Comparative Study of Reamed vs Unreamed Interlocking Intra Medullary Nailing for Fracture Shaft of Tibia

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Authors’ contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

ABSTRACT

Tibia is the commonest bone to sustain open injury because of subcutaneous position. Treatment of open fractures requires simultaneous management of both skeletal and soft tissue injury. Intramedullary nailing with reaming is generally considered to be contraindicated for open fractures tibia, because it damages the endosteal blood supply which will lead to non-union, deep infection. However, recent studies with or without reaming in open fracture tibia shows no influence in healing of fracture. Purpose: To compare the clinical and radiological results of intramedullary interlocking nailing of open fractures of the tibial shaft after reaming versus unreamed medullary canal. The aim and objective is a comparative study on the technique, outcome and time taken for clinical and radiological union in either of the reamed or unreamed interlocking nailing in tibial shaft fractures. The operative technique, advantages and disadvantages, follow up, time taken for bony and radiological union and complications if any and overall functional outcome will be evaluated in patients. The follow up of patients will be done in the immediate post operative period and subsequently at periodic intervals both clinically and radiologically and the result so obtained will be compared.
Keywords: Tibia; intramedullary nailing; healing of fracture; radiological union.

1. INTRODUCTION

Tibia is one of the most commonly fractured bones in the body. Fracture tibia in adults is one major cause of morbidity. Common causes are High velocity motor vehicle accidents, direct blows or assault and gunshot injuries.

As tibia is the most majorly affected bone in the body, this becomes the target study in common [1,2]. These fractures pose a serious problem because of their subcutaneous location and precarious blood supply and resultant problems in union. Trauma surgeons have not yet reached a consensus on a single treatment protocol for all patients with tibial shaft fractures. Fractures of the tibia cannot be treated successfully in all cases with only one approach or a single simple set of rules 2-4. In this study, two modalities of fixation of shaft of tibia fractures were chosen and compared: 1) reamed interlocking intramedullary nailing; and 2) unreamed interlocking intramedullary nailing.

It may be simple or compound in nature. These fractures pose a serious problem because of their subcutaneous location and hence problems in union [3,4]. Trauma surgeons have not reached a consensus on a single treatment protocol for all the patients with tibial shaft fractures till date.

The surgeons must individualize the treatment of each fracture taking into account the personality of fractures as described by Nicolle. The surgeon must be prepared and competent to use the functional methods of closed treatment, external fixation and techniques of internal fixation including intra medullary rods, interfragmentary screws, plate osteosynthesis and intra medullary locking nails [5,6,7]. A comparative study was conducted on technique, outcome and time taken for clinical and radiological union on either of reamed or Unreamed interlocking nailing. Advantages, disadvantages, follow up and complications if any and over evaluated in patients. The follow up of patients will be done in the immediate post operative period and subsequently at periodic intervals both clinically and radiologically and the result so obtained will be compared.

2. MATERIALS AND METHODS

On admission of patients to the hospital, appropriate measures were taken to resuscitate the patient and to evaluate and treat associated and treat associated limb and life threatening injuries. Once a patient is stabilized, X-ray of the affected leg is taken in both antero - posterior and lateral views including the knee and ankle joints. All the fractures are classified according to AO classification for diaphyseal fractures of tibia [8-10]. The degree of comminution was assessed by Winquist and Hansen’s classification. In closed fractures Tscherne and Gotzen classification for soft tissues was used. Fractures in children, fractures extending to the articular margin and fractures with neurovascular deficit were excluded from the study.

All the patients who were received in the casualty with tibial fractures were immobilized with an above knee POP slab initially. After stabilization of the general condition, surgery was planned. Every alternate case was treated with either reamed or unreamed interlocking nailing of the tibia to stimulate a randomized controlled trial. In case of open fractures, thorough wound debridement was done in emergency theatre on day of admission [9,11]. Antibiotic prophylaxis and tetanus prophylaxis was given and wound dressing was done and finally internal fixation was done at an appropriate time.

