

Functional Outcome with Surgical Management in Distal Tibia Fracture

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Abstract:

Introduction: Distal Tibia fractures continue to be one of the most controversial fractures that we treat. Most of the controversy resides in the treatment techniques, as the indication for surgery is fairly clear. Plate osteosynthesis with Minimally invasive plate osteosynthesis (MIPPO) principle for fractures of the distal tibia is often associated with good healing but infection, and hardware problems. Locked intramedullary nailing is the treatment of choice for closed fractures of the tibial shaft. For proper alignment, the nail should be centrally placed in both the proximal and distal fragments, but does not fit properly into the distal fragment of the lower third of the tibia. This places additional stress on the distal locking bolts and may lead to breakage and malalignment. **AIMS AND OBJECTIVES;** The main aim of the study is to compare the functional recovery of the patients who had distal extraarticular fracture, AO type 43A treated with Intramedullary interlocking nail and plate osteosynthesis (Mippo). Also The aim of treating a fracture is to produce a stable construct which allows early mobilisation and weight-bearing, but with minimal complications. **MATERIALS AND METHODS;** This study was done in the department of orthopedics from June 2010 to January 2013 in young age above 18yr and below 60 yr. which includes 30 patients with distal tibia fractures. Patients having fracture of distal tibia at metadiaphyseal area. 1. Extraarticular fracture, minimum of 3cm of distal fragment 2. Age above 18yrs and less than 60yr old 3. Open fracture Gustilo Anderson type 1 and type 2 **SUMMARY;** In this study 30 cases of distal tibia fracture were treated surgically with internal fixation with IMIL nail for 15 cases and ORIF plating for 15 cases. In our study of 30 cases AO Type 43, 12 cases were type A1, 9 (76%) patients operated with IMIL nail and 3 (23%) patient with plating. Type A2 we had 12 cases out of which 5 patients (41.6%) treated with nail and 7 patient (58.3%) treated with plate. Type A3 we had 6 cases. one case 16.6% treated with nail and 5 cases 83.3% with plate. We faced more malalignment (11.11%), delayed union (16.6%), non union (5.5%), secondary procedure (22.2%) done for the complication was more with nail. where as with plate group we never had significant malalignment. Had one delayed union (32 weeks) for which no secondary surgery done, One superficial skin necrosis of surgical site. **CONCLUSION;** In study of distal tibia fracture OTA/AO 43 Type A, we compared with both nail and plate surgery. We conclude that segmental alignment is difficult with nail due ankle joint is near, more distal the fragment difficult to treat with nail. Because of more complication associated with nail than plate. We conclude plating in distal tibia fracture AO 43 Type A is safe and provide better alignment than nail.

I. Introduction

The management of Distal tibia fractures has always held a particular interest for orthopaedic surgeons. Not only are these fractures relatively common, but they are often difficult to treat. The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones. Until relatively recently, surgeons had to rely on nonoperative management, and the incidences of nonunion, malunion, and joint stiffness were high. Tibial diaphyseal fractures commonly affect young males, and a severe fracture complicated by nonunion or infection often results in employment loss or other social and economic problems. These complications also place a considerable strain on the health services of all countries. Surgical stabilization of fractures and early mobilization of the patient provides best clinical outcome. Although treatment planning for fracture should be considered individually to achieve the optimal results. The effect of decision must be considered in the light of overall injury status and general condition of the patient. Distal Tibia fractures continue to be one of the most controversial fractures that we treat. Most of the controversy resides in the treatment techniques regarding the choice of implants, as the indication for surgery is fairly clear.

Some surgeons treat the fracture based on fracture pattern and level of the fracture, mostly on external fixation if soft tissue injury is found, whereas others use predominately plate fixation and some prefer nailing techniques. These areas of controversy would seem to be an excellent target for prospective clinical research. Surgeons should be warned, however, that there are reasons that answering these questions is exceedingly difficult. Fracture patterns are complex, diverse, and technically demanding and do not lend themselves well to random allocation. In addition, the factors that lead to good versus poor outcomes often depend on treatment

techniques than other factors, which can be controlled. For these reasons, new treatment techniques may need to continue to be evaluated in case series and cohort studies.

