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Study of Functional Outcome in Distal Tibia Fracture Managed with Multidirectional Nailing vs Plating

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ABSTRACT
Distal tibia fractures are more common in young adults mostly caused due to high energy, rotational forces or direct bending forces. They constitute of up to 8% of the tibial fractures and less than 12% Of lower extremity fractures. Management is challenging because it is subcutaneous and it has precarious blood supply with soft tissue injury. To compare the outcome of extra articular fracture distal tibia managed with multidirectional Interlock nailing and plating. Single centre prospective and retrospective study was conducted in tertiary care centre in Maharashtra during the period of June 2020 to December 2021. Both sex patients were included in the study. Follow up was 18 months. Skeletally immature patients, patients with comorbidities like diabetes mellitus were excluded. AOFAS score was used to calculate functional outcome. Mode of trauma in both nailing and plating groups were road traffic accidents (75%) followed by domestic accidents (25%). The AOFAS score was slightly better in nailing group(p value significant). Post operative Infection found in 28% of patients in plating group. Mean of the functional score was found better in nailing group. Result of the study shows that these modalities can be used for treatment of distal tibia fractures. Time required for union was shorter in intra medullary nailing group. In nailing group, functional ankle scores were higher. We concluded that Intramedullary interlocking nailis a satisfactory method for managing distal tibia fractures with good functional outcome and higher union rate.

INTRODUCTION

Distal tibia fractures arelow/high energy bending or rotation forces. These fractures constitute upto 8 % of tibial fractures and less than 12% Of lower extremity fractures. Management is little bit challenging as the bone is subcutaneous and with precarious blood supply with soft tissue injury. Distal tibia fracture is associated with blisters and massive swelling due to subcutaneous location. Skin condition is very important to determine the plan of management and timing of intervention. The aim of treating includes restoring mechanical axis, near full range of motion and joint stability. It is a difficult task to manage such cases looking towards condition of soft tissue at the time of trauma. Plan of management includes closed reduction and multidirectional intra medullary interlock (IMIL) nailing and open/closed reduction and internal fixation with distal tibia plating/ MIPO (minimally invasive plate osteosynthesis) technique. Fixation of such cases depends on local skin condition, fracture pattern and bone quality. In this study, we will compare and evaluate the results of fixation with multidirectional Interlock nailing vs plating.

Aims and objectives: To compare the outcome of extra articular distal tibial fractures managed with multidirectional Interlock nailing and plating.

MATERIALS AND METHODS

Single centre prospective and retrospective study was conducted in tertiary care centre in Maharashtra during the period of June 2020 to December 2021. Both sex patients were included in the study. Follow up was 18 months. Skeletally immature patients, patients with comorbidities like diabetes mellitus were excluded. AOFAS score was used to calculate functional outcome.

Methodology: All fresh distal tibia fracture patients were admitted and followed for 18 months with serial x-rays taken at 6 weeks, 3 months, 6 months, 12 months and 18 months. The choice of surgery for the patients for whom which surgery will be done was decided based on the fracture pattern. After the surgery, postop x-rays were done immediately. All patients were started with static quadriceps strengthening exercises, active range of motion of ankle and knee. Check dress was done on the postoperative day 3. Signs of infections was checked. Broad spectrum antibiotics were given to all post op patients for 2 days. Patients were called on day 15 for suture removal and to check signs of infection. Nil weight bearing followed by partial weight bearing was advised until signs of healing was seen radiologically or clinically. Full weight bearing was allowed after that. All the patients were followed up and evaluated on basis of the American Orthopaedic Foot and Ankle Society (AOFAS).

RESULTS

Descriptive statistics like standard deviation (SD) and mean for variables, percentages and frequencies were calculated for categorical variables and determined. Using Chi Square test, the association between variables were analyzed. To, compare mean of quantitative variables between study groups, Unpaired t test was used. Bar diagram and pie charts were used for visual representation of the data. Level of significance was set at value 0.05.

The mean age of patients in nailing group was 39.20 and in plating group was 43.07. The minimum age was 27 years and maximum age was 71 years (Table 1).

Out of 6 females 4 (26.7%) were in nailing group and 2 (13.3%) were in plating group and out of 24 males 11 (73.3%) were in nailing group and 13 (86.7%) in plating group (Table 2).

As compare to plating group, nailing group didn't get any local skin complication.

In plating group, 3 patients (20%) out of 15 patients got local skin complications, which was treated with intervention like wound wash and secondary suturing (Table 3).

Functional outcome in this study was calculated with AOFAS (The American Orthopaedic Foot And Ankle Score) (Fig. 1).

Scoring was done at regular intervals like 6 weeks 3 months 6 months 12 months 18 months. It was observed over 18 months that functional outcome was significant (p-value significant).

