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# REAMED VERSUS UNREAMED INTRAMEDULLARY INTERLOCKING NAILING FOR OPEN TIBIAL FRACTURES – AN OBSERVATIONAL STUDY

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**Abstract**

**Background and objectives:** With increase in population, industrialization and traffic density there is high incidence of road traffic accidents. The incidence of high energy trauma are increasing in the same proportion. Tibial diaphyseal fractures are the commonest long bone fractures encountered by most orthopedic surgeons. One third of the length of tibial surface is subcutaneous, Open fractures are more common in tibia than in any other major long bone. This led us to design study of reamed versus unreamed intramedullary interlocking nailing for open tibial diaphyseal fractures.

**Materials and methods:** 60 consecutive patients who had open fractures of tibial shaft were treated with wound debridement and interlocking intramedullary nailing with or without reaming during the period from October 2009 to September 2011. The patients have been followed up for 6-8 months during this study.

**Results:** open tibial diaphyseal fractures surgically managed both reamed and unreamed gave good functional results. In our study according to Johner and Wruh's criteria there is no significant difference in reamed and unreamed intramedullary interlocking nailing for open tibial diaphyseal fractures.

**Interpretation and Conclusion:** Thorough and early wound debridement and early wound coverage along with intramedullary interlocking nailing for open tibial diaphyseal fractures is the key to minimize deep infection. No significant difference in fracture union for both the groups.

**Keywords:** *Open tibial diaphyseal fractures, Reamed, Unreamed, Interlocking nailing*

## Introduction:

With increase in population, industrialization and traffic density there is high incidence of road traffic accidents, The incidence of high energy trauma is increasing in the same proportion.[1] Because one third of the tibial diaphyseal surface is subcutaneous, open fractures are more in tibia than in any other major long bones.

High velocity injuries with contamination not managed appropriately leads to bacterial colonization and infections.[2] The best of clinical judgment has to choose the most appropriate treatment for a particular pattern of injury.[3]

Prevention of infection, bony union and functional range of movements are the milestones for successful treatment of open tibial fractures. They are achieved in the chronologic order mentioned.

The intramedullary nailing has become an attractive option since image intensifier has made closed intramedullary nailing possible. As nail is a load sharing implant, with stands axial, torsional and bending forces when appropriately sized nail is used.

Until recently, all intramedullary interlocking nailing involved Reaming. The rate of infection after treatment of open tibial fractures with intramedullary nailing with reaming has been relatively high, causing most investigators to discourage the use of this technique for grade II and III open tibial fractures. Court - Brown Published clinical data on the use of reamed intramedullary nails in the management of open tibial fractures. They suggested that reamed locking intramedullary nailing is a safe and effective technique for management of open tibial fractures.[4]

In open fractures, there is no significant difference in the time of union or number of additional procedures performed to obtain union in patients with reamed nail insertion compared with those of unreamed nail insertion.[5] Reaming and unreaming for interlocking nailing in open tibial fractures is still controversial.[6] A subgroup analysis of randomized trials of reamed and unreamed intramedullary nailing technique has been performed for open tibial fracture treatment, Reamed intramedullary nailing, compared with unreamed intramedullary nailing significantly reduce the risk of nonunion and implant failures, but it led to no significant difference in compartment syndrome, mal-union or infection rates in tibial fractures.[7]

This led us to design, Reamed versus unreamed intramedullary interlocking nailing for open tibial fractures.

## Aims and Objectives:

To study the fracture union and clinical outcome of open diaphyseal fractures of Tibia treated with reamed versus unreamed intramedullary interlocking nailing.

## Materials and Methods:

This study involved both male and female patients with open fractures of tibia, who presented to casualty, 60 patients who had open fractures of tibial shaft were treated with wound debridement and interlocking intramedullary nailing with or without reaming. All the patients had open tibial fractures and were fresh traumatic in nature, aged above 18 years.

