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Fracture of a Bipartite Medial Hallux Sesamoid Masquerading as a Tripartite Variant: A Case Report and Review of the Literature

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ABSTRACT

We report a case of a competitive athlete who complained of chronic pain over the first metatarsal head in the absence of preceding trauma that was exacerbated with forced plantar flexion of the big toe. Initial radiographic findings suggested a tripartite appearance of the medial hallux sesamoid, and the patient was treated as for sesamoiditis. However, persistent symptoms over a period of 12 months necessitated further imaging with magnetic resonance, which confirmed a fracture of the bipartite medial hallux sesamoid. Considering that it is clinically important to differentiate between a tripartite/multipartite hallux sesamoid variant and a fracture of a bipartite hallux sesamoid, an expedient diagnosis is vital to avoiding complications of stress fractures. This can be a diagnostic challenge for the radiologist, emergency physician, and orthopedic surgeon, requiring a high index of suspicion. Accurate and timely diagnosis can be achieved with a clear history, detailed physical examination, and appropriate radiological evaluation.

Diagnosing bipartite or multipartite hallux sesamoid fractures is extremely challenging for the radiologist, emergency physician, and orthopedic surgeon. This is because of the rarity of bipartite or multipartite hallux sesamoid fractures in the current literature, the wide range of normal variation of the hallux sesamoid complex, and subtle differences in the appearances of normal variation and fracture on imaging. Patients also often present with chronic plantar hallux pain rather than acute injury, which can be difficult to localize and diagnose. Timely diagnosis and management is critical in preventing complications of a missed hallux sesamoid fracture. We aim to illustrate this with our case report and present effective strategies in tackling this intimidating diagnosis.

Case Report

A 15-year-old competitive player of floorball (a type of floor hockey) first presented to her family physician with persistent pain in her left foot over the region of the first metatarsal head for 3 months. This was exacerbated with running and forced plantar flexion of the big toe and was alleviated with rest. There was no preceding direct trauma over the region of concern. Physical examination revealed focal tenderness over the plantar aspect of the left first metatarsal head.

The initial left foot radiograph (Fig. 1) demonstrated a tripartite appearance of the medial hallux sesamoid, and the possibility of sesamoiditis was raised. The patient was given analgesia and referred to orthopedic surgery. She was evaluated 1 week later by the attending orthopedic surgeon, who confirmed the diagnosis of sesamoiditis. At that time, the patient demonstrated focal tenderness over the hallux sesamoids that was aggravated on dorsiflexion of the big toe and on weightbearing. However, there was good range of motion in her hallucal metatarsophalangeal and interphalangeal joints without any significant swelling compared with the contralateral big toe. Hence, the patient was treated with analgesia, advised to reduce axial loading, and discharged from follow-up.

The patient continued playing floorball competitively. She subsequently presented to her family physician 10 months after her first presentation with recurrent painful symptoms on weightbearing that were not relieved with oral analgesia. In view of her persistent symptoms, a referral to sports medicine was made. Two weeks later, at her sports medicine consultation, physical examination revealed swelling and tenderness of the left first metatarsal head with no bony deformity. Pain was reproduced on tip-toeing gait and relieved with normal gait. A repeat left foot radiograph (Fig. 2*A*) performed during this consultation showed widening of the tripartite configuration of the medial hallux

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Fig. 1. Initial frontal left foot radiograph showing a tripartite appearance of the medial hallux sesamoid (white arrow). No significant overlying soft tissue swelling was appreciated. Note is also made of periarticular osteopenia in the metatarsophalangeal and interphalangeal joints. The clinical diagnosis of sesamoiditis was made.

sesamoid. An additional axial projection (Fig. 2*B*) through the sesamoid bones showed cortical irregularity of the laterally positioned fragment of the proximal medial hallux sesamoid. The possibility of nonunion of a sesamoid fracture was raised. Magnetic resonance imaging (MRI) was then performed (Fig. 3), confirming the presence of a transverse fracture through the proximal bipartite medial hallux sesamoid with marrow edema and distraction of the fracture fragments.

The imaging findings and the likelihood of repetitive stress resulting in fracture nonunion were explained to the patient. A trial of conservative management was offered by the sports medicine physician, with the alternative of surgical resection if the patient was keen to continue with competitive floorball. After consultation with a foot and ankle surgeon, the patient opted for the former. She was treated with oral analgesia and immobilization and advised to avoid sporting activities. The patient was followed by orthopedic surgery from September 2017 to July 2018. Her last consultation after 1 year of conservative treatment revealed resolution of symptoms.

