

# Comparative Study of Interlocking Nailing versus Dynamic Compression Plating in Fractures of Tibia in a Secondary Level Hospital in Bangladesh

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### Abstract

**Introduction:** Tibial diaphyseal fractures are the commonest long bone fractures in adults, most commonly managed by intramedullary interlocking nailing. However, several meta-analysis show that locking plate osteosynthesis is equally effective in managing tibial diaphyseal fractures and are associated with less number of complications.

**Aim:** To compare the results of fixation of tibial fractures following plating and nailing in terms of union, patient satisfaction and complications.

**Materials and Methods:** A hospital based non randomized clinical trial was performed from January 2018 to December 2019 where closed or open diaphyseal or metaphyseal-diaphyseal fractures of the tibia (closed or open Gustilo Anderson type 1 through 3B) were included. Simple sequential allocation was used for allotting the patients to two groups, one for interlocking nailing and other for plating. The patients were followed up for clinical, radiographic and functional results.

**Results:** Thirty patients with 30 involved limbs completed follow up for one year. The duration of surgery and average blood loss during surgery was 75.45±3.03 minutes and 165.00±5.31 ml respectively in case of nailing and 85.05±2.54 minutes and 184.29±5.33 ml respectively in case of plating and their difference was statistically significant. In our study union was achieved in less than 20 weeks in 21 (70%) of the patients and 25-30 weeks in nine (30%) cases. The average time of union in our study was 19.55±0.69 weeks in case of interlocking nailing and 20.38±1.39 weeks in case of plating and there was no statistically significant difference between the two. However, there is statistically significant difference in the functional score in between the two groups in terms of Lower Extremity Functional Score (LEFS). Delayed union in one case of nailing and two cases of plating, valgus malunion in one case of nailing and joint stiffness in two cases each of nailing and plating were the major complications observed.

**Conclusion:** There was no difference between the two modalities in terms of fracture union. Complications were lesser but more serious in case of plating. Patient satisfaction was more with plating.

### Key Words:

Interlocking nail, Dynamic compression plate

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### Introduction

Tibia shaft fractures are the most common long bone fractures.<sup>1</sup> Incidence of tibial diaphyseal fractures (26 per 100,000 persons per year in an average population) is the

highest among long bone fractures.<sup>2</sup> They usually occur in young and active patients and are often due to high-energy trauma like motor vehicle accidents, sports or falls from height, direct trauma like road traffic accidents often cause concomitant severe soft tissue damage with a high incidence of open fractures.<sup>3</sup> The lack of soft tissue covering of the tibial shaft and difficult blood supply make these fractures vulnerable to infection and non-union.<sup>4</sup> Tibial shaft fractures are severe injuries and may result in permanent disability. Several treatment options ranging from non-operative to operative treatment including adjunctive strategies are known. Operative treatment is the most established option. Surgeons can choose from a

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huge variety of implants ranging from external fixation to intramedullary nailing. Despite a large number of studies published on this topic the method of choice is still controversial but there is a tendency towards intramedullary nailing. Randomized pilot trial by Mauffrey C et al., to determine the functional outcome after locking-plate or intramedullary nailing, demonstrated an adjusted difference of 13 points in the disability rating index in favor of the intramedullary nail but this was not statistically significant.<sup>5</sup> Saied A et al., in their randomized control trial of plating versus nailing for closed non-comminuted fracture tibia with intact fibulae, concluded that both nailing and plating were equally suitable for such fractures, but the patients in whom intramedullary nails are used may require additional surgeries to achieve union, and complain of knee pain.<sup>6</sup> Till today, it remains inexplicable which is a better option amongst the two, but data show that interlocking nailing is the preferred choice of most surgeons.<sup>7</sup> So, we conducted a study to compare the results of both bone fractures of the leg in terms of the rate of union, quality of the limb, incidence of complications and patient satisfaction. Plating allows an anatomical reconstruction of the bone, maintains mechanical stability and re-establishes endosteal vascular continuity. When compression plating or interlock nail is used active exercises can be started early and ultimate union is quickened. This reduces the morbidity period considerably. The main dis-advantage reported with plating has been skin necrosis with resultant infection and restricted weight bearing. Compression Plating (DCP) enabled a congruent fit between the screw and plate hole at different angles of inclination and has proved successful in achieving axial compression. Intramedullary nailing popularized by Kuntscher for shaft fractures of the lower extremities has proven its value. The appeal of intramedullary techniques derives from the perception of the surgeon of ease of surgical techniques, protection of soft tissue envelope of the tibia and early weight bearing. With the introduction of reaming, indications for intramedullary nailing were greatly extended.<sup>8</sup>

### Materials and methods

We performed hospital based non-randomized clinical trial at the Department of Orthopaedics, 250 Bedded General Hospital, Tangail, lasting two calendar years (from January 2018 to December 2019) after attaining due permission from the Institutional Research Ethics Board. All the adult patients (>18 years of age) with closed fractured tibia with

or without fibula who presented later than 48 hours or in whom surgery was delayed beyond 48 hours because of comorbidities or haemodynamic instability and were operated by a consultant were included in the study. Patients with evidence of osteoporosis, open or pathological fractures and fractures having intra articular extension or associated compartment syndrome were excluded from the study. The patients attending casualty with fracture tibia were initially resuscitated and fracture was immobilized with groin to toe Plaster of Paris (POP) slab. The fracture extent, comminution and geometry were assessed by radiographs taken in anteroposterior and lateral views.

