

## ORIGINAL ARTICLE

# Comparison Between Intramedullary Nailing and Plating in Diaphyseal Tibial Fractures with Intact Fibula: Randomized Controlled Trial

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## ABSTRACT

**Aim:** To compare between intramedullary nailing and plating in diaphyseal tibial fractures with intact fibula

**Study design:** Randomized controlled trial

**Place and duration:** This study was conducted at Pakistan Institute of Medical Sciences Islamabad, Pakistan from February 2020 to February 2021.

**Methodology:** During these two years of study period, 1470 limb fracture patients were treated at our institute from which 114 were qualified to participate in this study. A total of 73 patients who were eligible for the experiment were enrolled, and a total of 69 of them were monitored for at least a year. Plating fractures and intramedullary nailing are both common surgical methods that may be used in the treatment of fractures in the femur. Patients' reports of pain or discomfort in the limb were significant predictors of failure in both therapies. We monitored the factors including the length of surgery, the quantity of blood lost, and the time it took to accomplish union.

**Results:** Intramedullary nailing resulted in a single nonunion ( $P = 0.285$ ) and one patient developed a late, deep infection in the screw position ( $P = 0.478$ ), which was cured by screw removal. Although the intramedullary group required more procedures to accomplish union, the tibial fractures in both groups were healed in around 4 months (dynamization was done in 4 patients, representing 12.1% of the total,  $P = 0.047$ ). Two patients in the intramedullary group (6.1%) and four patients in the plate group (11.1%) had implants removed during the follow-up period, which was not statistically significant ( $P = 0.675$ ). A statistically significant difference between the two groups was found only when it came to the number of patients reporting limb pain and the number of people reporting knee discomfort ( $P = 0.001$ ). The plate group included 29 patients with no complaints, whereas the intramedullary group had 18 patients (54.4%) with no complaints and 13 patients (39.5%) with knee discomfort.

**Conclusion:** Both methods are suitable treatments for closed noncomminuted solitary tibial fractures, as per the findings of this study; moreover, patients who receive intramedullary nails are more likely to require additional operations to achieve union and to complain of discomfort in their limbs or knees.

**Keywords:** tibial fracture, nailing, bone plates, intramedullary

## INTRODUCTION

The most frequent form of long bone fracture is a tibia fracture. (1) There is debate in the literature about how to treat these fractures properly, and it has been suggested that this problem is both prevalent and controversial, it ought to be addressed, which is true in this situation.(2)

Tibial fractures with intact fibula have been known to cause difficulties for over half a century. Although about 10–15 percent of tibial fractures have intact fibula, this may cause parts of the tibial fracture to stay separated. (3) (4) According to Jackson and Macnab a varus malunion may occur when a tibial fracture occurs without a fibular fracture. (5) According to Sarmiento and Latta and Teitz et al, these fractures, particularly diaphyseal forms, will achieve union later and frequently with a varus deformity. It has also been reported that issues have arisen during intramedullary canal reaming during nailing such fractures. (6)

Using intramedullary nailing to stabilize closed diaphyseal noncomminuted tibial fractures may only serve

to maintain bone alignment in some cases; in these cases, it may be preferable to use a plate, which may serve to maintain bone alignment and compression to the shattered segments at the same time. We attempted to address the issue of whether approach would generate superior results for these fractures in the current investigation. Current study was conducted to compare between intramedullary nailing and plating in diaphyseal tibial fractures with intact fibula.

## METHODOLOGY

This randomized controlled trial was conducted at Pakistan Institute of Medical Sciences Islamabad, Pakistan from February 2020 to February 2021. After a detailed explanation by the researchers; all patients signed a written informed permission form to participate in the study. Permission was taken from the ethical review committee of the institute. The following criteria were used to determine who was eligible: Non pregnant female or male over the age of 18 years, with diaphyseal tibial fractures (closed or

open). Gustilo-Anderson diaphyseal tibial fracture, and Winquist and Hansen comminution type 0, 1, or 2, such that if a plate is utilized, there is no need for a lag screw. There is no evidence of bone or visceral injuries anywhere in the body. Neither compartment syndrome nor any other underlying illness that might impair bone union. Pregnancy is not present.