Discussion

The medial and lateral hallux sesamoids are embedded within the medial and lateral slips of the flexor hallucis brevis tendon at the level of the first metatarsal head. The hallux sesamoids are invariably present in all patients, and they function to confer mechanical advantage and reduce friction of the hallux flexor tendons.

There is considerable variation in the configuration and bilaterality of the hallux sesamoids. A bipartite medial hallux sesamoid (Fig. 4*A*) is the most common variant and is seen in up to 33.5% of patients (1,2). The hallux sesamoid complex may be subject to pathologies such as trauma, infection, inflammation, and degeneration, of which trauma is by far the most common. The medial hallux sesamoid is more commonly injured owing to its position directly under the first metatarsal head (3).

Acute plantar hallux pain is typically caused by excessive axial loading or direct trauma. However, chronic pain may be clinically diagnosed as sesamoiditis. This presentation can be owing to a stress fracture, osteonecrosis, osteochondritis, or osteochondrosis. Chronic stress in prolonged or repetitive plantar flexion in ballet dancers, athletes, and high-heel wearers has been postulated to contribute to sesamoiditis (2). Physical examination should be directed toward identifying the exact location of pain involving the medial or lateral sesamoid and mobility and stability of the first metatarsophalangeal joint. However, differentiating a hallux sesamoid fracture from sesamoiditis using clinical findings remains difficult (4).

Distinguishing between a bipartite hallux sesamoid variant and a hallux sesamoid fracture, or in our case, telling the difference between a tripartite hallux sesamoid (Fig. 4*B*) and a fracture of the medial hallux sesamoid, can be extremely difficult. However, there are various radiographic features that have been described to help assist in this distinction.

Appearances that suggest a fractured hallux sesamoid include irregular poorly corticated margins, comminution, and exaggerated separation of fragments. Conversely, a bipartite/multipartite variant should

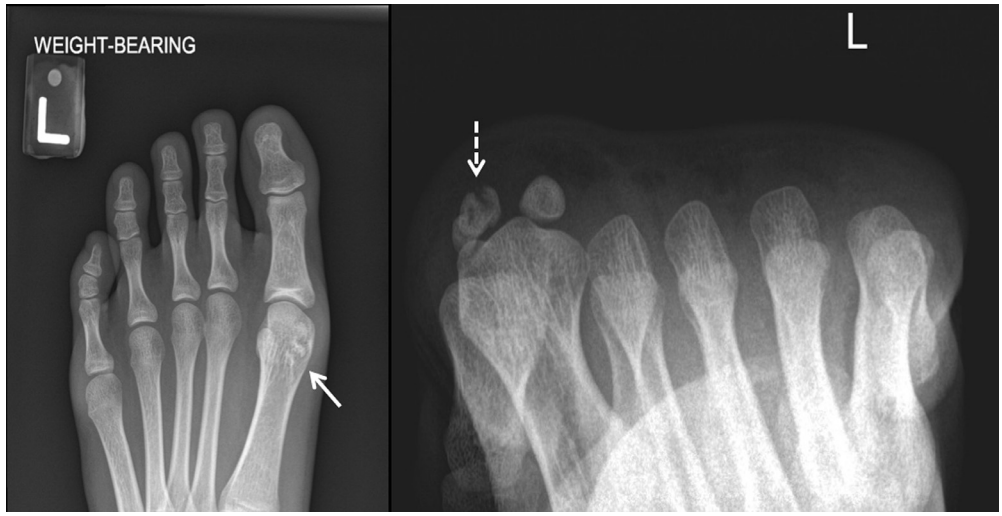

Fig. 2. Frontal (*A*) and axial (*B*) projections of the repeat left foot radiograph. (*A*) Widening of the interval between the bony fragments of the tripartite appearance of the medial hallux sesamoid (solid white arrow). (*B*) Cortical irregularity at the medial cortex of the laterally positioned fragment (dashed white arrow).