Table 1: Comparison of age between study groups (N = 30)

	Groups			
	Nailing (n = 15)		Plating (n = 15)	
Age (years)	No.	Percentage	No.	Percentage
≤30	4	26.70	2	13.30
3140	6	40.00	4	26.70
4150	3	20.00	6	40.00
5160	1	6.70	2	13.30
>60	1	6.70	1	6.70
Mean SD	39.20	12.16	43.07	11.17

Chi-square test, p = 0.663, Not significant

Table 2: Comparison of gender between study groups (N = 30)

	Groups			
	Nailing (n = 15)		Plating (n = 15)	
Gender	No.	Percentage	No.	Percentage
Female	4	26.7	2	13.3
Male	11	73.3	13	86.7

Chi-Square test, p = 0.361, Not significant

Table 3: Comparison of local skin complications between study groups N = 30

	Groups			
	Nailing (n = 15)		Plating (n = 15)	
Local skin complication	No.	Percentage	No.	Percentage
Superficial Infection			3	20.0
None	15	100.0	12	80.0

Chi-square test, p = 0.068, Not significant

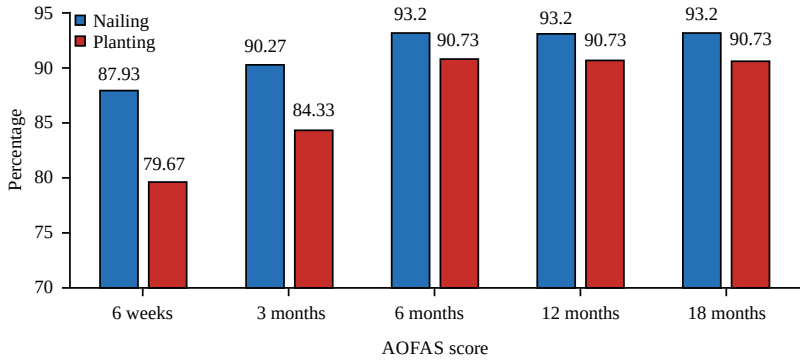

Fig. 1: Comparison of AOFAS score

Fig. 2: Local skin complication

Local skin complication in plating group. It was managed with wound wash and secondary closure (Fig. 2).

DISCUSSION

Age and sex wise distribution: Our study shows that almost half patients that is 15, have undergone plating procedure, they were from 41-50 years age which is 40% and 4 (26.7%) from 31-40 years age group. From those patients who have been managed with Intra medullary nailing, majority were from 31-40 years age, which is 6 (40%) and from less than 30 years age group it was 4 (26.7%).

Mean age from Intermedullary nailing group was 39.20±12.16 years while mean age from plating group was 43.07±11.17 years. The difference in mean age was found to be not significant (p>0.05)

Mahendra and Singh[1] Group A (plating) had included 20 patients (male 12, female 8) with mean age of 41.90±15.27 years and Group B (intramedullary nailing) include 25 patients (male 16, female 9) with mean age of 41.04±14.07 years which says that the injury is more common in middle age group. There was no statistical difference for age between these groups. Retrospective study of 113 patients in which extra articular distal tibial fractures treated with either plating or Interlocking nailing, Vallier *et al*.[2] reported the mean age to be 39.1 years. All of these observations were comparable to our study.

Saji *et al*.[3] had included 30 patients in his study, out of which 25 were males (83.3%) and 5 were females (16.7%) with an average age of 37 years.

Baral and Kandel[4] included 42 cases with minimum followup of one year, during which period all cases got radiological signs of union. The mean age of patients in the intra medullary interlock nailing group

and plating groups was 37.38 and 46.116 years, respectively, with a standard deviation of ±12.188 and ±16.116 respectively.

Shreekantha *et al*.[5] included 30 patients. The duration of followup was from 9 to 22 months (average 14.1 months) which had 20 men (66.67%) and 10 women (33.34%) with age range from 21 to 70 years old, with an average age of 40.9 years.

In his study, males were affected predominantly accounting for 83.3% compared to females, which was 16.7%.

Jafarinejad *et al*.[6] series had incidence comparable to our study, with males being 88.4%.

This suggests that males are more commonly involve in outdoor activities and drive a vehicle that's relatively more prone to accidents and trauma. It was observed that in Indian setup, males do more outdoor activities which leads to more chances of them getting trauma and fractures.

Distribution according to mode of injury: Most common cause for the trauma was road traffic accident in 12 (80%) and 13 (86.7%) in nailing and plating group respectively. The statistical difference in cause of injury was not found significant (p>0.05).

The incidence of injury due to RTA was almost comparable to the series of Pawar *et al*.[7] (60%) and Holagundi *et al*.[8] (73%).

Vaza *et al*.[9] had also found road traffic accident as most common mod of injury in both groups.

Shreekantha *et al*.[11] also observed that high energy trauma has caused most of the fractures.

Mahendra and Singh[1] observed that road traffic accident was primary modeof injury in patients (67%).

The reason of high incidence of RTA can be attributed to increased numbers of vehicle, overcrowding, poor road condition and ignorance of traffic rules. Fall from height and assault also contributed to the causes of injuries.

