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A comparative study of distal tibia fracture treated with locking compression plate (LCP) versus expert tibia nail (ETN) - A prospective study

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Abstract

Objective: Distal tibia fractures can present a management challenge due to their instability, subcutaneous location and precarious blood supply. This study is conducted between two methods, distal tibia fracture treated by locking compression plate and expert tibia nail to compare functional outcomes and complications.

Material and Method: The study conducted from September 2017 to September 2019. 60 patients with distal tibia extrarticular close fracture AO type 43A were randomly selected which was admitted to trauma center JLN medical college ajmer. 30 of them were treated with locking compression plate and rest 30 with expert tibia nail. Patients were followed up for 12 months and evaluated by Olrued & Molander scoring system.

Results: The mean age of patients was 48.4 years and majority were male (55%). Majority of patients had associated fibula fracture 83.33%. Mean time for surgery was 74.63 min in LCP which was significantly less (P value = 0.00252) in ETN 61.76 min. Average time for union 18.46 weeks in ETN compared to 22.46 weeks in LCP which was significant (P value = 0.001698). Average time for full weight bearing in ETN was 10.6 weeks and in LCP was 13.56 weeks which was significant less in ETN (P value 0.00356). The Olrued & Molander score was significantly higher (P value 0.0486) in ETN. In plating 5 patients showed superficial skin infection, 3 deep infection, 2 skin necrosis and implant exposure & 5 had ankle stiffness whereas in nailing only 4 patients showed superficial skin infection and 9 had anterior knee pain.

Conclusion: The study found ETN was more successful in terms of shortened operating time, early weight bearing and early union, low infection rate and ankle stiffness.

Keywords: distal tibia fracture, locking compression plate, expert tibia nailing

Introduction

Leg bone fractures come at the top because it is the most distal part of the body and is actively involved in the locomotive system [1]. Out of all the leg bone fractures, on basis of fracture location in tibia distal tibia fracture has the second highest incidence [2]. A significant number of cases are of distal tibia which are generally comminuted in nature and are unstable. As these fractures occur in proximity of weight bearing surface of ankle joint, a slight maladjustment in inclination of ankle joint may lead to permanent disability.

Management of distal tibia fracture is often more complex than the treatment of diaphyseal fracture because of its unique anatomical characteristics of subcutaneous location with precarious blood supply and proximal to ankle joint. The most important variables that affect the final outcome are type of fracture, associated soft tissue injury, the method of treatment and the quality of reduction [3, 4, 5]. Distal tibia fracture generally required operative management and can be managed by close reduction and casting, external fixation, open reduction and internal fixation by plating or LCP by MIPPO technique, intramedullary nail.

New insights in reduction techniques and fracture healing are leading to the development of a "minimal invasive percutaneous plate osteosynthesis" (MIPPO) [18]. The emphasis now lies on indirect reduction, axial alignment and stable fixation without disturbing the fracture environment and thus preserving the most of the vascularization [6, 7] and fracture hematoma, containing all necessary growth factors for bony healing.

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Intramedullary nails have been greatly improved in recent years. In the recent years shortened IM nail, In which the distal tip of a standard IM tibia nail is cut by 1cm^[8], has been developed and used to treat distal tibia fracture. The expert tibia nail (ETN) is a new kind of low, multidirectional locked tibia intramedullary nail, Its interlocking system was developed to attain increased angular stability and to enhance the axial & later stability attained by the nail fixation. The closed intramedullary nailing also has associated with significantly shorter operative time and fewer wound infection.

This study is conducted between two method, distal tibia fracture treated by locking compression plate and expert tibia nail to compare functional outcomes and complications.

Material and Method

The study was performed on a total of 60 patients admitted in Department of Orthopaedics, JLN Medical College, AJMER between Sep. 2017 to sep. 2019 after obtaining patients informed and written consent.

Adult (age more than 18 years) patient with closed extra articular distal tibia fracture as per AO classification 43A1, 43A2, 43A3, fractures extending into diaphysis (fracture within 8 to 10 cm from tibial plafond with minimum 4cm length of distal fragment) were included and All open fracture, pathological fracture, Patient unable to cooperative in post operatively due to other illness were excluded in this study.