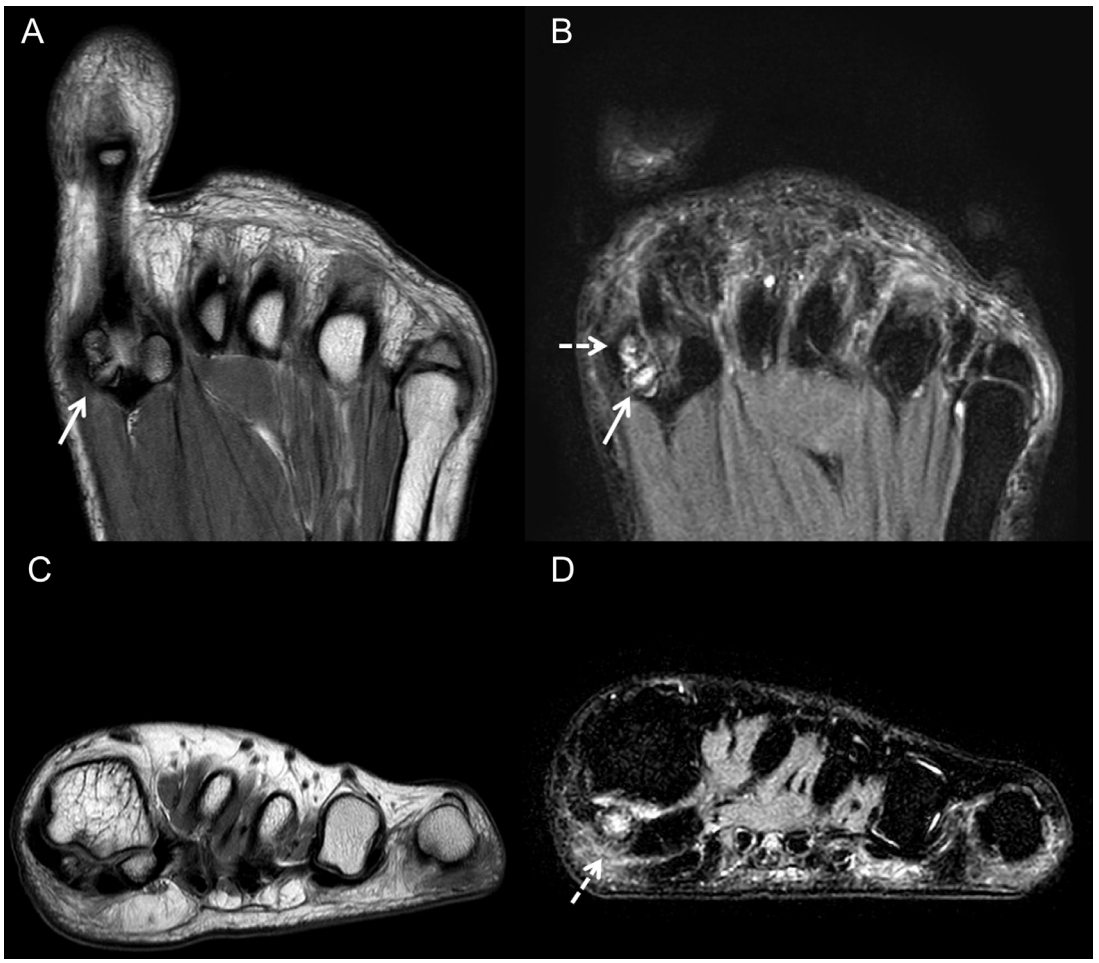

Fig. 3. Selected coronal proton density (*A*), T2-weighted fat-suppressed (*B*), axial proton density (*C*), and T2-weighted fat-suppressed (*D*) magnetic resonance images showing a transverse fracture through the proximal fragment of the bipartite medial hallux sesamoid (solid white arrow) with marrow edema and distraction of the fracture fragments. Marrow edema is also noted in the distal fragment of the bipartite medial hallux sesamoid (dashed white arrow), possibly secondary to sesamoiditis.

Fig. 4. Frontal right foot radiograph of a 24-year-old male (*A*) showing the normal appearance of a bipartite medial hallux sesamoid with smooth well-corticated margins. Frontal left foot radiograph of a 45-year-old male (*B*) showing an example of the normal appearance of a tripartite medial hallux sesamoid with smooth well-corticated margins and an incongruent fit.

have a smooth, well-corticated outline and equally separated fragments. It has been described that bipartite/multipartite hallux sesamoid variants are larger in size than a unipartite sesamoid, whereas a fractured hallux sesamoid is usually equal or smaller in size than its counterpart. Previous studies have also proposed that multipartite variants have convex margins that do not fit well together, whereas fractured fragments often fit well together (2,3). This is confounded by several patterns of partition of hallux sesamoids that do not follow this rule, which adds to the difficulty of making a definite diagnosis on first presentation (5). Feldman et al (6) have opined for the presence of callus formation on follow-up radiographs or absence of partition in previous films as the most specific criteria for fracture of a hallux sesamoid.

