

## FUNCTIONAL AND CLINICAL OUTCOMES OF LISFRANC INJURIES OF FOOT: A COMPARATIVE STUDY OF SURGICAL AND CONSERVATIVE MANAGEMENT APPROACHES

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### Abstract

**Background:** Lisfranc injuries are rare but potentially debilitating midfoot injuries. Effective management is critical to achieving optimal functional outcomes. This study evaluates the demographic distribution, injury classification, treatment modalities, and functional outcomes in patients with Lisfranc injuries. **Materials and Methods:** A prospective study was conducted on 30 patients with Lisfranc injuries, categorized based on Myerson's classification. Patients underwent either conservative management or surgical intervention using K-wires, CC screws, or plating. Functional outcomes were assessed using the American Orthopaedic Foot & Ankle Society (AOFAS) score, Visual Analog Scale (VAS) for pain, and range of motion (dorsiflexion and plantarflexion). Statistical analyses were performed to evaluate pre- and post-treatment improvements. **Result:** The majority of patients (93.33%) were male, with a mean age of  $37.83 \pm 11.54$  years. Road traffic accidents were the most common cause (50%). Type B2 injuries were predominant (40%). Conservative management was used in 2 cases (6.67%), while 28 patients (93.33%) underwent surgical intervention. The mean healing time was  $9.27 \pm 1.78$  weeks. Post-treatment AOFAS scores significantly improved ( $36.6 \pm 4.64$  to  $89.4 \pm 3.56$ ,  $p < 0.001$ ), and VAS scores decreased ( $8.36 \pm 0.90$  to  $2.3 \pm 0.6$ ,  $p < 0.001$ ). Plating provided the best functional outcomes, with the least movement restriction (30%). Complications were minimal, with infection being the most common (13.33%). **Conclusion:** Surgical management, particularly plating, is superior to conservative approaches in improving functional outcomes for Lisfranc injuries. Early intervention is crucial to optimize recovery and minimize complications.

## INTRODUCTION

Lisfranc injuries are relatively uncommon but represent a significant challenge in orthopedic practice due to their potential to cause debilitating long-term consequences if not managed appropriately.<sup>[1]</sup> These injuries involve disruption of the tarsometatarsal joint complex and can result from high-energy trauma, such as road traffic accidents, or low-energy mechanisms, like twisting injuries.<sup>[2]</sup> Despite advances in diagnostic techniques and treatment modalities, Lisfranc injuries remain frequently misdiagnosed or inadequately managed, contributing to poor functional outcomes.<sup>[3,4]</sup> The Myerson classification system serves as a cornerstone for categorizing Lisfranc injuries based on the pattern of disruption.<sup>[5]</sup> This classification aids

clinicians in tailoring management strategies, which range from conservative approaches to various surgical interventions, including K-wire fixation, CC screw fixation, and plating.<sup>[6]</sup> Surgical intervention is often preferred for unstable injuries, as it helps restore the anatomical alignment of the midfoot, thereby improving load-bearing function and reducing the risk of arthritis.<sup>[7]</sup>

This study aims to provide a comprehensive analysis of the clinical presentation, mode of injury, and management outcomes of Lisfranc injuries. Functional outcomes were assessed using objective measures such as the American Orthopaedic Foot & Ankle Society (AOFAS) score and Visual Analog Scale (VAS) for pain. By comparing conservative and surgical management strategies, this study seeks to identify the optimal approach for achieving

favorable clinical and functional outcomes in patients with Lisfranc injuries. Additionally, this study evaluates the complications associated with various treatment modalities and their impact on patient recovery.<sup>[8-12]</sup>

## MATERIALS AND METHODS

**Study Design:** This prospective observational study evaluated the functional and clinical outcomes of Lisfranc injuries managed through conservative and surgical interventions. The study was conducted from 1st November 2020 to 30th October 2022 in the Department of Orthopedics, Prathima Institute of Medical Sciences, Karimnagar.

**Study Population:** A total of 30 patients with Lisfranc injuries were included in the study. Patients were selected based on predefined inclusion and exclusion criteria and followed for a period of 6 months.

### Inclusion Criteria:

- Patients aged above 18 years.
- Patients who provided informed consent for the study.
- Patients diagnosed with Lisfranc injuries.

### Exclusion Criteria:

- Skeletally immature patients.
- Patients with pre-injury non-ambulatory status.
- Patients with pre-existing foot deformities.
- Patients medically unfit for surgery.

