



ORIGINAL ARTICLE

COMPARISON OF INTRAMEDULLARY NAILING AND PLATING IN TIBIAL FRACTURES: IMPACT ON MOBILITY RECOVERY

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Background: Tibial shaft fractures are common and often require surgical fixation. This study compared intramedullary nailing (IMN) and plating for early postoperative mobility. **Methods:** A retrospective review was conducted on 480 adults with closed diaphyseal tibial fractures (240 IMN, 240 plating). Physiotherapy notes documented the first day of active knee/ankle mobilization. Outpatient visits provided data on time to partial and full weight-bearing. For comparison between groups *t*-test was used and $p \leq 0.05$ was considered statistically significant. **Results:** Time to joint mobilization was significantly shorter with IMN (3.0 ± 1.60 days) than plating (6.0 ± 1.55 days), with a mean difference of -3.0 days (95% CI: -3.28 to -2.72; $p < 0.0001$). Times to partial (6.68 vs 6.73 weeks; mean difference -0.05, 95% CI: -0.31 to 0.21; $p = 0.707$) and full weight-bearing (8.57 vs 8.45 weeks; mean difference 0.12, 95% CI: -0.15 to 0.39; $p = 0.389$) were not significantly different. **Conclusion:** IMN allows significantly earlier joint mobilization than plating. As weight-bearing timelines were similar, IMN is preferred when early motion is a priority.

Keywords: Early mobilization, Intramedullary nailing, Plating, Tibial shaft fracture, Weight-bearing

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INTRODUCTION

Bone fractures are very common injuries and significantly impact the lives of many patients. They are a public health issue and pose a significant economic challenge.¹ Fractures are an economic burden for individuals, families and healthcare systems and can result in lost wages, reduced productivity, disability, poor quality of life, significant medical expenses, and even death.²

Among the long bones, tibia is the most commonly fractured.³ This type of fracture is commonly caused by high-energy trauma such as road traffic accidents and falls from significant heights. The management of this fracture is complex due to several complicating factors such as inadequate local soft tissue coverage, more skin tension and anatomical ischemia at the fracture site.⁴ Multiple treatment modalities are used for the treatment of tibial fractures depending upon fracture type and patient needs. These include, but are not limited to, intramedullary nailing, plating, screw fixation, intramedullary fixation with locked screws, minimally invasive plate osteosynthesis, and external fixators, with each offering specific benefits for different fracture patterns.⁵

Intramedullary nailing and plating are two common surgical techniques employed to address tibial fractures. Intramedullary nailing is widely accepted as the treatment of choice for tibial diaphyseal fractures.⁶ In this procedure, the fracture is either reduced manually or with the help of tools. A

small proximal incision is made and through it a guidewire is inserted. The medullary canal is then reamed to slightly widen it. For the last step, an intramedullary nail is placed over the guidewire to span the length of the fracture.⁷ The implanted nail acts as an internal splint with load sharing characteristics.⁸ This technique significantly reduces soft tissue involvement. In traditional plating, larger incisions are usually required, which leads to increased soft tissue and periosteal damage.⁹ IMN promotes biological bone healing by preserving the integrity of surrounding tissues and maintaining the vascular supply.¹⁰ Consequently, IMN is associated with a shorter period of disability and faster fracture union.¹¹ Plating, on the other hand, is a more invasive procedure. In plating, an incision is given over the skin and soft tissues are retracted to expose the fractured bone. After the surgeon aligns the fractured bone in its normal anatomical position, a plate is fixed to the surface of the bone spanning the fracture site. The plate is then secured to the bone with screws. According to some literature, plating, when compared with intramedullary nailing, is associated with a reduced risk of fracture malalignment, with no significant differences in bone union, wound complications, and superficial or deep infection.¹² When compared to IMN, plating is a much simpler and cheaper procedure, not requiring an image intensifier, an orthopaedic table, or a specialized nail-inserting assembly.

This study evaluates and compares intramedullary nailing and plating for tibial diaphyseal

fractures, specifically in terms of early mobility and weight-bearing. The findings will help guide surgical decision-making and improve patient care.

MATERIAL AND METHODS

This was a two centre retrospective study done from 5 Jun 2021 to 5 Jun 2024 at Jinnah International Hospital, Abbottabad and Al-Yousaf Hospital, Abbottabad. The data was collected from patient records. A total of 521 patients underwent intramedullary nailing or plating operations for tibial fractures, of which 251 intramedullary nailing and 270 plating operations were done. Two hundred and forty (240) patients fulfilling the inclusion criteria from each group were randomly selected, using Stata-17, to ensure equal group sizes for balanced statistical comparison.

