



## A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF LISFRANC INJURIES TREATED BY FLUOROSCOPIC GUIDED CLOSED REDUCTION AND PERCUTANEOUS FIXATION

### Orthopaedics

|                                 |                                                                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Dr Ramasubba Reddy</b>       | Professor, Department of Orthopaedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Byrasandra, Jayanagar, Bengaluru, Karnataka, India.                             |
| <b>Dr T H Prakashappa</b>       | Professor, Department of Orthopaedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Byrasandra, Jayanagar, Bengaluru, Karnataka, India.                             |
| <b>Dr Manjunatha Swamy S H*</b> | Junior Resident, Department of Orthopaedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Byrasandra, Jayanagar, Bengaluru, Karnataka, India. *Corresponding Author |
| <b>Dr Shravan M Kaginele</b>    | Junior Resident, Department of Orthopaedics, Sanjay Gandhi Institute of Trauma and Orthopaedics, Byrasandra, Jayanagar, Bengaluru, Karnataka, India.                       |

### ABSTRACT

**Objective:** To assess functional outcomes and postoperative complications of Lisfranc fracture dislocation treated at our institute with closed reduction and percutaneous fixation using K wire and CC screws. **Methodology:** It is a prospective study conducted at 'Department of Orthopaedics', Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore. This study included 30 cases between JAN 2021 – JULY 2022 treated by fluoroscopic guided closed reduction and percutaneous fixation. Functional outcomes were assessed using AOFAS Score. **Result:** Out of 30 patients, 93.3% had good outcome, 6.7% had fair outcome and none of the patient had poor outcome at the 1year follow-up. Mean AOFAS score was  $77.10 \pm 4.93$ . **Conclusion:** Closed reduction and percutaneous fixation of Lisfranc fracture dislocation using K wire and CC screws is a minimally invasive procedure and majority have good functional outcome.

### KEYWORDS

Lisfranc fracture dislocation, K wire, CC screw and AOFAS score.

### INTRODUCTION

The term Lisfranc injury refers to a spectrum of injuries involving the tarsometatarsal (TMT) complex(1). Incidence reported as 1 per 55,000 persons, approximately 0.2% of all fracture(2). Historically the importance of the tarsometatarsal joint line has been attributed to the French gynecologist and Napoleonic surgeon Jacques L. Lisfranc, described an amputation technique through the TMT joint line(3).

Around 20% of Lisfranc fracture-dislocation tend to be diagnosed late or often missed, particularly when they occur during low energy injuries or with associated pure ligamentous injuries. More severe complications which includes post-traumatic osteoarthritis, foot deformities joint stiffness and loss of foot arch which leads to debilitating disabilities. Undisplaced and stable fracture dislocation are treated with conservative management by immobilization and non-weight bearing. Controversies regarding the surgical treatment of Lisfranc injuries includes a. osteosynthesis versus primary arthrodesis b. trans articular screws versus dorsal plates; and c. the most appropriate surgical approach(4).

For a satisfactory outcome in surgical corrections of Lisfranc injuries early accurate diagnosis and the anatomical reduction of the fracture dislocation is utmost important. Widely described surgical treatment for this fracture is the open reduction and internal fixation (ORIF) with screws, plates, K-wires or a combination of them. The open approach also carries risk or complications like wound dehiscence, infection and complex regional pain syndrome (CRPS).

Many a times painful hardware warrants second procedure of hardware removal following the osteosynthesis with plate. In order to minimize the occurrence of post-operative complications and the soft tissue damage, different percutaneous techniques have been practiced and discussed in literatures(5). The purpose of this study is to assess the results of the treatment of Lisfranc fracture-dislocation treated at our institute with closed reduction and percutaneous fixation considering complications.

### Methodology Study Design

A prospective study was conducted at the Department of Orthopaedic Surgery, Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore from JANUARY 2021 to JULY 2022. This study consists of 30 cases of Lisfranc's Fracture Dislocation treated operatively by Cannulated Cancellous Screws and K wires. The cases were selected

according to inclusion and exclusion criteria. The functional outcome was evaluated using AOFAS Score.

