CASE REPORT

Thompson and Hamilton type IV Freiberg's disease with involvement of multiple epiphyses of both feet

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SUMMARY

A 17-year-old boy reported left second and third toe pain after axial loading injury to his left foot. Radiographs showed collapse of the second metatarsal heads and epiphysal irregularities of the fifth metatarsal heads and the condyle of the proximal phalanx of the hallux of both feet. The patient was diagnosed to have Thompson and Hamilton type IV Freiberg's disease. He was screened for epiphysal dysplasia of the other sites. He had on and off bilateral hip and knee pain. Radiographs showed bilateral symmetrical epiphysal abnormalities with morphological change as focal concavity in bilateral femoral heads and fragmentation of the patellar articular surface with preservation of the patellofemoral joint space.

BACKGROUND

Freiberg's disease is avascular necrosis of the metatarsal (MT) head. Avascular necrosis of the second MT head has been recognised as the fourth most common osteochondrosis of the body.¹ The classical location of this disorder is the second MT head (68%), although it can also be found in the other lesser MTs, most commonly the third (27%), followed by the fourth (3%). The fifth MT head is rarely involved.² Cases of multiple and bilateral MT involvement have also been reported.^{3–6} Thompson and Hamilton classified Freiberg's disease into four types. In type I, there is no degenerative joint disease and the articular cartilage is intact. In type II, there are periarticular spurs with intact cartilage. In type III, there is severe degenerative joint disease with loss of articular cartilage. Type IV is quite rare and may represent a form of epiphysal dysplasia in that more than one MT head is involved.⁷ We present a case of Freiberg's disease involving multiple MTs of both feet. The patient was finally diagnosed to have a mild form of multiple epiphysal dysplasia.

CASE PRESENTATION

A 17-year-old boy landed on his left foot axially after a jump while playing badminton. He later had left second and third toe pain and noticed a bony bulge at the dorsum of the left second metatarsophalangeal (MTP) joint region. He consulted a bonesetter and was diagnosed to have left second MTP joint dislocation; closed manipulation was performed. The pain and bony bulge persisted and he attended the emergency room. Another closed manipulation was attempted but the symptoms persisted. He was admitted to our department for further management. Clinically, he walked without

normal push off the left foot. There was a bony prominence and tenderness over the left second MT head and mild pain over the third MT head dorsum. There was no associated joint swelling. The active motion of the second MTP joint was diminished, ranging from 30° of dorsiflexion to 0° of plantarflexion (figure 1). He did not have any foot pain before this incident.

INVESTIGATIONS

Radiographs of the left foot showed flattened second MT head with preservation of the joint space (figure 2). CT scan showed epiphysal irregularities of the left second and fifth MT heads and the condyle of the proximal phalanx of the hallux. There was incidental finding of epiphysal irregularity of the right second MT head (figure 3). MRI of the left foot suggested Freiberg's disease of the second and fifth MT heads (figure 4). He was diagnosed to have Thompson and Hamilton type IV Freiberg's disease. He was screened for epiphysal dysplasia of the other sites. Detailed clinical history was taken and he had on and off bilateral hip pain and knee pain for 10 years. The pain mainly occurred on standing after prolonged sitting. The pain was not severe and did not affect his sport and daily activity. He had not sought any medical advice before. Radiographs and CT of the right foot showed epiphysal irregularities of the second and fifth MT heads and the condyle of the proximal phalanx of the hallux, although to a less severe extent than in the left foot (figure 5). Radiographs and MRI of the hips showed bilateral symmetrical epiphysal abnormalities with morphological change as focal concavity in bilateral femoral heads. There was no associated signal change suggestive of avascular necrosis or Perthes disease. Radiographs of the knees showed fragmentation of the patellar articular surface with preservation of the patellofemoral joint space (figure 6). There was no dysplasia of the femoral condyles. Radiographs of the thoracic and lumbar spine were normal.

TREATMENT

The patient's left foot pain gradually subsided with conservative treatment of non-steroidal anti-inflammatory drugs and insole with MT support to relieve pressure over the MTP joints. He was also put on glucosamine (500 mg three times a day) as a nutritional supplement for the arthritic joints. He was regularly followed up for his joint problems.

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Figure 1 (A and B) There was prominence over the dorsum of the left second metatarsal head. (C and D) The active motion of the second metatarsophalangeal joint was diminished.

OUTCOME AND FOLLOW-UP

At 2 years follow-up, the patient did not have any hip pain. He has on and off mild toe pain on walking. His main concern was anterior knee pain on climbing stairs, but the pain is tolerable and he does not need regular analgesics. There was no interval change of the involved joints radiologically.