Total 1470 patients with leg fractures were sent to our institution, and 114 (7.75%) of them were qualified to participate since they had isolated tibial fractures. A total of 69 individuals who had a one-year follow-up period were included in the research. Patients were randomly assigned to one of two groups: those who received intramedullary nailing and those who received plating. The randomization was done by opening one of ten identical envelopes, half of which contained the phrase "intramedullary nailing" and the other half had the term "plate" After each set of ten patients was enrolled in the trial, the envelopes were changed.

To repair the fracture, the intramedullary nailing cohort used an intramedullary nail & two locking screws on each side (one in dynamic mode). The plating cohort employed an eight-screw thin plate (4.5 mm thick) on each side of the fractures, with four screws on each side. A tourniquet was not used in any of the surgeries. An anesthesia technician counted the number of gauzes to assess the quantity of bleeding. The length of the operation was measured by keeping track of the time from the start of the procedure to the end of the dressing. After the patient joined the ward, the quantity of drainage from the site using the Hemovac drain and the necessity for dressing changes due to bleeding were observed. The severity of pain was measured using a visual analogue scale, with scores of 1 and 2 indicating mild pain, 3 and 4 indicating moderate pain, 5 and 6 indicating severe pain, 7 and 8 indicating extremely severe pain, and 9 and 10 indicating unbearable pain. Patients were discharged 48 hours after being admitted to the hospital.

Patients were checked two weeks after surgery, then every month until union, and then once every six months following that. In the intramedullary nailing group, dynamization was done by removing the proximal or distal screw if the union was not apparent after 3–4 months (depending on the site of the fracture). If the union had not shown itself within six months, the case would be classified as a "nonunion" in both cohorts. The presence of callus at the fracture site, as well as the patient's ability to walk without discomfort and with the use of a cane, verified union. Clinical symptoms of erythema, edema, and heat were used to confirm superficial infection, whereas pus discharge was used to indicate deep illness. A single surgeon conducted all of the procedures and follow-up visits. Student's t-test, Chi-square test, Spearman & Fisher exact test were used to analyse the results using SPSS version 20 software.

## RESULTS

Total 1470 patients with leg fractures were sent to our institution, and 114 (7.75%) of them were qualified to participate since they had isolated tibial fractures. A total of 69 individuals who had a one-year follow-up period were included in the research.

Table 1 compares the two groups in terms of surgery length, surgical hemorrhage, Hemovac drainage, and pain intensity. Nonunion was seen in the intramedullary nailing group (3.1 percent), which means that the union had not occurred after six months ( $P = 0.285$ ). There was a  $4.30 \pm 1.48$  month median time to union in the plating group, compared to a  $4.34 \pm 1.45$  month median time in the intramedullary nailing cohort ( $P = 0.787$ ). It indicates that there was no statistically significant difference between the groups. Seven intramedullary nailing patients and four plating individuals required revision surgery ( $P = 0.675$ ). Six patients required reoperations for device removal because of acute knee or surgical site discomfort 18 months after full union (plating,  $n=4$ , and intramedullary cohort,  $n=2$ ),  $P = 0.675$ . If we had ignored the patient's wish for the device to be removed, the result would have remained the same.

Nine months after surgery, one patient in the intramedullary nailing group suffered an infection and abscess at the proximal screws location. After removing the screws and providing antibiotics, the infection was brought under control ( $P = 0.478$ ). It indicates that this was the only case of infection in either group. Complaints of pain in one's leg or at the surgery site were used to categorize patients into three categories. Thirty-nine of the patients (80.6%) in the plating group had no complaints; one patient (2.8%) experienced knee discomfort, and three patients (8.0%) reported experiencing pain in their arms or legs. The level of knee pain in the intramedullary nailing group was significantly greater

Table 1: Comparison of demographic features of the two groups

	Plate	Intramedullary nail	P-value
Female	6	30	0.286
Male	3	30	
Open fracture	26	17	0.052
Closed fracture	10	16	
Non comminuted	14	8	0.040
Comminuted type I	20	16	
Comminuted type II	2	9	
Hemovac drainage	65/28	69/31	0.603
Bleeding	338/89	353/13	0.536
Duration of operation	39/63	43/60	0.180
Pain			
Mild	3	1	0.435
Moderate	24	20	
Severe	9	12	

## DISCUSSION

In this study, we compared two strategies for treating tibial fractures with intact fibula. Neither approach had an advantage in terms of operation time or rate of union. Patients in the intramedullary nailing group had a greater rate of complaints and required more operations to achieve union.

