



## **Union in Fracture Tibia Managed with Closed Intramedullary Interlocking Nail, Our Hospital Results**

**Lachman Das Maheshwari<sup>a#</sup>, Muhammad Khan Pahore<sup>b†</sup>, Madan Lal<sup>c‡</sup>,  
Syed Salman Adil<sup>d†</sup>, Bheesham Kumar<sup>e†</sup>, Niaz Hussain Keerio<sup>e\*†</sup>  
and Syed Shahid Noor<sup>f</sup>**

<sup>a</sup> Liaquat University of Medical and Health Science Jamshoro Pakistan.

<sup>b</sup> Bilawal Medical College Jamshoro at BMCH Kotri, Pakistan.

<sup>c</sup> Sheikh Khalifa Medical, City Ajman, United Arab Emirates (UAE).

<sup>d</sup> Shaheed Mohtarma Benazir Bhutto Medical College, Pakistan.

<sup>e</sup> Muhammad Medical College and Hospital Mirpurkhas, Pakistan.

<sup>f</sup> Liaquat National Hospital and Medical College Karachi, Pakistan.

### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JPRI/2021/v33i50B33451

Editor(s):

(1) Dr. Q. Ping Dou, Barbara Ann Karmanos Cancer Institute, Wayne State University, USA.

Reviewers:

(1) Eric Lüdke, Switzerland.

(2) Daljeet Singh Dhanjal, Lovely Professional University, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/75645>

**Original Research Article**

**Received 10 September 2021**

**Accepted 14 November 2021**

**Published 19 November 2021**

### **ABSTRACT**

**Introduction:** The purpose of this research was to present our hospital results in union of fracture Tibia managed with close intramedullary interlocking nail.

**Methods:** This research was carried out at Liaquat University of Medical and Health Science Jamshoro Pakistan from June 2020 to June 2021. A total of 250 patients with a closed tibial shaft fracture were recruited from the emergency room and outpatient clinics for this study. Our study's clinical outcomes were categorized as union, nonunion, delayed union, or malunion based on the

# Senior Registrar Orthopedic

† Associate Professor Orthopedic

‡ Specialist Orthopedic

\*Corresponding author: E-mail: [niaz\\_h@hotmail.com](mailto:niaz_h@hotmail.com);

criteria. All of the patients were given anesthesia, either general or spinal. All of the patients were tracked for a period of nine months.

**Results:** In 90–150 days, about 88 percent (220/250) of patients had union, with a mean of 110.68. Union occurred in 11.2 percent (28/250) of patients in 95–109 days, with a mean of 103.38. There were 7.2 percent (18/250) delayed unions and 4.8 percent (12/250) non unions treated with dynamization and bone transplant. The outcomes were outstanding in 88 percent (220/250) of the patients and good in 7.2 percent (18/250). Our patients all had full range of motion in their knees and ankles at the time of their examination.

**Conclusion:** We found that this approach is beneficial due to early mobilization (early weightbearing), reduced complexity, good outcomes, and low cost.

*Keywords: Tibia; osteomyelitis; vehicle accident injury; interlocking nail.*

## 1. INTRODUCTION

The tibia is the body's longest and most often fractured bone. Tibial shaft fractures occur in about 2/1000 people per year in the general population [1]. It has been found that nonoperative treatment of high-energy-induced displaced tibial shaft fractures is linked with a significant risk of malunion, joint stiffness, and a subpar long-term functional outcome [2,3]. To treat closed displaced tibial shaft fractures, intramedullary fixation devices such as Centro medullary nails (K nails and V nails), interlocking intramedullary nails (reamed or unreamed), and numerous flexible intramedullary pins, such as Ender nails, have been utilized [4]. The most successful way of treating diaphyseal tibial fractures in adults is to utilize intramedullary interlocking (IMIL) tibial nailing [5,6]. In terms of biology and biomechanics, it has several benefits over plate osteosynthesis [7]. To determine if closed IMIL nailing is safe and effective, researchers have conducted several trials [8]. An image intensifier for the C-arm is commonly used in closed reduction, closed nailing, and locking bolts on both the proximal and distal ends [9-11]. This prospective study's ultimate objective is to early rehabilitation and accomplish fracture union, as well as a short hospital stay and a favorable fracture healing response.