In Plate osteosynthesis for fractures of the distal tibia is often associated with delayed healing, infection, and hardware problems²⁹.with MIPPO method rate of delayed union and infection rate is come down.Locked intramedullary nailing is the treatment of choice for closed fractures of the tibial shaft^{31,32}.For proper alignment, the nail should be centrally placed in both the proximal and distal fragments^{4,29},but most of the time does not fit properly into the distal fragment of the lower third of the tibia which leads complications. This places additional stress on the distal locking bolts that may lead to breakage and malalignment.Intramedullary nailing of more distal fractures is possible, but the ability to maintain a mechanically stable reduction becomes more difficult¹⁰. We assessed the results of intramedullary nailing and plate osteosynthesis for fractures of the distal tibia and fibula.

II. Aims And Objectives

The main aim of the study is to compare the functional recovery of the patients who had distal extra articular fractureAO type 43A treated with Intramedullary interlocking nail and plate osteosynthesis.Also The aim of treating a fracture is to produce a stable construct which allows early mobilization and weight-bearing, but with minimal complications.some study shown that patients with a distal metaphyseal fracture of the tibia would recover better after closed IMN than after open reduction and internal fixation with plating^{3,5}. We also compared the operating time, imaging time, rate of wound problems, the time to union of the fracture and mobility after one year.

And also to assess incidence of distal tibia fracture, To study the better modality of surgical treatment various factors affecting the functional outcome, study complication associated with each surgical treatment.

III. Classification

Classification systems have been devised to describe more accurately the wide range of distal tibial fractures. The AO/OTA classification system provides a comprehensive description of distal tibial fractures. **AO\OTA 43Type A** fractures are extraarticular distal tibial fractures, which are subdivided into groups A, B, and C, based on the amount of metaphyseal comminution and intra articular extension.In type A again subdivided into ,43A1 simple extraarticular fracture. 43A2 metaphysial wedge,43A3 metaphysial comminution.

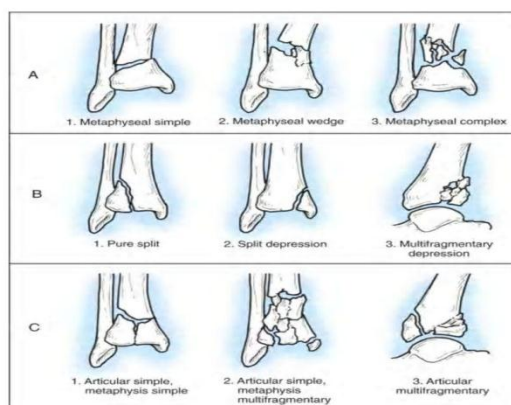


Fig. 51-14 Classification of Orthopaedic Trauma Association. A, Tibia/fibula, distal extraarticular. B, Tibia/fibula, distal, partial articular. C, Tibia/fibula complete articular.
(From Orthopaedic Trauma Association Committee for Coding and Classification: Fracture and dislocation compendium. J Orthop Trauma 10(suppl 1):1, 1996.)

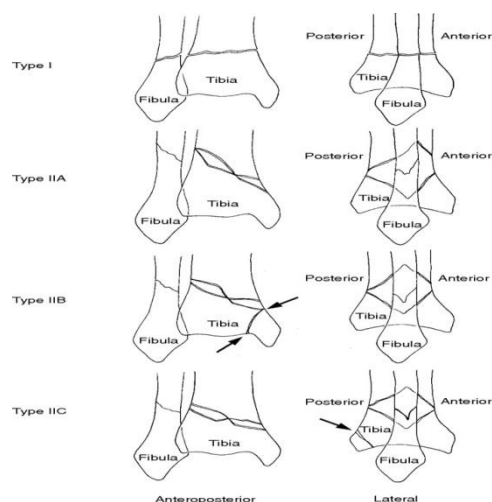
Another classification by Robinson¹ et al

Type I simple extra articular,transverse or oblique

Type IIa -extra articular

IIb - associated with medial malleoli fracture

IIc - associated with posterior malleoli



IV. Materials And Methods

This study was done in the department of orthopedics at Bangalore medical college from June 2010 to January 2013 in young age above 18yr and below 60 yr. which includes 30 patients with distal tibia fractures.

