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Open reduction and internal fixation of displaced Lisfranc fracture dislocations using k-wires

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Abstract
Introduction: Open reduction and internal fixation has been recommended as the treatment for most unstable injuries of the Lisfranc (tarsometatarsal) joint. It has been thought that purely ligamentous injuries have a poor outcome despite such surgical management.
Aim and Objective: The aim of this study was to evaluate the outcome of early open reduction and internal fixation in the management of patients with Lisfranc injuries.
Materials and Methods: The study was conducted in the Department of Orthopaedics, Govt. Bone and Joint, Hospital, Barzulla an associated Hospital of Govt. Medical College, Srinagar on Lisfranc joint. In this study a total of 18 cases of Lisfranc injuries were enrolled.
Results: Full weight bearing was allowed at 10-12 weeks. Anatomical reduction was obtained in 17 (94.44%) patients. At the follow-up of 6 months the average calculated AOFAS Score was 83.28. In this study overall complications were seen in 4 (22.22%) patients. Good to fair results were seen in 17 (94.44%) patients.
Conclusion: Open reduction and internal fixation with Kirschner wire offers excellent curative effect and can avoid postoperative complications and improve the patients' quality of life.

Keywords: Lisfranc fracture, open reduction, Kirschner wire

Introduction
The Lisfranc injury is an injury of the foot in which one or more metatarsal bones are displaced from the tarsal bones. The term 'Lisfranc dislocation' is attributed to the French Napoleonic era field surgeon, Jacques Lisfranc, who described a method of forefoot amputation through the tarsometatarsal articulation [1]. Lisfranc injuries are fracture–dislocations of the tarsometatarsal joint complex. The spectrum of injury ranges from low energy sports injuries, to high energy crush injuries [2]. The same variability accounts for the extent of injury, which may be purely ligamentous or associated with fractures of the metatarsals, cuneiforms, navicular and cuboid [2]. Our understanding and treatment modalities of these injuries has evolved during recent decades as a result of diagnostic advances computed tomography scanning [3, 4].
Up to 20% of Lisfranc fracture–dislocations are misdiagnosed or missed during the initial evaluation [5]. This makes early and accurate diagnosis a prerequisite for appropriate management of these injuries in order to avoid long-term sequelae and functional impairment. The general consensus is that anatomical reduction and stabilisation of the Lisfranc joint is imperative for good outcome [4, 6-9]. Conservative management with closed reduction and plaster immobilisation does not appear to have a role in the contemporary treatment of Lisfranc injuries because the initial reduction is often lost when soft tissue swelling subsides [9]. There are a variety of treatments which have been advocated for these injuries. Some surgeons advocate closed fixation using percutaneous wires and/or screws, while others prefer open reduction and internal fixation (ORIF) [2-4, 6].
Fixation with Screws provides the most stable fixation, however most of the times a second surgery is often necessary to remove the hardware. This study primarily focused to find out the treatment outcome using open reduction and fixation with K-wires.

Materials and Methods

The study was conducted in the Department of Orthopaedics, Govt. Bone and Joint, Hospital, Barzulla an associated Hospital of Govt. Medical College, Srinagar on Lisfranc joint from July 2019 to June 2022. In this study a total of 18 cases of Lisfranc injuries were enrolled. Among enrolled patients there were 7 (38.89%) males and 11 (61.11%) females. The mean age of the study population was 46.5 (range 22-67) years. Most patients were in the age group of 22-40 years (Table 1). The fractures were classified according to Myerson classification of Lisfranc injury which were classified as Type A; total incongruity of the Tarsometarsal joint, Type B1; partial medial incongruity, Type B2; partial lateral incongruity and Type C1 and C2; a divergent pattern, with partial or total displacement.

Table 1: Demography of patients

Parameters		No. of patients	Percentage
Gender	Male	12	66.67
	Female	6	33.33
Age group	18-40 Years	9	50
	41-60 Years	6	33.33
	61-70 Years	3	16.67
Mode of injury	Road traffic accidents	11	61.11
	Fall	6	33.33
	Others	1	5.56
Side	Right	5	27.78
	Left	13	72.22
	Both	0	0
Type of fracture according to Myerson classification	A	14	77.78
	B1	3	16.67
	B2	1	5.55
	C1	0	0
	C2	0	0

Inclusion criteria

- Age >18 years and < 70 years
- Displaced Lisfranc injury

Exclusion criteria

- Patients< 18 or >70 years.
- Infected fractures.
- Medical co-morbidities such as diabetes, liver disease, or chronic renal disease.