**Classification of Injuries:** Injuries were classified using Myerson's classification system into five types (Type A, Type B1, Type B2, Type C1, Type C2) based on the pattern of tarsometatarsal joint disruption. Radiographs and CT scans were used for injury evaluation, including mortise depth and second TMT joint height, to assess injury stability.

**Intervention:** Conservative Management: Stable injuries were managed with below-knee casting for 6–8 weeks. Clinical and radiological assessments were conducted biweekly. Weight-bearing was initiated at 6 weeks if stability was maintained, followed by progressive weight-bearing upon healing.

**Surgical Management:** Unstable injuries were managed surgically using one of the following methods:

**K-Wire Fixation:** 2 mm and 2.5 mm K-wires.

**CC Screw Fixation:** 4 mm cannulated screws.

**Plating:** Mini recon plates.

Patients were immobilized postoperatively in a cast for 6–8 weeks, followed by weight-bearing as tolerated. Plates were removed 4–5 months after surgery.

**Data Collection:** Clinical details, admission notes, operative notes, progress records, and follow-up outpatient records were analyzed. For patients unavailable for outpatient follow-up, phone interviews were conducted. Healing was confirmed based on:

Absence of pain on palpation or motion.

No warmth or discomfort on weight-bearing.

Radiographic evidence of articular congruity.

### Outcome Measures:

**Primary Outcomes:** Functional outcomes were measured using the American Orthopaedic Foot & Ankle Society (AOFAS) midfoot score. Pain was assessed using the Visual Analog Scale (VAS).

**Secondary Outcomes:** Range of motion (dorsiflexion and plantarflexion). Movement restriction percentages. Complications, including infections and stiffness.

**Radiographic Assessment:** Evaluated for osteoarthritis and stability at 6-month follow-up.

**Statistical Analysis:** Data were analyzed using Microsoft Office (Word and Excel) and SPSS version 26.0. Paired t-tests were used to compare pre- and post-treatment outcomes, with p-values <0.05 considered statistically significant. Results were presented in tables and graphs.

**Ethical Approval:** The study was conducted in accordance with ethical guidelines. Institutional Ethics Committee approval was obtained before the study, and informed consent was secured from all participants.

## RESULTS

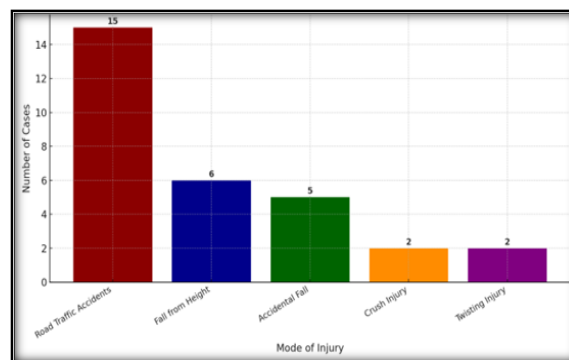


Figure 1: Mode of Injury Distribution

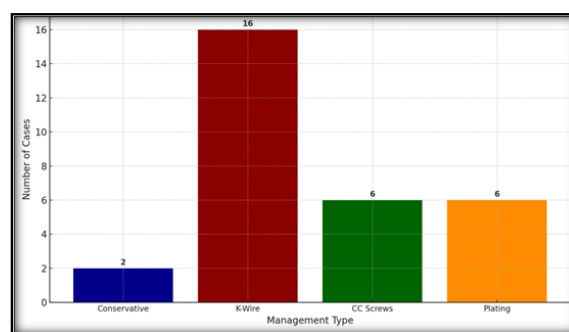
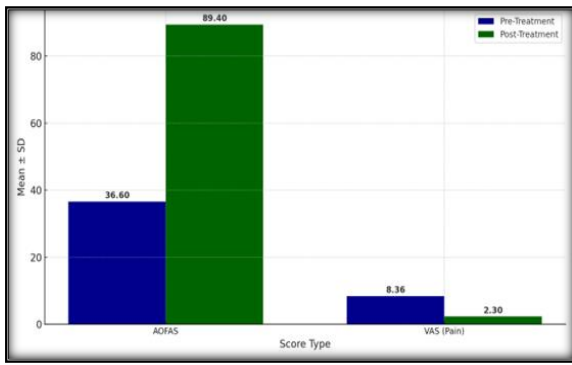
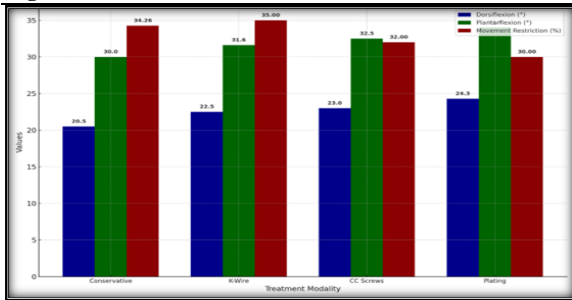