The Patients with Distal tibia fracture who came to our hospital Grouped into Group A and Group B. For each Group patients are Randomly allocated with help of computer. Group A patients are treated with Intramedullary interlocking nail, Group B Patients are treated with open reduction and internal fixation with Plating. Preoperatively History taken regarding Mode of injury, Time of injury, Personal history, Treatment history are documented. Work up done for surgical management. Consent was taken from all the patient.

This prospective Randomized study was analyzed. This study was done after approval from the ethical Committee of our hospital.

Inclusion Criteria ; Patients having fracture of distal tibia at metadiaphysis.

1. Extraarticular fracture, minimum of 3cm of distal fragment
2. Age above 18yrs and less than 60yroid
3. Patients who are medically fit for surgery

Exclusion Criteria

1. Pathological fracture.
2. All open fracture
3. Patients who are medically Unfit and not willing for surgery.

Postoperatively, patients were kept non-weight-bearing. Active and passive movements were encouraged. At 6weekly the progress of healing was assessed using radiographs and weight bearing was initiated. Malalignment (angulations of $>5^\circ$ in any plane) was assessed by comparison with the normal leg. Patients were followed up at 6, 12, 18 and 24 week and then every 3 months during the first year and 6 monthly thereafter. Assessment of the patient with Functional recovery was done with American orthopaedic foot and ankle surgery (AOFAS)²⁷ minimum 5month after injury.

V. Observations

A comparative study done for distal 3rd tibia fracture Treated with intramedullary nailing Group A and Plating Group B in Orthopaedic department between date of June 2010 to January 2013.. follow up done minimum 5months. following observation made in the study.

1) Age distribution; In our study majority of the Patients are from age group 18-29 years (43.3%). The youngest patient was 18 years old and oldest was 54 years. Out of 13 cases of second decade, 8(26.6%) cases Randomized into Group A, remaining 5(16.6%) cases into Group B. There was 10 cases from 3rd decade, 4(13.3%) cases into Group A and 6(20%) cases into Group B, 3 cases from 4th decade 1(3.3%) case to Group A and 2(6.6%) case to Group B, 4 cases from 5th decade, 2(6.6%) cases into Group A and 2 cases into Group B Randomly divided.

2. Sex distribution; Majority of the patients were males 80.6% (24) and 19.3% (6) patients were females. In our study there was 24(80%) Male and 6(20%) female patients present. In Group A 11(36.6%) males and 4(13.3%) Female patients undergone surgery. In Group B 13(43.3%) male and 2(6.6%) Female undergone surgery

3) Side distribution : In our study 23(76.6%) patients had right side injury out of which 13(43.3%) patient undergone treatment under Group A and 10(33.3%) patients under Group B. 7(23.3%) patients had left side out of which 2(6.6%) patients taken treatment under Group A and 5(16.6%) patients under Group B

4)Mode of injury; In our study we had 22 patients who sustained Road Traffic Accident(73.3%).4(13.3%)patients direct injury,4(13.3%)patients had fall from height.

5)Type of fracture;In our study 12 patients had AO 43A1,9patients undergone treatment under GroupA and 3 patients under Group B. 12 Patients had AO 43A2 type,in which 5 patient undergone treatment under Group A and 7 patient under Group B.6 patients had AO43A3 type ,in which 1 patient undergone treatment under GroupA and 5 patients under GroupB.

6)Associated injuries ;our study had 4 head injury,2 clavicle and 2 medial malleoli fracture.

7)Complication;In our present study we had 3 cases of Delayed union and one case Gone into Non union in Group A.Where in group B had one case superficial infection and Delayed wound healing.

8)Secondary procedure; 4 out of 15case had require secondary procedure in Nailing group and 1 case in Plating group.

surgery	No of cases	percentage
Nail	4	Dynamisation 2
		Bone grafting 1
		Exchange nail and bone graft 1
Plate	1	6.6%

9)Intra and post operative variable:In given below table we compared intra operative and post operative variables.The mean operating time in nail i.e GroupA was 123 minutes,where in GroupB 107 minutes,mean radiating time was 3 minutes in groupA and 2.2minutes in groupB.Mean union time in groupA Is 21 weeks and 20 weeks in groupB.one patient had Wound problem in groupB.3patients complained knee pain from groupA. In groupA 3 patients had delayed unionand one patient had non union. 10days was the mean hospital stay in both group.2 patient had malalignment from groupA.

