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Original article

Comparative study of functional outcome after extra-articular fracture of distal tibia treated with plating VS nailing after one year of follow up

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ABSTRACT:

BACKGROUND: Most of the series of study on fractures of distal tibia contains a proportion of fractures of distal tibial metaphysis without any extension into the joint or with minimal extension into joint. less invasive methods were developed to treat diaphyseal fractures of the tibia.

MATERIAL & METHOD: A prospective, non- randomised, observational study carried for 2 years, 35 patients with a fracture of the distal tibia with or without fibula fracture received operative treatment were chosen. Trauma radiographs were used to determine the location and AO classification of the fractures in the selected patients. All patients received treatment with ORIF plating or IM nailing depending on the surgeon's choice. 12 were treated with ORIF plating and 14 with IM nailing. Eventually, 10 matched pairs of patients were assessed for functional outcome after one year of follow up.

OBSERVATION & RESULTS: **A)** 2 of 10(20%) nailing patient had restricted knee flexion of 10 degree as compared to normal side. None of plating group patient had restricted knee flexion. **B)** In plating group 3 out of 10 patients (30%) had restricted ankle dorsiflexion as compared to normal side . None of nailing patient had restricted ankle dorsiflexion .**C)** 2 out of 10 (20%) patients from nailing group had clinical rotational mal-alignment of 10 degree each as compared to plating group 1 out of 10 (10%), That is of 10 degree.

CONCLUSION: From this study we concluded that Functionally the difference between plating and nailing is not significant.

KEYWORDS: Extra-Articular Fracture Distal Tibia, Plating, Nailing

INTRODUCTION:

Most of the series of study on fractures of distal tibia contains a proportion of fractures of distal tibial metaphysis without any extension into the joint or with minimal extension into joint[1,2]. The mechanism of injury and prognosis of these fractures are different from Pilon fractures[33,4] . But their proximity to ankle makes the primary treatment more complicated than that of tibial diaphysis fracture. This justifies the separate review of the epidemiology and prognosis of these injuries[5] Closed fractures of the tibial shaft traditionally have been treated with closed reduction and a cast. Since the late 1950s, open reduction and internal fixation (ORIF) was reserved for situations in which an adequate reduction could not be obtained or maintained by conservative means. ORIF often necessitates extensive dissection and tissue devitalisation, creating an environment less favourable for fracture union and more prone to bone infection. As a result, other, less invasive methods were developed to treat diaphyseal fractures of the tibia. The most successful, closed intramedullary (IM) nailing, has been associated

With minimal soft tissue injury, shorter time to union and a shorter period of disability compared with closed reduction and fixation with a cast [6–8]. IM nails have been greatly improved in recent years and indications for their use have been extended to fractures closer to the ankle joint [910]Plating has always been implanted of choice for the fracture of tibial Pilon, and subsequently it has also been useful for extra-articular tibial fractures (AO/OTA type 1 Pilon Fracture).Which have evolved over the years with better surgical technique with minimal exposure and better fixation using locking compression plate, due to better understanding of delicate soft tissue anatomy of this area.So, fractures in this area can be treated

primarily with both plating and nailing, but neither clear demarcation of indication for particular modality nor improved superiority over another has been proved.

The purpose of this prospective study was to compare the functional results of patients with unstable extra-articular unilateral closed or type I (Gustillo and Anderson) open extra-articular fractures of the distal tibial shaft, treated with ORIF with those treated with closed reduction and IM nailing.

AIMS & OBJECTIVES: To compare functional outcome between plating and nailing for extra-articular fracture of distal tibia (4 cm to 11 cm proximal to tibial plafond) comparing

1. Knee range of motion and pain
2. Ankle Range of motion and pain
3. Clinical rotational mal-alignment

MATERIAL & METHOD:

This was a prospective, non- randomised, observational study carried 2 years, 35 patients with a fracture of the distal tibia with or without fibula fracture received operative treatment. Trauma radiographs were used to determine the location and AO classification of the fractures in the selected patients. 26 patients met our inclusion criteria of minimum 18-year age and Closed or type I open extra-articular fracture of the distal tibial diaphysis. (within 4 cm to 11 cm proximal to distal tibial articular surface) AND Exclusion criteria was earlier fractures of the tibial shaft on the same side proximal or distal intra-articular fractures of the tibia, temporary treatment with an external fixator, fracture of contralateral tibia or ipsilateral femur, pathological fracture and GA Type 2 and 3 open fracture. All patients received treatment with ORIF plating or IM nailing depending on the surgeon's choice. 12 were treated with ORIF plating and 14 with IM nailing. Of the patients treated 2 patients were lost to follow-up for various reasons. The remaining 10 patients treated with ORIF Plating were matched roughly to 10 patients treated with IM nailing on the basis of gender, age decade, and the AO classification of the fracture. Eventually, 10 matched pairs of patients were assessed for functional outcome after one year of follow up.

