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Management of bilateral lisfranc fracture

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Abstract
We report a case of traumatic Lisfranc injury resulting from a bicycle-to-bicycle collision during a race. Patient sustained bilateral feet Lisfranc injury and was treated with open reduction and internal fixation with screws for both feet. At the 10th-month of follow-up, he was able to achieve premorbid functional status of daily living. In order to avoid permanent functional disability and anatomical deformity, it is of utmost importance to achieve an early diagnosis through clinical and radiological evaluation. The appropriate treatment for displaced Lisfranc injury is surgical intervention followed by a period of immobilization.

Keywords: lisfranc fracture, bilateral feet, screw fixation, early diagnosis

Introduction

A Lisfranc joint is composed of the articulation between the first, second, and third metatarsals bones, and the cuneiform bones (Figure 1). Lisfranc injury is one which involves disruption of the bones or ligaments forming the torsometers joint complex, occurring at a rate of 1 per 55,000 to 60,000 annually [1]. The structures belonging to the Lisfranc joint complex form the so-called "Roman arch", the transverse arch of the foot. The base of the second metatarsal, together with its strong plantar ligamentous structures, anchoring itself as the keystone between the medial and lateral cuneiform bones and is thus fundamental for the stability of the entire arch [2].Injuries to the Lisfranc joint complex account for approximately 0.2-0.9% of all fractures [3].The injury is named after Jacques Lisfranc de St. Martin, a French surgeon and gynecologist who noticed this fracture pattern amongst cavalry men, in 1815, after the War of the Sixth Coalition. He performed an amputation through the tarsometatarsal joint for gangrene during the Napoleonic Wars. Both low-energy and high-energy midfoot trauma can lead to Lisfranc joint injury, which can be caused by both direct and indirect mechanisms [4]. Direct Lisfranc injuries are usually caused by a crush injury, such as a heavy object falling onto the midfoot. Indirect Lisfranc injuries are caused by a sudden rotational force on a plantar flexed (downward pointing) forefoot. Examples of this type of trauma include a person falling forward after stepping into a storm drain [5].

It is crucial to recognize these injuries early and to start treatment. Anatomical reduction and stabilization of the joint is mandatory. Failure to recognize and treat these injuries will lead to midfoot arthritis, chronic pain, and functional instability. In this case report, we present a case of bilateral Lisfranc injury in a cyclist.

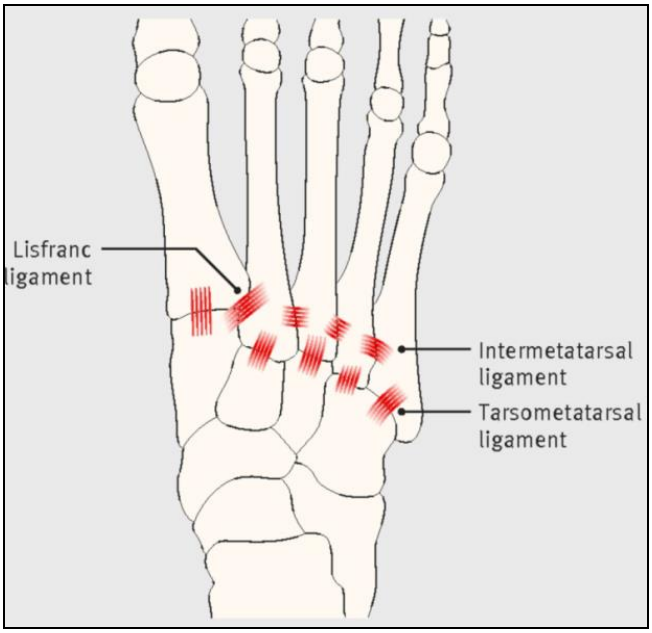

Fig 1: Ligamentous attachments of the lisfranc articulation.

