

# Frequency of Union in Open Tibia Fractures treated with Unreamed Intramedullary Interlocking Nails

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## Authorship and contribution Declaration:

Each author of this article fulfilled ALL 4 Criteria of Authorship:

1. Conception and design or acquisition of data, or analysis & interpretation of data.
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## ABSTRACT

**Objectives:** To determine the frequency of union in open tibia fractures treated with unreamed interlocking intramedullary tibial nails.

**Methods:** This descriptive study was conducted in Department of Orthopaedics and Spine Surgery Ghurki Trust Teaching Hospital Lahore from 15<sup>th</sup> February 2018 to 14<sup>th</sup> November 2019. All patients with open diaphyseal tibial fractures fulfilling the inclusion criteria were fixed with unreamed interlocking intramedullary nails. Patients were followed up at intervals for nine months and clinical and radiological union was noted at final follow up visit.

**Results:** The total number of patients in our study were 214. The mean age of our study participant was 45.47 ± 9.65 years. Male patients were 133(62.15%) and female 88(37.85%). Majority(87.85%, n=188) patients revealed clinical and radiological union at nine months while 26(12.1%) patients had non union. No major complication noted.

**Conclusion:** High union rate had been achieved in open tibial fractures treated with unreamed interlocking nails. Unreamed interlocking nails therefore, can be used to treat Gustilo Anderson type I and type II diaphyseal fractures of tibia with good results.

**Keywords:** Tibial fractures, unreamed, intramedullary nailing, union.

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## INTRODUCTION

Tibia is commonly recognized as the most substantial weight-bearing bone of the body.<sup>1</sup> The rapidly growing industrialization of high speed automobiles has led to an increase in accidents resulting in fractures of the tibial shaft accounting for 26 individuals per 100,000 population per year.<sup>2,3</sup> The frequency of tibial fracture and its potential complications like infection and non union is more commonly reported in male than in female.<sup>4</sup> The protocols of managing open tibial fracture depend on injury type, fracture location and contamination but generally treated with external fixator as damage control method.<sup>5</sup> However, the

emphasis is on early mobility and weight bearing with minimum morbidity.<sup>6,7</sup> Unreamed interlocking nail has been used in open tibial fractures because it has excellent union rates as it does not interfere with endosteal and periosteal blood supply.<sup>8,9</sup> In addition to preserving periosteal blood, tibia nails are also able to maintain soft tissue envelope however, due to the wide medullary cavity this fixation is mechanically less stable in distal tibia fractures.<sup>10,11</sup> Comparative studies of managing open tibial fractures with external fixator versus unreamed interlocking nail reported superior results in terms of higher union rates and less

complications in interlocking nails than in external fixators.<sup>12</sup>

We received a large number of open tibial fracture in our hospital on daily basis and the usual treatment option is external fixator. Majority of our patients belong to poor families and most of them are the sole financial supporter of their families. Since external fixators are associated with many complications including prolonged absence from job and more frequent re operations thus causing huge economic burdeon. Interlocking nail however, if proved effective will be adopted as first line treatment option in our set up for Gustilo Anderson type I and II tibial fractures. The objective of our study was to determine the frequency of union in open tibia fractures treated with unreamed interlocking intramedullary tibial nails.

## METHODS

This descriptive study was conducted in Department of Orthopaedics and Spine Surgery Ghurki Trust Teaching Hospital Lahore from 15<sup>th</sup> February 2018 to 14<sup>th</sup> November 2019. Patients of either gender and age with open tibial shaft fracture (Gustilo Anderson type I and type II) received within 24 hours were included in our study. Patients with fractures within 5cm of knee or ankle joint, floating knee injuries, pathological fractures, associated vascular injury, compartment syndrome, bilateral tibial fractures and polytrauma patients requiring surgical intervention by other specialities were excluded. The study was approved by the Ethical Committee of our hospital and informed written consent was obtained from all participants. All the patients were managed according to ATLS protocol in Accident and Emergency Department. Complete history, clinical examination and radiographs of the affected extremity were obtained in all patients.

After thorough wash and debridement, fracture was fixed with closed unreamed interlocking intramedullary nail of appropriate size and diameter under image intensifier by a consultant surgeon of not less than 3 years post fellow ship experience. Depending upon the location of fracture and degree of communitation interlocking nail was either locked at one end or both ends or left unlocked as appropriate. Broad-spectrum antibiotics and analgesics were started according to hospital protocol. The patient was discharged home after educating about wound care, range of motion and instructions for weight bearing.

Patients were followed up at two weeks, four weeks, six weeks and eight weeks initially and then monthly for nine months. In each visit clinical assessment was done by examing the wound and

inquiring about pain on weight bearing and temperature. Radiographs were orderd to see for callus formation on AP and lateral view at the fracture side. Dynamization was performed by removing proximal or distal locking screws in cases of delayed union. Debridement, dressing and antibiotics were prescribed for infected cases.

We analyzed our data with SPSS version 22. All continuous variables such as age and Body Mass Index (BMI) was represented as mean ± standard deviation and categorical data like gender and non-union was presented as frequency and percentages. Stratification for age, gender and BMI was done and post stratification Chi-square test was applied and  $P < 0.05$  was considered significant.

