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A comparitive study of plate osteosynthesis versus intramedullary nailing for distal tibia fractures

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Abstract
Introduction: For the past decade, nailing and plating for fracture reduction has been successful in treating fractures of lower extremity especially distal tibia. The goal of the techniques is to apply stable fixation while maintaining the fracture biology and minimizing the soft tissue problems.
Methodology: On admission of the patient, a careful history was elicited from the patient and/or attainders to reveal the mechanism of injury and the severity of the trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. General condition was assessed with the vital signs and systemic examination. Methodical examination was done to rule out fractures at other sites.
Results: In our study, 16% of patients had excellent results, 62% of patients had good results and 12% of patients had fair results and 10% of patients had poor results
Conclusion: Complications are more in nailing compared to plate osteosynthesis. Functional outcome of plating and nailing is comparable

Keywords: Plate Osteosynthesis, Intramedullary Nailing, Distal Tibia Fractures

Introduction
The difficulty in treating the fractures of distal tibial end is exemplified by orthopedists, who in the first half of twentieth century believed these injuries were so severe and fraught with so many complications that the fracture was deemed not amenable for surgical reconstruction [1].
Distal tibial fractures represent a significant challenge to most of the surgeons today. They are only 1-10% of lower extremity fractures [2]. Conservative treatment by cast application leads to prolonged immobilization, leading to ankle and knee stiffness affecting quality of life of the patient [3]. Introduction of locking compression plate was a revolution in the evolution of management of fractures where prolonged bed rest is avoided and return to work is satisfactorily helpful.
For the past decade, nailing and plating for fracture reduction has been successful in treating fractures of lower extremity especially distal tibia. The goal of the techniques is to apply stable fixation while maintaining the fracture biology and minimizing the soft tissue problems [4-6]
Compared to conventional plates, locking plates impart a higher degree of stability and provides better protection against primary and secondary loss of reduction

Methodology
I) Inclusion criteria
a. Age: Above 18 years upto 60 years of either sex
b. Distal Tibial extra articular fractures
c. Open fractures (Gustilo type-I, type-II and type-III)

II) Exclusion criteria:
a. Pathological fractures
b. Old neglected fractures
c. Old fractures with implant failure

Surgical Techniques

- On admission of the patient, a careful history was elicited from the patient and/or attainders to reveal the mechanism of injury and the severity of the trauma.
- The patients were then assessed clinically to evaluate their general condition and the local injury.
- General condition was assessed with the vital signs and systemic examination.
- Methodical examination was done to rule out fractures at other sites.
- Local examination of the injured extremity revealed swelling, deformity and loss of function.
- Palpation revealed tenderness, abnormal mobility and crepitus at the fracture site
- Distal neurovascular status was assessed by the posterior tibial artery and dorsalis pedis artery pulsations, capillary filling, local temperature, pallor and paresthesia.
- Antero-posterior and lateral radiographs of the affected leg along with ankle were taken and the fracture patterns were classified based on the AO/OTA classification of fractures of distal tibia.
- The limb was then immobilized in an above knee Plaster of Paris slab till definitive fixation with locking compression plate or nailing was done.
- Patients with open fractures were graded using the Gustilo-Anderson classification for open fractures.
- Antibiotics were started immediately for all patients.
- Injection Cefotaxime 1gram intravenous twice daily along with injection Amikacin 500mg intravenous twice daily were the antibiotics
- Injection Tetglob (Tetanus immunoglobulin) 500IU IM and single dose of tetanus toxoid was given.
- After obtaining the necessary radiographs, Type-I and II open fractures were treated by cleaning of the wound with copious amount of normal saline and Hydrogen peroxide followed by painting of the skin around the wound with Povidone iodine and surgical spirit.
- This was followed by primary wound closure.
- The limb was then immobilized in an above knee Plaster of Paris slab till definite fixation was done.
- In the Type-III fracture, patient was taken for emergency wound debridement and external fixator was applied primarily and secondarily after soft tissue edema got relieved and patient was planned for definitive fixation of fracture.