## 2. METHODS

This study was conducted at Liaquat University of Medical and Health Science Jamshoro Pakistan from June 2020 to June 2021. The current study comprised a total of 250 individuals who had been brought to our facility with a fracture shaft of the tibia. Everyone who had surgery provided written informed permission; they were informed about their treatment plan, costs associated with the procedure, hospital stay following the surgery, and problems

associated with anesthesia. In order to keep track of fracture healing, joint mobility, and implant failure on a clinical and radiological level, it was important to check in with the patients again after surgery. Broken bones that heal in 16 weeks or less are considered excellent; those that heal in 24 weeks or less with treatable complications like infection (osteomyelitis), implant failure, or navicular bone resorption are considered good; and those that heal in less time are labeled "poor."

Fractures that heal in less time are labeled "excellent." Fractures that healed between three and six months following the start of therapy were referred to as delayed union, while those that did not heal within eight months were referred to as nonunion. This needed to be investigated further. The research comprised patients with a closed tibial fracture over the age of 16, who arrived within a week after the event and had not previously undergone surgical treatment for the fracture. It was decided to eliminate patients who were malnourished and those who had open or pathological fractures, as well as those who had fracture nonunion. In order to rule out the possibility of further injuries, a comprehensive examination of patients was performed upon arrival. It was shown that the majority of patients had their tibias closed reamed interlocked during the first seven to fourteen days of their injuries. As long as the patient was hemodynamically unstable, had an active infection at the injury site, or was pyrexia, delayed interlocking nailing was used to stabilize their overall state. For the surgery, the patients lied face down on a standard operating table.

Tibial access was gained by a midline patellar incision that extends from the patella's lower pole to a point 1 centimeter distal to the tibial tuberosity. The entry site was created by retracting the patellar tendon along the medial

half of the tibial tuberosity, around 1.5–2 cm distal to the joint line. It was critical to maintain the knee joint flexible when designing the entry location. After being connected to the medullary canal, an olive-tipped guidewire was inserted into the entry site. Under image intensification, the fracture was decreased with longitudinal traction and manipulation. Following reduction, the guidewire was inserted into the distal fragment and centered in the anteroposterior and lateral projections of the fragment. Once the guidewire had been switched and a suitably sized nail had been put, the procedure continued. It was decided to use the jig for the first locking, then impact the fracture before doing the distal locking by hand. A minimum of 9 months was spent following up with each patient. It was necessary to utilize 236 static nails and 42 dynamic nails in total. The proximal locking was accomplished with a jig, while the distal locking was accomplished using a freehand method. An antibiotic dressing was used after the wound was closed with a suction drain in the conventional manner. During the second post-operative day, the drain was removed.

On the 2nd postoperative day, rehabilitation exercises such as touch-down weight-bearing began and, on the 14th, postoperative day, the sutures were removed, and These patients were

clinically and radiologically assessed 9 months following surgery for the time of union. In the patients that were examined, we looked for delayed union (more than 4–6 weeks postoperatively) and nonunion (9 months following surgery). The statistical analysis, which was limited to the computation of the proportion of patients who had excellent, good, and terrible outcomes, comprised patients with unions, malunions, delayed unions, or nonunion. The study's functional findings were evaluated using the Johner and Wruhs criteria.

### 3. RESULTS

In this study, there were 250 participants, with 80 percent (200/250) of the participants being male and 20 percent (30/250) of the participants being female.

Tibial fractures were found in about 64.8 (162/250) percent of patients in the middle one-third of the study, 20 percent (50/250) in the proximal one-third, and 15.2 percent (38/250) in the distal one-third. For the sake of simplicity, the patients were split into three groups based on their chronological age. Patients under the age of 40 were considered to be at the young age group.

