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RESEARCH ARTICLE

CLINICORADIOLOGICAL AND FUNCTIONAL OUTCOMES OF LISFRANC INJURIES MANAGED BY DIFFERENT TREATMENT MODALITIES IN A TERTIARY CARE CENTRE

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Abstract

Background: The lisfranc injuries are and have poor functional outcomes. The aims of this study was to compare the functional and radiological outcomes of lisfranc injuries by different treatment modalities.

Methods: A study of 46 patients treated for a Lisfranc injuries, over a period of 6 years at a tertiary care centre was performed. Of these 6 were managed conservatively. 22 by transarticular screws alone, 7 by K wires only and remaining 11 by combination of transarticular screw and K wire. The primary outcome measures included the American Orthopaedic Foot and Ankle Society score, and the secondary outcome was the radiological Wilppula classification of anatomical reduction.

Results: Road traffic accidents (RTA) was the most common mode of trauma in the study. The average length of followup after surgery was 29 months and mean AOFAS score achieved was 73.12. The analysis of radiological long-term data according to Wilppula showed 32 patients with good results, 9 with fair results and 5 with poor results.

Conclusion: We concluded in our study that better functional outcomes were seen with anatomic reduction, independent of the fixation technique.

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Introduction:-

The Lisfranc joint complex describes the tarsometatarsal joints (TMTJ) and the ligamentous attachments that provide structural support to the transverse arch of the midfoot.[1] Acute injuries to the tarsometatarsal (TMT) or Lisfranc joint are rare accounting for 0.1% to 0.4% of all fractures and dislocations. Despite improvements in diagnosis, missed or overlooked injuries are common. Especially the isolated pure ligamentous TMT instability is misdiagnosed in up to 20%[2]. These injuries can have devastating consequences and are often associated with poor functional outcomes and high rates of disability due to arch collapse and post traumatic arthritis.[3] Classically, open reduction with screw fixation has been the gold standard for the first and second TMT joints, while for the fourth and fifth TMT joints, K-wires are commonly used.[4] While diagnosing Lisfranc injury if clinical suspicion is present after what appear to be negative plain radiographs, computed tomography (CT) or magnetic resonance imaging (MRI) can be performed. CT scanning will identify minor subluxations and subtle fractures not found on plain X rays and can serve as a valuable preoperative planning tool, especially if 3D imaging is available. MRI is particularly helpful in non-displaced or minimally displaced injuries as it is able to identify bone edema and/or

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individual ligament damage [5].MRI has a sensitivity and predictive value of 94% when identifying disruption of the LF ligament complex [6].

In the present study we have studied Clinicoradiological and functional outcomes of lisfranc injury managed with different methods in our centre.

Material And Methods:-

It is a retrospective, observational study of patients with Lisfranc injury who were managed operatively in Government Medical College, Jammu during the study period between March 2015 to March 2021. Patients with lisfranc injuries were enrolled in the study after fulfilment of the inclusion and exclusion criteria and taking proper consent. The study was conducted after approval by Institutional Ethical Committee.

Inclusion criteria were age between 20 -80 years, skeletal maturity and open reduction and internal fixation of a Lisfranc joint injury. Indications for surgery were instability, displacement of at least 1mm any plane, and purely ligamentous injury. Stability was assessed on stress radiographs or fluoroscopy, with the examiner looking for at least 1mm of malalignment of the medial column line [7] and/or loss of the colinear relationship of the second metatarsal and the middle cuneiform on the anteroposterior radiograph and of the fourth metatarsal and the cuboid on the oblique radiograph[8].and /or fracture of base of second metatarsal.

Patient were excluded from the study if, age was less than 20 years, were lost to follow-up or uncontactable, or had Charcot or inflammatory arthropathy and if were not willing to participate in the study.

We found from the MRD database that 83 patients were surgically treated for lisfranc injury during the study period. They were contacted by telephone. 37 were not available; 20 could not be contacted by telephone, 12 of them had inadequate medical records, and 5 were not willing to participate in the study. Hence, all of them were excluded from the study. Remaining 46 patients(n=46) were enrolled in the study and their parameters were studied. All patients gave informed consent for participation in the study. Patient data including gender, age, smoking habits, diabetic status, trauma mechanism, open or closed injury, treatment modality, function and radiological course, post-operative complications and follow-up data were collected.

