

## REAMED VS UNREAMED INTRAMEDULLARY NAILING FOR TIBIAL SHAFT FRACTURE : A PROSPECTIVE COMPARATIVE STUDY

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### Abstract

The option to treat tibial shaft fractures with either reamed or unreamed intramedullary nailing. The aim of this study was to compare the reamed vs unreamed intramedullary nailing for tibial shaft fracture among 40 patients admitted in Mahatma Gandhi Medical College & Hospital, Jaipur during the study period of 18 months with satisfying the following inclusion & exclusion criteria were included in this study. All patients were enrolled in this study and allocated into two groups. Group A (n=23) allocated to the reamed nailing and Patients in Group B (n=17) allocated to the unreamed nailing. All patients received postoperative care according to the same protocol. The mean age of patients in reamed and unreamed intramedullary nailing group was 42.65±17.010 and 46.53±18.527 (P>0.05). Included patients were predominantly male category and involved in related accidents. Mode of injury is highly associated with road traffic accident which accounts for about 55% (P>0.05). According to the johner Wrus criteria, there were 18 patients had excellent to good outcome in ureamed group and 10 patients in reamed group. No complications were found in majority of the cases. The present study showed that most of the patients exhibited excellent functional and radiological results according to Johner-Wruhs, Lysholm and LEFS criteria, respectively, after treatment with reamed and unreamed nailing procedure.

## INTRODUCTION

Fractures of long bones constitute the majority of emergency operating room procedures in most trauma centers. Tibial fractures are the most common long bone fractures. With increasing numbers of vehicles on the roads in India, complex trauma cases caused by traffic accidents have increased progressively. Tibia is one of the most common bones to sustain open injury. Because of its subcutaneous position, fractures of the tibia more commonly result in an open fracture than any other long bone. Indirect injuries are usually low energy and the open fracture occurs from within. Direct injury is usually high energy and result in open fracture.<sup>[1,2]</sup> The National, Center for Health Statistics has reported an annual incidence of 492,000 fractures of the tibia and fibula in the United States.<sup>[3]</sup>

The aims of treatment for tibial shaft fractures are re-establishing pre-injury anatomy and function with lower complication rates.<sup>[4]</sup> Evidence favors the use of intramedullary nails to stabilize diaphyseal fractures of the tibia.<sup>[5,6]</sup> Several methods have been used for treatment of fracture, including compression plating, reamed or unreamed intramedullary nailing

and external fixation.<sup>[7,8]</sup> Among them, intramedullary nail fixation has shown to be an effective method for treating both open and closed tibial fractures.<sup>[9-11]</sup> However, the choice between two alternative intramedullary nailing approaches, reamed or unreamed, is an ongoing controversy. Reamed intramedullary nailing has the advantage of providing optimal biomechanical stability; however, reaming of the medullary canal may also lead to endosteal blood flow damage, bone necrosis, compartment syndrome and infection.<sup>[12,13]</sup> Unreamed nailing preserves the endosteal blood supply and may therefore improve fracture-healing and decrease the risk of infection.<sup>[3,4,14]</sup>

A number of prospective, randomized controlled trials have compared the effects of reamed and unreamed intramedullary nailing of lower extremity fractures. Meta-analyses of these trials have suggested large reductions in the risk of nonunion, or failure of the fracture to heal, in association with the use of reamed intramedullary nailing (relative risk, 0.44; 95% confidence interval, 0.21 to 0.93).<sup>[6,9,15,16]</sup> Nevertheless, methodological limitations, including lack of concealment, blinding, and standardization of care, have left the efficacy of reamed intramedullary

nailing uncertain. This study was designed to compare the effects of reamed and unreamed intramedullary nailing approaches. To overcome the limitations of previous studies, the design involved concealed central randomization, blinded adjudication of outcomes (i.e., independent committee review of all primary outcome events), and disallowing reoperation before six months.

### Objectives

1. To assess the effects of fixation of tibial shaft fracture with reamed intramedullary nailing.
2. To assess the effects of fixation of tibial shaft fracture with unreamed intramedullary nailing.
3. To assess the functional and radiological outcomes after 6 months follow-up.

## MATERIALS AND METHODS

A prospective comparative study carried out the effects of fixation of tibial shaft fracture with reamed and unreamed intramedullary nailing among 40 patients admitted in Mahatma Gandhi Medical College & Hospital, Jaipur during the study period of 18 months with satisfying the following inclusion & exclusion criteria were included in this study. Approval from the hospital ethics committee was obtained before the investigation was begun, and the patients gave informed consent before they were entered into the study. All patients were enrolled in this study and allocated into two groups. Group A (n=23) allocated to the reamed nailing and Patients in Group B (n=17) allocated to the unreamed nailing.

