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A study of functional outcome of lisfranc fracture dislocations managed by various operative methods in rural south Indian population

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Abstract
This study is an attempt to analyse the midterm results of "functional outcome of lisfranc fracture dislocations managed by various operative methods" in rural south Indian population. Lisfranc Fracture dislocations have low incidence as they are commonly missed. Painful malunion or impaired functions may result if not treated adequately. Anatomic reduction and internal fixation is recommended. The study involves 15 patients, aged 18 to 65 admitted to our hospital, Rajah Muthiah Medical College, Chidambaram for period of 24 months from May 2016 to April 2018.Myerson's Classification of lisfranc fracture disloaction was used to classify and manage the injuries accordingly. Patients were managed with surgical reduction (Open or closed) using Kwires/Screws. Post operatively immobilisation was done using BK cast/slab for a period varying from 4 - 12 weeks and later Gradual weight bearing allowed after 6 -8 weeks. AOFAS Midfoot score was used to document the prognosis. The study involves 15 patients, 11 men and 4 women aged 18 to 65 years (mean = 31) admitted to our hospital, for period of 24 months from May 2016 to April 2018 (mean follow up period - 9 months). Patients with anatomic reduction achieved higher mean AOFAS foot score.Type B fractures had a better outcome than Type A and Type C fractures.Thus we conclude that Anatomic reduction is the mainstay in the operative management of Lisfranc fracture dislocations.

Keywords: Lisfranc joint injury, lisfranc fracture dislocations, metatarsal fracture, midfoot injuries, K wire / screw fixation

Introduction
Lisfranc Fracture dislocations are uncommon due to highly constrained configuration of the Tarsometatarsal joints which are secured by ligments. They have low incidence as they are commonly missed. Lisfranc injuries commonly occur in high energy impact like motorvehicle accidents. Painful malunion with impaired functions may result if not treated adequately. Closed reduction and plaster immobilisation leads to unsatisfactory results and redisplacement of the joints. Anatomic reduction and internal fixation is recommended.
Present study is an attempt to evaluate the *Functional Outcome of Lisfranc Fracture Dislocations Managed by Various Operative Methods* - Open /Closed reduction with Screws & K wires.

Aims & Objectives
To analyse the midterm results of "Functional Outcome of Lisfranc Fracture Dislocations Managed by Operative Methods" in rural south Indian population.

Materials and methods
The study involves 15 patients, aged 18 to 65 admitted to our hospital, Rajah Muthiah Medical College, Chidambaram for period of 24 months from June 2016 to April 2018. Patients were evaluated using weight bearing X rays whenever possible and CT scan if necessary.
Myerson's Classification of lisfranc fracture disloaction was used to classify and manage the injuries accordingly [1, 10].

- Type A - Total incongruity of the Tarsometatarsal joints
- Type B1 - Partial incongruity of the first ray (partial medial incongruity)

- Type B2 - Partial incongruity - displacement of lateral four metatarsals (partial lateral incongruity)
- Type C1 and C2 - A divergent pattern, with partial or total displacement

Surgery was indicated in those patients with instability, which was defined as ≥1 mm of malalignment of the medial column on stress X rays [14, 15] or disruption of normal alignment of the cuboid and fourth metatarsal on oblique X rays, or loss of normal alignment of the second metatarsal and middle cuneiform on anteroposterior X rays [2, 3]. These Patients were managed with surgical reduction (Open or closed reduction) using K wires/Screws [4]. Post operatively all patients were immobilised using Below knee cast/slab for a period of 4-12 weeks and later Gradual weight bearing allowed after 6 -8 weeks. Post operative periodic X rays were taken to study malalignment, Non union, subluxation, Post traumatic arthritis [5]. In all cases, AOFAS (American Orthopedic Foot & Ankle score) Midfoot score is used to document the prognosis pre operatively and post operatively at the end of 6 weeks & 3/ 6/12 months.Anatomic alignment was defined as the medial border of the second metatarsal in line with that of the middle cuneiform on anteroposterior X rays, the medial border of the fourth metatarsal in line with that of the cuboid on oblique X rays, and the lateral border of the third metatarsal in line with that of the lateral cuneiform on oblique X rays [12].