**Table 1. Outcome of results of tibial interlocking nails (n=250)**

Outcomes	n (%)
Excellent	220 (88)
Good	18 (7.2)
Poor	12 (4.8)

**Table 2. Age and sex variations in study group (n=250)**

Age (years)	Male (%)	R (%)	L (%)	Female (%)	R (%)	L (%)	Total (%)
<40	112 (44.8)	59 (23.6)	53 (21.2)	30 (12)	17 (6.8)	13 (5.2)	142 (56.8)
40-60	55 (22)	28 (11.2)	27 (10.8)	11 (4.4)	6 (2.4)	5 (2)	66 (26.4)
>60	33 (13.2)	17 (6.8)	16 (6.4)	9 (3.6)	3 (1.2)	6 (2.4)	42 (16.8)
Total	200 (80)	104 (41.6)	96 (38.4)	50 (20)	26 (10.4)	24 (9.6)	250 (100)

**Table 3. Site of fracture (n=250)**

site	Tibia		
	Total (%)	R (%)	L (%)
Proximal one-third	50 (20)	30 (12)	20 (8)
Middle one-third	162 (64.8)	82 (32.8)	80 (32)
Distal one-third	38 (15.2)	18 (7.2)	20 (8)
Total	250	130 (52)	120 (48)

**Table 4. Percentage of cases that had unions, malunions, delayed unions, or nonunion (n=250)**

	Total cases (%)
Union	220 (88)
Delayed Union	18 (7.2)
Nonunion	12 (4.8)
Malunion	0 (0)

In this group, 12 percent (30/250) of the participants were females, while 44.8 percent (112/250) of the participants were men. Patients between the ages of 40 and 60 years old were classified as being in the middle age group. Females constituted 4.4 percent (11/250) of the group, while males constituted 22 percent (55/250). Patients above the age of 60 were included at the old age category. In this group, 3.6 percent (9/250) of the participants were females, while 13.2 percent (33/250) were men. Patients with diabetes accounted for about 12.8 percent (32/250) of the population, with 4.8 percent (12/250) of those using insulin. Female patients with diabetes accounted for 3.8 percent (8/250) of the total and were using an oral hypoglycemic medication. The clinical outcomes of our investigation were evaluated on the basis of the following criteria: union, nonunion, delayed union, or malunion (if there was no union). The patients were followed up on based on their current clinical condition. With a mean of 110.68 days, over 88 percent (220/250) of patients achieved union between 90–150 days. Diabetes was diagnosed in almost 12.8 percent (32/250) of our patients. Patients were permitted to begin touch-down walking with crutches on the second day of surgery if they felt comfortable. Union was accomplished in 11.2 percent (28/250) of patients in 95–109 days, with a mean of 103.38 days. All patients, with the exception of ten, began partial weight-bearing on the sixth week and complete weight-bearing on the twelve weeks after surgery. The no weight-bearing ambulation of these 10 patients was continued until the callus was evident on radiography. They had comminution at the location of the fracture. All of our patients were able to move their knees and ankles completely without restriction. There were 12 patients who complained of postoperative knee discomfort, accounting for 4.8 percent (12/250). The pain disappeared on its own after 2 weeks. Because of an evident gap at the fracture site on subsequent radiographs, 16.8 percent (42/250) of our patients required dynamization within 6 weeks after the surgery. This occurred as a result of excessive distraction of the fracture during the procedure. They were dynamized and were encouraged to walk with

bearing full weight. The screw with less essential stability (the screw that was further away from the fracture) was selected, and it was removed under the influence of local anesthetic. There were 26 delayed unions that were addressed by dynamization, accounting for 7.2 percent (18/250). Only 4.8 percent (12/250) of our patients were classified as nonunion, and these patients were treated with bone transplant and dynamization in our research. Patients had great outcomes in 88 percent (220/250) of cases, good results in 7.2 percent (18/250), and bad results in 4.8 percent (12/250) of cases.