2.1 Technique of Reamed Interlocking Nail

A fracture table was used during the surgery. The anaesthesia given was either general/spinal/epidural. Fracture table was used during the surgery. After anaesthesia, the patient was placed in supine position, with the injured leg bent at 90 degrees at the knee with the help of a padded attachment. Tourniquet was used for all the patients. Nail length was measured pre operatively. On the patient’s uninjured leg, distant; 1’rom the tibial tubercle to the tibiotalar joint line was measured and 30 – 40 mm subtracted to obtain the required nail length. Intra operatively nail length was obtained by measuring the exposed length of the guide wire and subtracting it from the total length of the guide wire. The nail diameter depends on the bony anatomy and the diameter of the reamed canal. Commonly 9 or 10 size nails were used in this present study.

2.2 Surgical Approach

- Anterior midline patellar ligament splitting approach
3. RESULTS AND DISCUSSION

In the period between May 2012 and May 2014, 20 patients with tibial shaft fractures who were treated by surgery with closed reduction and internal fixation with either reamed or Unreamed interlocking nailing were taken up for the comparative study. Of the 20 patients 10 were reamed nailing and 10 were unreamed nailing.

In the present study, 11 cases were males and 9 were females. The male to female ratio was 3.75:1 showing a male preponderance in the study. In the P.A. BLACHUT's study the male to female ratio was 3:1. In our present study the study was 21 years old and the oldest was 86 years old. The patients between 21-mean average age incidence was 35 years. The peak incidence in this age group common and comprised the majority of the cases. In P.A. BLACHUT's study also right sided fractures comprised the majority. In our present study 78.94% of cases were due to road traffic accidents.

3.1 Sex Distribution

Reamed nailing: Out of 10 cases, there were 6 males and 4 females in the study. The male to female ratio was 4:1.

Unreamed nailing: Out of 10 cases, there were 5 males and 5 females in the study. The male to female ratio was 3:5:1.

3.2 Age Distribution

In this present study, the age incidence of the patients were from 21 years to 86 years. The youngest patient was 21 years old and the oldest patient was 86 years old. The patients between the age groups 21-30 years comprised the majority.

Table 1. Male to female ratio

| Gender | Reamed | Unreamed |
|--------|--------|----------|
| Male   | 6      | 5        |
| Female | 4      | 5        |

Table 2. Age distribution

| Age   | Reamed | Unreamed |
|-------|--------|----------|
| 21-30 | 2      | 1        |
| 31-40 | 1      | 2        |
| 41-50 | 2      | 2        |
| 51-60 | 2      | 2        |
| 61-70 | 2      | 1        |
| 71-80 | 1      | 2        |

3.3 Side Distribution

Out of the 20 cases, 11 patients had right sided injuries which comprised the majority and 9 patients sustained left sided injuries.

3.4 Mode of Injury

Reamed nailing: 6 cases in this group sustained injuries due to road traffic accidents and 4 cases were due to simple fall.

Unreamed nailing: 7 cases in this group sustained injuries due to road traffic accidents and the remaining 3 cases were due to simple fall.

3.5 Classification of Fractures Involved in the Study

The fractures were classified as per AO classification and winquist and Hansen classification.

Table 3. Side distribution

| Side | Reamed | Unreamed |
|------|--------|----------|
| Right| 6      | 5        |
| Left | 4      | 5        |

Table 4. Mode of injury

| MOI  | Reamed | Unreamed |
|------|--------|----------|
| RTA  | 6      | 7        |
| FALL | 4      | 3        |
3.6 AO Classification

**Reamed nailing:** Out of 10 cases, 15 cases were of AO type A, 4 cases were of AO type B and 1 case was of AO type C. AO type A being the majority.

**Unreamed nailing:** Out of 10 cases, 3 cases were of AO type A, 3 cases were of type B and 4 cases being of type C. AO type C being the majority.

3.7 Winquist and Hansen Classification

**Reamed nailing:** Out of 10 cases, 4 cases were of type 1, 3 cases were of type 2, 3 cases of type 3 and none were type 4. Type 1 cases were the majority.

**Unreamed nailing:** Out of 10 cases, 3 cases were of type 1, 4 cases were of type 2, 3 of type 3 and 0 case was of type 4. Type 1 cases were the majority.

3.8 Location of Fracture

**Reamed nailing:** Out of 10 cases, 4 were located in the upper third, 3 in the middle third and 3 in the lower third.

**Unreamed nailing:** Out of 10 cases, 4 cases were located in the upper third, 4 cases in the middle third and 2 cases in the lower third.

