

Assessment of Outcome of Distal Tibia Fractures treated by Anterolateral Plating and Medial Plating at a tertiary care centre in Central India

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Abstract

Background: There are various treatment modalities in treatment of distal tibia fractures including plating, nailing, hybrid or ring fixator, etc. But very little work has been done to show the comparison between anterolateral plating and medial plating techniques for distal tibia fractures.

Methods: We included 58 patients with distal tibia fractures treated with anterolateral plating and medial plating. Patients were randomized using odd and even number allotment system and were operated upon with stainless steel pre contoured distal tibia locking plates using either medial or anterolateral approach. The functional and radiological outcome was assessed using Olerud and Molander score at six weeks, three months, six months, and one year.

Results: There were 58 patients included in the study. The mean age in the anterolateral group was 49.26 ± 15.73 years and in the anteromedial group was 39.77 ± 13.22 years. The most common mode of injury was road traffic accident. AO 43A1 was more common type of fracture seen in the anteromedial plating group (31.42%), while 43A3 fracture was more common in anterolateral plating group (34.78%). The mean Olerud and Molander score was significantly lower in the anteromedial plating group at 6 weeks postoperatively while it was comparable between the two groups at 3 months, 6 months and 12 months.

Conclusion: Anterolateral plating technique is associated with better functional outcome at the end of three months while both the techniques showed similar outcomes at long term follow up (one year). Patient selection, timing before surgery are also important factors while planning surgery.

Keywords: Distal tibia fracture, Anterolateral plating, Medial plating, Functional Outcome

Introduction

The surgical treatment of distal tibia fractures is one of the most controversial topics as it has typical soft tissue features and variable treatment options. All the surgical techniques have some advantages and disadvantages like difficult reduction in nailing technique, high rate of infection and non union in plating technique[1,2]. There are various techniques to treat distal tibia fractures like nailing, plating, minimally invasive plating technique, etc. All these modalities help to provide a stable and strong fixation[3,4,5]. Skin and soft tissue complications, delayed union, nonunion are fairly widespread in distal tibia fractures. The main reason for these complications is reduced blood supply and thin soft tissue cover around the bone. Most of the fractures occurring in the distal tibia are high energy trauma with higher frequency of open injuries, soft tissue damage and neurovascular injuries[6]. The most common technique for distal tibia

plating is by medial approach. But there is always a risk of wound dehiscence, infection, implant prominence etc[7,8]. There is a risk of damage to the superficial peroneal nerve in medial approach which can be avoided in anterolateral approach[9]. There is a high chance of ankle joint stiffness following anterolateral plating. The plan of this study was to evaluate the outcomes of distal tibia fractures treatment with use of two dissimilar types of plate fixation

Materials & Methods

The study was carried out on 58 patients with distal tibial fractures admitted at a tertiary care institute in Central India during the study period from May 2015 to December 2019. The permission to conduct the study was taken from the Institutional Ethics Committee. All the patients coming to the hospital who sustained injury in distal leg and diagnosed with fractures of distal tibia were considered for the study. Written informed consent was taken from all the patients / relatives before considering them to be a part of the study. Patients with age >18 years, closed distal third tibia fractures with/without articular extension, AO Type 43A1; 43A2; 43B1; 43B2 and 43C1 were included in the study. Patients with pathological fractures, compound fractures, neurovascular injuries, other fractures in ipsilateral limb were excluded from the study.

All the patients who were clinically suspected to have distal third tibia fractures underwent X ray of the distal leg with ipsilateral ankle and knee joint for confirmation of the