Pre-operative planning

All the patients were explained and motivated about the cosmetic problems and difficulties in daily routines by the application of an external fixator. Appropriate and valid written consent was taken. The patient was taken for surgery after routine investigation and after obtaining fitness towards surgery. The investigations done were Hemoglobin percentage, fasting blood sugar, blood urea, serum creatinine, HIV, HbsAg and ECG. A dose of tetanus toxoid and antibiotic was given pre-operatively. Preparation of the part was done before the day of surgery. Instruments we rechecked and sterilized before hand.

Post-Operative period

- Immediate post-operative complications like fat embolism and compartment syndrome, neurological damage and vascular injury is looked for.
- Wound infection is watched for in the post-operative period.
- Parenteral antibiotics are given for 5 days and continued in the form of oral antibiotics till suture removal which is done between 1-2 weeks.
- Active quadriceps exercises are restarted on the 1st post-operative day with active ankle and toe movements with knee mobilization as far as the patient is comfortable and free of pain.
- Radiograph of the leg is taken to assess the fracture alignment, nail placement and locking screws.
- The patient is made to ambulate from the 3rd post-operative day without bearing weight on the operated leg with crutches or walker.
- Suture removal is done between 1-2 weeks usually after the 10th day if the wound has healed.

Follow-up

- The patients were followed up at intervals of 4 weeks for up to 6 10months to assess the functional and radiological union. The fracture was designated as united, when there was periosteal bridging callus at the fracture site at least in three cortices in the anteroposterior and lateral views. Trabeculations extending across the fracture site was also taken into consideration.
- Partial and full weight-bearing were allowed based on radiological and consolidation of the fractures.
- The scoring system used in this study was Ankle evaluation scoring system (Merchant & Dietz) and Criteria For Evaluation Of Final Results (Johner & Wruhs)

Results

Table 1: Comparison of AO type in two groups studied

AO type	Plating Group	Nailing Group	Total
A1	11(35.5%)	7(36.8%)	18(36%)
A2	12(38.7%)	8(42.1%)	20(40%)
A3	8(25.8%)	4(21.1%)	12(24%)
Total	31(100%)	19(100%)	50(100%)

P=0.927, Not significant, Fisher Exact test

Table 2: Comparison of Duration between trauma & surgery in two groups studied

Duration of trauma & surgery		Plating Group	Nailing Group	Total
2		26(83.9%)	16(84.2%)	42(84%)
7		0(0%)	2(10.5%)	2(4%)
10		5(16.1%)	1(5.3%)	6(12%)
Total		31(100%)	19(100%)	50(100%)
Mean ±SD		3.29±2.99	2.95±2.32	3.16±2.74

P=0.672, Not significant, Fisher Exact test

Table 3: Comparison of Type of surgery in two groups studied

Type of surgery	Plating Group	Nailing Group	Total
CRIF	19(61.3%)	14(73.7%)	33(66%)
ORIF	12(38.7%)	5(26.3%)	17(34%)
Total	31(100%)	19(100%)	50(100%)

P=0.369, Not significant, Chi-Square test

Table 4: Comparison of ROM distribution in two groups studied

ROM	Plating Group	Nailing Group	Total
40	0(0%)	3(15.8%)	3(6%)
50	13(41.9%)	9(47.4%)	22(44%)
55	8(25.8%)	0(0%)	8(16%)
60	10(32.3%)	7(36.8%)	17(34%)
Total	31(100%)	19(100%)	50(100%)
Mean ± SD	54.52±4.35	52.11±7.13	53.60±5.63

P=0.143, Not significant, Student t test

Table 5: Comparison of Scoring in two groups studied

Scoring	Plating Group	Nailing Group	Total
60-70	2(6.5%)	3(15.8%)	5(10%)
71-80	12(38.7%)	3(15.8%)	15(30%)
81-90	16(51.6%)	10(52.6%)	26(52%)
>90	1(3.2%)	3(15.8%)	4(8%)
Total	31(100%)	19(100%)	50(100%)
Mean ± SD	81.74±7.46	79.58±9.72	80.92±8.36

P=0.380, Not significant, student t test

Table 6: Comparison of Complications in two groups studied

Complications		Plating Group (n=31)	Nailing Group (n=19)	Total (n=50)
Nil		26(83.9%)	12(63.2%)	38(76%)
Yes		5(16.1%)	7(36.8%)	12(24%)
	Infection	2(6.5%)	1(5.3%)	3(6%)
	Malunion	2(6.5%)	4(21.1%)	6(12%)
	Non-union	1(3.2%)	2(10.5%)	3(6%)

