

# Lisfranc injury: ORIF vs primary arthrodesis for pure ligamentous injuries

## Introduction

It is widely known that untreated Lisfranc injuries have a poor outcome; however there has been little agreement as to the ideal treatment of the injury in the acute setting. Since its description several modalities of treatment have been described ranging from reduction and cast immobilization to arthrodesis. Open reduction and internal fixation has become the treatment of choice of most orthopaedic surgeons and arthrodesis utilized as a salvage procedure.<sup>1,2</sup> In recent literature the use of primary arthrodesis in the acute setting of Lisfranc injury has been explored.<sup>3</sup>

Two cases of Lisfranc injury are presented here and management options discussed.

## Case 1

This case is that of a twenty-two years old male cyclist who sustained trauma to his right foot during training. He reported that he lost control of his bike and collided with a queue of cyclist. During the event his left foot got entangled in the straps of the pedal of the bike as he fell from the bike. There was immediate swelling with an inability of the ambulate. He was subsequently taken to the emergency room where his foot was noted to be markedly swollen, with tenderness over the midfoot. Posterior tibial artery was palpated, there was difficulty in palpating a dorsalis pedis pulse but sensory examination was normal. Radiographs were done and they revealed a disruption of the tarsometatarsal joint with no apparent fractures, (Figure 1). He was diagnosed as having a pure ligamentous homolateral fracture dislocation of the tarsometatarsal joint. The patient was admitted for management of the soft tissue and had open reduction and primary fusion of the middle and intermediate columns two weeks later (Figure 2). At one year postoperatively he ambulated pain free across uneven surfaces and had a foot and ankle outcome score of 90.



Figure 1 Anterior Posterior and Lateral Views of the Left Foot.

Volume 7 Issue 3 - 2017

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**Received:** October 04, 2016 | **Published:** February 16, 2017



Figure 2 Post operative Radiographs, Anterior Posterior and Oblique Views of Left Foot.

## Case 2

An otherwise well twenty year old rugby player who sustained trauma his right foot during a game. His foot was plantar flexed when he was tackled from the side with a resultant twisting motion to his foot. He complained of immediate pain, swelling and inability to ambulate. He was unable to complete the game and was taken to the emergency department. Examination findings revealed a grossly swollen foot with palpable pulses and exquisite tenderness over the midfoot. There were no sensory deficits. Plain radiographs done revealed a complete ligamentous Lisfranc injury (Figure 3). Closed manipulation was performed and post manipulation radiographs were deemed acceptable. He was admitted with a protocol of limb elevation and icing for acute management of his soft tissue. Primary medial column arthrodesis and k wire fixation of the lateral column was undertaken seven days later. His postoperative period was uneventful

and the K wires in the lateral column were removed at six weeks (Figure 4). He returned to full contact sport at 8 months post injury with no complaint.



**Figure 3** Anterior Posterior and lateral radiograph of the Left Foot showing a pure ligamentous Lisfranc injury.



**Figure 4** Anterior Posterior and Oblique views of the left Foot at 8 weeks post operative (Post removal of K-wires).

## Discussion

Lisfranc injuries are relatively rare injuries with either pure bony or ligamentous disruption at the tarsometatarsal joint or a combination of both.

There is a high rate of missed or misdiagnosed injuries as it relates to Lisfranc injuries.<sup>4</sup> A number of classification systems exist which are mostly descriptive.

The first classification was by Quenu and Kuss in 1909 in which injuries were classified into three categories based on the pattern of displacement; homolateral, isolated and divergent. Hardcastle et al.<sup>5</sup> in 1982 modified the original classification into a Type A; complete disruption of the tarsometatarsal joint, Type B; partial disruption of the tarsometatarsal joint and a Type C or divergent pattern. Myerson et al.<sup>6</sup> further modified this classification by sub categorizing Type B and C injuries. In Type B injuries, medial and lateral dislocations were divided into a Type B1 and B2 respectively. While type C was divided into C1 and C2 depending on whether there was partial or complete

disruption of the joint.<sup>6</sup> These classification systems are mostly descriptive and while they serve to standardize description of injury patterns they have not been shown to correlate with outcomes.<sup>2,6,7</sup>

