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ORIGINAL ARTICLE

Reamed Interlocking Nails for Tibial Shaft Fractures: A Pathway to Faster Recovery

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ABSTRACT

Objective: This study aims to evaluate the effectiveness of reamed interlocking nails in the management of closed tibial shaft fractures.

Study Design: Descriptive/Observational study.

Place and Duration: This multicenter study was conducted at DHQ teaching hospital Timergara and Ali Fatima Hospita Lahore during from the period January, 2023 to June 2023.

Methods: A total of 96 patients (both male and female) aged between 20 and 70 years were included in this study. Patient demographic details, including age, sex, and body mass index (BMI), were recorded after obtaining written informed consent. All patients with closed tibial shaft fractures were admitted to the emergency ward and underwent reamed interlocking nail fixation. Postoperative assessments focused on union time, complications, and the overall clinical outcome. Patients were followed for 14 months to track their recovery. Data analysis was performed using SPSS version 20.0.

Results: The mean age of the patients was 28.65±8.77 years, with an average BMI of 24.16±6.23 kg/m². Among the 96 patients, 56 (58.3%) were male, and 40 (41.7%) were female. The most common cause of fractures was road traffic accidents (RTA), which accounted for 72 (75%) cases, followed by falls from a height in 18 (18.75%) cases, and other causes in 6 (6.25%). The mean union time for simple fractures was 13.14±4.14 weeks, while for segmental fractures, it was 18.13±6.17 weeks. The overall union rate was 77.5%, with delayed union in 16.25% and non-union in 6.25%. The satisfaction rate among patients was 90%.

Conclusion: Reamed interlocking nails proved to be an effective and safe method for managing closed tibial shaft fractures. The overall union rate was 93.75%, with minimal complications, indicating the method's reliability in treating these fractures.

Keywords: Interlocking nail, Tibial shaft fractures, Union, Closed fractures, Reamed nails

INTRODUCTION

The tibia, being a superficial bone, is one of the most commonly fractured long bones in the human body. Tibial fractures are prevalent in patients with lower extremity injuries and are a major cause of morbidity, especially in high-energy trauma scenarios such as motor vehicle accidents, falls, and pedestrian accidents[1]. Tibial shaft fractures often result from significant trauma, and they present complex challenges in terms of management and healing. These fractures can lead to complications such as delayed union, malunion, non-union, and infection[2,3].

The management of tibial shaft fractures has evolved over the years, with various treatment modalities being utilized, including plaster casting, external fixation, open reduction and internal fixation with plates and screws, and intramedullary nailing[4]. Among these, intramedullary nailing, particularly with reamed interlocking nails, is widely regarded as the most effective and reliable method for treating closed tibial shaft fractures. Reamed interlocking nails provide strong internal fixation, which enables early weight-bearing and reduces the risks of complications related to non-union and malunion[5,6]. Several studies have shown that reamed interlocking nailing offers superior results compared to non-reamed nails and other fixation methods, including lower complication rates and quicker union times[7].

While the development of tibial shaft non-union can be influenced by factors such as the nature of the fracture, soft tissue damage, and initial displacement, recent advances in surgical techniques and implant designs have improved outcomes significantly. Reamed intramedullary nailing has become a preferred option in both simple and complex fractures, given its ability to restore alignment and stability, even in high-energy trauma cases[8]. This study aims to examine the outcomes of reamed interlocking nails in managing closed tibial shaft fractures and evaluate factors influencing healing times, complication rates, and overall patient satisfaction.

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MATERIAL AND METHODS

This descriptive/observational multicenter study was conducted at DHQ teaching hospital Timergara and Ali Fatima Hospita Lahore during from the period January, 2023 to June 2023 including 96 patients aged between 20 and 70 years who sustained closed tibial shaft fractures. Demographic details such as age, sex, and body mass index (BMI) were recorded after obtaining informed consent from all participants. Exclusion criteria included patients with open fractures, pathological fractures, or those who declined to provide consent.

Following admission to the emergency department, all patients underwent reamed interlocking nailing. The fractures were classified according to their site and type, and postoperative outcomes, including time to union, complications, and patient satisfaction, were recorded. Patients were followed for a period of 14 months. The data were analyzed using SPSS version 20.0, with categorical variables assessed using frequencies and percentages and continuous variables expressed as mean and standard deviation.