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diagnosis. The fractures were classified according to AO classification. All the patients were planned for surgery after routine pre operative workup. Patients were randomized using even odd system and patients were operated upon with stainless steel pre contoured distal tibia locking plates using either medial or anterolateral approach. All the patients were operated under spinal anaesthesia. Out of the 72 patients considered for the study, 58 patients gave their consent to be a part of this study. Parenteral antibiotics in the form of third generation injectable cephalosporin was given 1 hour prior to surgery. Patients were given IV antibiotics for 3 days followed by oral antibiotics for 5 days. Post operative assessment was done using standard anteroposterior and lateral view X rays. Patients were started with physiotherapy on day 1 in the form of active toe movements, ankle range of motion exercises as per pain tolerance. Patients were advised physiotherapy in the form of non weight bearing mobilization for 6 weeks, later on started with partial weight bearing with support for 4-6 weeks and full weight bearing mobilization by the end of 10-12 weeks. The functional and radiological outcome was assessed using Olerud and Molander score for clinical assessment at six weeks, three months, six months, and one year. Score of more than 90 was considered to be excellent, 75-89 was considered good, 60-74 was considered fair and less than 60 was considered to be poor score.

Lack of visible bone union after six months was graded as delayed union. Angular deformation > 5 degrees visible on anteroposterior and lateral views was regarded as axial deformity of the extremity. Implant loosening or breaking, secondary arthritis of the ankle joint were also assessed using post operative radiographs.

Results

There were 23 patients in the anterolateral plating group and 35 patients in the anteromedial plating group. The mean age in the anterolateral group was 49.26 ± 15.73 years and in the anteromedial group was 39.77 ± 13.22 years. In the anterolateral plating group, there were 9 (39.1%) females and 14 (60.9%) males; while in the anteromedial plating group, there were 5 (14.3%) females and 30 (85.7%) males. In both the anterolateral and anteromedial plating groups, the most common mode of injury was road traffic accident, followed by slip fall and fall from height. Out of the total 58 patients, 38 patients had suffered road traffic accident, 8 patients fell due to slipping, 5 patients each of fall from height and while walking, 2 patients had assault injury.

Left side involvement was more commonly seen in the anteromedial plating group (57.1%), while right side involvement was more commonly seen in the anterolateral plating group (60.9%).

AO 43A1 type was the most common type of fracture seen in the anterolateral plating group (34.78%), while 43A3 type was more common in anteromedial plating group (31.4%).(Table 1)

In the anterolateral plating group, distal fibula fracture was seen in 18 patients (78.3%), while in the anteromedial plating group it was seen in 28 patients (80.0%). In most of these patients, fibula was fixed first to maintain the length and allow easy reduction of tibia fracture using plate or Rush Nail. One third tubular plate was used in all the patients who underwent plating for distal fibula fracture (Nine patients in anterolateral plating group and fifteen patients of anteromedial plating group). Fibula fracture was undisplaced in five patients (two in anterolateral plating group and three in anteromedial plating group) and was managed conservatively. There were a few patients with additional comorbidities. In anterolateral plating group, hypertension was seen in two patients, and one patient had undergone CABG. In the anteromedial plating group, hypertension was seen in four patients.

Out of the total patients included in the study, 91.3% patients of the anterolateral plating group and 85.7% patients of the anteromedial plating group did not have any postoperative complications. One (4.3%) patient each in the anterolateral plating group had rush nail removal done at 6 months and superficial infection non-union fibula. While in the anteromedial plating group, 3 patients had wound dehiscence which were managed conservatively with regular dressings and extended antibiotic course to avoid infection. Two patients had delayed discharge from suture site. Pus culture was sent in both the patients. In one patient, there was no growth. He was given prophylactic IV antibiotics for 7 days and his wound dried completely. One patient had growth of Staph. aureus. He was managed using IV antibiotics for 2 weeks followed by oral antibiotics for 4 weeks. His wound became completely dry by the end of 2 weeks itself.

In the anterolateral plating group, 73.9% patients had excellent outcome, 5 patients (21.7%) had good outcome at the end of 12 months (Figure 1). One death was reported in this group. In anteromedial plating group, 88.6% patients had excellent outcome and 4 patients (11.4%) had good outcome at the end of one year.(Figure 2) (Table 2)

Three patients in anterolateral plating group and one patient in anteromedial plating group had slight malreduction. In one patient of anteromedial plating group(43C3 type), a small beak was visible towards lateral side when follow up X ray was taken at 6 weeks. A similar beak was visible towards medial side in 2 patients of anterolateral plating group at the end of 6 weeks. One of the patients had history of jerk 8 weeks post operatively but didn't come to hospital. There was a palpable bony overgrowth on the medial side at 3 months follow up but it was painless and was left as such.