**Table 5. AO classification**

| AO type | Reamed | Unreamed |
|---------|--------|----------|
| Type A  | 5      | 3        |
| Type B  | 4      | 3        |
| Type C  | 1      | 4        |

**Table 6. Winquist and Hansen classification**

| Type | Reamed Nailing | Unreamed Nailing |
|------|----------------|------------------|
| I    | 4              | 3                |
| II   | 3              | 4                |
| III  | 3              | 3                |
| IV   | 0              | 0                |

**Table 7. Location of fracture**

| LOF      | Reamed | Unreamed |
|----------|--------|----------|
| Upper    | 4      | 4        |
| Middle   | 3      | 4        |
| Lower    | 3      | 2        |

**Table 8. Fibular involvement**

| Involvement     | Reamed | Unreamed |
|-----------------|--------|----------|
| Fibula same level | 5      | 6        |
| Fibula different level | 4 | 3        |
| Fibular Intact  | 1      | 1        |

**Table 9. Rate of clinical union**

| Weeks | Reamed | Unreamed |
|-------|--------|----------|
| 15-18 | 2      | 2        |
| 19-22 | 6      | 5        |
| 23-26 | 2      | 2        |
| >26   | 1      | 0        |
Table 10. Rate of radiological union

| Weeks  | Reamed | Unreamed |
|--------|--------|----------|
| 17-20  | 2      | 2        |
| 21-24  | 6      | 5        |
| 25-28  | 2      | 2        |
| >28    | 1      | 0        |

3.9 Fibular Involvement

**Reamed nailing:** Out of 10 cases, 5 cases had fibula fractured at the same level as tibia fractured, 4 cases had fibula fractured at different level and 1 cases had intact fibula.

**Unreamed nailing:** Out of 10 cases, 6 cases had fibula fractured at the same level as tibia fractured, 3 cases had tibia fractured at different level and 1 cases had intact fibula.

3.10 Rate of Clinical Union

**Reamed nailing:** Out of 10 cases, 2 cases showed union between 15 to 18 weeks, 11 cases between 19 to 22 weeks, 6 cases between 23 to 26 weeks and one case did not allow union beyond 26 weeks.

**Unreamed nailing:** Out of 10 cases, 5 cases showed union between 15 to 18 weeks, 9 cases showed union at 21 to 22 weeks and 5 cases showed clinical union between 23 to 26 weeks.

3.11 Rate of Radiological Union

**Reamed nailing:** Out of 10 cases, 2 cases showed radiological union between 17 to 20 weeks, 11 cases showed union at 21 to 24 weeks, 6 cases showed union at 25 to 28 weeks and one case did not show any signs of radiological union beyond 28 weeks.

**Unreamed nailing:** Out of 10 cases, 5 cases showed radiological union between 17 to 20 weeks, 9 cases showed union at 21 to 24 weeks and 4 cases showed union at 25 to 28 weeks.

Intramedullary nailing is a well-established method for stabilization of long-bone shaft fractures. But the choice between reamed and unreamed intramedullary nailing for the treatment of tibial fractures is a hot topic. In the past, experimental and clinical studies have found that the changes in cardiac and pulmonary hemodynamics, biomechanical testing of stiffness and strength, the circulation of the surrounding muscles and intramedullary pressure are different between reamed and unreamed intramedullary nailing. So we carried out a comprehensive search strategy to compare the therapeutic outcome of reamed and unreamed intramedullary nailing for tibial fractures. From the meta-analysis, we found that there were no statistically significant differences between the two methods concerning infection, compartment Syndrome, thrombosis, time to union, delayed union (nonunion), malunion and knee pain. But there was a significantly higher fixation failure in the unreamed group than in the reamed group. Our results recommend reamed nails for the treatment of closed tibial fractures.

4. CONCLUSION

Intramedullary nailing is the proven choice of treatment for adult tibial shaft fractures, despite the fact that controversy exists regarding the choice of reamed or unreamed intramedullary nailing. There are no clear indications or contraindications for choosing either option.

The rate of clinical and radiological fracture union, functional outcome and complications were similar in both the study groups. Considering the ease of performing the technique and the decreased operative time, unreamed interlocking nailing may have an edge over reamed interlocking nailing.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline Patient's consent and ethical approval has been collected and preserved by the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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