### Sample Size

30 cases of Lisfranc fracture dislocation were taken up for the study at Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore.

### Inclusion Criteria

1. Patients older than 18
2. Patients with Meyerson type B and type C Classification
3. Closed fracture
4. Minimal swelling
5. Ability to understand the content of the subject information / informed consent form and to be willing to participate in the clinical investigation.

### Exclusion Criteria:

1. Comminuted intraarticular fracture at base of first or second metatarsal.
2. Open fracture.
3. Lisfranc fracture associated with compartment syndrome
4. Previous attempt at surgical management of same injury.
5. Significant peripheral vascular disease
6. Patient with foot deformity due to diabetes.
7. Rheumatic diseases.
8. Polytrauma
9. Neurological limb

### Pre Operative Evaluation

Patients admitted to the hospital history taken regarding the mode and velocity of injury, examined clinically for the condition of the skin and subcutaneous tissue, closed or open injury, presence of other injuries, distal neurovascular status, presence of compartment syndrome, Routine investigation and anterior – posterior, oblique and lateral radiographs were taken for the involved foot. Weight bearing X rays if necessary. Temporarily immobilized with below knee slab and gave adequate analgesics. After prior informed consent, a pre-operative anaesthetic evaluation is done. Pre-op planning of fixation is made.

### Intraoperative

Under spinal anaesthesia, subjects were put in supine position on standard operating table. Operating part was scrubbed thoroughly with betadine 7.5% and painted with 5% betadine and draped. Closed reduction with manual traction and dorsiflexion of foot. Under fluoroscopic guidance, K wire or 4 mm cannulated cancellous screw passed.

Case 1



Figure 1: Pre op X ray of 38-year male patient showing anteroposterior, oblique and lateral view

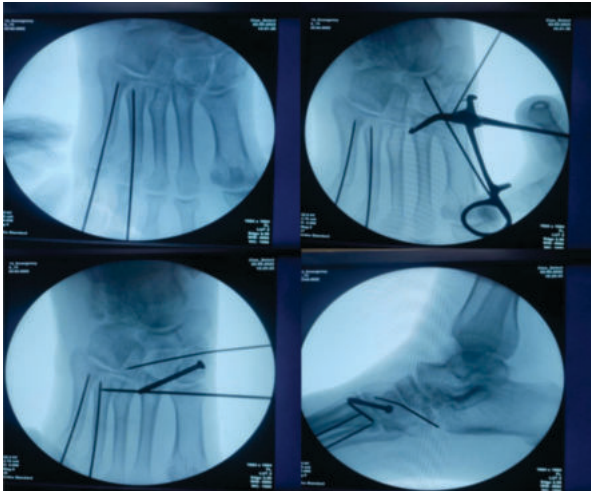


Figure 2: Fluoroscopic images of closed reduction and percutaneous fixation with cc screw and k wire



Figure 3: Immediate post op X-ray

Case 2



Figure 4: Pre op X ray of 31year male patient showing anteroposterior, oblique and lateral view.

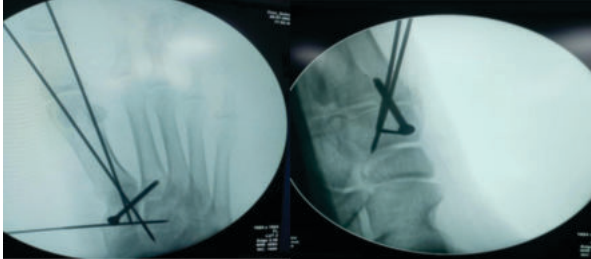


Figure 5: Fluoroscopic images of closed reduction and percutaneous fixation with cc screw and k wire



Figure 6: Postop X-ray

Postoperative Care

Non weight bearing for 6 week with below knee slab After 6 weeks, radiographs obtained and K wire removed. A weightbearing plaster cast or walker boot for another 6-week, progressive weightbearing as tolerated started.