Out of the total patients, 5 patients in anterolateral plating group and 2 patients had delayed union. Two patients in anterolateral plating group had non union. Wound dehiscence was seen 3 patients of anteromedial plating group and 2 patients in anterolateral plating group.

The mean injury-operation interval in the anterolateral plating group was 5.96 ± 5.94 days and in the anteromedial

Table 1: Distribution of patients according to AO Fracture Classification

Fracture Classification	Anterolateral Plating		Anteromedial Plating	
	No.	%	No.	%
43A1	3	13.04	11	31.42
43A2	2	8.69	4	11.42
43A3	8	34.78	5	14.28
43B1	1	4.34	1	2.85%
43B2	2	8.69	5	14.28
43B3	1	4.34	1	2.85
43C1	4	17.39	5	14.28
43C2	1	4.34	2	5.71
43C3	1	4.34	1	2.85
Total	23	100	35	100

Table 2: Outcome Analysis in both the methods

Outcome	Anterolateral Plating		Anteromedial Plating	
	No.	%	No.	%
Excellent outcome	17	73.9	31	88.6
Good outcome	5	21.7	4	11.4
Fair outcome	0	0	0	0
Poor outcome	0	0	0	0
Death	1	4.3	0	0
Total	23	100	35	100

plating group, it was 5.31 ± 4.54 days. The difference was found to be statistically not significant ($p=0.643$).

The mean duration of surgery (min) in the anterolateral plating group was 72.39 ± 8.24 minutes and in the anteromedial plating group, it was 72.14 ± 7.89 minutes. The difference was found to be statistically not significant ($p=0.909$).

The mean blood loss (ml) in the anterolateral plating group was 53.48 ± 11.02 ml and in the anteromedial plating group, it was 53.57 ± 11.22 ml. The mean union time (weeks) in the anterolateral plating group was 15.26 ± 2.03 weeks and in the anteromedial plating group, it was 20.00 ± 1.61 weeks. The difference was found to be statistically significant ($p=0.001$), showing a significantly longer mean union time in the anteromedial plating group in comparison to the anterolateral plating group.

Table 3: Comparison of mean Olerud and Molandar Score at different time intervals

Time Interval	Anterolateral Plating [Mean±SD]	Anteromedial Plating [Mean±SD]	't' value	P value
6 weeks	24.78 ± 3.53	20.51 ± 6.17	3.004, df=56	0.004*
3 months	34.35 ± 4.59	37.43 ± 7.51	-1.759, df=56	0.084, NS
6 months	54.13 ± 6.15	55.43 ± 10.67	-0.528, df=56	0.600, NS
12 months	88.18 ± 5.88	89.86 ± 4.92	-1.159, df=55	0.251, NS

The mean Olerud and Molandar score was significantly lower in the anteromedial plating group at 6 weeks postoperatively ($p=0.004$), while the mean Olerud and Molandar score was comparable between the two groups at 3 months, 6 months and 12 months ($p>0.05$). (Table 3)

Discussion

Distal tibia plating is one of the most common surgeries performed all over the world with excellent outcomes. There have been modifications in the surgical techniques and minimally invasive technique are coming up to be the most suitable choice. AO has also described these techniques for percutaneous and anatomical fixation of plates [10,11]. All the surgeries involving the distal tibia fractures need proper pre operative planning. It helps to understand the fracture pattern and determine which technique would be better in that particular type of fracture. Anterolateral approach is the most popular approach for distal tibia fractures [12]. It allows sufficient exposure of the distal end of tibia as well as the fibula and pre contoured anterolateral locking plate can be easily applied for fracture fixation [13]. As there is good soft tissue coverage over the plate in this approach, there is less risk of wound dehiscence although there is a chance of damage to superficial peroneal nerve.