Patients who were managed conservatively, were kept on POP slab. Adequate limb elevation was given and once the swelling subsided it was converted to cast. Rehabilitation protocols were same for operative as well as non operative group.

Operative Procedure

Each patient was given prophylactic dose of antibiotic pre operatively. All patients were operated under spinal anaesthesia. In case of open injuries through wound wash and debridement was done before proceeding for fixation of lisfranc injury. A universal dorsal approach was used, centered between the second and third metatarsals, providing access to the second and third TMT (Tarsometatarsal) joints. Separate dorsal incision was used for the fourth/fifth TMT joint and a medial incision for the first TMT joint. Adequate care was taken to protect the branches of the superficial and deep peroneal nerve and the dorsalis pedis artery. The second TMT joint was reduced first as this was considered the key for the reduction and then the medial TMT and lateral TMT joints were reduced. Initially, K wires were inserted to hold the reduction and then 4.0 mm Cannulated screws were inserted. The remaining TMT joints were then screened for instability. Fourth and fifth TMT joints were stabilized by K wires, if needed. Patients who had very poor skin and extensive swelling despite adequate elevation and were treated with open reduction and K wires fixation of all five TMT joints instead of screws.

Postoperatively, all patients were kept nonweight bearing in a POP slab for 6 weeks followed by progressive weight bearing for the next 6 weeks in an aircast boot. Sutures were removed after 14 days post operatively and K wires were removed after 6 – 8 weeks. All patients were referred for physiotherapy at 6 weeks. Patients were followed up in the OPD at regular intervals with radiographs.

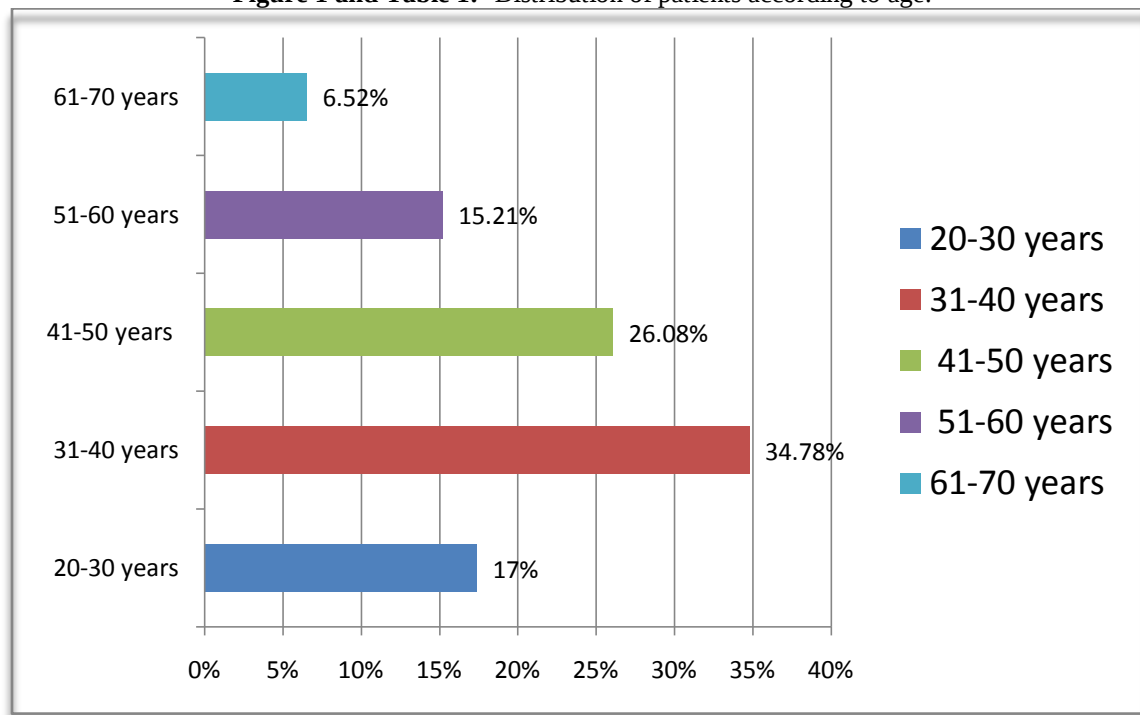
Functional outcomes were measured by the American Orthopaedic Foot and Ankle Society (AOFAS) midfoot score[9]. The AOFAS score is based on a scale of 0 to 100 points, with 100 points indicating an excellent or maximum outcome. Long term radiographical data were divided as good, fair and poor results according to Wilppula.[10]. Using this system a good anatomical reduction is described as a good overall shape of the foot, with a