#### 4. DISCUSSION

For the treatment of tibial shaft fractures, intramedullary nailing (IMIL) has been a popular and effective method in recent years. Interlocking nails are often accomplished with the aid of an image intensifier. In our analysis, the most prevalent mode of injury was a vehicle accident injury, which accounted for 59.13 percent of all injuries. Among the other types of damage, 6.25 percent were caused by falls, 3.84 percent by labor accidents, and 30.76 percent by direct force injury or physical attacks. There were 42 percent transverse fractures, 32 percent oblique fractures, ten percent spiral fractures, four percent segmental fractures, and twelve percent comminuted fractures. Among the fractures described by Middendorp et al. (2011), transverse fractures (48 percent), oblique fractures (42 percent), spiral fractures (6 percent), and segmental fractures (4 percent) were the most common [12]. Tibial fractures were the most prevalent kind of fracture in this series, occurring in the middle third (64.74 percent) and upper third (19.42 percent), followed by the lower third (15.82 percent) [13].

There were two malunions in Kutty et. al's research of 45 patients with reamed interlock nails; in contrast, our findings indicated that union occurred in 90–150 days with a mean of 110.68 days and no malunion, which is quite comparable to other studies' findings [14]. In our investigation, we used a nail after reaming the canal to finish the job. In our facility, this is

standard operating procedure. Many studies show that reamed interlocking nails cause more bleeding, take longer to perform and raise the risk of pulmonary embolism, as well as adult respiratory distress syndrome [15]. When a patient has specific risk indicators, such as concomitant chest trauma and anemia, we have a fair policy of waiting and stabilizing the patient. When the patient is stable and ready for surgery, closed reamed statically locked intramedullary nailing can be done. On the other hand, infections have been reported in 12 cases (4.31 percent), and these have been treated with suitable medicines for a period of two weeks. In our facility, we frequently lock the doors using the static mode of operation. In this study, all of the fractures were treated using an intramedullary nail that was statically locked. Two hundred and forty-nine patients out of 250 were successfully reunited without any complications. Forty-two of our patients required dynamization, which is the removal of a proximal or distal screw, before they could begin partial weight-bearing on their legs. At the end of the fourth month, there were no radiological indications of union in 26 individuals. They were dynamized and urged to walk with their entire weight on their shoulders. Twelve of our patients were unable to join their bones. Bone grafting was used to treat him. The unionization rate in our analysis is 88 percent, which is extremely similar to the published series of 86.33 percent [16]. Various studies have shown that reamed locked nailing of tibial shaft fractures results in a 97 percent –100 percent union rate. Following a three-month consolidation phase, Ekland advises static nailing be changed to dynamic nailing for improved fracture consolidation [17]. If comminuted fractures are present, this period may be prolonged to five months if needed. A patient's functional result after suffering a tibial shaft fracture is probably the most significant factor to take into consideration when determining the optimal form of treatment for a particular fracture pattern. In addition to other variables, successful early fracture union in a tibial shaft fracture is the most demanding outcome in terms of long-term functional outcome. The lack of a control group that received treatment using a different modality might have been a possible drawback of our study. At follow-up in 9 months, 220 (88 percent) of the patients said that their result was great, whereas the remaining patients reported that they were dissatisfied. At follow-up, comparing to the contralateral side, all patients had progressed to osseous union and had regained a complete

range of mobility after their rehabilitation program.