Figure 2: Management and Outcomes Distribution



**Figure 3: Pre and Post Treatment Functional Scores**



**Figure 4: Functional Outcomes by Treatment Modality**

### Images of Lisfranc Injuries of foot



**Figure 5: Pre OP X- Ray**



**Figure 6: Post OP X- Ray**



**Figure 7: Post OP Clinical Image**

**Demographic Characteristics:** A total of 30 patients with Lisfranc injuries were included in the study. The mean age was  $37.83 \pm 11.54$  years, with the majority being male (93.33%). The male-to-female ratio was 28:2, reflecting a significant male predominance. Patients managed conservatively had the highest mean age ( $42.5 \pm 3.53$  years) compared to those undergoing surgical interventions [Table 1].

**Mode of Injury:** The most common cause of injury was road traffic accidents (50%), followed by falls from height (20%), accidental falls (16.67%), and crush and twisting injuries (6.67% each). This trend reflects the high-energy nature of these injuries [Table 2].

**Injury Classification:** According to Myerson's classification, Type B2 injuries were the most frequent (40%), followed by Type B1 (30%) and Type A (16.67%). Type C2 injuries accounted for 13.33%, while no Type C1 injuries were observed [Table 3].

**Management and Healing:** Of the 30 patients, 16 (53.33%) underwent surgical management with K-wires, 6 (20%) with CC screws, and 6 (20%) with plating. Only 2 patients (6.67%) were managed conservatively. The average healing time was  $9.27 \pm 1.78$  weeks, with conservative management showing the shortest mean healing time (8 weeks) compared to surgical approaches [Table 4].

**Functional Outcomes:** The AOFAS scores improved significantly from a pre-treatment mean of  $36.6 \pm 4.64$  to a post-treatment mean of  $89.4 \pm 3.56$  ( $p < 0.001$ ). Similarly, VAS pain scores reduced from a mean of  $8.36 \pm 0.90$  to  $2.3 \pm 0.6$  post-treatment ( $p < 0.001$ ), indicating a substantial reduction in pain levels following treatment [Table 5].

**Complications:** The overall complication rate was low, with 4 cases of infection (13.33%) and 1 case of stiffness (3.33%). All infections were effectively managed [Table 6].

**Functional Assessment by Treatment Modality:** Patients treated with plating demonstrated the best functional outcomes, with a mean dorsiflexion of  $24.3 \pm 5.0^\circ$  and plantarflexion of  $34.0 \pm 5.5^\circ$ , alongside the least movement restriction (30%). Conservative management showed poorer functional outcomes, with a mean dorsiflexion of  $20.5 \pm 3.8^\circ$  and plantarflexion of  $30.0 \pm 4.7^\circ$ , and a movement restriction rate of 34.26% [Table 7].

**Table 1: Demographic Characteristics of Patients.**

Characteristic	Conservative (n = 2)	K-Wire (n = 16)	CC Screws (n = 6)	Plating (n = 6)	Total (n = 30)
Mean Age (years)	42.5 ± 3.53	36.19 ± 13.27	37.48 ± 13.96	36.92 ± 14.32	37.83 ± 11.54
Male (%)	100%	93.75%	83.33%	100%	93.33%
Female (%)	0%	6.25%	16.67%	0%	6.67%

**Table 2: Mode of Injury**

Mode of Injury	Number of Cases	Percentage (%)
Road Traffic Accidents	15	50.00
Fall from Height	6	20.00
Accidental Fall	5	16.67
Crush Injury	2	6.67
Twisting Injury	2	6.67
Total	30	100

**Table 3: Injury Classification Based on Myerson's Criteria**

Myerson Type	Number of Cases	Percentage (%)
Type A	5	16.67
Type B1	9	30.00
Type B2	12	40.00
Type C1	0	0.00
Type C2	4	13.33
Total	30	100

**Table 4: Management and Outcomes**

Management Type	Number of Cases	Percentage (%)	Mean Healing Time (weeks)
Conservative	2	6.67	8
K-Wire	16	53.33	9
CC Screws	6	20.00	10
Plating	6	20.00	10
Total	30	100	9.27 ± 1.78