Patients who were skeletally mature at the time of diagnosis (18 years or older), had a closed diaphyseal tibial fracture with or without ipsilateral fibula involvement, had a minimum follow-up duration of 6 months and had undergone either IMN or plating were selected in this study. All patients who had fractures involving proximal or distal intra-articular regions of tibia, compound (open) or pathological fractures of the tibia, any associated fracture apart from ipsilateral fibula fracture and uncontrolled diabetes mellitus or hypertension were excluded from the study.

All patients underwent surgery under the same standardized protocol. Before the procedure, patients underwent a detailed history and physical examination, and the injured limb was immobilised with a back slab. Intraoperative records confirmed that all intramedullary nailing and plating procedures followed institutional guidelines for fracture reduction, fixation, and hardware placement. After the procedure, patients received intravenous antibiotics (ceftriaxone) for three days, followed by seven days of oral therapy. Fracture classification was performed on radiographs according to the AO system by the operating surgeon. Daily physiotherapy notes were reviewed to identify the first day on which patients achieved active knee and ankle mobilization. After discharge, routine outpatient follow-up visits occurred biweekly. Physiotherapy notes and data on progress toward weight-bearing milestones were reviewed from their medical files.

For categorical variables, frequencies and percentages were calculated. For quantitative variables, independent sample *t*-test was applied, assuming equal variances, to compare the mean time for knee and ankle mobilization in days, partial weight bearing, and full weight bearing in weeks between the nailing and plating groups, and $p \leq 0.05$ was considered statistically significant. Results for continuous outcomes are presented as Mean $\pm$ SD, and the mean differences between groups are reported with their 95% confidence interval.

RESULTS

There were a total of 352 male and 128 female patients. Among the male patients, 184 underwent plating and 168 underwent nailing. Among the female patients, 72 underwent nailing while 56 of them underwent plating. This reveals that a higher proportion of males underwent both nailing (70%) and plating (76.67%) compared to females, who comprised only 30% and 23.33% of the respective groups.

The nature of injury among patients varied across both treatment groups. Road traffic accidents were the most common cause, accounting for 112 cases (46.67%) in the nailing group and 128 cases (53.33%) in the plating group. Blunt trauma was responsible for 64 cases (26.67%) in the nailing group and 48 cases (20.00%) in the plating group. Falls were reported in 40 patients (16.67%) who underwent nailing and 48 patients (20.00%) who underwent plating. Physical assault accounted for 8 cases (3.33%) in each group, while sports injuries were found in 16 patients (6.67%) in the nailing group and 8 patients (3.33%) in the plating group. This shows that road traffic accidents were the predominant cause of tibial fractures in both treatment groups.

Table-1 highlights the age distribution of patients treated for tibial fractures using nailing and plating. Most cases were in the younger age groups, particularly between 18–37 years, accounting for 66.67% of nailing and 70% of plating cases, with the 28–37 age group being the most common. As age increased, the number of cases significantly declined, with only 10.00% of plating and 6.66% of nailing performed in patients over 58 years.

Table-2 shows the distribution of tibial fracture cases based on the AO classification for both nailing and plating procedures. It shows that AO42-A1 fractures were the most common in both groups, representing 36.67% of nailing and 33.33% of plating cases. AO42-A2 and AO42-A3 were also common, with the former being more frequent in plating (26.67%) and the latter in nailing (20.00%). Complex fractures (AO42-C3) occurred only in the nailing group, while AO42-B2 and AO42-B3 were fairly evenly distributed between the two groups.

The comparison of postoperative recovery metrics is shown in Table-3. The time to knee and ankle mobilization was significantly shorter in the IMN group than in the plating group, with a mean difference of -3.00 days (95% CI: -3.28 to -2.72; $p < 0.0001$). In contrast, there were no statistically significant differences in the time to partial weight-bearing (mean difference -0.05 weeks; 95% CI: -0.31 to 0.21; $p = 0.707$) or full weight-bearing (mean difference 0.12 weeks; 95% CI: -0.15 to 0.39; $p = 0.389$).