## CONCLUSION

Closing the fracture site with interlocking nails in a tibial shaft fracture allows for early weightbearing, which results in faster fracture union and reduced morbidity. We assume that closed interlocking nailing is the most successful treatment for tibial shaft fractures because of the high incidence of union and low rate of infection associated with this technique.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

Formal approval was taken from Institutional Medical Ethics Committee.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Batta V, Dwyer AJ, Gulati A, Prakash J, Mam MK, John B. No difference in the long term final functional outcome after nailing or cast bracing of high energy displaced tibial shaft fractures. *Journal of trauma management & outcomes*. 2012;6(1):1-6.
2. Tahririan MA, Ziaei E, Osanloo R. Significance of the position of the proximal tip of the tibial nail: An important factor related to anterior knee pain. *Advanced biomedical research*. 2014;3.
3. Li H, Yu D, Wu S, Zhang Y and Ma L. Multiple Comparisons of the Efficacy and Safety for Seven Treatments in Tibia Shaft Fracture Patients. *Front. Pharmacol*. 2019;10:197.
4. Kishore Kumar M. "Fracture union in closed interlocking nail in tibial shaft fracture *IOSR Journal of Dental and Medical Sciences (IOSRJDMS)*, 2019;18(8):4551.
5. Ravi, Kiran HG, et al. "Management of diaphyseal fractures of tibia in adults treated either with cast or intramedullary

- nauling with special reference to enders nail." Journal of Evolution of Medical and Dental Sciences. 2016;5(60):4225+.
6. Yaligod, Vishwanath et al. "Minimizing the complications of intramedullary nailing for distal third tibial shaft and metaphyseal fractures." Journal of orthopaedics 2013; 11(1):10-8.  
DOI:10.1016/j.jor.2013.12.002
  7. Glatt V, Evans CH, Tetsworth K. A Concert between Biology and Biomechanics: The Influence of the Mechanical Environment on Bone Healing. Front Physiol. 2017; 7:678.
  8. Zelle BA, Boni G. Safe surgical technique: intramedullary nail fixation of tibial shaft fractures. Patient Saf Surg. 2015;9:40.
  9. Rohilla, Rajesh et al. "Locked intramedullary femoral nailing without fracture table or image intensifier." Strategies in trauma and limb reconstruction. 2011;6(3):127-35.
  10. Rohilla, Rajesh; Singh, Roop; Magu, Narender K, Devgan, Ashish; Siwach, Ramchander; Sangwan, Sukhbir Singh. Simultaneous Use of Cannulated Reamer and Schanz Screw for Closed Intramedullary Femoral Nailing. ISRN Surgery. 2011:1–8.
  11. Hsu, Wei-En; Yu, Ching-Hsiao; Chang, Chih-Ju; Wu, Hung-Kang; Yu, Tsong-Han; Tseng, Ching-Shiow. C-Arm Image-Based Surgical Path Planning Method for Distal Locking of Intramedullary Nails. Applied Bionics and Biomechanics, 2018: 1–10.  
DOI:10.1155/2018/4530386
  12. Keerio NH, Valecha NK, Rehman Nu, Soomro MA, Silro AK, Jokhio MF. Comparison between Plating and Intramedullary Nailing in the treatment of distal tibia fractures: A prospective comparative study. RMJ. [cited August 06, 2021]; 2021;46(3): 568-571
  13. Sahu RL. Fracture union in closed interlocking nail in tibial shaft fracture. J Orthop Traumatol Rehabil. 2018;10:124-7
  14. Kutty S, Farooq M, Murphy D. et al. Tibial shaft fractures treated with the AO unreamed tibial nail. Ir J Med Sci 2003;172:141.
  15. By The Canadian Orthopaedic Trauma Society Reamed Versus Unreamed Intramedullary Nailing of the Femur: Comparison of the Rate of ARDS in Multiple Injured Patients, Journal of Orthopaedic Trauma: July 2006;20(6):384-387.
  16. Memon FA, Memon A, Keerio NH. Functional Outcome of Diaphyseal Tibial Fractures Treated by Intramedullary Interlocking Nail, LUMHS Experience. InMed. Forum 201728(3):75.
  17. Afzal et al. Study to Determine the Efficacy of Illizarov Fixator for the Treatment of Complex Tibial Plateau Fractures. Journal of pharmaceutical research international (JPRI). 2021;33(33B):27-32.

© 2021 Maheshwari et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle4.com/review-history/75645>