## Surgical Technique:

Patient on supine position, Vertical Patellar tendon incision made over skin extending from centre of the inferior pole of patella to the tibial tuberosity. Entry port was made using a curved Bone Awl. Serial reaming of 0.5mm increments done until 1.5cm more than nail diameter was achieved for reamed intramedullary nailing. Intramedullary Interlocking nail was assembled to the Jig handle and inserted through the entry port and checked under image intensifier, proximal locking was done with the help of jig handle slots and drill sleeves.

Open wounds were debrided and thorough wound wash given, skin approximated or left open based on wound condition and sterile dressing done. Efforts were made to obtain definitive coverage of the wound as the wound is healthy with split thickness skin grafting.

## Post-Operative Care:

All patients were kept nil oral for 6hours postoperatively. Adequately I.V fluids / Blood transfusions are done. I.V antibiotics and I.M analgesics .Check X-ray of the operated tibia full length including knee and ankle joints in both A-P and lateral views.

Active knee, ankle and toe mobilization started after overcome from anesthesia.

Further follow up is done at monthly intervals and each patient was individually assessed clinical and radiological.

## Results:

The present study includes 60 open fractures of the tibial shaft surgically treated with interlocking intramedullary nailing by reaming and without reaming. The patients have been followed up for 6-8 months during this study. All these patients

were available for follow up.

Majority of the patients were from age group 18-30 years (36.67%) (graph:1), the youngest patient was 18 years old and the oldest patient was of 62 years. Fracture incidence is more in males, Male 54(90%) and 06( 10%) were females. Right tibial fracture constituted majority of the patients. In our study right sided fractures were 43 patients (71.67%) and left sided fractures were 17 patients (28.33%). RTA major cause was 49 patients (81.67%) (grahp:2) of which reamed were 23(76.67%) and unreamed 26(86.67%). Fall 7 (11.67%) patients. open fractures of the tibia were Gustilo type I(23.3%), II (46.67%), IIIA(25.0%), IIIB(5.0%).

Average time of bone union (graph:3) in reamed group is 30.5wks and unreamed group in 29.5wks. In reamed group of 30 patients, 13patients (43.33%) excellent results (graph:4), 12 patients had good results (33.33%), 4 fair (13.33%) and 1 had poor (3.33%). In unreamed group of 30 patients, 10 patients (33.33%) had excellent results, 11 patients had good results (36.67%), 5 fair (16.67%) and 4 had poor (13.33%).
Over all results of the study showed 23 patients (38.33%) excellent results, 23 patients good results (38.33%), 09 fair (15%) and 05 case poor (8.33%) results.

Superficial infection were 12 (20%) patients developed superficial infections out of which 06 (20%) where in reamed group and 06 (20%) were in unreamed group the infection found is Staphylococcus aureus and pseudomonas on culture and on sensitive intravenous Antibiotic treatment and regular sterile dressings infection resolved.

Deep infections were total 5 out of which reamed group were 01 and in unreamed group 04. None of the patients developed compartment syndrome, fat embolism.

Late complications were backing of the distal locking screw is seen in 1patient, it didn't involve the bone union. None of the nails were broken or were bent. 2 patients (3.33%) noticed pain and knee stiffness in unreamed group with none of the patients in reamed group. valgus deformity noticed in 2 patients (6.67%) in reamed group and none in unreamed group.

Delayed union noticed in 03 patients (5.0%), in reamed group 01 patient (3.33%) and in unreamed group 02 patients (6.67%). Non-union noticed 02 patients (3.33%) i.e, 01 patient each in reamed and unreamed group.

Valgus deformity and non-union together noticed in 02 patients (3.33%) i.e, 01 patients in both reamed and unreamed group.