Table-1: Age distribution among the cases

Age Group (years)	Nailing		Plating	
	Cases	Percentage	Cases	Percentage
18–27	64	26.67	80	33.33
28–37	96	40.0	88	36.67
38–47	40	16.67	32	13.33
48–57	24	10.0	16	6.66
58–67	8	3.33	16	6.66
68–77	8	3.33	8	3.33
Total	240	100	240	100

Table-2: Distribution of cases according to AO classification

AO Type	Nailing	Percentage	Plating	Percentage
AO42-A1	88	36.67	80	33.33
AO42-A2	40	16.67	64	26.67
AO42-A3	48	20.00	24	10.00
AO42-B2	32	13.33	40	16.67
AO42-B3	16	6.67	24	10.00
AO42-C2	8	3.33	8	3.33
AO42-C3	8	3.33	0	0.00
Total	240	100	240	100

Table-3: Comparative postoperative recovery metrics (IMN vs Plating)

Outcome measure	IMN group	Plating group	Mean difference (95% CI)	p
Knee/ankle mobilization (days)	3.00±1.60	6.00±1.55	-3.00 (-3.28 to -2.72)	<0.0001
Partial weight bearing (weeks)	6.68±1.50	6.73±1.41	-0.05 (-0.31 to 0.21)	0.707
Full weight bearing (weeks)	8.57±1.54	8.45±1.51	0.12 (-0.15 to 0.39)	0.389

DISCUSSION

In this study, the majority of the cases were found to be in the younger age groups, between 18–37 years of age. As the age increased, the number of cases decreased, with only 10.00% of plating and 6.66% of nailing performed in patients over 58 years. This can be explained as people in younger age groups are more physically active and thus more prone to trauma. Another study suggests that tibial shaft fractures follow a bimodal distribution, with peaks at ages 20 and 50.¹³

In our current study, the majority of the patients were males in both nailing (70%) and plating (76.67%) groups. This is consistent with previous literature that shows that the incidence of tibial fracture is more in males.¹⁴ A possible explanation could be that in general males are more involved in activities that expose them to high energy trauma.

This study suggests that road traffic accidents were the most common cause of tibial fractures in both groups, accounting for 46.67% of nailing and 53.33% of plating cases. This finding is consistent with previous literature which also shows RTA to be the most prevalent cause.^{15,16} In another study, fall from height was the most common cause.¹⁷ In our current study, AO42-A1 fractures were the most common in both groups, representing 36.67% of nailing and 33.33% of plating cases. This finding is consistent with

previous literature which also shows that the fracture type AO42-A1 is the most common.¹⁴ However, another study revealed that the fracture type AO42-A2 is the most common.¹⁸

This study shows that patients treated with nailing had a shorter mean time for knee and ankle mobilization (3±1.60 days) compared to those treated with plating (6±1.55 days). This difference was statistically significant ($p<0.0001$). This finding is consistent with previous research which also shows that patients who underwent IMN had a shorter knee and ankle mobilization time.¹⁹ In our study, mean time for partial weight bearing is nearly identical for both groups, with nailing at 6.68±1.50 weeks and plating at 6.73±1.41 weeks. This difference was not statistically significant ($p=0.707$). Similarly, mean time for full weight bearing is similar for patients treated with nailing (8.57±1.54 weeks) and plating (8.45±1.51 weeks). This difference was also found to be statistically insignificant ($p=0.389$). Regarding these weight bearing outcomes, the literature is mixed. This finding in our study deviates from other studies which shows that nailing results in quicker return to weight bearing.^{4,9,20,21} However, the findings in our research align with other research, which shows that there is no significant difference in time to weight bearing.¹¹

As with all research studies, there are certain limitations in our study. The imbalance in AO fracture classification between IMN and plating groups (Table-2), represents a confounding factor. Variation in patient compliance postoperatively, and individual variability in healing could impact recovery times, which may not be fully accounted for in the present study

CONCLUSION

The IMN provides a statistically significant advantage in knee and ankle mobilization time, with patients achieving mobility in 3±1.60 days on average compared to 6±1.55 days for those treated with plating. This means that there is a clear advantage of IMN in early mobilization. However, there was no significant difference between the groups in time taken to partial and full weight-bearing. These findings suggest that while IMN may facilitate earlier joint mobilization, both IMN and plating had statistically similar time frames for weight bearing recovery.

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Authors approved the draft and are accountable in ensuring that questions related to accuracy or integrity of the work are duly investigated and resolved.

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