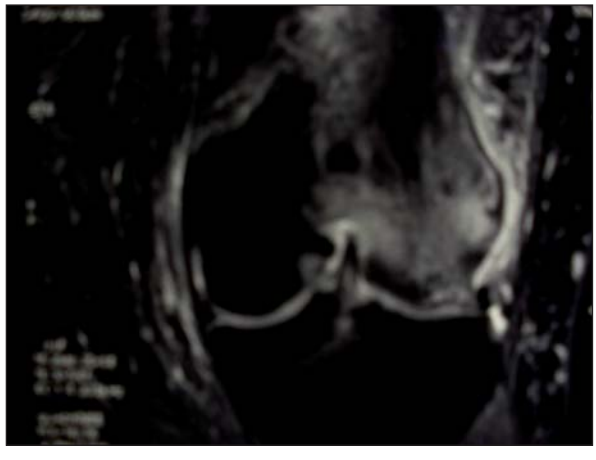


Figure 5. Transient osteoporosis of the lateral femoral condyle of the left knee.



oedema and regional migratory osteoporosis, which revealed 63 cases. They classified the cases into primary and secondary bone involvement. Primary describes the first site or bone involved by transient osteoporosis; subsequent sites or bones are described as secondary transient osteoporosis rather than regional migratory osteoporosis. The radiology of transient osteoporosis, transient bone marrow oedema and regional migratory osteoporosis was indistinguishable.

Incidence

The incidence of transient osteoporosis syndromes is difficult to estimate, being a rare set of conditions. Radke et al (2001) reported an incidence of 10 in 2400 patients over a 2-year period. The conditions have a 3:1 male to female ratio with an average age of 49 years in males and 46 years in females. The current series is small but a higher number of females were affected and five of seven women were postmenopausal.

Case series in the literature

There are several case series in the literature that report syndromes in which acute pain in the foot is associated with bone marrow changes that resolve with time. The involved bone is most commonly the talus followed by the navicular, the cuneiforms and the forefoot.

Regional migratory osteoporosis was first described by Duncan et al (1967) who reported three cases, one involving the foot. Radiographs of this case showed involvement of the metatarsals and tarsal bones. A biopsy was taken of the second metatarsal which showed decalcalcified trabecular bone. The patient had a 6-month history of acute forefoot pain and was treated with an 8-week course of oxyphenbutazone and prednisone.

Radke et al (2001) reported ten patients who, on the basis of magnetic resonance imaging, were suspected to have transient bone marrow oedema. In eight cases the talus was affected, in one the cuboid and in one the navicular bone. Four were treated with core decompression and had immediate pain relief. Six were treated conservatively and also became pain-free but with considerable delay.

Gigena et al (2002) reviewed five patients with transient osteoporosis affecting the talus; all were treated conservatively and improved over 6–12 months.

KEY POINTS

- Transient osteoporosis is a rare cause of foot pain.
- The diagnosis is made when clinical assessment and magnetic resonance imaging have excluded other causes.
- Review by a multidisciplinary team is helpful as the diagnosis is generally not obvious.
- Treatment is conservative and symptomatic resolution usually occurs within 6 months.

Fernandez-Canton et al (2003) reported the results of 32 patients diagnosed with transient bone marrow oedema who were treated conservatively. The initial magnetic resonance examinations showed that transient bone marrow oedema had affected an average of 4.7 individual bones. Magnetic resonance imaging at 1 year showed resolution of bone oedema in 18 patients (72%), partial improvement in five (20%) and no improvement in two (8%). Six patients (24%) developed similar symptoms in the other foot during follow up. Further bone marrow oedema developed in bones of the same foot that were initially normal, or in uninvolved areas in the same affected bone, in six of seven patients on follow-up magnetic resonance imaging.

In their review of the world literature, Cahir and Toms (2008) found four cases had primary regional migratory osteoporosis of the foot and 10 cases involving the ankle.

Treatment

The patients in this series were managed conservatively, assuming the benign course of the disease. Most of the case series show resolution with conservative treatment.

Yamamoto and Bullough (2000) showed evidence that transient osteoporosis of the hip occurs as part of a reparative response to the initial trigger of a trabecular insufficiency fracture. Turner et al (1989) proposed that transient osteoporosis of the hip might be an early stage of avascular necrosis. The pain of avascular necrosis is caused by increased intramedullary pressure, therefore core decompression has been recommended to reduce the duration of symptoms (Hofmann et al, 1993). In cases of transient osteoporosis affecting the foot there is evidence that decompression is effective (Calvo et al, 1997; Radke et al, 2001). A potential disadvantage of this treatment is of causing further weakening in an already osteoporotic bone and inducing a fracture, which is a suspected complication of decompressing avascular necrosis of the hip (Beltran et al, 1990). However, this has not been reported in transient osteoporosis (Neuhold et al, 1992).

Conclusions

Transient osteoporosis is a rare cause of pain in the foot with an unknown aetiology. There is a broad differential diagnosis. The terminology in the literature concerning similar syndromes can be confusing but may part of a spectrum of disease. A multidisciplinary assessment is useful as this condition is a diagnosis of exclusion. **BJHM**

Conflict of interest: none.

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