



Reverse floating first metatarsal and floating third metatarsal with Lisfranc fracture dislocation: an unusual injury

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A 25-year-old man complained of severe pain in the right foot after a traffic accident. There was a wound on the medial aspect of the foot extending over the length of the first metatarsal. There was no sign of vascular compromise and sensations were intact. Radiographs showed dislocation of the first tarsometatarsal (Lisfranc) and metatarsophalangeal joints with the head of the first metatarsal facing proximally and plantarward (reverse floating first metatarsal), a segmental fracture of the second metatarsal, fracture dislocation of the third metatarsal from the metatarsophalangeal and tarsometatarsal joints (floating third metatarsal), and fractures at the base of the fourth and fifth metatarsals and of cuneiforms. Open reduction and internal fixation were performed. The metatarsal head was buttonholed through the capsule and muscles and was released and reduced. The fractured second metatarsal was reduced and stabilized with a K-wire. The third floating metatarsal was aligned and fixed with a K-wire. A below-knee posterior plaster splint was applied for six weeks. Full weight bearing was started at 10 weeks. The patient returned to his activities with only minimal discomfort. This is the first reported case of plantar Lisfranc dislocation and reverse floating first metatarsal.

Key words: Dislocations/surgery; metatarsal bones/injuries; metatarsophalangeal joint/injuries/surgery.

Floating metatarsal is a unique and rare injury in which the first metatarsal is dislocated both proximally and distally.^[1] There are few reports on floating metatarsal injury accompanied by a Lisfranc fracture dislocation.^[2-4] We report on an unusual case of plantar Lisfranc fracture dislocation with reverse floating first metatarsal and floating third metatarsal in a young man. To the best of our knowledge, this injury has not been previously reported in the English literature.

Case report

A 25-year-old man was brought to our emergency department after sustaining an injury to the right foot following a road traffic accident. The patient was conscious and complained of severe pain in the right foot. Initial examination showed a deformed

foot with emptiness over the first metatarsal area and plantar fullness along with tenderness of the anterior foot. There was a wound on the medial aspect of the foot extending over the length of the first metatarsal. There was no sign of vascular compromise and sensations were intact. Radiographs showed dislocation of the first tarsometatarsal (Lisfranc) and metatarsophalangeal joints with the head of the first metatarsal facing proximally and plantarward (reverse floating first metatarsal), a segmental fracture of the second metatarsal, fracture dislocation of the third metatarsal from the metatarsophalangeal and tarsometatarsal joints (floating third metatarsal), and fractures at the base of the fourth and fifth metatarsals and of cuneiforms (Fig 1).

Open reduction and internal fixation were performed. After debridement, the wound on the medial



Fig. 1. (a) Anteroposterior radiograph showing 'reverse floating first metatarsal', segmental fracture of the second metatarsal, fracture dislocation of the third metatarsal from the metatarsophalangeal and tarsometatarsal joints (floating third metatarsal), fractures at the base of the fourth and fifth metatarsals and of cuneiforms. (b) Lateral view showing reverse floating metatarsal in the plantar direction.

side was extended proximally. The metatarsal head was buttonholed through the capsule and muscles. The metatarsal head was released and reduced. The fractured second metatarsal was reduced and stabilized with a K-wire under image intensifier. The third floating metatarsal was aligned and fixation was secured with a K-wire (Fig. 2). After closure, a below-knee posterior plaster splint was applied. The splint was removed at six weeks followed by wire removal and partial weight bearing was allowed in an Aircast splint. Full weight bearing was started at 10 weeks. The patient returned to his activities with only minimal discomfort.

Discussion

The tarsometatarsal joint is inherently stable. The base of the second metatarsal is the keystone of the Lisfranc complex, being inset so that the medial and lateral cuneiform bones provide support on either side of the base of the second metatarsal, locking it in place.^[1] The other four metatarsals have relatively little bony support. The dorsal ligaments and capsule are relatively weak compared to the strong plantar ligaments. The Lisfranc ligament itself is a strong oblique ligament extending from the lateral aspect of the medial cuneiform to the base of the second metatarsal. The plantar fascia adds to the plantar stability; hence, dislocations usually occur

in the dorsal direction.^[2] The joint is relatively unprotected on the dorsal side, making the dorsal dislocation more common.