Case presentation

A 34-year-old male patient presented to the emergency department (ED) with complaint of pain in his bilateral feet. He had a fall from his bicycle after colliding with another cyclist during a road bicycle racing while both his feet were stuck to the pedal straps sustaining immediate onset of severe bilateral feet pain resulting in inability to bear weight. Clinical examination revealed swelling and tenderness on palpation over the dorsal aspect of both feet. Plantar ecchymosis were present bilaterally. Radiological examination showed displacement of the first, second and third tarsometatarsal joint of right foot (figure2) whereas left foot sustained Lisfranc injury of the first and second tarsometatarsal joint (figure 4). Open reduction and internal fixation was done successfully for this patient. Postoperatively, boot slabs were applied and non-weight bearing ambulation was advised for at least 6 weeks. This is followed by2 weeks of physiotherapy to maximize ankle and foot range of movement before allowing for gradual weight-bearing.

Fig 2: X-ray anteroposterior (AP) view of right foot showing the Lisfranc injury with enlargement of the tarsometatarsal joints of first, second and third toes.

There is an increase in space between the medial and intermediate cuneiforms.

X-ray lateral view shows dorsal displacement of the base of the 1st metatarsal bone.

Fig 3: Fixation of the right metatarsophalangeal joints with three cannulated screws.

Fig 4: X-ray anteroposterior (AP) view of left foot showing the Lisfranc injury which was fixed with two cancellous screws.

Discussion

A typical Lisfranc joint complex involves the first 3 metatarsal bases articulate with their respective cuneiforms, and the lateral 2 metatarsals articulate with cuboid. It can be divided into 3 parts by "columns". The medial column is formed by the first cuneiform and the first metatarsal, the median column by the second and third cuneiform and the second and third metatarsals and the lateral column is formed by the cuboid and fourth and fifth metatarsals. The second metatarsal is known as the "keystone" of the Lisfranc joint. It is recessed between the medial and lateral cuneiform bones and attached to the medial cuneiform by the oblique Lisfranc ligament. Injury to this small ligament can result in instability [6] in view of lack in transverse ligament between the first and second metatarsals. An approximate of 20 to 24% of Lisfranc fractures has been missed during the early assessment, leading to misdiagnosis and mismanagement [6].

The Hardcastle *et al*. (figure 6) has been widely accepted as the preferred Lisfranc dislocation-fracture classification system, which is a modification from Quenu and Kuss (figure 5) classification. This classification divides Lisfranc injuries into 3 types, namely type A, B and C. Type A, also known as total incongruity, characterized by complete derangement of the Lisfranc joint in a single plane. This may result in lateral or dorsoplantar displacement. Type B1 consists of medial displacement of the first tarsometatarsal joint, and Type B2 consists of lateral displacement of all, or a combination of, the remaining joints. Type C is a divergent displacement involving some or all of the tarsometatarsal joints [7].

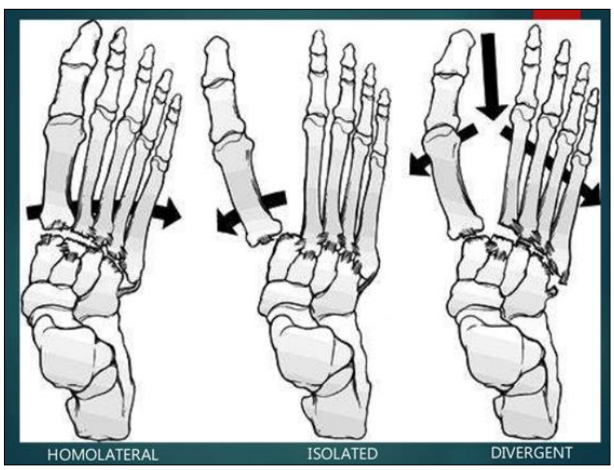

Fig 5: The Quenu Kuss Classification of Lisfranc fracture.

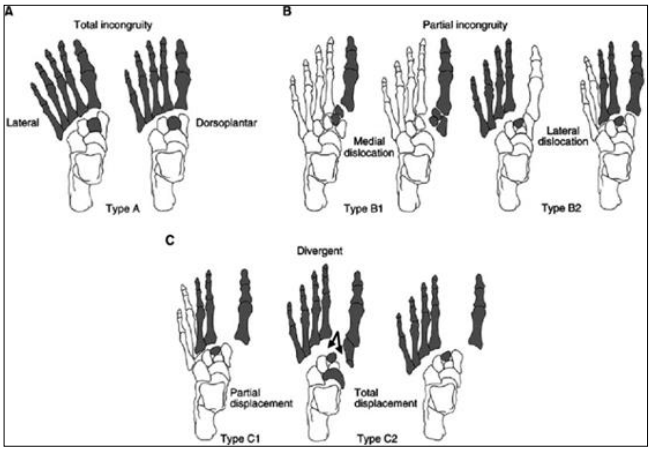

Fig 6: The Hardcastle Classification of Lisfranc fracture.