diastasis between the 1st and 2nd metatarsal bases < 5 mm and the presence of slight or no arthrosis. A fair anatomical reduction is described as a 1st and 2nd metatarsal base diastasis of 6 mm to 9 mm and slight or moderate arthrosis. Finally, a poor anatomical reduction is defined as marked deformity (e.g. cavus, abduction or adduction, shortening, or 1st metatarsal dislocation), with a diastasis between the 1st and 2nd metatarsal bases of > 10 mm and moderate to severe arthrosis.

Results:-

Out of 46 patients included in study , 35 were male (76.08%) while 11 were female(23.91%). Mean age of injury being 38.2 years (23-64 years). Distribution of patients according to age is depicted in Figure 1 and Table 1. Right side was injured in 25 patients (54.34%) while 21 patients(45.65%) had injury to left side .Road traffic accidents(RTA) was the most common mode of trauma accounting for 36 cases (78.26%) followed by fall accounting for 8 cases(17.39%) and two cases(4.34%) of assault .12 patients(26.08%) had sustained open injury while remaining 34 patients(73.91%) had closed injury . 9 patients (19.56%) had some associated injury other than the lisfranc injury . Of all the patients studied 12(26.08%) were smoker and 9(19.56%) were diabetic ,4(8.69%) were hypertensive while 3 (6.52%)of them suffered from both diabetes as well as hypertension .

Figure 1 and Table 1:- Distribution of patients according to age.



Age group	No. of patients	Percentage (%)
20-30 years	8	17.39
31-40 years	16	34.78
41-50 years	12	26.08
51-60 years	7	15.21
61-70 years	3	6.5

Of 46 patients in the study group , 6(13.04%) were managed conservatively by POP slab which was later on converted to cast . 22 patients(47.82%) were managed by transarticular screws alone , 7(15.21%) were managed by K wires only and 11(23.91%) by combination of transarticular screw and K wire as shown in Table 2. 33(71.73%) out of 46 patients were operated with in 2 weeks while 13(28.26%) were operated after 2 weeks . Patients were operated on average 10 days after injury . Mean surgical time was 76 minutes . Mean blood loss was 90 – 120 ml .Mean time of hospital stay was 5-7 days .

Table 2:- Different methods of management and their respective AOFAS and Wilppula scores.

Management	No. of patients	Percentage	Mean AOFAS Score	Mean WilppulaScore
Conservative	06	13.04%	76.4	73.8
Transarticular(TAS) screw only	22	47.82%	74.2	73.4
K wire fixation only	07	15.21%	73.6	73.2
Trans articular screw and K wire fixation	11	23.91%	75.6	73.8

The followup period varied from 12 months to 64 months, and the average length of followup after surgery was 29 months (2.4 years). 13 patients had more than 4 years of followup and 10 patients had at least 1 year of followup at the time of their last review.

Table 3:- Mean follow up of patients managed by different methods of fixation.