Medial approach is preferred in patients where the major fracture fragment is towards the medial side. In these patients, pre contoured medial distal tibia locking plates are used. In most of the cases, minimally invasive surgical technique is preferred. Contraindication to this method is poor condition of skin and soft tissue in the area of the medial malleolus.

The mean age in the anterolateral group was 49.26 ± 15.73 years and in the anteromedial group was 39.77 ± 13.22 years. This is comparable to the studies done by, Redfern et al [14] (38.3 years), Hasenboehler et al [15] (45 years) Sitnik et al [16] (43 years).

The mean duration of surgery (min) in the anterolateral plating group was 72.39 ± 8.24 minutes and in the anteromedial plating group, it was 72.14 ± 7.89 minutes. In the study done by Hasenboehler E [15], the average time of surgery was 86.6 min while it was 82 min. in study done by Borg et al. [17] and 86.2 min. in study done by Paluvadi et al. [18]

Lee et al. [19] performed a study in 2009 in which he compared operative management of fixation of distal tibia with medial and lateral plates. The study suggested that the rate of surgical site infection in medial plating was higher as compared to lateral plating ($p=0.047$). They also observed that patients with medial plate had more implant prominence as compared to lateral plates ($p<0.001$).

Piatkowski et al. in 2015 (20) compared both the anterolateral and medial plates in distal tibia fractures and they concluded that medial approach using minimally invasive technique had minimal risk and was advised

whenever possible. When there is intraarticular comminuted fracture of distal tibia and MIPO is not possible, surgical approach should depend on the type of fracture, soft tissue condition and risk factors associated with the patient.

In our study we found that 73.9% patients of anterolateral plating and 88.6% patients of anteromedial plating group had excellent outcome at 12 months follow-up. 5 (21.7%) patients of anterolateral plating group and 4 (11.4%) patients of anteromedial plating group had good outcome at 12 months.

Excellent outcome was higher in the anteromedial plating group in comparison to the anterolateral plating group. The mean AOFAS Score in study done by Paluvadi et al.[21] was 95.06 at final follow up, 83.9 in the study done by JJ Guo et al.[22] and 85 in the study done by Collinge et al.[23]

The mean Olerud and Molandar score was significantly lower in the anteromedial plating group at 6 weeks postoperatively ($p=0.004$), while the mean Olerud and Molandar score was comparable between the two groups at 3 months, 6 months and 12 months ($p>0.05$).

The outcome according to Olerud and Molandar Score was comparable between the two groups.

There were a few limitations of our study. We did not calculate the sample size as per a priori sample size calculation. Our study sample was small and so it cannot be justified to the whole community. Our study was a short term study (one year) and thus long term results in both the procedures cannot be identified.

Conclusion

Fractures of distal tibia are not easy to understand and it

requires many factors which should be considered before planning surgery and choosing the approach for surgical fixation like fracture pattern, intra-articular extension and soft tissue condition. We conclude that minimally invasive plating osteosynthesis with locking plates is a convincing treatment formula with lesser complications. when the skin is in poor condition. Earlier union was evident with anterolateral plating while excellent recovery were evident with anteromedial plate. An Anterolateral approach is chosen over anteromedial approach as it offer better soft tissue coverage and is associated with lower rate of wound healing complications by avoiding incision over subcutaneous border of tibia. Trained surgeon, efficient preoperative planning, and a well-planned postoperative protocol are important for improving the outcome.

Clinical Relevance

This study will help in identifying the various aspects of clinical outcome of distal tibia fracture operated by anteromedial approach with precontoured medial plate and anterolateral approach with anterolateral plate designed for distal tibia fracture. Both have their advantages and disadvantages. Medial approach is easier with lesser chance of neurovascular damage as compared to anterolateral approach. On the other hand, there is higher chance of wound dehiscence in medial approach since the plate is superficial as compared to anterolateral approach. The final outcome at the end of one year was almost similar in both the approaches.

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