Distribution according to side involved: Right side was involved in both groups (40%, 66.7%) as against left side (60% and 33.3%), respectively in nailing and plating group. The difference in the proportions were not significant (p>0.05).

The american orthopaedic foot and ankle score (AOFAS): Functional outcome was measured with the help of AOFAS score in our study and it was statistical significant with p<0.05.

Fang *et al*.[11] in his study didn't find it significant according to AOFAS.

Mean surgery time: Mean surgical time for Intra medullary nailing was 92.00±9.96 minutes and for plating group it was 118.67±13.02 min. The difference in mean time duration was found to be significant with p<0.05.

It means average time required for surgery for intermedullary nailing method was less as compared to plat in method.

It is comparable to studies done by Li *et al*.[12] (2012) and Guo *et al*.[13] (2010) which was 60 min and 81.2 min in nailing group and 70 min and 97.9 min in distal tibia plating group respectively.

Mahendra and Singh[1] found that mean surgical time in group treated with plating was 94.50±10.11 min compared to group managed with nailing which was 79.00±5.59 min and it was found to be statistically significant (p<0.05)

Duration of immobilisation: Partial Weight bearing in nailing group was started after 6.47±1.55 weeks while in patients with plating group was 9.87±2.20 weeks. Difference in the mean time duration was found as significant statistically (p<0.05).

It means it can be summarised as nailing group have started early weight bearing as compared toplating group (Table 4).

Mahendra and Singh[1] observed that mean time for partial weight bearing inplating group was 13±6.34 weeks and in nailing group was 12±2.14 weeks (t-value 0.15, p-value >0.05).

Saji *et al*.[3] found that the mean time for starting partial weight bearing in nailing group was 4.6±1.07 weeks compared to plating group which was 6.70±1.33 weeks and was statistically significant (9<0.0001).

Signs of union: In this study we observed that the mean weeks for union of fracture after surgery from nailing group was 21.40±1.12 weeks and in plating group it was 23.40±6.19 weeks. The difference in mean time duration was not significant(p>0.05)

This duration observed here was similar to studies done by Li *et al*.[12] (21.3±3.5 in nailing group and 23.1±3.6 in patients managed with plating).

Vaza *et al*.[9] had reported 23.45 weeks and 26 weeks in nailing and plating group respectively. Pawar *et al*.[7] found that the time of radiological union was 17.43 weeks and 21.40 weeks in nailing group and plating group respectively, which wasn't statistical significant (p>0.05).

Revision surgery/intervention for complication: Postoperative complication like delayed union, wound infection with dehiscence were found in plating group

Table 4: Average time for partial weight bearing

Author	Year	Interlocking (weeks)	Plating (weeks)
Present study	2023	7.18± 1.1	9.46± 2.22
Pawar *et al*.[7]	2014	4.4	7.07
Vaza *et al*.[9]	2014	7.6	9.5
Mahendra and Singh[1]	2017	12±2.14	13±6.34
Saji *et al*.[3]	2017	4.6± 1.07	6.70± 1.33

but not in nailing group. Out of 15 in plating group 3 patients required revision surgery in the form of woundwash + secondary suturing.

In the study of Guo *et al*.[13], total of 10 patients (8.8%) with complications such as nonunion and delayed union, from which 8 cases (12%) were from nailing group and 1 case (2.7%) was from the plating group.

Vallier et al.[2] observed 8 patients with non union/ delayed, from which 5 and 3 were from nailing and plating group respectively.

Mahendra and Singh *et al*.[1] found that skin infection occur over medial malleoli leading to hardware exposure in 2 patientand prominence of implant with mild pain around the malleoli was found in 6 patients (30%) in plating. Deep infection occurred in 1 patient in plating group which was managed with debridement and secondary suturing with prolong antibiotics. Superficial infection found in 2 patients in plating group which was managed with antibiotics and dressing. No patients in nailing group has showed signs of infection. In nailing group, 2 patients had diffuse and mild pain around medial side of leg over screw head and 7 patients had anterior knee pain and discomfort while kneeling (28%).

Saji *et al*.[3] observed that deep infection in 1 patient (4.76%) and superficial skin infection in 3 patients (14.28%) was seen in patients in plating group and 1 patient (4.76%) in interlock nailing group.
Other similar studies by Nork[14], Guo[13], Bahari *et al*.[15] and Fang *et al*.[11] had shown similar complication pattern.

CONCLUSION

Distal tibia fractures are common injuries of lower limb which occurs mostly due to road traffic accidents fall. Due to proximity to ankle joint and subcutaneous nature, its management is troublesome.

Multidirectional interlock Nailing has the advantage of early union of the fracture, early weight bearing, shortened operating time and decreased wound problems causing decreased morbidity implant related problems.

Nailing has advantages likeless invasive surgery, mean operating time, partial and full weight bearing time and union time.

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