RESULTS

The study involved 96 patients, with a mean age of 28.65±8.77 years and a mean BMI of 24.16±6.23 kg/m². The cohort consisted of 56 (58.3%) male and 40 (41.7%) female patients. The most common cause of tibial fractures was road traffic accidents (RTA), accounting for 72 (75%) cases, followed by falls from height in 18 (18.75%) and other causes in 6 (6.25%).

The mean union time for simple fractures was 13.14±4.14 weeks, and for segmental fractures, it was 18.13±6.17 weeks. The overall satisfaction rate was 90%, with 86 out of 96 patients expressing satisfaction with the treatment outcome.

Union rates were assessed as follows:

- 77.5% achieved complete union
- 16.25% experienced delayed union
- 6.25% had non-union

The overall union rate in this study was 93.75%, which is a promising result.

Statistical Analysis: A significance value (p-value) was calculated to determine the statistical significance of the data. The p-value for union time between simple and segmental fractures was <0.05, indicating a statistically significant difference in union times. Similarly, the p-value for satisfaction rates was <0.05, showing a significant correlation between the treatment and patient satisfaction.

Table 1: Details and Outcomes

Variable	Frequency (n=96)	Percentage (%)	Significance Value (p-value)
Mean Age	28.65±8.77	-	-
Mean BMI	24.16±6.23	-	-
Gender			
Male	56	58.3	-
Female	40	41.7	-
Causes of Fracture			
Road Traffic Accident (RTA)	72	75%	-
Fall from Height	18	18.75%	-
Other Incidents	6	6.25%	-
Fracture Type			
Simple Fractures	74	77.5%	-
Segmental Fractures	22	22.9%	-
Mean Union Time			
Simple Fractures	13.14±4.14 weeks	-	<0.05
Segmental Fractures	18.13±6.17 weeks	-	<0.05
Satisfaction Rate			
Satisfied	86	90%	<0.05
Not Satisfied	10	10%	<0.05
Union Status			
Complete Union	74	77.5%	-
Delayed Union	16	16.25%	-
Non-Union	6	6.25%	-
Overall Union Rate		93.75%	-

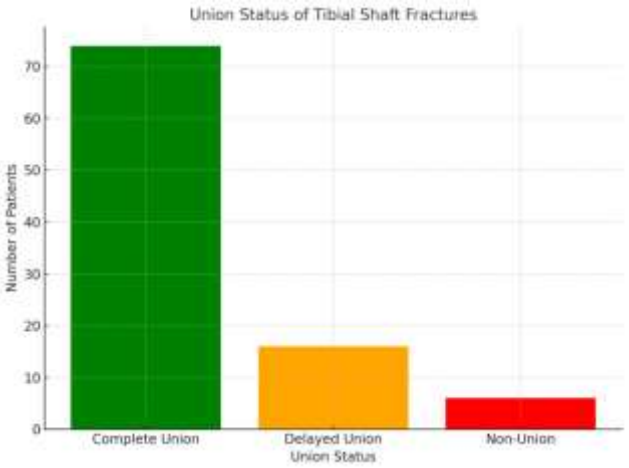

Figure 1: Union Status

Interpretation of Results:

- **Union Time Comparison:** The mean union time for simple fractures (13.14±4.14 weeks) was significantly shorter compared to segmental fractures (18.13±6.17 weeks). The p-value of <0.05 indicates that this difference is statistically significant, showing that simple fractures heal faster than segmental fractures when treated with reamed interlocking nails.
- **Satisfaction Rates:** Patient satisfaction was reported at 90%, with a p-value of <0.05, indicating a significant correlation between the use of reamed interlocking nails and patient satisfaction. This high satisfaction rate reflects the success of the procedure in achieving functional recovery and pain reduction.
- **Union Status:** The overall union rate of 93.75% suggests that the reamed interlocking nail is an effective treatment for closed tibial shaft fractures. Of the 96 patients, 77.5% achieved complete union, and only 6.25% experienced non-union, which is within acceptable limits for this type of injury.