	Group A	GroupB
Mean operating time(min)	123	107
Mean radiation time(min)	3	2.2
Meantime of union(wk)	21	20
Wound problem	0	1
Knee Pain	3	0
Delayed union	3	0
Malalignment	2	0
Mean Hospital stay (day)	10	10
Non union	1	0
Secondary procedure	26.6%	6.6%

10.Functional outcome; The functional outcome was assessed by American ankle and foot score.In our study 8(53.3%)patients had exellent ,4(26.6%) patients had good,1(6.6%) patient had fair and 2(13.3%)patients had poor functional outcome from groupA.In groupB ,8(53.3%) patients had excellent,6(40%)patients had good and 1(6.6%)patient had fair outcome

VI. Discussion

The management of Distal tibia fractures has always held a particular interest for orthopaedic surgeons. Not only these fractures relatively common, but they are often difficult to treat. The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones. Until relatively recently, surgeons had to rely on nonoperative management, and the incidences of nonunion, malunion, and joint stiffness were high.Due to increase in number of vehicle and increase high velocity motor vehicle accidents, prevalence of fracture is increased.

In prospective Randomized study of distal tibia fracture treated with closed reduction and internal fixation with intramedullary nail GroupA compared with open reduction and fixation with plating GroupB. The study done in kg hospital and post graduation institute between june 2010 to January2012.In our study we compared 15 cases in each group .we compared our study with other studies which are published before in journal.

Age Discussion; Mean age of Krishna¹⁹ et al study was 35yr,Kasper w jassen¹⁵ et al study mean age was 43.3 year,jiayuan hong²⁶et al study had mean age of 38years.J J.Guo²⁰ et al study had mean age of 54year in nailing group and 51 year in plating group. In our study mean age was 39year in both group.

Sex Discussion;Sex distribution with other study was compared krishna¹⁹ et al study had 60%male patients and 40% female patients.kasper w janssen¹⁵et al study nailing group had 25% male,25%female and in plating group

had 25% male and 25% female. J J Guo²⁰ et al had 40% female and 59% male in nailing group, 41% female and 59% male in plating group.

Side Discussion; Side distribution in many study not quoted J J Guo²⁰ et al had 54% of left side had taken treatment with nailing and 51% of left side taken treatment with plating. In our study 23 case (76.6%) had on right side in which 43% treated with nailing group A, 33% treated under plating group B. 7 cases (23.3%) had on left side, 2 case treated with nail and 5 cases treated with plate group.

Associated Injury Discussion; We had 13% (4 case) Head injury but who are managed conservatively and all of these underwent surgery in Group A after randomized, 6.6% (2 case) had clavicle fracture and these are treated one on each group. 6.6% (2 case) had medial malleoli fracture and both are treated under group A.

Type Of Fracture; We followed OTA/AO classification as other Author also did and compared the prevalence of type of fracture and treatment they undergone.

43A1	KASPER ¹⁵	J.J Guo ²⁰	Our study
Group A	58%	29%	60%
Group B	33%	31%	20%
43A2			
Group A	16%	36%	33%
Group B	50%	29%	46%
43A3			
Group A	25%	34%	6%
Group B	16%	39%	33%

Kasper w janssen¹⁵ et al study treated 58% of the type A1 fracture with nailing 38% cases with plate. J J Guo²⁰ et al study treated 29% of the type A1 fracture with nailing and 31% treated with plate. Our study 60% of the cases treated with nailing and 20% with plate. Type A2 fracture kasper¹⁵ et al study treats 16% with nailing, 50% with plating, J J Guo²⁰ et al study treats 36% nailing and 29% plating, our study 33% of the patients treated with nailing group and 46% with plating group. Type A3 fracture, kasper¹⁵ et al study had 25% cases treated with group A and 16% with group B. J J Guo²⁰ et al had treated 34% cases with group A and 39% with group B. Our study had 6% case treated with group A and 33% cases with group B.