**Discussion:**

Open tibial shaft fractures management continues to be a problem with several complications. Those fractures, usually caused by high energy trauma, have numerous problems resulting from the poor soft tissue coverage and limited vascular supply of tibia which may cause mal-union, infection and sometimes resulting in amputation. With the current wound management, surgical fixation technique and improved implants have minimized the prevalence of these complications, but the optimum management of open fractures of the tibial shaft is still evolving.[9]

Interlocking intramedullary nailing with reaming solves the problem of mal-union as it maintains length but are associated with high risk of infection in open tibial fractures. However, reaming result in destruction of all vessels in the medullary canal and increases in medullary pressure which leads to infiltration of medullary fat, blood clots and bone debris into the vascular channels.

Smith JE[10] 18 open tibial fractures treated with reamed intramedullary nailing had 33% infection, most of the fractures associated with severe soft tissue injury. Some traumatologists believe that intramedullary nailing with reaming may be used safely for fractures with less severe wounds. Klemm KW[11] reported that six infections (6.5%) developed after the use of interlocking intramedullary nailing with reaming in a large series of 93 open tibial fractures.

Lottes JO[12] reported a 7.2 percent rate of infection after treatment of 256 open tibial fractures with the use of his nail without reaming. The 27 percent rate of mal-union in the series Swanson TV[13] demonstrates that mal-unions can be a problem even for fractures that have been judged to be axially stable.

Christopher FG's[14] In a prospective randomized study of 123 patients with reamed and unreamed intramedullary nailing had no significant rate of fracture union and additional procedures performed.

Mohith B[15], In a randomized study it was found that tibial shaft fractures treated with reamed intra medullary nailing reduces rate of non-union and implant failure as compared with unreamed nailing.

Mohit B's[17], In blinded randomized trial of 1319 adults with tibial shaft fractures it was found that no difference between approaches in patients with open fractures and possible benefit for reamed intramedullary nailing in

patients with closed fractures.

Keating JF[16], In a prospective randomized study of 91 patients with open tibial shaft fractures found clinical & radiological results of nailing after reaming are similar to those of nailing without reaming. More screws had broken when reaming had not been done.

Helfet DL's[18], In a blinded randomized controlled trial of 1319 patients with tibial shaft fractures it was found that unreamed intramedullary nailing may preserve the endosteal blood supply. Possibly improving fracture healing and decreased risk of infection were as the reamed intra medullary nailing will increase fracture stability.

In current series 60 patients of open fractures of shaft of the tibial were treated by reamed or unreamed interlocking intramedullary nailing over a period of two years. They were followed up for 6-8 months. The purpose of this study was to evaluate the end results of treatment in these patients.

These patients were of different age groups, occurred in both sexes and the open fracture were of different types.

**Age distribution:**

The average age of all patients in this series was 36.6 years. The fracture was more common in the age group of 28-37 years. Study conducted by Court-Brown CM[19] showed that the average age was 35 years. Mohit B's[17] study of 1319 patients mean age was 39.5yr of which reaming group is mean age is 39.1yr and unreamed intramedullary nailing group mean age is 39.8yr for open fractures of tibia. Christopher FG's[14] in his study of 123 patients the average patients age was 33.8yr.

**Sex distribution:**

There were 54 male and 06 female patients showing male preponderance which is comparable with Mohit B's[17] study 2008 showed that there were 904 men and 322 women and Christopher FG's[14] study there were 74 males and 16 females.

**Nature of violence:**

In our study RTA (81.67%) was most common mode of injury, which is comparable to Mohit B's[17] study RTA (57.1%) and Christopher FG's[14] there were RTA (48.6%).

**Results:**

In our study Reamed group had (43.33%) excellent results and unreamed group (33.33%) had excellent results, with average time of bone union in reamed group is 30.5wks and unreamed group in 29.5wks which is comparable with Keating JF's[16] reamed group 30wks and unreamed group in 28wks.

Complications in our study were backing of the distal locking screw is seen in 1patient, it didn't affect the bone union. In our series there were no cases of implant failure i.e. nail breakage or bending of implant. Non-union and valgus deformity was noticed in 2 patients, 1 in reamed group and 1 in unreamed group. In contrast to our study series published by Christopher FG's[14] had nail and screw breakage of 9 in unreamed group and 1 pt with non-union and valgus deformity. Keating JF's[16] study also showed screw breakages in 4 reamed group and 12 in unreamed group, Mal-union was seen in 3 cases of which 2 belonged to unreamed group. Anglen JO's[20] had 1 broken locking screw in reamed group with 5 non-union in unreamed group and 1 in reamed.