Inclusion criteria

- Patient aged above 18 years.
- Open fractures
- Insufficient closed anatomic reduction
- Insufficient stability after closed reduction

Exclusion criteria

- Severly moribund patients
- Skeletally immature patients
- Pre existing Foot deformity
- Preinjury status non ambulatory
- Polytrauma patients/Crush injuries of foot

Observation and results

The study involves 15 patients, 11 men and 4 women aged 18 to 65years (mean = 31) admitted to our hospital, Rajah Muthiah Medical College, Chidambaram for period of 24 months from May 2016 to April 2018 (mean follow up period - 9 months). Fractures were classified as Type A(n=2), TYPE B (n=10), and TYPE C(n=3). 9 patients injured the right foot; 2 patients had open fractures; 2 patients injured 5 tarsometatarsal joints; 9 patients injured only the medial column; Patients were followed up for 6 To 18 months (Mean, 9) months.11 patients were fixed with screws alone, 4 with K-wires alone, Mean AOFAS midfoot score was 76.5 [11]. Patients with anatomic reduction (n=12) achieved higher mean AOFAS foot score at the end of 6 months (78.3vs.66.5) when compared to patients with non-anatomic reduction (n=5). Associated tarsal bone injuries were observed in 4 cases (n=4) which had not much impact on final functional outcome. Functional outcome was graded according to AOFAS scores (Chart-2) as Excellent (Scores 85-100), Good (Scores 70-84), Fair (Scores 50-69), Poor (Scores<50). Thus, 'Excellent' outcome was seen in 6 patients (n=6),'Good' outcome was noted in 7 patients (n=7),'Fair' outcome was noted in 3 patients (n=3) while none of the patients had 'Poor' outcome.There was no significant difference between outcome of closed and open fractures and patients managed with closed and open reduction [16, 17]. Post-traumatic arthritis found to be more common in patients with non-anatomic reduction. 2 patients (n=2) with compound fractures developed superficial skin infections, both treated with antibiotics. One patient presented with screw breakage, for which implant exit was done. One patient had impending compartment syndrome but resolved on limb elevation. No patients had deep venous thrombosis, compartment syndrome, vascular compromise, or reflex sympathetic dystrophy. 3 patients (n=3) developed post-traumatic arthritis. Two patients developed flat foot. Two patients (n=2) presented with neglected injuries and underwent primary arthrodesis [7, 8, 9].

Fig 1: Type B fracture dislocation

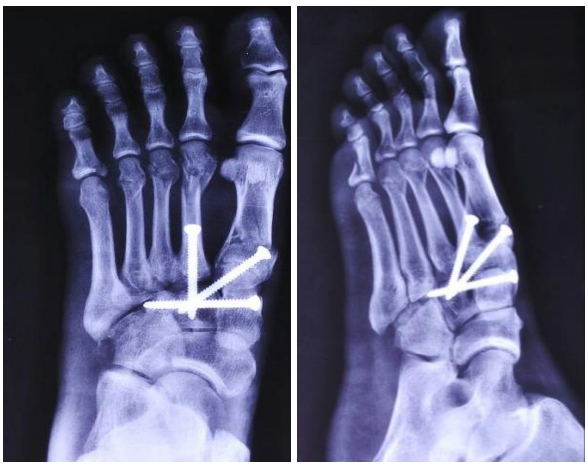

Fig 2: Medial Column Rigid fixation using 3.5mm cortical screws

Fig 3: Closed reduction using reduction clamp under C Arm control

Fig 4: Method of closed reduction in Operating table

Fig 5: Open reduction using double linear incision & Primary arthrodesis in a case of neglected lisfranc fracture dislocation.

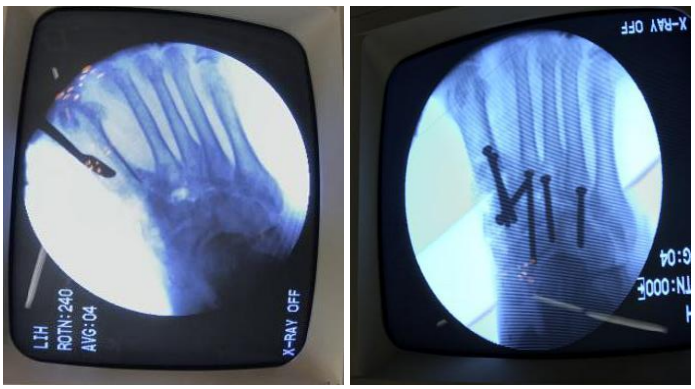

Fig 6: C Arm images after primary arthrodesis

Discussion

Treatment includes closed or Open reduction with internal fixation K Wires or Cortical screws [13]. Lisfranc injuries are often misdiagnosed as the plantar ecchymosis sign and the fleck sign at the base of the second metatarsal are easily missed. Road traffic accidents are the most common causes. The injury mechanism can be direct and indirect [6]. Direct forces (fall of heavy objects) crush and displace the metatarsals in a plantar direction and medially or laterally. Under indirect rotational forces (in RTA) the forefoot probably is in plantar flexion. The dorsal aspect of the foot is weaker than the plantar aspect and hence displacement occurs in that direction. Type B fractures had a better outcome than Type A and Type C fractures.If fractures are not treated properly, malunions, difficulty in walking and painful deformities may occur. Stable anatomic reduction paves way for good functional outcome.