Further radiographic imaging with an axial projection through the hallux sesamoids or serial radiographic surveillance can be performed to guide the clinician in decision making. A comparison radiograph of the contralateral foot can be helpful, but because of variability in bilaterality, the absence of a bipartite/multipartite hallux sesamoid does not confirm a fracture in the affected foot. In equivocal cases, evaluation with a Technetium-99m bone scan or MRI can be helpful. A bipartite/multipartite hallux sesamoid will yield normal results on a bone scan, but radioisotope uptake will be expected in a fracture within 24 hours of antecedent trauma. MRI can provide further information such as marrow edema arising from a recent fracture and associated soft tissue injuries (7).

It is clinically important to differentiate between a multipartite hallux sesamoid and a fracture of the medial hallux sesamoid. An expedient diagnosis is vital to avoiding complications of stress fractures, which include fracture nonunion or malunion and avascular necrosis owing to the poor healing potential of the hallux sesamoids (8). Delayed union or nonunion of hallux sesamoid fractures are more likely to occur in missed or delayed diagnosis owing to to negative radiographic evidence, misinterpretation of symptoms as soft tissue injuries, or a concomitant confounding forefoot injury (9). An early diagnosis can also lead to institution of appropriate conservative treatment and potential obviation of surgical management. Conservative management includes a trial of reduced activity and immobilization over 6 months to a year, analgesia, footwear modification, orthotics, physiotherapy, and steroid injections. Electric and ultrasound stimulation of nonunited fractures can be alternatives to surgical intervention in cases of acceptable bony alignment and when the fracture gap is not too large (10). Surgical management is performed when conservative management fails. This may involve percutaneous/open screw fixation or bone grafting in minimally displaced fractures, which has shown good outcomes (4,11). Sesamoidectomy and partial sesamoidectomy show utility in severely displaced or comminuted fractures and those complicated by avascular necrosis or secondary osteoarthritis. Although concerns of altered hallux mechanics resulting in poor plantarflexion strength and hallux cock-up deformity have been described, the available literature suggests reasonable functional outcomes (4,12).

In conclusion, a high index of suspicion is required for the rare diagnosis of a bipartite hallux sesamoid fracture, which can be a diagnostic challenge. It should not be confused with a tripartite/multipartite hallux sesamoid variant, and this can be achieved with a clear history, detailed physical examination, and appropriate radiological evaluation. Accurate and timely diagnosis, as well as early institution of conservative management, is crucial in avoiding fracture nonunion. In competitive athletes or patients with persistent symptoms, the option of surgical management should be explored.

References

1. Rodeo SA, Warren RF, O'Brien SJ, Pavlov H, Barnes R, Hanks GA. Diastasis of bipartite sesamoids of the first metatarsophalangeal joint. Foot Ankle 1993;14:425–434.
2. Miller TT. Painful accessory bones of the foot. Semin Musculoskel Radiol 2002;6:153–161.
3. Mellado JM, Ramos A, Salvadó E, Camins A, Danús M, Saurí A. Accessory ossicles and sesamoid bones of the ankle and foot: imaging findings, clinical significance and differential diagnosis. Eur Radiol 2003;13(suppl 4):164–177.
4. Ribbans W, Hintermann B. Hallucal sesamoid fractures in athletes: diagnosis and treatment. Sports Orthop Traumatol 2016;32:295–303.
5. Karadaglis D, Grace D. Morphology of the hallux sesamoids. Foot Ankle Surg 2003;9:165–167.
6. Feldman F, Pochaczevsky R, Hecht H. The case of the wandering sesamoid and other sesamoid afflictions. Radiology 1970;96:275–283.
7. Karasick D, Schweitzer ME. Disorders of the hallux sesamoid complex: MR features. Skel Radiol 1998;27:411–418.
8. Jones JL, Losito JM. Tibial sesamoid fracture in a softball player. J Am Podiatr Med Assoc 2007;97:85–88.
9. Boike A, Schnirring-Judge M, McMillin S. Sesamoid disorders of the first metatarsophalangeal joint. Clin Podiatr Med Surg 2011;28:269–285.
10. Anglen J. The clinical use of bone stimulators. J South Orthop Assoc 2003;12:46–54.
11. Anderson RB, McBryde AM Jr. Autogeneous bone grafting of hallux sesamoid nonunions. Foot Ankle Int 1997;18:293–296.
12. Biedert R, Hintermann B. Stress fractures of the medial great toe sesamoids in athletes. Foot Ankle Int 2003;24:137–141.