Clinical findings that raise suspicion of a Lisfranc injury includes gross oedema of foot, where passive abduction and pronation motion is particularly provocative of sharp onset of foot pain. Presence of ecchymosis on the plantar aspect of the foot has been reported to be a profound indicator signifying midfoot injury [8]. A minority of cases has shown that Lisfranc injury can result in compartment syndrome of the affected foot or limb, prompting the surgeons to be more vigilant of this catastrophic condition.

The diagnosis of Lisfranc injury can be made by evaluation of radiological evidences - anteroposterior, lateral and 30° oblique X-rays of the foot while bearing weight, as it highlights the instability of foot in various planes caused by the injury [9]. The commonest radiological finding in Lisfranc injury is diastasis of the base of the first and second metatarsals. However, any fracture of the base of the first three metatarsals calls for suspicion of a Lisfranc joint injury. Any displacement of more than 2 mm between the base of the first and second metatarsals merits further evaluation for a Lisfranc injury and a should be further detailed with comparison of the uninjured foot. An inability to visualise the medial cortex of the second metatarsal perfectly lining up with the medial border of the second cuneiform also should raise suspicion of said diagnosis. Other clues on radiographs may include the "fleck" sign, a bony fragment seen in the space between the first and second metatarsal bases, which represents an avulsion of the second metatarsal base at the attachment of Lisfranc's ligament [9]. Minor displacement and smaller fractures may only be detected with computed tomographs (CT) or magnetic resonance imaging (MRI). CT has several advantages over conventional X-ray imaging's as itis a rapid imaging sequence without the need for special positioning of the patient, ability to demonstrate subtle fractures and has a higher sensitivity (25-33%) of detecting midfoot fractures. CT is more a powerful and sensitive device compared to radiography, which has been found to have a lesser sensitivity for midfoot fractures [10]. The superior capacity of MRI to depict the ligamentous tissues allows for excellent detection of midfoot injury, including those radiographically occult lesions [11].

The treatment of non-dislocated injuries, however, is controversial. Mild sprains to the Lisfranc joint, where there is no evidence of diastasis, may be treated by immobilization [12]. Some cases of stable injuries might benefit from activity modification and non-surgically with a plaster boot with strictly non-weight-bearing for six weeks. If pain persists after 6 weeks, an orthopedic boot with weight-bearing is used for a further four weeks. Recent practice suggests strong consensus that it is crucial in dislocated injuries to achieve exact anatomic reduction and stable internal fixation, which is best obtained with open reduction and internal screw fixation (ORIF). Cortical screw fixation is preferred to Kirschner wire (K-wire) fixation for these types of injuries [13]. The aim is to reduce and secure the joint without diastasis between the lateral borders of the medial cuneiform to the second metatarsal. Surgery may be delayed to allow resolution of oedema and optimization of general health. The definitive surgical intervention must be deferred 10 to 15 days until the healing of the soft tissues and the appearance of wrinkles on the skin (wrinkle sign). Thus, primary treatment by open reduction and internal fixation of Lisfranc injury gives good functional outcome, better patient satisfaction and early return to work in my patient in comparison to delayed fixation in previous published articles [14].

Conclusion

Injuries of Lisfranc joint complex are difficult to be detected both clinically and through imaging. Heedful examination and investigation are required to diagnose the injury as a patient may present with symptoms similar to sprains or other minor injuries. The suspicion should be raised in every subject presenting with swelling of the foot with an inability to weight bear. Proper detection of injury to the tarsometatarsal joints can be done with the help of weight-bearing X-ray imaging's, CT scan and MRI. Poor functional outcome are commonly associated with a delay in diagnosis or inadequate treatment and, in some cases; it can lead to medical liability.

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