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CASE REPORT

Lisfranc fracture dislocations - An important and easily missed fracture in the emergency department

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ABSTRACT

Two case reports are presented of Lisfranc fractures. There have been many incidents of missed injury in the past and the radiographs are reproduced here together with the important radiographic features. Early diagnosis and orthopaedic referral are necessary because operative treatment is often required.

Keywords:

Lisfranc, fracture, dislocation.

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Introduction

The Lisfranc joint has been the eponym of the tarsometatarsal joint since Jacques Lisfranc (1790-1847), a field surgeon in Napoleon's army. He described an amputation through this joint for gangrenous injuries of the forefoot. He never wrote on fracture dislocations of the joint.

This is an important area because traumatic lesions in the area of the Lisfranc joint pose considerable diagnostic and therapeutic difficulties because of the complexity of the anatomical configuration. The diagnosis is frequently missed at first presentation (1). It has been estimated that the diagnosis of tarsometatarsal dislocation is overlooked in as many as 20% of cases (2,3,4). These injuries can lead to profound disability if they go undiagnosed or if appropriate treatment is delayed. Missed injuries may present late to the clinician with a number of manifestations including post-traumatic arthrosis, pes planus and forefoot abduction (5) and resultant chronic disability (3). The incidence of the injury is low but few injuries carry such a high potential for chronic secondary disability.

Fig 1. A-P and oblique radiographs illustrating fractures of the third, fourth and fifth metatarsals. On the oblique radiograph, the medial border of the fourth metatarsal does not line up with the medial border of the cuboid and the lateral border of the third metatarsal shaft does not form a straight line with the lateral border of the lateral cuneiform on the oblique view. the medial border of the fourth metatarsal does not line up with the medial border of the cuboid.

Fig 2. Lateral radiograph, illustrating dorsal displacement at the tarso-metatarsal joint.

Case Reports

Case One

A 33 year old patient presented to the Hospital after having fallen from a first floor window during the early hours of the morning. He presented about ten hours after the incident with a painful, swollen and tender right foot, there was no gross deformity and no neurovascular deficit noted. Antero-Posterior (A-P) and oblique radiographic examination showed fractures of the 3rd, 4th and fifth metatarsals and disruption of the tarso-metatarsal joints (Figure 1), lateral X-ray (Figure 2) confirmed dorsal displacement of the metatarsals at this joint. Under general anaesthaesia the dislocations of the third and fourth tarso-metatarsal joints were clinically obvious, they reduced closed with ease and were held in place satisfactorily with Kirschner wires through the metatarsals and directed into the tarsal bones.

Following the above treatment he has been reviewed when he denied any pain or stiffness, he had a full range of movement of his ankle and subtalar joints and was walking pain-free.

Case Two

The second case involved a 74 year old lady whose foot was run over by a moped as she stepped from the kerb. There was not much swelling or tenderness but there was obvious deformity of the second toe (Figure 3).

Fig 3. Clinical picture of case 2.

Radiological examination showed a complete Lisfranc fracture dislocation with fractures of the bases of the second, third and fourth metatarsals (Figure 4).

This patient required open reduction and internal fixation. Post-operatively she has had a satisfactory result.

Discussion

The three most common mechanisms described for injury to Lisfranc joint are twisting of the forefoot, axial loading of the fixed foot and crush injury.

The direct mechanism of injury usually involves a crush injury with dislocation resulting in displacement of the metatarsal bases in either a plantar or dorsal direction depending on the forces applied.

Indirect trauma is more common and is caused by rotational forces applied to the forefoot or axial loading of the plantarflexed and fixed foot. Examples include equestrian or motorcycle accidents in which the forefoot is trapped and forcefully plantarflexed and abducted on the tarsal bone: motor vehicle accidents in which the plantarflexed foot is braced against the floorboard with the force of body weight causing hyperplantarflexion of the foot at the dorsal aspect of the tarsometatarsal joint and stepping off a kerb or missing a step with the ankle in extreme equinus, the toes hyperextended and the vertical force directed to the metatarso-cuneiform ligaments causing rupture of the dorsal ligaments of the Lisfranc joint.

The incidence of Lisfranc joint injury was once thought to be very low, it is now, however, no longer considered to be a rarity, partly because of the increasing incidence of major trauma (6,7) but also because of the realisation that even minor trauma can cause disruption of the joint. It has been found that the most common failure in primary diagnosis was the appreciation of metatarsal fractures and midtarsal bone injuries without recognition of the incongruence of the tarso-metatarsal joint (1).

At the mid tarsal joint the distal row of tarsal bones (anterior facets of the three cuneiforms and the cuboid) and the five metatarsal bases (8) interlock and stability of the joint is afforded by the keystone of the second metatarsal base which is recessed proximally and interlocks between the medial and lateral cuneiforms, giving rise to complex anatomy and biomechanics. The sheer number of the skeletal elements and their complex interrelationships leads to considerable diagnostic and therapeutic difficulties and the injury is frequently missed on initial evaluation in the accident department (1).