**Table 5: Pre- and Post-Treatment Functional Scores**

Score	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	p-value
AOFAS	36.6 ± 4.64	89.4 ± 3.56	< 0.001
VAS (Pain)	8.36 ± 0.90	2.3 ± 0.6	< 0.001

**Table 6: Complications**

Complication	Number of Cases	Percentage (%)
Infection	4	13.33
Stiffness	1	3.33
Total	5	16.67

**Table 7: Functional Outcomes by Treatment Modality**

Modality	Mean Dorsiflexion (°)	Mean Plantarflexion (°)	Movement Restriction (%)
Conservative	20.5 ± 3.8	30.0 ± 4.7	34.26
K-Wire	22.5 ± 4.1	31.6 ± 5.3	35.00
CC Screws	23.0 ± 4.5	32.5 ± 5.1	32.00
Plating	24.3 ± 5.0	34.0 ± 5.5	30.00

## DISCUSSION

This study evaluates the functional and clinical outcomes of Lisfranc injuries managed through conservative and surgical interventions. The findings provide critical insights into optimal management strategies and highlight factors influencing recovery.

### Key Findings and Comparison with Literature

The majority of patients in this study were male (93.33%), a trend consistent with the findings of Singh et al (2021),<sup>[11]</sup> who reported that Lisfranc injuries predominantly occur in males due to high-energy trauma such as road traffic accidents.<sup>[13]</sup> The most common injury pattern in our study was Type B2 (40%), aligning with Mascio et al (2022),<sup>[14]</sup> who

emphasized the predominance of ligamentous injuries involving partial displacement in Lisfranc fractures.

Significant functional improvement was observed post-treatment in this study, particularly among surgically managed patients. The AOFAS score improved from 36.6 ± 4.64 pre-treatment to 89.4 ± 3.56 post-treatment (p < 0.001), and VAS scores decreased from 8.36 ± 0.90 to 2.3 ± 0.6 (p < 0.001). These findings align with Hu et al (2014),<sup>[10]</sup> who demonstrated the superior efficacy of surgical interventions in restoring midfoot function and reducing pain compared to conservative treatments.

Comparison of Treatment Modalities

Plating demonstrated the best outcomes among surgical techniques, with the highest dorsiflexion ( $24.3^\circ \pm 5.0^\circ$ ) and plantarflexion ( $34.0^\circ \pm 5.5^\circ$ ) alongside the least movement restriction (30%). These results are supported by Park et al (2020),<sup>[8]</sup> who highlighted the biomechanical advantages of plating in achieving stable anatomical alignment. K-wire and CC screw fixation also provided favorable outcomes, although slightly inferior to plating in terms of range of motion and movement restriction. Conservative management was limited to stable injuries and resulted in poorer outcomes, consistent with findings by Graef et al (2021),<sup>[9]</sup> who reported that conservative treatment is less effective for unstable Lisfranc injuries.

**Complications:** The overall complication rate in this study was 16.67%, with infection being the most common (13.33%). This is comparable to the rates reported by Moracia-Ochagavía et al (2019),<sup>[13]</sup> who highlighted infection and stiffness as common complications following Lisfranc injury treatment. Early implant removal and meticulous postoperative care in our study likely contributed to minimizing these complications.

**Clinical Implications:** Our findings emphasize the importance of accurate diagnosis, prompt intervention, and appropriate selection of surgical techniques based on injury stability and classification. Li et al,<sup>[12]</sup> (2020) also emphasized that surgical management tailored to the specific injury pattern yields superior functional recovery and reduces long-term complications.

#### Limitations

The study has certain limitations, including a relatively small sample size and a short follow-up period of 6 months. Longer follow-up is required to assess the development of post-traumatic osteoarthritis and other long-term outcomes. Additionally, the study was conducted at a single center, which may limit the generalizability of the findings.

## CONCLUSION

This study highlights that surgical management, especially with plating, significantly improves functional outcomes in Lisfranc injuries compared to conservative treatment. Patients managed surgically demonstrated higher AOFAS scores ( $89.4 \pm 3.56$ ) and better range of motion, with plating showing the least movement restriction (30%) and highest dorsiflexion ( $24.3^\circ \pm 5.0^\circ$ ). Pain reduction was also more pronounced in the surgical group, as indicated by lower VAS scores ( $2.3 \pm 0.6$ ). Conservative management was associated with poorer outcomes and limited utility for unstable injuries. Early surgical intervention tailored to injury type is crucial for

optimal recovery and minimizing long-term complications.

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