DISCUSSION

The typical presentation of Freiberg's disease is a female adolescent experiencing her growth spurt with pain localised to the second MT head that is worse with bearing weight and walking.¹ The presentation of our case is atypical in that the patient did not have foot pain before the injury and the acute

onset of pain only began after the injury. The top-listed differential diagnoses were trauma related, for example, acute dislocation of the MTP joint. This is the reason for attempted closed reduction by the bone setter and the emergency room doctor. Another possible diagnosis was acute fracture of the MT head. This was unlikely because of absence of MTP joint swelling. Imaging studies confirmed the diagnosis of Freiberg's disease of the left second MT head and incidentally detected epiphyseal involvement of multiple MTs and phalanges of both feet. Detailed history taking and imaging revealed a more global involvement and the left second toe problem was only the tip of the iceberg, so to speak, of a generalised disease. We believed that the patient suffered from a mild form of multiple epiphyseal

Figure 2 Radiographs of the left foot showed flattened second metatarsal head with preservation of the joint space.

Figure 3 CT scan showing epiphyseal irregularities in the left second metatarsal (MT) head (A), fifth MT head (B), proximal phalangeal condyle of the hallux (C) and the right second MT head (D).

dysplasia because of epiphyseal irregularities of both femoral heads, patellae and multiple MT heads, and phalangeal condyles of both feet.

Potential aetiological factors for Freiberg's disease include trauma, impaired vascularity and systemic disorders.¹ Thompson and Hamilton pointed out that multiple MT involvement may represent a form of epiphyseal dysplasia.⁷ Multiple epiphyseal dysplasia is a genotypic chondrodystrophy

characterised by impaired endochondral ossification affecting multiple epiphyses, and is broadly classified into mild (Ribbing) and severe (Fairbank) types.^{8,9} The key imaging features include underdevelopment, irregularity and fragmentation of the epiphyses, most prominently noted in the hips, knees, ankles, hands and feet.¹⁰ Involvement of the joints of the upper limbs is less severe and causes relatively fewer symptoms than that of the lower limbs.¹¹ In the hips, acetabular underdevelopment and

Figure 4 MRI of the left foot showed Freiberg's disease of the second metatarsal (MT) head (A and B) and fifth MT head (C and D).

Figure 5 (A) Frontal radiographs of both feet. Epiphyseal irregularity was present at bilateral metatarsophalangeal joints, with marked flattening and sclerosis of the articular surfaces at bilateral second metatarsophalangeal joints. Corresponding joint spaces were preserved. (B) Oblique view of the right foot showed flattening of the articular surface of the second metatarsal (MT) head, sclerosis of the fifth MT head and fragmentation of the distal articular surface of the proximal phalanx of the hallux. (C and D) CT of the right foot showed sclerosis of the fifth MT head and fragmentation of the distal articular surface of the proximal phalanx of the hallux.

shortening of the femoral necks are concomitant findings. Double layered patellae were found to be associated with multiple epiphyseal dysplasia.¹² It consists primarily of two components of patellar bone: an anterior segment and a usually

smaller posterior segment. Each segment can be a single ossified portion or be fragmented into several smaller sections.¹² We believe that the patellae in our patient represent a variant of the double-layered patellae. Moreover, absence of spinal and

Figure 6 (A) Frontal radiographs of both hips showing focal concavity and sclerosis at the superomedial aspect of both femoral heads. Femoral necks were shortened. Acetabular roofs were irregular and underdeveloped with increased acetabular angles, and both iliac crests were hypoplastic. (B) T1-weighted MRI of both hips; (C) T2-weighted fat-suppressed MRI of both hips. MRI showed that there was no fragmentation or intramedullary signal alterations over the femoral heads to suggest avascular necrosis. (D) Lateral radiograph of the left patella. Fragmentation of the patellar articular surface was present, with preservation of the patellofemoral joint space.

metaphyseal involvement excluded the diagnosis of spondyloepiphyseal dysplasia and spondyloepimetaphyseal dysplasia.¹³

Conservative treatment was opted for the patient's foot pain as it was still tolerable and did not affect his daily activity. Operative treatments could have been considered if his foot pain had deteriorated. The operative choices depend on the stage of the degenerative change of the joint and include core decompression, osteotomy to decompress the joint or restore the articular congruity, arthroscopic or open joint debridement, grafting and interpositional arthroplasty.^{1 14 15}

Learning points

- ▶ A foot problem can be part of a generalised condition.
- ▶ The surgeon should be aware of the systemic cause of forefoot pain and manage the associated problems or refer the patient to the relevant specialty.
- ▶ Freiberg's disease involving multiple metatarsals should alert the clinician to the possibility of multiple epiphyseal dysplasia.
- ▶ Radiological monitoring of the involved joints is needed, as premature osteoarthritis is a common sequel to multiple epiphyseal dysplasia.

Competing interests None.

Patient consent Obtained.

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