The outcome of this injury pattern seems to hinge more on the extent of ligamentous disruption. Patients with pure ligamentous disruption tend to have worse outcomes as it relates to healing and arthrosis as compared to ones with fracture dislocations.<sup>2,4,7</sup>

There is general consensus that early achievement of an anatomic reduction and fixation results in better outcome when compared to non-operative management and non-anatomic reductions.<sup>2,7</sup> Despite this, the subset of patients with pure ligamentous injury have an increased risk of arthrosis when managed with open reduction and internal fixation regardless of the achievement or failure to achieve an anatomic reduction.<sup>2,8</sup> This often times results in the need for secondary surgery and arthrodesis. Due to this, some authors have proposed arthrodesis as the primary treatment option for pure ligamentous injuries of the Lisfranc joint. Kuo et al.<sup>9</sup> in their study of Ninety two patients looking at the outcomes after open reduction and internal fixation of Lisfranc injuries incidentally found a 40 % rate of degenerative changes of pure ligamentous injuries compared to an eighteen percent in the fracture dislocation group.<sup>2</sup>

The idea of primary fusion in Lisfranc injuries dates back to 1962 when it was suggested by Granberry and Lipscomb and subsequently in 1976 when Bonnel and Barthelemy suggested primary arthrodesis after observation of poor outcomes in their follow up of 23 patients.<sup>10,11</sup> Ly and Coetzee in their prospective randomized trial of 41 patients in evaluation of primary arthrodesis versus open reduction and internal fixation for pure ligamentous Lisfranc Injuries found a loss of reduction and or arthrosis in 71% of patient in the open reduction group.<sup>3</sup> They concluded that a limited medial column fusion had a better short to medium term outcome in comparison to orif in purely ligamentous Lisfranc injuries. The average followup in this study was 42.5 months, which may be considered short and evaluation of long term outcomes would be useful. Mullier et al.<sup>3</sup> compared open reduction and internal fixation to both complete (medial and lateral columns) and partial arthrodesis (medial column only) with a followup of thirty months. They found better functional outcome with the orif group at the end of the study. , Infact they found that 94% of the patients in the orif group had evidence of osteoarthritis. The followup in this study was again short. Long term follow up of these patients would be good to assess the clinical outcome. Systemic review by Sheibani-Rad et al.<sup>3</sup> found equivalent results for orif and primary arthrodesis with a slight advantage in terms of clinical outcome for the primary arthrodesis group.<sup>3</sup>

Arthrodesis effectively limits motion at a joint but biomechanically often increases stresses across neighboring joints due to abnormal loading. This increases the risk of degenerative joint disease in adjacent motion segments or articulations. Based on this premise Arthrodesis for years has been reserved as a salvage procedure. Mann et al in there seven year follow up of forty patients treated with arthrodesis of the mid foot for osteoarthritis found few cases of adjacent segment or joint arthrosis attributing it to the limited motion that normally took place in these joints.<sup>12</sup>

Arthrodesis in Lisfranc injuries has been primarily targeted at the medial column with preservation of the lateral column. The lateral column has greater arc of motion in the sagittal plane than the other tarsometatarsal joint. This facilitates the accommodation of walking on uneven surfaces.<sup>13</sup> In biomechanical studies bicolumnar fusion has been shown to increase the calcaneocuboid pressures in comparison

to isolated medial column fusion but the clinical effects have not yet been evaluated.<sup>14</sup> Isolated Medial column fusion has been shown not to have an effect on calcaneocuboid pressure.<sup>14</sup> Primary arthrodesis of Lisfranc injuries targeting the medial column only would prevent the need for a secondary surgery in Lisfranc injuries that are at high risk of secondary arthrosis while preserving motion in the lateral column to accommodate locomotion on uneven surfaces.

## Conclusion

Lisfranc injuries represent a complex disruption at the tarsometatarsal joint and while several classifications exist, these are mostly descriptive and offer little to guide management and predicting prognosis. Outcome seems to be more dependent on the extent of ligamentous injuries. There is general consensus that anatomic reduction provides the best outcome. Purely ligamentous Lisfranc injuries seem to have a worse outcome and a higher risk of arthrosis even when anatomic reduction is achieved. Primary medial column arthrodesis in this subset may decrease the need for secondary operation without significant effect on function or locomotion.

## Acknowledgments

None.

## Conflicts of interest

None.

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