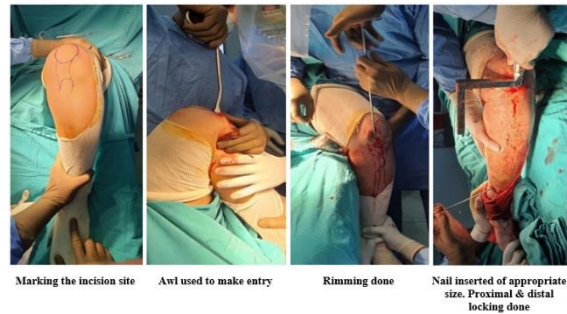
### Operative Protocol

- X ray of the injured leg in AP & Lateral views were taken.
- The fracture tendency for valgus or varus and antecurvatum or recurvatum deformity was noted.
- The angle of mal-alignment was measured.
- fracture was classified according to AO and Gustilo-Anderson Classification
- Fracture location from the proximal or distal articular surface was measured.
- The length of fracture was also measured.
- The diameters of medullary canal at isthmus and at the level of fracture were measured.
- Patients with a bilateral fracture were assigned the same treatment for both fractures.
- Patients were allocated to fracture fixation with an intramedullary nail following reaming of the intramedullary canal (the reamed nailing group) or with an intramedullary nail without prior reaming (the unreamed nailing group).

All patients received postoperative care according to the same protocol. The study investigators hypothesized that the benefits of reamed nailing suggested by the previous literature may have been due to a lower threshold for early reoperation in patients managed with unreamed nailing. We therefore disallowed reoperations within the first six months following surgery. Exceptions to the six-month rule included reoperations performed because

of infections, fracture gaps, nail breakage, bone loss, or malalignment. Patients, outcome assessors, and data analysts were blinded to treatment allocation.

**Management and Follow-up:** All patients (>18 year age) presenting with Tibia shaft fracture were randomized for the study by chit in box method. X ray Leg (AP, Lateral) was taken along with routine preoperative blood investigations. GT slab was applied before surgery.



**Statistical Analysis:** All the demographic details, base line data and postoperative data were recorded in the case report form over the course of the study. The Categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 22.0 statistical Analysis Software.

## RESULTS

Of the 40 patients who were screened for eligibility in the study during the study period and were included in the analysis. Included patients were predominantly male category and involved in related accidents. The mean age of patients in reamed and unreamed intramedullary nailing group was  $42.65 \pm 17.010$  and  $46.53 \pm 18.527$  ( $P > 0.05$ ). Mode of injury is highly associated with road traffic accident which accounts for about 55% ( $P > 0.05$ ). 60% of the patients sustained injury on the left side and 40% on the right side, however, there was left sided predominance compared to the right side ( $P > 0.05$ ). Closed fracture was represented 60% of the total and remaining 40% of the open fracture ( $P > 0.05$ ). AO classification of both the groups had similar incidences ( $P > 0.05$ ). The mean knee Rom score was  $127.83 \pm 8.233$  in reamed and  $127.06 \pm 8.671$  in unreamed group ( $P > 0.05$ ). Mean Lysholm score was  $90.57 \pm 6.352$  in reamed and  $88.35 \pm 9.611$  in unreamed group ( $P > 0.05$ ). Mean LEFS score was  $70.70 \pm 6.799$  in reamed and  $67.59 \pm 11.544$  in unreamed group ( $P > 0.05$ ). Average time of union in our study was 5.28 months in reamed and 4.94 in unreamed group ( $P > 0.05$ ).

According to the johner Wrus criteria, out of 23 patients in reamed group, there were 10 excellent, 8

good, 5 fair and 0 poor outcomes while in unreamed group, there were 5 excellent, 5 good, 5 fair and 2 poor outcomes ( $P>0.05$ ) [Table 1]. In this study, no

complications was found in majority of the cases. The cases with infection also had stiffness of the knee joint ( $P>0.05$ ) [Table 2].

**Table 1: Johner Wrus classification of both the groups.**

		JOHNER WRUS				Total	P value
		Excellent	Good	Fair	Poor		
Group	Reamed	10	8	5	0	23	0.316 (NS)
	Unreamed	5	5	5	2		
Total		15	13	10	2	40	

**Table 2: Complications of both the groups**

		Complication				Total	P value
		No complication	Infection	Knee stiffness	Knee stiffness & Arthritis		
Group	Reamed	20	1	2	0	23	0.411 (NS)
	Unreamed	15	1	0	1		
Total		35	2	2	1	40	

## DISCUSSION

Aim of study is to assess the effects of fixation of tibial shaft fracture with reamed and unreamed intramedullary nailing in 40 cases. The analysis of the results was made in terms of - age of the patient, sex distribution, mode of injury, side of fracture, injury criteria, functional and radiological outcome and complications. Tibial shaft fractures are more commonly seen in the active productive age group (20 to 30 years) due to high-energy trauma.