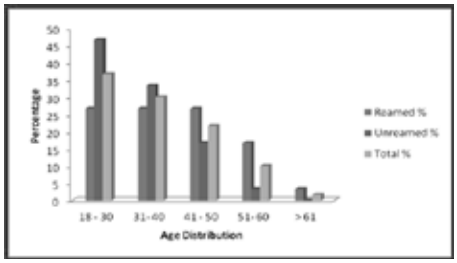
In our series, no patient developed fat embolism, compartment syndrome, peroneal nerve palsy and reflex sympathetic dystrophy. Patients who required wound closure was achieved by repeated wound debridement and once the wound was healthy split thickness skin grafting was done. Coverage of wound was done by debridement and later skin grafting.

**Conclusion:**

This study reinforces earlier studies that use of both reamed and unreamed intra medullary inter locking nails is feasible in open diaphyseal fractures of tibia. The presence of the wound upto type IIIB may not increase the chances of spreading the infection. Intra medullary stabilization helps in early mobilization of the patient, preventing joint stiffness, minimal hospital stay and early return to activity. Repeat wound debridement allows the wound to granulate well. Results between Reamed and Unreamed intra medullary nailing of open tibial fractures marginally altered the complication rate except for type IIIB where there was significant decrease in complication rate with unreamed nails.

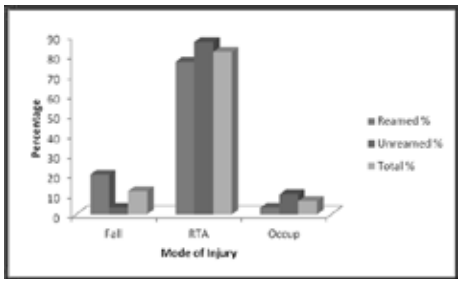
**Graph 1: Age distribution**

| Age Group | Reamed group | | Unreamed group | | Total | |
|---|---|---|---|---|---|---|
| | No of Patients | % | No of Patients | % | No of Patients | % |
| 18 - 30 | 8 | 26.67 | 14 | 46.67 | 22 | 36.67 |
| 31- 40 | 8 | 26.67 | 10 | 33.33 | 18 | 30.00 |
| 41 - 50 | 8 | 26.67 | 5 | 16.67 | 13 | 21.67 |
| 51- 60 | 5 | 16.67 | 1 | 3.33 | 6 | 10.00 |
| > 61 | 1 | 3.33 | 0 | 0.00 | 1 | 1.67 |



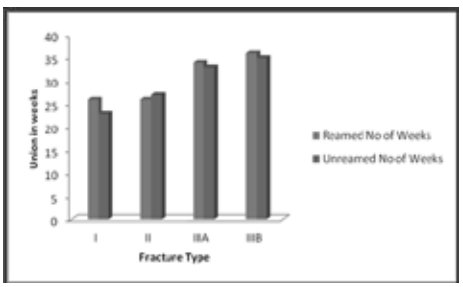

**Graph 2: Mode of Injury**

| Mode of Injury | Reamed group | | Unreamed group | | Total | |
|---|---|---|---|---|---|---|
| | No of Patients | % | No of Patients | % | No of Patients | % |
| Fall | 6 | 20.00 | 1 | 3.33 | 7 | 11.67 |
| RTA | 23 | 76.67 | 26 | 86.67 | 49 | 81.67 |
| Occup | 1 | 3.33 | 3 | 10.00 | 4 | 6.67 |