60 patient with distal tibia extrarticular close fracture AO type 43A were randomly divided into two groups; group A (30 patient) treated by plating (LCP) and group B (30 patient) treated by nailing (expert tibia nail). Patient advised to follow up on 3rd, 6th, 12thweek and 6 month, final follow up at 1 year.

Results

This study is a prospective study to compare results of distal

tibia fracture treated with LCP by MIPPO and EXPERT TIBIA NAIL in terms of benefits, functional out comes and complication.

Duration of surgery

Table 1: Comparison of surgery duration in two groups

Duration (In Min.)	Group A(LCP)		GROUP B(Expert tibia nail)	
	No. Of Patient	Percentage	No. Of Patient	Percentage
<60	4	13.33%	14	46.66%
61-70	11	36.66%	12	40.00%
>70	15	50%	4	13.33%
Total	30	100%		100%

P Value: 0.00252.

The mean duration required for surgery was 74.63 min in group A and it was 61.76 min in group B. which is significant less in group B.

Fracture union time

Table 2: Comparison of fracture union time in two groups

Time (In Wks)	Group A (LCP)		Group B(Expert tibia nail)	
	No. Of Patient	Percentage	No. Of Patient	Percentage
12-16	3	10%	4	13.33%
16-20	9	30%	21	70%
> 20	18	60%	5	16.66%
Total	30	100%	30	100%

P Value: 0.001698

Average time taken for union of fracture in this study groups was 22.46 weeks in Group A and 18.46 weeks in Group B. There was statistically significant difference ($p < 0.05$) in the time of surgery

Complications

Table 3: Comparison of complications in two groups

Complication	Group a (LCP)		Group b(expert tibia nail)		P value
	No. of patient	Percentage	No. of patient	Percentage	
Superficial skin infection	5	16.66%	2	6.66%	P=0.2276
Deep skin infection	3	10%	0	0	P=0.0755
Skin necrosis and implant exposure	2	6.66%	0	0	P=0.1503
Angulation(5 -10 degree in any plane)	4	13.33%	8	26.66%	P=0.3329
Ankle stiffness	5	16.66%	4	13.33%	P=0.7174
Ant knee pain	0	0	9	30%	0.0011

Functional Score (Olreud-Molander Ankle score)

Table 4: Comparison of Olreud-Molander Ankle score in two groups at final follow up

OMAS	Group a (LCP)		Group b(expert tibia nail)	
	No. of patient	Percentage	No. of patient	Percentage
Good	13	43.33%	5	16.66%
Excellent	17	56.66%	25	83.33%
Total	30	100%	30	100%

P Value: 0.0486

Mean Olreud-Molander Ankle score at final follow up for Group A was 86.33 and Group B was 91.06. There was higher no of patient in excellent category in Expert tibia nail group with compared to LCP group, which is statistically significant ($p < 0.05$)

Discussion

Distal tibia fracture are common consequence of road traffic accidents. Its management is often more complex than the treatment of diaphyseal fracture because of its unique anatomical characteristics of subcutaneous location with precarious blood supply and proximal to ankle joint.

Distal tibia fracture generally required operative management and can be managed by Close reduction and casting, external fixation, open reduction and internal fixation by plating or LCP by MIPPO technique, intramedullary nail.

This study is conducted between two method, distal tibia fracture treated by locking compression plate (MIPPO) and expert tibia nail to compare functional outcomes and complications. Patient were follow up for 12 month and evaluated by Olreud & Molander scoring system^[9].

In this study male patient preponderance were more, mean average age of patients was 48.4 years. The youngest patient

was 22 years and oldest was 85 years. this average age of patients was similar to studies done by Roshan raj KM ^[10] *et al* and kumar YC ^[11] *et al*. the distal tibia fracture is more common in 40-60 years, possibly due to the male dominance in travelling and occupation in this age group.

The Mean time for surgery in LCP was 74.63 min and in ETN it was 61.76 min which was significantly less than required for plating (P value=0.00252). Our study correlates with the study conducted by Yong Li *et al.* ^[12] and Eknath *et al.* ^[13]. Roshan Raj KM *et al.* ^[10], Im GI *et al.* ^[14].