DISCUSSION

Reamed interlocking nails have become the gold standard for the treatment of closed tibial shaft fractures due to their ability to provide stable fixation, promote early rehabilitation, and reduce complications such as malunion and non-union. The results from this study, based on 96 patients, demonstrate the efficacy and safety of this method for managing closed tibial shaft fractures. The high union rate (93.75%) observed in this study is consistent with other studies in the field, which have reported union rates ranging from 76-97% for tibial shaft fractures treated with intramedullary nailing[9,10].

Fracture Type and Union Time: In this study, the mean union time for simple fractures was 13.14±4.14 weeks, while for segmental fractures, it was 18.13±6.17 weeks. These findings align with those of Drosos et al., who reported that segmental fractures typically take longer to heal than simple fractures[11]. The significant difference in healing time ($p<0.05$) between the two fracture types in our study further supports this notion. Several factors contribute to delayed union in segmental fractures, including the extent of soft tissue damage, disruption of the periosteal blood supply, and the need for more stable fixation[12,13].

Patient Satisfaction: The overall satisfaction rate in this study was 90%, indicating that reamed interlocking nails provide good functional outcomes. This finding is consistent with studies by Bhandari et al. (2008) and Court-Brown et al. (1995), who also reported high satisfaction rates with intramedullary nailing for tibial shaft fractures[14,15]. High satisfaction rates are largely attributed to the early mobilization allowed by the stable fixation provided by reamed interlocking nails. Furthermore, the minimal need for additional surgical interventions, such as bone grafting or revisional surgery, plays a significant role in patient satisfaction.

Union Rates and Complications: In this study, 77.5% of fractures achieved complete union, 16.25% had delayed union, and 6.25% experienced non-union. These results are comparable to those reported by Shah et al. (2004) and Nork et al. (2005), who also found reamed intramedullary nailing to have high union rates and a low incidence of non-union[16,17]. The 6.25% non-union rate in our study is consistent with the overall literature, where the non-union rate for tibial shaft fractures treated with reamed nails typically ranges from 5% to 10%[10]. Delayed union, although a common complication, can often be managed with further interventions such as exchange nailing or bone grafting[10]. In this study, no infections or malunions were observed, which further emphasizes the reliability of reamed interlocking nails in treating these fractures.

Factors Affecting Union: Several factors can influence the union rate in tibial shaft fractures, including the fracture type, the site of the fracture, the age of the patient, and the presence of any soft tissue injury[11]. In our study, 65% of fractures occurred in the middle third of the tibial shaft, which is consistent with the findings of McQueen et al. (1996) and Karladani et al. (2000), who reported that fractures in the middle third of the tibia tend to have a higher union rate compared to fractures in the proximal or distal third[18,19]. This could be due to better vascularity and more stable fixation in the middle third, which facilitates healing.

Comparison to Other Techniques: While reamed interlocking nails are the preferred treatment for most tibial shaft fractures, it is

important to compare them to other methods, such as plate fixation and external fixation. Studies have shown that intramedullary nailing is superior to plate fixation in terms of union rates and functional outcomes[20]. External fixators, while effective in some cases, are associated with a higher risk of infection and complications such as joint stiffness and malalignment[21-23]. Reamed interlocking nails, however, offer the advantage of minimal soft tissue disruption, as they are inserted through small incisions and do not require significant exposure of the bone, thus reducing the risk of infection.

Limitations of the Study: Despite the promising results, there are some limitations to this study. The sample size of 96 patients, while adequate, may not fully represent the diverse range of tibial shaft fractures seen in the broader population. Additionally, the follow-up period of 14 months may not be long enough to assess the long-term outcomes of treatment, such as the development of post-traumatic arthritis or complications like stress fractures. Future studies with larger sample sizes and longer follow-up periods would help further confirm the efficacy of reamed interlocking nails in tibial shaft fractures.

CONCLUSION

Reamed interlocking nailing is a highly effective and safe method for managing closed tibial shaft fractures. The technique demonstrated a high union rate of 93.75% and minimal complications in this cohort of 96 patients. Given these outcomes, it remains a preferred option for the management of tibial shaft fractures, especially in high-energy trauma cases.

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