METHODOLOGY:

1. Active range of motion at ankle joint measured clinically. From neutral position equinous and dorsiflexion were assessed (Figure 1). 2. Active range of motion at knee joint measured clinically. From neutral position extension and flexion were assessed (Figure 2). 3 .Rotational mal-alignment (Figure 3): it is difficult to measure exact rotational mal-alignment without 3-D reconstructed CT scan. We used following clinical method for checking any rotational difference in both tibiae. by recording the position of the patient's feet. Patients were asked to sit on the examining table with their patellae pointing forward and to relax their feet. Then a model (a sheet board for marking the position of the feet) was placed under their feet to record the rotation difference. For removing observational errors, only mal-alignment >5 degrees are considered.

A Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured.[11]

The patient was instructed to squat, and was ask to grade the pain, by drawing a line on a 100 mm horizontal line starting from 0 on left denoting no pain up to the vertical line on the right-hand side 100 denoting excruciating pain, on separate lines for knee pain and ankle pain

STATISTICAL ANALYSIS:

Mean and SD of measurable characteristics were seen and comparison is conducted using student's 't' test. Also, countable quality is analysed and described the variable in the percentages. 5% level of significance is adopted to distinguish the significant differences.

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RESULTS:

Age, sex and hospital stay showed no significant difference.

1. Standard AO classification for fractures of long bones applied. We tried to match two groups according to fracture classification as near as possible (Table 1).

AO classification	Nailing	Plating
A1	6	3
A2	2	1
A3	0	1
B2	1	2
C1	0	2
C3	1	1

Table 1: Standard AO classification for fractures of long bones

2. Operative time for Plating group was slightly higher 83 minutes (78 – 104 minutes) (SD 12.37) than Nailing group 87 mins (60-102 mins) (SD 9.47). but statistically no significant difference between the Operative time was found (Table 2). (Using students test, t = 0.8522, p value = 0.4052 >0.05)

Operative Time in minutes	**Nailing**	**Plating**
Mean	83	87.2
SD	12.4	9.47

Table 2: Operative time for Plating and Nailing group

3. 2 of 10(20%) nailing patient had restricted knee flexion of 10 degree as compared to normal side. None of plating group patient had restricted knee flexion (GRAPH 3).

Knee flexion	**Nailing**	**Plating**
Normal	8	10
Restricted	2	0

Table 3: Knee Flexion

4. In plating group 3 out of 10 patients (30%) had restricted ankle dorsiflexion as compared to normal side None of nailing patient had restricted ankle dorsiflexion.

5. 2 out of 10 (20%) patients from nailing group had clinical rotational mal-alignment of 10 degree each as compared to plating group 1 out of 10 (10%), That is of 10 degree. (TABLE 4)

Rotational mal-alignment in degrees	Nailing	Plating
Absent	8	9
Present	2	1

Table 4: Rotational Malalignment

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The mean visual analogue score for nailing patient was 23 (8-47) (SD 10.26) slightly higher than plating group, mean 18.4 (6-38) (SD 9.41). but statistically there is no significant different. Using students test t = 1.0442, p value = 0.3101 >0.05. (TABLE 5)

VAS Score for knee pain	Nailing	Plating
Mean	23	18.4
SD	10.3	9.41

Table 5: VAS Score for knee pain

Mean ankle pain in Nailing group was 22.5 (8-47) (SD 11.02) and plating patients 28.2 (6-48) (SD 12.73). There is no significant difference between the VAS score for ankle pain in nailing and plating patients. Using students test t = 0.5365, p value = 0.2987 > 0.05(TABLE 6)

VAS Score for ankle pain	Nailing	Plating
Mean	22.5	28.2
SD	11	12.7

Table 6: VAS Score for ankle pain

DISCUSSION:

Distal non-articular fracture of tibia (located 4cm to 11cm of tibial plafond)[12] are complex injuries to manage. Particularly when associated with open injury or soft tissue damage. We compared two primary modalities of treatment of closed or GA type 1 open injuries, intramedullary nailing and open reduction and internal fixation with plate and screw. We tried to match 10 patients of nailing group with 10 patients of plating group in terms of age, sex and AO classification. The mean age of nailing group of patients was 41.6 years and plating group was 38.6 years. The patient's age ranges from 20 years to 60 years, with preponderance in younger age group due to moderate to high velocity injuries. Heather et al[12] reported mean age of 39.1years for non-articular distal tibial fracture , while Court-brown[13] have reported 37.2 year mean age for tibial diaphyseal fracture. We had 7 male patients and 3 female patients in each group for comparison.

In A1 type, had 6 patients from nailing and 3 in plating group. 2 patients from nailing group and 1 from plating had A2 type of fracture. 1 patient from plating group hadA3 fracture pattern. 1 patient from nailing and 2 from plating had type B2 fracture. 2 patients from plating group had C1 fracture. And C3 type 1 patient from each group was found. did not consider type 2 and 3 Gustilo Anderson open fracture. Only one patient from plating group had type 1 open fracture. Who developed superficial skin infection? Operative time for Plating group was slightly higher 83 minutes (78 – 104 minutes) than Nailing group 87 mins (60-102 mins) but statistically no significant difference between the Operative time was found. Im GI et al[14] have reported that duration of operation for nailing group was 72 mins and in plating group 89 mins. While Kasper et al[15] have noted higher operative time for plating (107 mins) and nailing (123 mins) but they have mentioned it is including the anaesthesia.

The nailing group had hospital stay of mean 5.2 days (4-11 days) and plating group had 5.4 days (3-14 day) There was no significant difference between the hospital stay of nailing and

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plating patients. Various studies have noted hospital stay from 5 to 10 days [12,15]2 of 10(20%) nailing patient had restricted knee flexion of 10 degree as compared to normal side. None of plating group patient had restricted knee flexion.Kasper et al [15] also found knee flexion difference of >10 degrees in 1 out of 12 patient of nailing group, in plating group.

In plating group 3 out of 10 patients (30%) had restricted ankle dorsiflexion as compared to normal side. None of nailing patient had restricted ankle dorsiflexion. Kasper et al[15] found 25 % patients having restricted ankle dorsiflexion in each group. While Im GI et al[16] measured ankle dorsiflexion in degrees, nailing patients had mean 14 degrees of dorsiflexion while plating patient had 7 degrees.For anterior knee pain the mean visual analogue score for nailing patient was 23 (8-47) slightly higher than plating group, mean 18.4 (6-38) but statistically there is no significant different. Mean ankle pain in Nailing group was 22.5 and plating patients 28.2 (6-48). There is no significant difference between the VAS score for ankle pain in nailing and plating patients.

In one study[15] they recorded anterior knee pain separately on VAS for kneeling and squatting. Anterior Knee Pain (pain during kneeling) was significantly higher after IM nailing than after ORIF (mean 43 [range 0–100] versus 7 [range 0–50]; p>0.05). The second score with regard to Anterior Knee Pain (pain during squatting) was also higher after IM nailing than it was after ORIF (mean 29 [range 0–95] compared with 9 [range 0–50]; p=0.14).

2 out of 10 (20%) patients from nailing group had clinical rotational mal-alignment of 10 degree each as compared to plating group 1 out of 10 (10%), That is of 10 degree. Kasper et al found Two (16.7%) patients had rotational malalignment of >15° after ORIF versus 3 (25%) after IM nailing[15].

None of our nailing group had any complications other than discussed above.In plating group 2 patients (20) had soft tissue complications.One patient had delayed wound healing. One patient developed superficial infection at surgical site may be because it was type 1 open (inside out) injury. They responded well to conservative treatment.

CONCLUSION:

Functionally the difference between plating and nailing is not significant.As of now both the treatment modalities stand on same ground for their use in distal extra-articular tibial fractures and more research is needed to throw light on demarcating the indications of both.For significant soft tissue damage nailing is more suitable than plating, as there no soft tissue handling around fracture site reducing the complication of infection and non-union.Use of poller screw improves the control over distal fragment during nailing.Use of MIPPO technique is recommended wherever possible. It reduces soft tissue complications.

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