Leg fractures with intact fibula accounted for around 8% of fractures in the current study, which is lower than the proportion reported in the literature. (7) Despite the fact that we couldn't uncover any reason for our decreased percentage of undamaged fibula. Locked intramedullary nailing is the current standard therapy for tibial fractures and the surgical intervention technique of choice.(8) While the principal textbook advises intramedullary nailing for

tibial shaft fractures, our research revealed no scientific evidence to support this assertion, which was based on a comparison of several procedures. Instead, the basis for this assertion is exclusively based on the findings of a survey of orthopaedic doctors, who virtually unanimously favored intramedullary nailing. (9) Many studies have, of course, compared the two procedures, but almost all of them were limited to distal & metaphyseal fractures, and the fundamental issue has been on the need and method of fibula fixation, that is still a matter of great debate today. (10-13) Despite our best efforts, we were only able to identify a few research similar to this one: According to an abstract of a study that looked at both comminuted and noncomminuted fractures, nailing is superior for comminuted fractures, whereas plating is superior for noncomminuted fractures.

Another experiment, which included (14) patients with open, closed, and comminuted fractures, came to the same conclusion as the first one (15) Another research, for which just an abstract was published, revealed that a locking plate was a superior treatment option to intramedullary nailing, leading to fewer problems and a lower overall cost than the traditional procedure. (15) The use of tourniquet was avoided in both cohorts in this investigation because it is contraindicated with intramedullary canal reaming due to the risk of intramedullary bone necrosis. This precludes the use of a tourniquet in the plating group for the purpose of a consistent research procedure, albeit there are studies that advise against use in the plating of tibial fractures as well. (16, 17)

Although a follow-up time of one year or longer was not accomplished for all of the patients in this trial, but no difference was found between two groups in terms of the requirement for procedures to remove a device. It's worth noting that the majority of tibial fracture nail removals are done in response to complaints of discomfort in the knee or at the screw site. (18) As a result of this finding, we believe that patients who get this treatment are more likely than those who undergo plating to need surgery for device removal. This finding shows that a longer-term investigation is required.

Patients in nailing group stated of more severe limb discomfort as a consequence of the treatment. Our study found that 39.4 percent of patients in the nailing group complained of anterior knee soreness. This is a lower percentage than in most of the other trials that were cited; we only found one study that had pain statistics that were comparable to ours. (19) In individuals who have had intramedullary nailing for tibial fractures, knee soreness is a somewhat common side effect, with 50–70 percent of patients experiencing it. (20, 21)

Because these fractures tend to heal in valgus, we implanted both distal and proximal interlocking screws in dynamic mode, with the distal interlocking screw being more distal than the proximal interlocking screw. In four of our intramedullary patients, we may have performed unnecessary dynamization because stable fractures may not need static locking, even if we removed both proximal screws for dynamization. (22)

In our study, there were no occurrences of infection or nonunion among the patients who had plating. Plating is seldom used in the treatment of tibial shaft fractures;

however, it is sometimes employed in patients with osteoporosis, and when there is a channel with a tiny diameter; these are circumstances when the nail is truly difficult to employ. As a result, we were unable to compare our results to those of others. The tibial canal's diameter is often insufficient; in one research, percent of individuals had a canal diameter of less than 8 mm. (23) The most serious issue with plating is periosteal destruction, which may be avoided with less intrusive procedures. Screws & plates have been used less often for a long period due to the growth in popularity of intramedullary implants, as previously indicated, and we were unable to find a current publication concerning the rate of infection in patients who got this treatment. Our findings suggest that the use of plates, particularly when performed with minimal soft tissue manipulation, is a reasonable choice for treatment with fractures similar to those experienced by our patients, a conclusion reached by experienced surgeons earlier in the study and one that our surgeon appeared to believe by the end of the study. (24)

## CONCLUSION

Both methods are better treatments options for closed noncomminuted solitary tibial fractures, as per the findings of this study; moreover, patients who receive intramedullary nails require more operations to achieve union and to complain of discomfort in their limbs or knees.

**Permission:** It was taken from the ethical review committee of the institute

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**Conflict of interest:** None

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