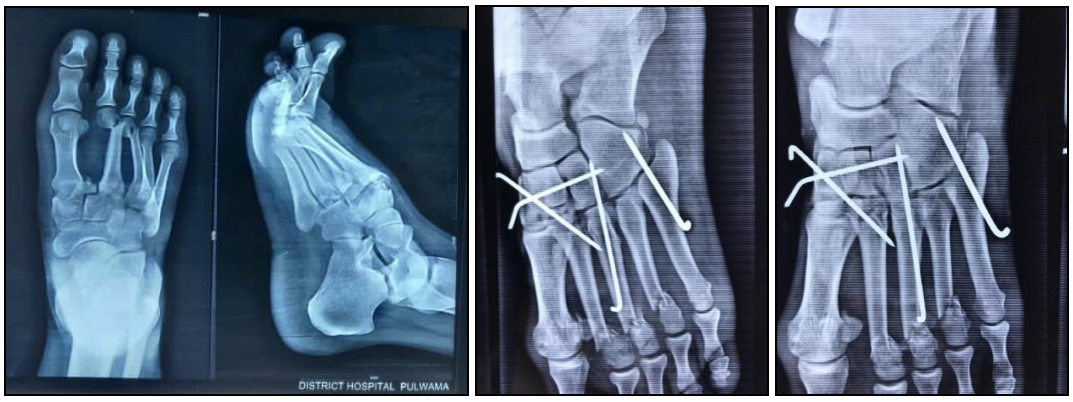
Surgical Technique

A dorsal longitudinal incision was made between the first and second metatarsal. The extensor hallucis longus tendon and dorsalis pedis artery were identified and proteced. Tarsometatarsal joint was reached and cleared of any debris.

The first tarsometatarsal joint was reduced by aligning the medial border of medial cuneiform to the medial border of the first metatarsal. The second metatarsal was then reduced to the medial border of middle cuneiform. The joints were fixed with Kirschner wires. In some cases a second longitudinal incision was made centered between the third and fourth metatarsals and the third metatarsocuneiform joint was reduced. The fourth and fifth metatarsals usually reduced once the above three reductions were achieved and were held with one or two transarticular K-wires from the base of 5th metatarsal to the cuboid.

Patients were placed in posterior slab with elevation and non-weight bearing. In two weeks stitches were taken out and patiens were placed in a short leg cast. Serial x rays were done in two weeks, six weeks, and twelve weeks. At the follow-up of twelve weeks the k-wires were removed and weight bearing was started and increased as tolerated. Patients were revaluated in 4 months for continuing physical therapy and muscle strengthening program. Patients were evaluated in 6 months and scoring was done. American orthopedic foot and ankle score system (AOFAS) score for the midfoot (score 0-100) was done that included Intensity of pain, Activity limitations, Footwear requirements, Walking distance depending on the quality of the walking surface, Foot axis.

Case 1



A B C

Fig 1: A (Displaced Lisfranc injury, B and C (ORIF done with K-wires)

Case 2

A B C

Fig 2: A (pre-operative radiograph), B (Immediate post-operative) and C (Final follow-up at 6 months)

Results

The mean operating time was 53.20 (range 45-70) minutes. Average time from injury to surgery was 1.98 (range 1-3days).

Full weight bearing was allowed at 10-12 weeks. Anatomical reduction was obtained in 17 (94.44%) patients. At the follow-up of 6 months the average calculated AOFAS Score was 83.28.

There was no case of compartment syndrome of foot in our series. In this study overall complications were seen in 4 (22.22%) patients. Loss of reduction was seen in 1 (5.56%) patients. There were 3 (16.67%) patients with superficial wound infection in this study, which subsided with oral antibiotics. Good to fair results were seen in 17 (94.44%) patients.

Discussion

Anatomic reduction and internal fixation is the standard treatment method of tarsometatarsal fracture dislocations. Most authors agree stable anatomic reduction leads to optimal results [10]. Open reduction allows direct visualization of the fracture dislocation for anatomical reduction.

The current study included 18 patients with mean age of 46.5 (range 22-67) years and there were 12 (66.67%) males and 6 (33.33%) females. The results were nearly agreed with the study of Ren et al. [11] who reported that he study population consisted of 38 (62.3%) male and 23 (37.7%) female patients, with a mean age of 39.4 (range 19-64) years.

Lisfranc injuries result from high-energy injuries. In our study, motor vehicular accidents were the most common cause of injury, a finding consistent with the already available literature. The mode of injury was road traffic accidents (RTA) in majority of patients in 11 (61.11%) patients followed by fall from height which was consistent with Hardcastle et al. [5], 40.3% RTA and Kuo et.al. [12], with RTA 42%.

The current study showed that the most prevalent complication was infection seen in 3 (16.67%), loss of reduction in 1 (5.56%) and overall complications were in 4 (22.22%) patients. Which is nearly similar to the study of Kohli et al. [13] who reported that of 27 patients with Lisfranc injuries complication were recorded in 6 patients (22.2%), superficial wound infection in 2 patients (7.4%), loss of reduction (early postoperator) in one patient (5.9%), delayed discharge in one patient (3.7%), compromised wound healing in one patient (3.7%) and Transient numbness in one patient (3.7%).

In this study the mean AOFAS score calculated at the follow-up of 6 months was 83.28, which is nearly equivalent to the study previously done by Ren et al. [11] where he reported that the mean AOFAS score was 89.9 (range 85-97) after 6 months follow up.

We believe that open reduction and K-wire fixation considerably improves the functional outcome in Lisfranc injuries. There is an added advantage that no second surgery for removal of hardware is required. The disadvantage is that this method needs longer period of immobilization in a cast. The limitation of our study is that there was no control group so that we could compare our results.

Conclusion

It could be concluded that anatomical reduction of Lisfranc injury can be achieved by open reduction and internal fixation with the Kirschner wires (K-wires). Normal structure of Lisfranc joint is regained to a great extent; injured ligaments were also repaired. Therefore, this method offers excellent curative effect and can avoid postoperative complications and improve the patients' quality of life.

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Conflict of Interest
Not available

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