After 12-week, cast or boot removed and patient is allowed to wear comfortable shoes with full weightbearing. Assessment done at OPD following postoperative visits at 6 week, 3 months, 6 months and at 1 year. At follow-up visit, patient is evaluated clinically, radiologically and Complications were noted.

Statistical Analysis

Based on these data the final outcome is assessed according to American orthopaedic foot and ankle society score (AOFAS).

RESULTS

The study consisted of 30 cases of Lisfranc's Fracture dislocation treated by surgical Procedure during the period JAN 2021 to JULY 2022. The following Observations were made in the present study.

Table 1: Summary of observation

| Basic Details                 | Mean $\pm$ SD    Median (IQR)    Min-Max    Frequency (%) |
|-------------------------------|-----------------------------------------------------------|
| Age (Years)                   | 33.20 $\pm$ 10.25    32.00 (25.25-38.00)   18.00 - 60.00  |
| Age                           |                                                           |
| 18-30 Years                   | 14 (46.7%)                                                |
| 31-40 Years                   | 9 (30.0%)                                                 |
| 41-50 Years                   | 5 (16.7%)                                                 |
| 51-60 Years                   | 2 (6.7%)                                                  |
| Gender                        |                                                           |
| Male                          | 25 (83.3%)                                                |
| Female                        | 5 (16.7%)                                                 |
| History                       |                                                           |
| RTA                           | 19 (63.3%)                                                |
| Slip and Fall                 | 11 (36.7%)                                                |
| Mechanism of Injury           |                                                           |
| Direct                        | 22 (73.3%)                                                |
| Indirect                      | 8 (26.7%)                                                 |
| Side                          |                                                           |
| Right                         | 16 (53.3%)                                                |
| Left                          | 14 (46.7%)                                                |
| Ecchymosis (Yes)              | 28 (93.3%)                                                |
| X-Ray                         |                                                           |
| Classification                |                                                           |
| B1                            | 6 (20.0%)                                                 |
| B2                            | 20 (66.7%)                                                |
| C1                            | 1 (3.3%)                                                  |
| C2                            | 3 (10.0%)                                                 |
| Fleck Sign (Yes)              | 14 (46.7%)                                                |
| Associated Injuries           |                                                           |
| Nil                           | 23 (76.7%)                                                |
| Calcaneum Fracture            | 3 (10.0%)                                                 |
| Metatarsal Fracture           | 3 (10.0%)                                                 |
| Distal Both Bone Leg Fracture | 1 (3.3%)                                                  |
| Procedure                     |                                                           |
| CRIF With K Wire              | 19 (63.3%)                                                |
| CRIF With K Wire & CC Screw   | 7 (23.3%)                                                 |
| CRIF With CC Screw            | 4 (13.3%)                                                 |

| AOFAS     | Mean $\pm$ SD    | Median (IQR)        | Min – Max   |
|-----------|------------------|---------------------|-------------|
| 6 Weeks   | 54.80 $\pm$ 3.83 | 55.00 (52.00-58.00) | 48.0 - 60.0 |
| 12 Week   | 63.87 $\pm$ 4.09 | 64.00 (62.00-66.00) | 52.0 - 70.0 |
| 6 Months  | 70.67 $\pm$ 4.11 | 70.00 (70.00-74.00) | 58.0 - 76.0 |
| 12 Months | 77.10 $\pm$ 4.93 | 78.00 (76.00-80.00) | 62.0 - 84.0 |