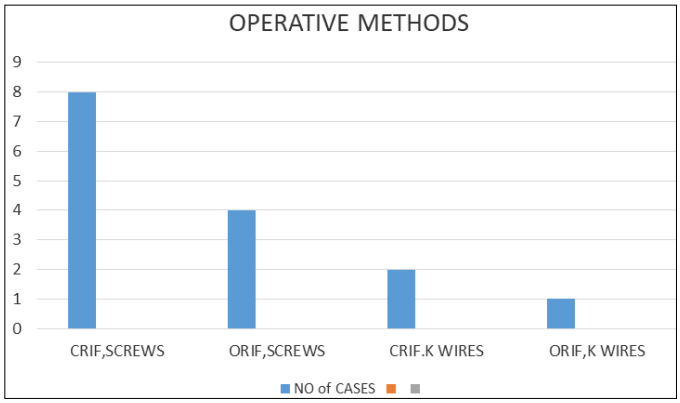

Chart 1: Various operative methods employed in management of Lisfranc Injuries

Fixation includes K wires or screws although K wires have slightly higher failure rates.Kwires are preferred for associated soft-tissue injury, comminuted fractures or impending compartment syndrome. In this study, the medial column was fixed with screws in most cases, which provided a stronger and more stable construct.K wires were used in open fractures and a case of impending compartment syndrome. In cases were primary arthrodesis was done, upto 4 Tarso Metatarsal joints were rigidly fixed with cortical screws.There are no definite guidelines for removal of implants after fixation of Lisfranc joint injuries. Kwire removal is usually done at weeks 6 to 8, whereas screws are removed at week 12 to year 3 or even left alone. Other factors determining the functional outcome include: Initial degree of soft tissue injury, Time from injury to operate, Prior history of native treatment, Degree of communition, Compliance of patient post operatively.

Fig 7: A case of neglected lisfranc fracture

Fig 8: Neglected Lisfranc fracture involving all 5 TMT Joints

Fig 9: CT imaging reaffirms the diagnosis along with fracture cuneiforms, navicular bones.

Fig 10: Immediate Post Op

Fig 11: One year follow up, patient having 'Good' functional outcome

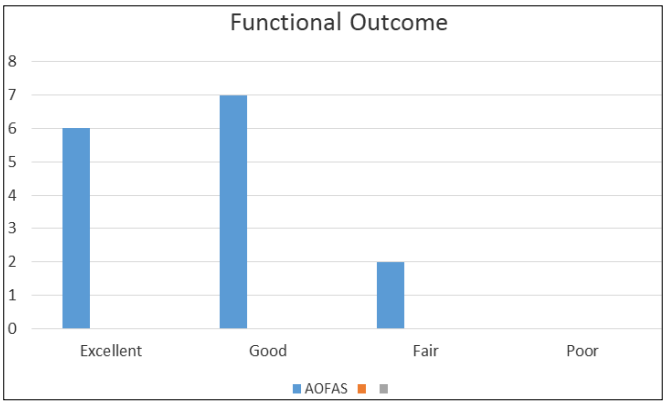

Chart 2: Functional outcome grading based on AOFAS scores.

In a study by M.Richter, H.Thermann *et al*. [18] summarised that early open anatomic reduction and optimal internal stabilisation improved the final outcome which concurred with our study.
In another study by S. Rammelt, W. Schneiders [19], the authors say that primary treatment by open reduction and internal fixation leads to significant better functional results than does secondary corrective arthrodesis for malunited fracture dislocations.
In the study by Xiao Yu, Qing-Jiang Pang *et al*. [20] the authors conclude that surgical treatment is essential for anatomic reduction.
In a similar study by Sushant D Ghate, Vidyasagar M Sistla *et al*. [21] the authors found that anatomic reduction is the most important predictor of outcome of lisfranc fracture dislocations, similar to our study.

Conclusion

Anatomic reduction is the mainstay in the operative management of Lisfranc fracture dislocations. Anatomic reduction was the most important predictor of outcome in patients. Those with anatomic reduction were less prone for arthritis and achieve better AOFAS scores. Articular cartilage damage, non-anatomic reduction, and improper internal fixation results in post-traumatic arthritis.The small sample size was a limitation for this study. Further studies with a larger sample and longer follow-up duration are necessary.

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