In our series majority of the patients were Males. This can be attributed to more involvement in RTA. The significance of tibial shaft fracture-related sex distribution was not available to comment on them. The highest number of patients belonged to the 20-30 year-old age group, followed by the 30-40 year-old age group. The mean age of patients in reamed and unreamed intramedullary nailing group was  $42.65\pm 17.010$  and  $46.53\pm 18.527$ . These findings correlate with those of Khan et al,<sup>[17]</sup> Salem,<sup>[18]</sup> Pratap et al,<sup>[19]</sup> Uikey et al,<sup>[20]</sup> and Vignesh et al.<sup>[21]</sup> The male/female ratio was 4:1, which is similar to that observed by Vignesh et al,<sup>[21]</sup> Zhang et al,<sup>[22]</sup> Uikey et al,<sup>[20]</sup> Lin and Hou,<sup>[23]</sup> Salem,<sup>[18]</sup> Court-Brown et al, and Prakash et al.<sup>[24,25]</sup>

In this study mode of injury is highly associated with road traffic accident (RTA) which accounts for about 55%. The present study found that RTA was the most common cause of tibial bone fracture. A similar finding was also observed by Prakash et al,<sup>[25]</sup> Court-Brown et al,<sup>[24]</sup> Pratap et al,<sup>[19]</sup> Uikey et al,<sup>[20]</sup> Vignesh et al,<sup>[21]</sup> and Zhang et al.<sup>[22]</sup> There were 60% cases with left side involvement and 40% cases with right side involvement. In study done by Choudhary et al, there were 30 male and 8 females. Pratap et al,<sup>[19]</sup> reported 55% left sided cases and 45% right sided. Uikey et al,<sup>[20]</sup> also reported 60% cases with left side involvement and 40% cases with right side involvement. Closed fracture was represented 60% of the total and remaining 40% of the open fracture. Choudhary et al,<sup>[26]</sup> there were 6 open fractures out of 20 in the reamed group and 3 open fractures out of 18 cases in the unreamed group.

Functional status: In our study of 40 patients, both groups had comparable functional outcomes at 12 months follow-up with the reamed group non significantly better than the unreamed group. Mean Lysholm score in the reamed patients was 90.57 and in the unreamed group was 88.35, while mean LEFS score in reamed group was 70.7 and in unreamed group was 67.59. Prakash et al.<sup>[25]</sup> reported mean Lysholm score of 91.5 in the reamed group and 90.1 in the unreamed group, while mean LEFS score were 71.4 and 69.2 in the reamed and unreamed group respectively.

In our study, according to the Johner Wrus criteria, out of 23 patients in reamed group, there were 10 excellent, 8 good, 5 fair and 0 poor outcomes while in unreamed group, there were 5 excellent, 5 good, 5 fair and 2 poor outcomes. Choudhary et al,<sup>[26]</sup> reported 80% excellent, 10% fair and 10% poor results in the reamed group and 72% excellent, 11% fair and 5% poor results in the unreamed group based on the Johner Wrus criteria.

Time of union: Average time of union in our study was 5.28 months in reamed and 4.94 in unreamed group. Trlica et al,<sup>[27]</sup> reported similar results in both group with mean time of 17.92 weeks in the reamed group and 18.12 weeks in the unreamed group. Choudhary et al,<sup>[26]</sup> reported slight difference in time for fracture union; average time of union in reamed group was 20.5 weeks and in unreamed group was 22.5 weeks. In a study done by Gaebler C et al 2011,<sup>[28]</sup> average time taken for union was 19 weeks and 17 weeks in the unreamed and reamed group respectively.

Complications: Our study of 40 patients reported two cases of knee stiffness and one case of infection among 23 cases of reamed group and one case each of knee stiffness, arthritis and infection among 17 patients of unreamed group. Choudhary et al,<sup>[26]</sup> had one case each of non-union, superficial infection, screw breakage, knee stiffness, ankle stiffness and knee pain out of 20 patients in the reamed group, while there was two cases of ankle stiffness and one case each of rotational deformity, knee stiffness and knee pain in 18 patients in the unreamed group.

Gaebler et al,<sup>[28]</sup> 2011 reported 4 cases of infection among unreamed patients and 5 cases among reamed group.

The present study has some limitations, including the relatively smaller sample size and brief follow-up period. Moreover, various potential factors that influence the functional and radiological outcomes of tibial shaft fractures, including sedentary lifestyle, occupation, smoking, alcohol consumption, diabetes mellitus, and chronic drug intake (e.g., NSAIDs [non-steroidal anti-inflammatory drugs] and steroids), were not investigated.

## CONCLUSION

The present study showed that most of the patients exhibited excellent functional and radiological results according to Johner-Wruhs, Lysholm and LEFS criteria, respectively, after treatment with reamed and unreamed nailing procedure. The use of both nailing variations to treat compound tibial fractures was associated with a low risk of deep wound infections and stiffness of knee joint. We found no significant differences in the outcomes of treatment of tibial fractures by reamed and unreamed intra-medullary nailing.

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