VII. Discussion About Complication

Im Gi¹⁰ et al in his study, ORIF can restore alignment better than IM nailing. They treated 64 consecutive distal tibia fractures with ORIF or IM nailing. They found an average angulations of 0.9° after plating versus 2.8° after IM nailing (p=0.01). kasper¹⁵ et al had malalignment in 2 of the 12 patients (17%) treated with plate and in 6 of the 12 patients (50%) treated with IM nailing (p=0.1). Vallier¹⁷ et al shown that angular malalignment is more with nail, varus of more than 5° in 29% and 5.4% with plating. Our study in the distal third of the tibia fracture, malignment in more than 5° varus found in 2 (13%) patients treated with nailing group none of the plating group had malalignment more than 5° varus or valgus.

Vallier¹⁷ et al had 12% delayed and non union with nailing group, 2.5% non union with plating group. Kasper¹⁵ et al in his study found 25% delayed union with nailing and 16.5% plating. Our study shows 16.6% delayed union with nailing and 6.6% with plate. One case 6.6% non union with nail.

Kasper¹⁵ et al study Mean time of radiographic union was 19 weeks with plate group and 21 week with nail group with J J Guo²⁰ et al study 17.7 weeks for mean radiographic union with nailing and 17.6 weeks for plate group. Vallier¹⁷ et al shown his study that mean union time is 19 weeks for both plate and nail group. Our study had mean radiographic union with plate is 20 weeks and 21 weeks with nailing group.

Hernigou P, Cohen D¹³. et al in 2000, The intra-articular structures particularly at risk of damage during tibial nailing are the medial meniscus, the lateral tibial plateau and the ligamentum transversum. A probable explanation is that the pain was not only caused by the articular penetration but also by the presence of the nail, i.e., by the bending strain exerted by the proximal part of the nail on the bone. Since unrecognized articular penetration occurs with the use of nails of large diameter in small patients, the bending strain at the upper end may also increase in such individuals.

J J Guo²⁰ et al had 13% of the patient who treated with nailing group had knee pain especially on bending. In our study three (20%) patients had anterior knee pain without hindering knee range of motion, especially when kneeling they had more pain. so it made them to remove the hardware.

Kasper¹ et al had Secondary procedure with nailing is more 25% compare to plate. In our study 26% secondary procedure done for three delayed union 20% and one non union (6.6%) in nail group, for which two patients underwent dynamisation and one patient bone grafting with exchange nailing, finally all cases united. one case non union treated with exchange nail and bone graft. One case 6.6% from plating group had delayed wound healing and necrosis for which wound debridement and secondary suturing did same patient had delayed union for which no secondary surgery done.

VIII. Intra And Post Operative Variable

J J guo²⁰et al ,compared intra and post operative variable,Mean operating time,Radiation time ,mean time to union patients with other complication we compared.

	J J Guo et al ²⁰		Our study	
	GroupA	GroupB	GroupA	GroupB
Mean operating time(min)	81.23	97.9	123	107
Mean radiation time(min)	21.2	3	3	2.2
Mean time to union(wks)	17.7	17.6	21	20
AOFAS Mean score	86.1	83.9	85.3	84.5
Wound problem(%)	6.8%	14.6%	0	6.6

IX. Conclusion

Our aim of study is to prove Concept of management of distal tibia fracture management with early union,weight bearing with less complications with either of the surgical methods of fixation. Management of these fracture even controversial but effectively can be treated with both Nail and plate.

Distal tibia is more subcutaneously placed hence soft tissue injury along with fracture should be consider carefully before planing for plate fixation.

In our comparative randomized study ,even though functional outcome with both the group was comparable.But considering the complication,requirement of secondary procedure with nailing was more.

Complication such as Delayed union,non union and malalignment was more with nailing.

One case which went into non union was typA3,probably due to comminution and difficult alignment peroperatively. 2 cases which wentfor delayed union treated with nail are oneA2 and one caseA1.

Malalignment with nailing was more probably due ankle joint is near and difficult reduction.

Mean functional out come and mean union time was comparable.In nailing mean union time was 21 week and plating 20 week.functional outcome measure with AOFAS mean score was not significantly different.

For fracture type 43A both Intramedullary interlocking nail and open reduction and plate fixation are good and comparable,but comparing to secondary complication plating is the better option.

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Illustration Of Cases;
Case 1;