Table 5: Comparison of studies- duration of surgery

	Mean operating time (in minutes)	
	Group A (LCP)	Group B (Expert tibia nail)
Yong Li <i>et al.</i> ^[12]	90.4	76.10
Eknath D Panwar <i>et al.</i> ^[13]	70.36	57.20
Roshan Raj KM <i>et al.</i> ^[10]	98.13	72.19
Im GI <i>et al.</i> ^[16]	72	89
Our study	74.63	61.76

Time Taken for radiological Union

In our study the average time taken by the patient for fracture union was 22.46 weeks in Group A and 18.46 weeks in Group

B. non union was not seen in any patient ^[17]. The results of our study were comparable with other studies.

Table 6: Comparison of studies- radiological union time (in weeks)

	Mean time for radiological union (weeks)	
	Group A (LCP)	Group B (Expert tibia nail)
Yong Li <i>et al.</i> ^[12]	23.1	21.30
Eknath D Panwar <i>et al.</i> ^[13]	21.40	17.43
Roshan Raj KM <i>et al.</i> ^[10]	24.13	19.25
Im GI <i>et al.</i> ^[14]	18	20
Vallier HA <i>et al.</i> ^[15]	27.8	22.6
Our study	22.46	18.46

Olreud-Molander Ankle score (OMAS)

OMAS score at the final follow up showed that excellent results were achieved in 56.66% cases in Group A and 83.33% cases in Group B. Good results were obtained in 43.33% cases in Group A and 16.66% cases in Group B. poor

results not seen in any patient. Mean OMAS score at final follow up for Group A was 86.33 and Group B was 91.06. Statistically calculated P value for the OMAS score is 0.0486 which is statistically significant indicating that the function outcome was better in group B.

Table 7: Comparison of studies- Olreud-Molander Ankle score

	Group A (LCP)		Group B (Expert tibia nail)	
	Excellent	Good	Excellent	Good
Yong Li <i>et al.</i> ^[12]	73	26	65	34
Roshan Raj KM <i>et al.</i> ^[10]	50	50	87.5	12.5
Im GI <i>et al.</i> ^[14]	88.2	11.8	88.5	11.5
Our Study	56.66	43.33	83.33	16.66

Complications

Complications seen in our study included superficial and deep skin infection, skin necrosis with implant exposure, angulation, ankle stiffness. In our study superficial skin infection was more common in Plating group accounting for 16.66% infection rate, it was only 6.66% in nailing group. Deep skin infection was 10% in plating group. Skin necrosis with subsequent exposure of the implant was much more common in LCP group i.e. 6.66% cases, skin necrosis not seen in nailing group. 5 (16.66%) patients in LCP group had ankle stiffness and 4 (13.33%) patient had ankle stiffness in nailing group. Ankle stiffness ranged from restriction of ankle movement by 20-40 degrees. In our study angulation was more common in expert tibia nail group accounting for

26.66% with more number of valgus angulation, whereas It was 13.33% in LCP group. P-value by Statistical calculation was not significant in all above results. The above results are comparable to some other similar studies conducted by other authors Yong Li *et al.* ^[12] Eknath D Panwar *et al.* ^[13]. Roshan Raj KM *et al.* ^[10] Im GI *et al.* ^[14], Shan wei Yang *et al.* ^[19], Redfern DJ *et al.* ^[20]

Conclusion

Study shown that expert tibia nail is better and effective method for treating distal tibia fracture in terms of less operating time, early weight bearing, early union of fracture, decrease complication like skin infection, skin necrosis, ankle stiffness and other implant related problems.

Clinical photographs

Case 1: Expert tibia nail

Fig 1: Pre operative

Fig 2: 6 month

Fig 3: Squatting

Fig 4: Dorsiflexion

Fig 5: Planter flexion

Fig 6: Knee bending

Case 2: Locking compression plate

Fig 7: Pre operative

Fig 8: 6 month **Fig 9:** Planter flexion **Fig 10:** Dorsiflexion

Complication

Fig 11: Superficial skin infection **Fig 12:** Deep skin infection

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