The patients were taken up for surgery after all routine preoperative investigations were found to be within normal limits. Thirty patients with 30 affected limbs were included in the study. After obtaining due consent, they were distributed into two groups using simple sequential allocation. The patients included in the first group underwent intramedullary interlocking nailing of the tibia and the rest underwent plating of the fractures.

Standard operative techniques were used in both the groups. In both the groups, the associated fibular fracture was not fixed unless it involved the lower one third.<sup>7</sup> Postoperatively the limb was kept elevated at all times and active toe movements were encouraged. The patient was monitored for excessive swelling, pain and distal circulation. The first dressing was done after three days of the operation when the slab was removed and active knee and ankle mobilization exercises started. Suture removal was done after 10 days unless infected. Partial weight bearing with two axillary crutches started according to the patient's tolerance. Full weight-bearing was allowed depending on the fracture pattern, stability of the fixation and regional pain. Biweekly follow up was undertaken till clinical union was evident with monthly X-rays to note the progress of healing. Whenever signs of clinical union were apparent, it was confirmed radiologically [Table/Fig-3]. Thereafter the patient was followed up monthly until six months and then two monthly till one year.

The outcome variables included duration of surgery, intraoperative blood loss (measured by weighing the mops before and after the surgery and adding this to the amount of collection in the negative suction machine), time for union, incidence and severity of complications, functionality of the limb (Karlstrom and Olerud criteria and lower extremity functional scale).<sup>9,10</sup>



**Fig.-1: ORIF by interlocking nail**



**Fig.2: ORIF by dynamic compression plate**

**Statistical analysis**

Statistical analysis was done using SPSS software. Kolmogorov and Smirnov analysis was used to confirm comparability of the two samples. Mean, standard error of mean and the distribution of each variable was calculated. Statistical significance was calculated

using the independent sample t-test for ordinal variables.

**Results**

30 patients with 30 involved limbs completed follow-up up to one year. The demographic characteristics of the population studied and the two groups are summarized in following Table:

	Nailing	Plating	Overall
Mean age (years) (mean± standard error)	40.80±3.35	39.81±3.31	40.29±2.33
Gender distribution			
Males	10	9	19
Females	5	6	11
Mode of injury			
RTA	11	10	21
Sports injury	2	3	5
Assault	1	0	1
Fall from height	1	2	3
Involved limb			
Right	8	10	18
Left	7	5	12
Associated fibular fracture	10	8	18
Duration between trauma and surgery (days) (mean± standard error)	7.1±3.28	7.09±3.53	7.1±3.37

In the present study 2 (6.67%) of the patients were between 18 to 20 years old, 4 (13.33%) were between 20 to 30 years old and another 10 (33.33%) were between 30 to 40 years old. Of the remaining, 8 (26.66%) were between 40 to 50 years old, 4 (13.33%) were between 50 to 60 years old and 2 (6.67%) were between 60 to 70 years old. The outcome variables are summarized in following Table:

Parameters	Nailing	Plating	p-value
Intraoperative blood loss (ml) (mean± standard error)	165.00±5.31	184.29±5.33	p=0.014
Duration of surgery (minutes) (mean± standard error)	75.45±3.03	85.05±2.54	p=0.019
LEFS score at six months (mean± standard error)	80.73±2.14	88.18±1.70	p=0.046
Karlstrom and Olerud score at six months (mean± standard error)	30.55±0.57	30.71±0.79	p=0.867
Time for union (weeks) (mean± standard error)	19.55±0.69	20.38±1.39	p=0.602

Intraoperatively, 6 (20%) of limbs (5 of nailing and 1 of plating group) lost 100-150 ml of blood and 24 (80%) (12 of nailing and 15 of plating group) lost 150-200 ml of blood during their respective surgeries.

In the present study, duration of surgery was 50-60 minutes in one (3.33%) case (of nailing), 60-70 minutes in 6 (20%) cases (5 of nailing and 1 of plating), 70-80 minutes in another 17 (56.66%) cases (9 of nailing and 8 of plating), 80-90 minutes in 6 (20%) cases (1 of nailing and 5 of plating).

Postoperative functional performance of the limb, as calculated by the Karlstorm Olerud Score at six months showed that 16 (53.33%) limbs had excellent, 8 (26.67%) good and 5 (16.67%) satisfactory and 1 (3.33%) patient had poor results according to Karlstrom Olerud score.

Patient satisfaction was better with plating, as 14 (66.7%) cases of plating reported a LEFS score more than 90 as compared to 10 patients (50%) of nailing.