Management	No. of patients			
	1 year follow up	2 year follow up	3 year follow up	4 year follow up
Conservative	00	00	02	04
Transarticular(TAS) screw only	04	06	08	04
K wire fixation only	02	02	01	02
Trans articular screw and K wire fixation	04	02	02	03
	Total = 10	Total =10	Total =13	Total =13

7 patients(15.21%) had radiological evidence of post traumatic osteoarthritis after operative intervention out of which 3(6.52%) were symptomatic . Out of 46 patients studied , 3(6.52%) complaint of hardware symptoms , 4 patients(8.69%) had superficial infection which resolved upon taking culture specific antibiotics. 3 patients(6.52%) had loss of reduction and 4 patient(8.69%) complaint of transient numbness in foot which resolved spontaneously over a period of 5-6 weeks post operatively. Secondary arthrodesis was done in 3 patients(6.52%) while 2 patients(4.34%) had taken injection in TMT joint for pain relief. Table 4 represents different parameters studied.

Mean AOFAS score was 73.12 (55-93). The analysis of radiological long-term data according to Wilppula showed 32 patients with good results, 9 with fair results and 5 with poor results. Mean AOFAS Score of patients managed by different fixation methods is depicted in table 5 and figure 2.

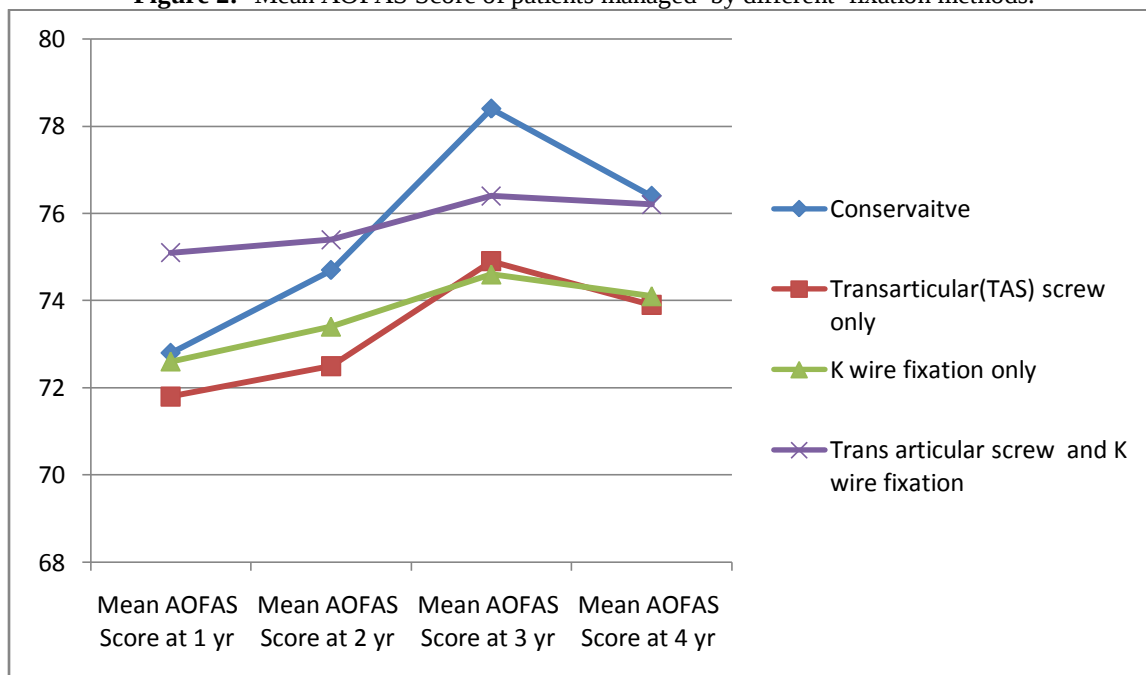
Table 4:- Various parameters studied.