The standard X-ray views often show only subtle incongruities of the joint or may even be normal (9). In examining radiographs of the feet the crucial relationships of the foot should be closely inspected. The medial aspect of the second metatarsal should line up with the medial border of the medial cuneiform on an A-P radiograph. Other consistent normal radiographic findings include continuity of the second and third inter-metatarsal space with the space between the lateral and medial cuneiforms on oblique view. Also, the lateral border of the third metatarsal shaft should form a straight line with the lateral border of the lateral cuneiform on the oblique view. On an oblique radiograph, the medial border of the fourth metatarsal should line up with the medial border of the cuboid, while on the lateral radiograph, an unbroken line should be noted on the dorsal border of the first and second metatarsals and their respective cuneiforms. In addition careful examination should be made for small avulsion fractures of the base of the second metatarsal and compression fractures of the cuboid. Associated fractures in the phalanges, metatarsal, midfoot and ankle should be sought. If fractures of the cuboid, cuneiforms, or the navicular or metatarsal shafts are found then disarticulation at the

Fig 4. A-P and oblique radiographs of case two illustrating complete Lisfranc dislocation with fractures of the bases of the second, third and and fourth metatarsals.

tarso-metatarsal joint must be suspected (2).

CT examination has been suggested in the detection of minor degrees of displacement (10), MR imaging may also prove to be useful in this area in the future (11), especially if the other foot is imaged for comparison at the same levels.

Lisfranc fracture dislocation can be divided into total, partial and divergent injuries. In a total dislocation all five metatarsals are dislocated laterally.

The goal in treating tarsometatarsal fracture dislocation is to re-establish a painless, stable and functional foot with precise anatomic reduction necessary to reduce future disability (3,12). In most cases adequate reduction cannot be obtained without open reduction and internal fixation because of comminution and soft tissue interposition.

Dislocations of the Lisfranc joint complex are traditionally fixed using Kirschner wires although, more recently fixation with cancellous screws has been used (3,13).

Summary

We describe two examples of Lisfranc injury, one a partial dislocation and one a total dislocation. They illustrate many of the principles of diagnosis and treatment of these injuries, the diagnosis was not obvious clinically in one of the cases. but the radiographs illustrate many of the radiological signs of Lisfranc dislocation well. As has been stated the injury is frequently missed and previous authors have suggested that this incidence may be reduced by (1) radiographical examination of any foot with pain and swelling from trauma (2). Fracture of the base of a metatarsal bone should be seen as an indicator of possible Lisfranc injury (14). These principles were followed in these cases.

Only by applying basic principles in all cases of foot injury will the incidence of misdiagnosis be reduced. The introduction of new imaging techniques may well increase the number of these injuries detected and increase the proportion of subtle, undisplaced injuries of this joint found.

References

1. Vuori JP, Aro HT. Lisfranc Joint Injuries: Trauma Mechanisms and Associated Injuries. *The Journal of Trauma*; **35(1):**40-45.
2. Kaplan JD, Karlin JM, Scurran BL *et al*. Lisfranc's Fracture-Dislocation: A Review of the Literature and Case Reports. *Journal of the American Podiatric Medical Association* 1991; **81:** 531-539.
3. Arntz CT, Hansen ST. Dislocations and fracture dislocations of the tarso-metatarsal joints. Orthopaedic *Clinics of North America* 1987;**18:**105-114.
4. Goosens M, De Stoop N, Lisfranc's fracture-dislocations: etiology, radiology, and results of treatment - a review of 20 cases. *Clinical Orthopaedics* 1983; **176:**154-162.
5. Myerson M. Tarsometatarsal Joint Injury: Subtle signs hold the key. *Phys Sports Med* 1993; **21(2):**97-107.
6. Heckman JD Fractures and Dislocations of the Foot. In Rockwood CA Green DP Bucholz RW (eds): Rockwood and Green's Fractures in Adults, 3rd ed. Philadelphia, JB Lippincott 1991, pp 2140-2151, 2160-2162
7. Richardson EG, Graves SC,: Fractures and Dislocations of the foot. In Crenshaw AH (ed): Campbell's Operative Orthopaedics, 8th ed. St Louis, Mosby- Yearbook, 1992, pp 2887-2892, 2877-2879.
8. de Palma L, Santucci A, Sabetta S, Rapali S Anatomy of the Lisfranc Joint Complex. *Foot & Ankle International* **18(6):**356-364.
9. Dewar FP, Evans DC, Occult Fracture-Subluxation of the midtarsal joint. *Journal of Bone and Joint Surgery* 1968; **50B:**386.
10. Lu J, Ebraheim NA, Skie M, Porshinsky B, Yeasting RA. Radiographic and computed tomographic evaluation of Lisfranc fracture-dislocation: a cadaver study. *Foot and Ankle International* 1997; **18(6):**351-355.
11. Preidler KW, Wang Y, Brossman J, Trudell D, Daenen B, Resnick D. Tarsometatarsal joint: anatomic details on MR images. *Radiology* 1996;**199(3):**733-736.
12. Ashworth MJ, Davies MB, Williamson DM Irreducible Lisfranc's injury: the 'toe up' sign. *Injury* **28(4):**321-322.
13. Arntz CT, Veith RG, Hansen ST, Fractures and fracture dislocations of the tarsometatarsal joint. *Journal of Bone and Joint Surgery of America* 1988; **70:**173.
14. Englanoff G, Anglin D, Hutson HR. Lisfranc fracture-dislocation: a frequently missed diagnosis in the emergency department. *Annals of Emergency Medicine*1995; **26(2):**229-233.