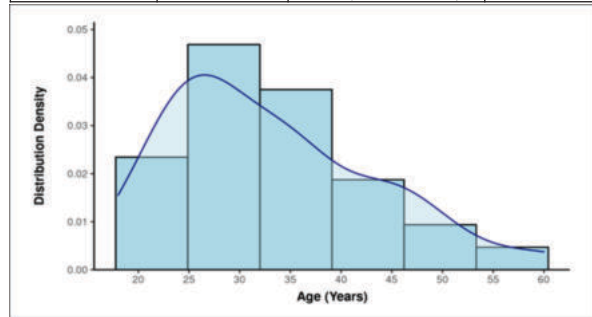


Figure 7: Histogram showing age distribution

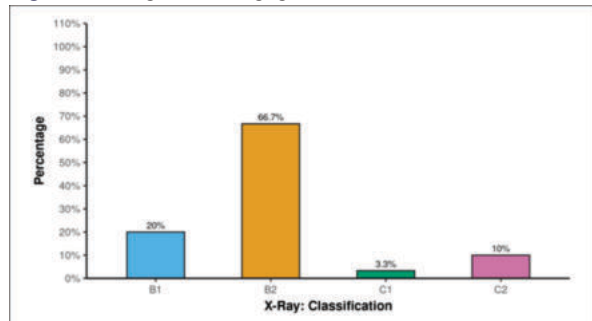


Figure 8: Distribution of study population according to Myerson classification

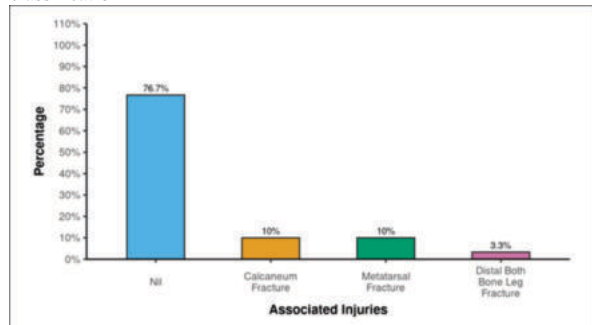


Figure 9: Distribution of study population according to associated injury

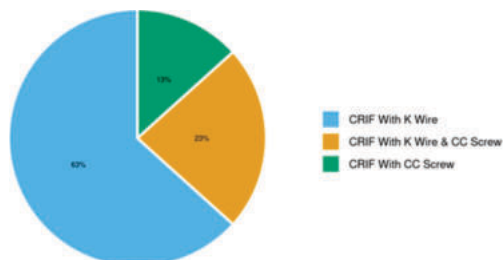


Figure 10: Distribution of study population according to procedure done.

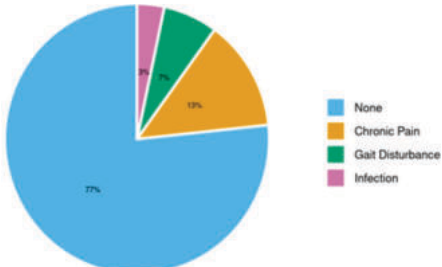


Figure 11: Distribution of study population according to complications

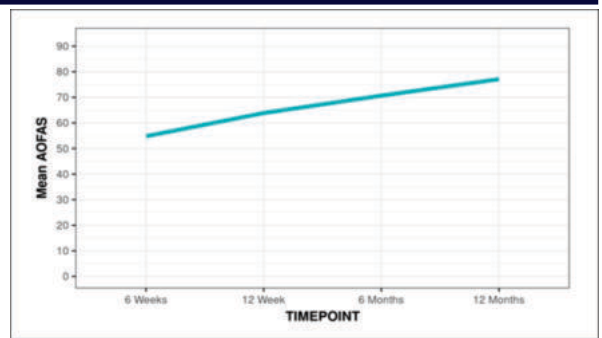


Figure 12: Change in AOFAS score over time.

### Case 3



Figure 13: Pre op x ray of 45-year female with Myerson type B2 Lisfranc's fracture dislocation



Figure 14: Immediate post op x ray



Figure 15: 1 year follow up x ray



Figure 16: Clinical picture showing functional outcome (plantar flexion and dorsiflexion).