P=0.096+ , Chi-Square test

Table 7: Comparison of Union of weeks in two groups studied

Union of weeks	Plating Group	Nailing Group	Total
12-14	23(74.2%)	14(73.7%)	37(74%)
15-16	6(19.4%)	5(26.3%)	11(22%)
17-20	2(6.5%)	0(0%)	2(4%)
Total	31(100%)	19(100%)	50(100%)
Mean ± SD	14.19±2.09	13.11±1.73	13.78±2.01

P=0.063+, Significant, Fisher Exact test

Table 8: Comparison of Results in two groups studied

Results	Plating Group	Nailing Group	Total
Poor	2(6.5%)	3(15.8%)	5(10%)
Fair	3(9.7%)	3(15.8%)	6(12%)
Good	21(67.7%)	10(52.6%)	31(62%)
Excellent	5(16.1%)	3(15.8%)	8(16%)
Total	31(100%)	19(100%)	50(100%)

P=0.605, Not significant, Fisher Exact test

Discussion

Fractures of distal tibia are among the most difficult fractures to treat effectively. The status of the soft tissue, degree of comminution sustained at the time of injury affects the long term clinical results. The goal of the operative treatment is to obtain anatomical realignment of the joint surface by providing enough stability to allow early motion. This should be accomplished using techniques that minimize osseous and soft tissue devascularization in the hopes of decreasing the complications resulting from treatment.

The present study was undertaken to compare the functional and radiological outcome of plate osteosynthesis versus intramedullary nailing for distal tibia fractures.

We evaluated our results and compared them to those obtained by various other studies utilizing various modalities of treatment.

The average time for fracture union in various studies conducted using various methods was between16-22 weeks. Our study had average fracture union of 14.2 weeks. In our study we found there is significant difference with respect to duration of union. Patients who underwent nailing for distal tibia fractures had faster union. In our study we found there is no significant difference in plating and nailing for distal tibia fractures with respect to range of motion.

In our study, 16% of patients had excellent results, 62% of patients had good results and 12% of patients had fair results and 10% of patients had poor results which was comparable to other studies[7]. In our study we found there is no significant difference in plating and nailing for distal tibia fractures with respect to functional and radiological out come when evaluated with Ankle evaluation scoring system (Merchant & Dietz) and criteria for evaluation of final results (Johner & Wruhs)

In a study conducted by C.Mauffrey *et al* [8]**,** a randomized pilot trial of "locking plate" fixation versus intramedullary nailing for extra-articular fractures of the distal tibia, three patients (6.8%) in the IM nail group and six (14.6%) in the locking-plate group had wound problems. Compartment syndrome was noted in one patient in each group.

In a study conducted by J. J. Guo [9]**,** wound complications were more common in the LCP Group, 14.6% compared with 6.8% in the IMN group. All were delayed wound healing.

Lau *et al* [10] reported a rate of late infection of 15% in MIPO fixation of a locking plate in distal tibial fractures and 52% of their patients had the implant removed because of skin impingement.

In a study by Kasper *et al* [7], 2 patients (16.7%) of IM nailing group had varus/valgus malalignment of >5°, two (16.7%) patients had rotational malalignment of >15° after ORIF versus 3 (25%) after IM nailing.

In a study by Sayed Abbas *et al* [11], assessment of the treatment outcome of closed extra-articular distal tibia fracture: IM nailing vs plating, non-union occurred in thirteen patients, 8 patients had non-union in plating group and 5 of 27 patients in IM nailing group. 11 of twenty seven patients in IM nailing group suffered from malunion while only 4 patients in the other group had this complication.

In our study, infection was observed in 2 (6.5%) patients in plating group and 1 (5.3%) patient in nailing group; infection was superficial which subsided with dressing and antibiotics. Malunion in 2 (6.5%) patients and 1 (3.2%) non-union in plating group, malunion in 4 (21.1%) patients and 2 (10.5%) non-union in nailing group was observed.

Conclusion

According to this study, 50 patients with fracture distal tibia have undergone plate osteosynthesis and IMIL nailing. There was no statistical significance between the two groups with respect to range of motion. Our results have shown that Union in nailing is better compared to plating.

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