Parameter studied	No. of patients	Percentage
Gender		
Male	35	76.08%
Female	11	23.91%
Mean age at injury	38.2 years (23 – 64 years)	
Side		
Right	25	54.34%
Left	21	45.65%
Bilateral	00	0%
Smoker	12	26.08%
Comorbidity		
Diabeties	09	19.56%
Hypertension	04	8.69%
Both diabetes and hypertension	03	6.52%
Hypo/hyperthyroidism	00	0%
Type of injury		
Open	12	26.08%
Closed	34	73.91%
Mode of Injury		

RTA	36	78.26%
Fall	08	17.39%
Assault	02	4.34%
Associated injury	09	19.56%
Mean time to surgery		
< 2 weeks	33	71.73%
>2 weeks	13	28.26%
Average waiting period for surgery		10 days
Mean surgical time		76 minutes
Mean blood loss		90 – 120 ml
Mean time of hospital stay		5-7 days
Management		
Conservative	06	13.04%
Transarticular(TAS) screw only	22	47.82%
K wire fixation only	07	15.21%
Trans articular screw and K wire fixation	11	23.91%
Mean AOFAS Score		73.12 (55- 93)
Wilppula		
Good	32	69.56%
Fair	09	19.56%
poor	05	10.86%
Complications encountered		
Hardware symptoms	03	6.52%
Superficial infection	04	8.69%
Deep infection	00	0%
Loss of reduction	03	6.52%
Implant failure	00	0%
Transient numbness	04	8.69%
Second procedure		
Secondary arthrodesis	03	6.52%
Implant removal	00	0%
TMT joint injection	02	4.34%
Radiological evidence of post traumatic osteoarthritis		15.21%
Symptomatic osteoarthritis	03	6.52%

Table 5:- Mean AOFAS Score of patients managed by different fixation methods.

Management	Mean AOFAS Score at 1 yr	Mean AOFAS Score at 2 yr	Mean AOFAS Score at 3 yr	Mean AOFAS Score at 4 yr
Conservative	72.8	74.7	78.4	76.4
Transarticular(TAS) screw only	71.8	72.5	74.9	73.9
K wire fixation only	72.6	73.4	74.6	74.1
Trans articular screw and K wire fixation	75.1	75.4	76.4	76.2
	Mean =73.07	Mean =74.0	Mean =76.07	Mean =75.15

Figure 2:- Mean AOFAS Score of patients managed by different fixation methods.**Discussion:-**

In the present study of 46 patients, we found that males were more commonly involved than females. Right side was commonly involved than left. In our study, RTA was the most common mode of trauma which is supported by the study done by Pereira CJ et al [11]. Mean age of injury in our study was 38.2 years. It was 40.1 years and 31.53 years in study done by Teng AL et al [12] and Pereira CJ et al [11] respectively.

Table 6:- Comparison of results with previous studies.

	No. of patients	RTA	POST COMPLICATION	OP	AOFAS Score
Jeifreys T et al (1963) [14]	22	9	8	-	-
Kuo R S et al (2000) [13]	48	20	12	-	80.2
Yuen J S et al (2001) [15]	11	-	2	-	-
Pereira CJ et al (2008) [11]	19	7	8	-	77.5
Present study	46	36	10	-	73.12

Mean AOFAS Score in our study was 73.12 which is slightly less than the AOFAS Score achieved in studies by Kuo R S et al (2000) [13] and Pereira CJ et al (2008) [11] as shown in table.

Wang et al [16] in a retrospective comparative study done on 34 patients comparing functional outcomes in patients with Lisfranc fracture dislocations treated with primary arthrodesis or ORIF concluded that during medium-term follow-up, mean AOFAS scores were comparable between groups (85 versus 84.3).

A prospective randomized study by Ly and Coetzee [17] comparing primary arthrodesis and ORIF for purely ligamentous Lisfranc injuries showed significantly improved mean AOFAS scores (88 versus 68.6; $P < 0.005$) at short- and medium term follow-up.

This study has a number of potential limitations. There was high proportion open injuries in our study. This is likely due to the severity of the injury at our level 1 trauma centre. Furthermore, younger patients may be less compliant with postoperative instructions due to social/psychological factors. Another consideration, although likely less of a factor could be the added stress placed on the implants in a younger, more active cohort.

Conclusion:-

We found that favorable long term outcomes depend on the quality of reduction emphasizing the importance of quality initial reduction on long-term results. Better functional outcomes were seen with anatomic reduction, independent of the fixation technique. However, there was no control group in our study which is one of other limitation of our study.

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Conflict of interest:

None declared.

Ethical approval:

The study was approved by the institutional ethics committee.

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