## DISCUSSION

Our study was prospective observational study consists of 30 cases of closed Lisfranc injury, which were selected after satisfying the inclusion and exclusion criteria and operated with fluoroscopic guided closed reduction and internal fixation with K wire and cc screw at Sanjay Gandhi Institute of trauma and orthopaedics from Jan 2021 to July 2022. The functional outcome was assessed using An American orthopaedics foot and ankle society score (AOFAS).

### Age

Mean age of the patients in our study was 33.20 years, ranging from 18 years to 60 years which was similar in other studies. **Michael Voskibian et al(6)** study with sample size of 31 patient reported mean age of 34.2 years. This shows that Lisfranc injury are more common in active, working, middle aged population.

### Sex

We had 25 (83%) male patient and 5 (17%) female patient with Lisfranc injury, with definite male preponderance. This finding similar to **Kirzner et al(7)** study with sample size of 108 patients reported 72.22 male and 27.78 female. This could be because males are attributed to higher physical activity, thereby predisposing them to the injury.

### Mode of injury

The mode of injury was Road traffic accident for 19 (63%) cases, whereas 11(36%) cases had a history of slip and fall which includes sports injury. Almost all the studies on Lisfranc point towards road traffic accident as the common mode of injury. This is comparable with **Aditya k Medhavi et al(8)** study with sample size of 30 patients showed 70% patients having RTA as mode of injury with 30% had slip and fall.

### Side Of Injury

Right side was 53% compared to left side 46%. This is comparable with **Aditya k Medhavi et al(8)** study with sample size of 30 showed injuries having right side 53.33% and left side 46.67%.

### Presence Of Ecchymosis

on clinical examination, ecchymosis present on plantar aspect of foot in almost 93% of cases.

### Lisfranc injury Type

Most Lisfranc fracture belongs to Myerson B2 type (66%), the least common type was C1 (3%). B1 and C2 type were 20% and 10% respectively. In our study we have excluded the Myerson type A. **Perugia et al(9)** studied on 42 patients in which 17 patients belong to Myerson type B which is comparable with our study.

### Fleck Sign

On radiological examination, fleck sign present in 46% of cases and absent in 54% of cases.

### Associated Fracture

Associated injuries present in 23 % of cases. 10% of cases had calcaneum fracture, 10% of cases had metatarsal fracture and 3 % of cases had distal both bone leg fracture.

### Procedure

About 63 % of patients had CRIF With K Wire fixation, 13 % of patient undergone CRIF with CC screw fixation and 23 % of patient undergone CRIF with both CC screw and K wire fixation. **Abdelgaid et al(10)** studied on 35 patients with closed Lisfranc injury used both K wire and cc screw for fixation, K wire used specifically for lateral column fixation.

### Functional Outcome

Functional outcome was assessed using AOFAS Score. Mean AOFAS Score at 6week, 12-week, 6 month and 1 year was 55%, 64 %, 71% and 77% respectively.

## Complication

13 % patient had chronic pain. 6% patients had gait disturbance. 1 patient had infection in the form of pin tract infection at K wire insertion site on 14<sup>th</sup> day, was treated with oral antibiotics and regular dressing.

## CONCLUSION

Closed reduction and percutaneous fixation of Lisfranc injury is a minimally invasive procedure with good functional outcome. Anatomical reduction is paramount to the success of treatment. In our study, anatomical reduction was achieved by closed means other than grossly unstable injuries. Percutaneous fixation with CC screw gives better functional outcome compared to K wire. However further randomized controlled studies with longer follow up are necessary.

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**Table 2: Comparison With Other Studies**

| Serial no | Series        | Average AOFAS | Sample size |
|-----------|---------------|---------------|-------------|
| 1         | Abdelgaid(10) | 87            | 32          |
| 2         | Perugia(9)    | 81            | 42          |
| 3         | Wagner(11)    | 94            | 22          |
| 4         | Present study | 77            | 30          |