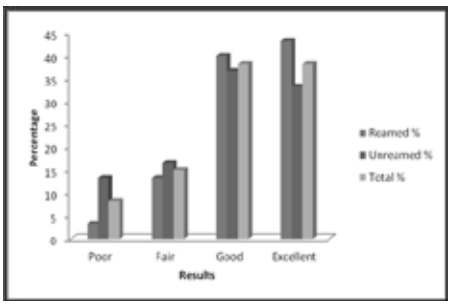

**Graph 3: Time to Union**

| Fracture Type | Reamed group No of Weeks | Unreamed group No of Weeks |
|---|---|---|
| I | 26 | 23 |
| II | 26 | 27 |
| IIIA | 34 | 33 |
| IIIB | 36 | 35 |

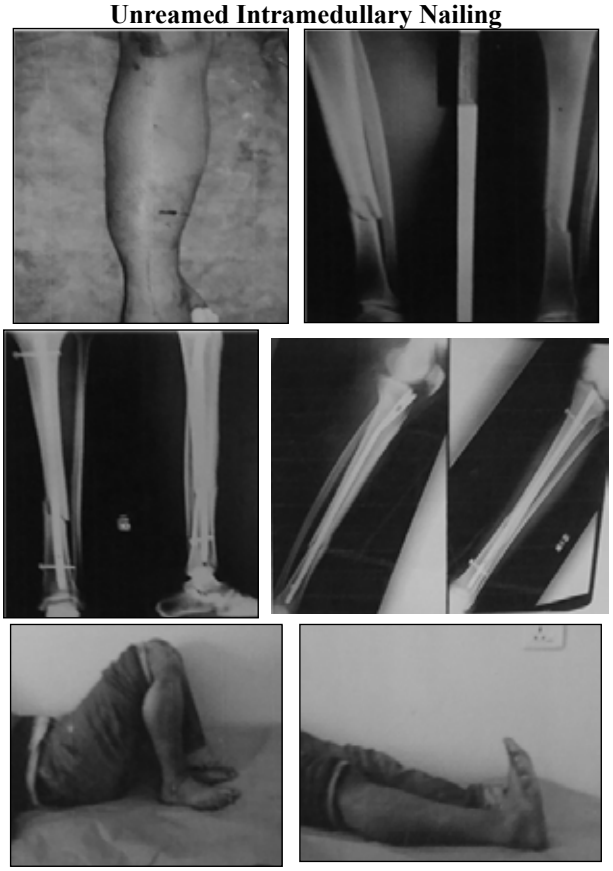



**Graph 4: Results**

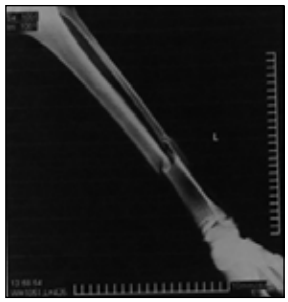
| Result | Reamed group | | Unreamed group | | Total | |
|---|---|---|---|---|---|---|
| | No of Patients | % | No of Patients | % | No of Patients | % |
| Poor | 1 | 3.33 | 4 | 13.33 | 5 | 8.33 |
| Fair | 4 | 13.33 | 5 | 16.67 | 9 | 15.00 |
| Good | 12 | 40.00 | 11 | 36.67 | 23 | 38.33 |
| Excellent | 13 | 43.33 | 10 | 33.33 | 23 | 38.33 |

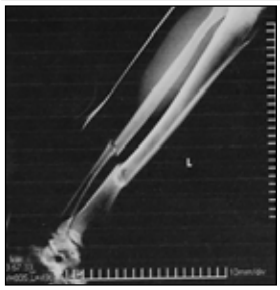


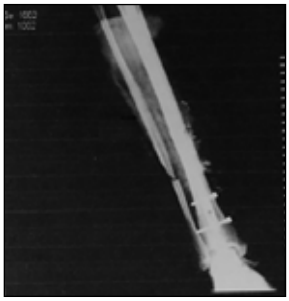

**Unreamed Intramedullary Nailing**



**Reamed Inrtramedullary Nailing**







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