Union was achieved in less than 20 weeks in 21 (70%) of the limbs (10 of nailing and 11 of plating) and 25-30 weeks in 9 (30%) cases (5 of nailing and 4 of plating).

The four cases of superficial wound infection (including 1 stitch abscess) was managed by local wound care and intravenous antibiotics (levofloxacin and clindamycin) over five days continued by oral clindamycin (300 mg twice daily) for next five days.

Knee stiffness, ankle stiffness and calf muscle atrophy was managed by appropriate physiotherapy supervised by a designated physiotherapist of the hospital.

There was no case of implant breakage or exposure of implant outside the skin in the present study.

There was no statistically significant difference between interlocking nailing and plate osteosynthesis in terms of time required for fracture union or functional status of the limb after six months. There was, however, statistically significant difference between the duration of surgery and amount of blood loss during surgery, both in favor of interlocking nailing. Major complications too, were lesser in case of nailing compared to plating. On the contrary, anterior knee pain and dropped hallux, which were detrimental to intermediate term patient satisfaction, were unique to nailing.

## Discussion

The average time interval between trauma and surgery was (mean± standard deviation) 7.1±3.37 days. This result is similar to that of Cheng W et al., where duration between injury and surgery had been 7.1±4.9 days.<sup>13</sup> This is due to the lack of proper communication facilities in the area where the patients presented late. Eight of the patients (3 of

nailing and 5 of plating) had history of manipulation by indigenous bone setters.

In the study by Ji J et al., average blood loss was 122 ml (range 100-350 ml) in case of nailing<sup>14</sup>, and was 175±96.9 ml in the study by Cheng et al., while plating, comparable to ours.<sup>13</sup>

Average duration of surgery was 94 minutes (range 60-132 minutes) for nailing by Ji J et al.,<sup>14</sup> and for plating by Cheng W et al.,<sup>13</sup> was 87±25.7 minutes.

In our study, the mean time for union was 19.55±0.69 weeks for nailing, with 20.38±1.39 weeks for plating and 19.98±0.78 weeks overall. Saied A et al., in their study had reported union in 4.30±1.48 months in plating and 4.34±1.45 months in case of interlocking nailing, with dynamization being required in four (12%) of the patients, while one case of non-union persisted even after that.<sup>6</sup> In the study by Vallier HA et al., the mean time to tibia fracture union for all patients was 4.7 months (range 2.5–14).<sup>13</sup>

Associated ipsilateral fibular fracture delayed the union, as evident from our study. However, this group of patients benefitted more from plating than from nailing in terms of time required for union, a finding also noted in the study by Saied A et al.<sup>6</sup>

Anterior knee pain had interfered with activities of daily living in four cases (20%) of the limbs among patients undergoing interlocking intramedullary nailing. In the meta-analysis by Katsoulis E et al., incidence of anterior knee pain was found to vary between 10% and 86% in various studies with mean of 47.4%.<sup>16</sup> They were managed with lifestyle modification, regular physiotherapy as advised by designated physiotherapist of the hospital and NSAIDs.

In our study, decreased range of knee motion compared to contralateral knee was found in one (5%) patient with nailing and two (9.6%) with plating and decreased range of ankle motion compared to contralateral ankle was found in one (5%) patient with nailing and two (9.6%) patients with plating. The loss of motion was less than 10° arc in the knee in all patients in both nailing and plating. However, in case of ankle, 10° loss of dorsiflexion was found in case of nailing and 5° each in plating. The study by Lefavre KA et al., showed decrease in ankle range of motion in 19 (57.6%) patients and in 6.1% there was decreased knee range of motion.<sup>17</sup>

Calf atrophy was found in one patient with interlocking nailing and two patients with plating. Again nine (27.3%) patients had a smaller calf on the affected limb by a margin of 0.5–1.0 cm in the study by Lefavre KA et al.,<sup>17</sup>

Implant prominence was seen in two (9.5%) patients with plate but did not warrant implant removal. Study by Shrestha Det al., showed 30% patients with tibial fractures having implant prominence which required hardware removal.<sup>18</sup>

Dropped hallux syndrome was found in three (15%) of the limbs with nailing. Chalidis B et al., had reported 0.8% incidence in their studies which required surgical exploration. However, all our cases were self-limiting and recovered without exploration within six months.<sup>19</sup>

### Limitation

This was a non-randomized clinical trial without blinding. Randomization and blinding would have lessened the bias. A randomized control study (preferably multi-centre) with larger sample size would have given more authentic conclusions.

### Conclusion

Though major complications are more with plate osteosynthesis in tibial fractures, the patients who were free of these major complications had lesser incidence of persistent pain or other chronic symptoms and were happier (better LEFS score) than their counterparts with interlocking nail. Plate osteosynthesis is a very simple, easy, rapid, reliable and effective method for management of tibial fractures in adults, especially in terms of patient satisfaction and can be considered as an effective alternative to nailing in selected patients.

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