## RESULTS

The total number of patients enrolled in our study were 214. The mean age was  $45.47 \pm 9.65$  years (range 16 to 60 years). Male patients were 133 (62.15%) and female 88 (37.85%). Majority (71.03%,  $n=152$ ) of our patients were in age range of 41 to 60 years followed by 28.97% (62) in age range 16 to 40 years. Right tibia was fractured in 143 (66.82%) patients and left in 71 (33.17%). Majority (69.62%,  $n=149$ ) of patients had Gustilo Anderson type I fracture while 65 (30.3%) patients had type II fracture. Communitated fractures were noted in 121 (56.54%) patients, transverse in 60 (28.0%) and oblique or spiral in 33 (15.4%). Road traffic accidents were the predominant cause of fracture in our patients noted in 141 (65.8%) patients followed by fall in 42 (19.6%) patients, heavy object in 21 (9.8%) patients and physical assault in 10 (4.6%) patients. The mean BMI was  $25.21 \pm 4.84$ . The mean duration of fracture was  $13.58 \pm 3.62$  hours.

**Table I:** Stratification of union in different age groups, gender, and BMI.

Age (years)	Union		p-value
	Yes	No	
16-40	58	04	<b>0.083</b>
41-60	129	23	
<b>Gender</b>			<b>0.926</b>
Male	116	17	
Female	71	10	
<b>BMI (kg/m<sup>2</sup>)</b>			<b>0.470</b>
≤27	105	13	
>27	84	14	

Majority (71%,  $n=152$ ) of fractures were stabilized with 9 milimeter interlocking nails while 8 milimeter nails

were used in 62(28.9%) patients. Interlocking nails were locked both proximally and distally in 145(67.7%) patients, only proximally locked in 32(14.9%) ,only distally locked in 21(9.8%) and without any locking in 16(7.4%).At follow up visits dynamization was performed in 41(19.1%) patients with delayed union out of which 32(72.0%) fractures ultimately healed. Overall majority(87.85%,n=188) patients revealed clinical and radiological union at nine months while 26(12.1%) patients had non union.The average union time was 16.4 weeks(range 12.5 to 36 weeks).Majority(69.2%.n=18) of non unions were noted in type II transverse fractures with 9 mm nails and were statically locked( $P$  value>0.05).Stratification of union in different age groups, gender and BMI(table I) shows no statistical significance ( $P$  value>0.05). Superficial infection was noted in 21(9.8%) patients which was resolved with dressing and antibiotics.No patient was lost to follow up.

## DISCUSSION

Although various treatment options for open tibia fractures are plaster cast,brace and external fixator, the complication rate is higher.<sup>13-18</sup> Plate and screw fixation gives good results in closed tibia fracture but are not recommended in open fractures.<sup>19-21</sup> Interlocking nails have been used to treat open diaphyseal fractures of the tibia with excellent union rates,early weight bearing and less chances of infection and malunion.<sup>22-24</sup>

The mean age of our study participants were  $45.47 \pm 9.65$  years and majority of our patients were male and in the age range of 41 to 60 years.These findings are consistent with other studies in literature.<sup>26-36</sup>

In our study union was achieved in 188(87.85%) patients as assessed in the last follow up visit at nine month while non union was noted in 26(12.1%) patients. Ziran and colleague<sup>37</sup> compared reamed and unreamed interlocking nails for the treatment of open tibia fractures and noted that healing rate in both groups were comparable.However more secondary procedures were required to achieve union in unreamed group.Keating<sup>38</sup> treated 50 open fractures with interlocking nailing after reaming and 44 without reaming.Unreamed group united earlier than reamed group(twenty nine weeks versus thirty week).Non union was noted in 12% patients in the unreamed group and 9% in reamed group( $P$  value 0.73).The author concluded that clinical and radiographic results in both groups were comparable except broken locking screws were more frequently noted in unreamed interlocking nails than in the reamed interlocking nails.

Saho<sup>39</sup> and colleagues in their meta analysis of four studies compared reamed and unreamed interlocking nail in open tibia fractures and concluded that no statistically significant difference was found in both groups in terms of union,infection,implant breakage and reoperation rate.Whittle<sup>40</sup> treated 50 open fractures with interlocking nail without reaming and achieved union in 96% of his patients at the end of seven months follow up.Infection was noted in 8% and screw breakage in 10% patients. Joshi <sup>32</sup> treated 60 open tibia fractures with unreamed interlocking nails and reported good to excellent outcome in 85.8% cases and poor outcome in 10.7% cases as assessed with Modified Ketenjian's criteria. Infected non union was reported in 6 patients,delayed union in 6 and early infection in 6 patients.Joshi however concluded that unreamed interlocking nails should not be applied in delayed cases of Gustilo Anderson type III fractures. Another study<sup>41</sup> reported average union time of 21.9 weeks in 42 open tibia fractures treated with unreamed interlocking nails.The rate of non union was reported in 10.8% of patients in this study.This study however included Gustilo Anderson type III fractures in addition to type I and II.

There were few limitations of our study.Firstly, the design of our study was descriptive.Secondly,we were not able to properly calculate the sample size of our study.Thirdly,type III fractures were excluded from our study.Fourthly,only tibia shaft fractures were included in our study.We therefore recommend further well designed studies on this topic to address all these limitations.

## CONCLUSION

High union rate had been achieved in open tibia fractures treated with unreamed interlocking nails.Unreamed interlocking nails therefore, can be used to treat Gustilo Anderson type I and type II diaphyseal fractures of tibia with good results.

**Conflict of Interest:** None

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