Derangement of the Lisfranc joints usually occurs by one of the three mechanisms: (i) twisting with



Fig. 2. Postoperative radiograph showing alignment and K-wire fixation.

forced abduction of the forefoot causing lateral displacement of the metatarsal; (ii) axial loading with the toes dorsiflexed and the ankle in equines; and (iii) crush injuries in which the force is applied on the dorsum of the metatarsal causing plantar displacement.^[3] The exact mechanism of injury in our patient cannot be said with certainty. It was probably caused by a combination of axial loading and crush injury. The crush injury first resulted in dorsal dislocation of the metatarsophalangeal joint. In a dorsal crush injury, the first metatarsal is usually displaced plantarward relative to the medial cuneiform causing dislocation of the Lisfranc joints. The continuing axial force further disrupted the soft tissues leading to severe displacement of the first metatarsal with its head lying in the proximal and plantar direction, which we termed as 'reverse floating metatarsal' (Fig 1). The force further imparted to the second tarsometatarsal joint, an extremely stable joint, could not dislocate it but resulted in a fracture. It further led to the fracture of the cuneiform, proximal fracture dislocation of the third metatarsal with dislocation of the metatarsophalangeal joint (floating third metatarsal), and fracture of the base of the fourth metatarsal. The high energy transmitted to the foot resulted in dehiscence of the skin on the medial aspect.

We preferred the dorsal approach to the plantar approach as it was more direct, safer and provided better visualization of the sesamoid complex for managing irreducible dislocations.^[3] The latter is associated with a higher risk for injury to the neurovascular structures and may result in a sensitive scar and troublesome scarring around the fat pads. We extended the medial incision to aid in the proximal exposure of the first metatarsal, which enabled a capsular and tendinous release.

Reduction of the distal dislocation should precede reduction of the proximal dislocation because it relieves tension on the plantar fascia and facilitates reduction of the tarsometatarsal dislocation.^[2,3] In our

case, dislocation of the first metatarsal was plantarward and bipolar and it lay in a reverse anatomical position. The sesamoid mechanism was intact, so closed reduction was not attempted. After the capsular and medial release of the conjoined tendons, it was promptly reduced to its position by manipulation and became stable. The reduced Lisfranc joint is usually fixed using either screws (cannulated or uncannulated) or Kirschner wires. Screw fixation provides more stability but overcompression may cause damage to the joint surfaces. Stabilization with Kirschner wires is simpler and the removal is easier, but fixation is less stable and there is always risk for pin track infections.^[1] Considering the open nature of injury and the segmental fracture of the second metatarsal, we used Kirschner wire fixation and found the entire construct to be stable.

Although floating of the hallux and double floating metatarsal have been reported,^[2-5] there has been no report on bipolar dislocation and reversal of the first metatarsal. This is the first reported case of plantar Lisfranc dislocation and reverse floating first metatarsal.

References

1. Leibner ED, Mattan Y, Shaoul J, Nyska M. Floating metatarsal: concomitant Lisfranc fracture-dislocation and complex dislocation of the first metatarsophalangeal joint. *J Trauma* 1997;42:549-52.
2. Milankov M, Miljkovic N, Popovic N. Concomitant plantar tarsometatarsal (Lisfranc) and metatarsophalangeal joint dislocations. *Arch Orthop Trauma Surg* 2003;123:95-7.
3. Kasmaoui el H, Bousselmame N, Bencheba D, Boussouga M, Lazrek K, Taobane H. The floating metatarsal. A rare traumatic injury. *Acta Orthop Belg* 2003;69:295-7.
4. Christodoulou A, Ploumis A, Terzidis I, Koukoulidis A. A combined proximal and distal dislocation of two adjacent metatarsals: double floating metatarsal bones (second-third). *J Orthop Trauma* 2003;17:527-30.
5. Shetty MS, Pinto D, Bhardwaj P. Isolated floating first metatarsal: report of an unusual injury. *J Foot Ankle Surg* 2007;46:185-7.