

Management of closed tibial shaft fractures with reamed inter locking nail

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Abstract

Objective: The objective of the study was to evaluate the results of closed reamed interlocking nail in the management of closed tibial shaft fractures.

Study Design: Descriptive Observational study

Place and Duration: This study was conducted in the Department of Orthopedic, Khyber Teaching Hospital Peshawar, from Jun 2007 to December 2008.

Patients and Method: A total of 32 patients above the age of 18 years were included in the study. Patients were admitted through accident and emergency department. Written informed consent was obtained from all patients. Detailed history was asked, every patients was assessed clinically and radiographically. Reamed interlocking intramedullary nailing was done as per protocol. Patients were followed for 1 year, and were evaluated for union, infection, range of motion of knee and ankle and implant problems. 2 patients were lost to follow up and the study was completed on 30 patients.

Results: All the fractures united without any need for bone graft. Simple fractures united in average period of 12.5 weeks while comminuted and segmental fractures took longer by four weeks, and united in an average of 16.5 weeks.

Two patients developed superficial infection at the site of screws which were treated accordingly with drainage and antibiotics and removal of the distal screw.

All the patients had full range of knee movement while 28 patients had full range of ankle movements. The remaining two patients had 15-20 degree loss of ankle dorsiflexion.

Nail breakage was not observed in any patient while two had breakage of the proximal and two had breakage of distal screws.

Conclusion: We concluded that closed intra medullary nailing for closed diaphyseal fracture of the tibia is a safe and rewarding technique which has high rate of union and relatively low complications rate, there is early return to activities.

Key Words: Fracture, fixation, internal, interlocking nail

Introduction:

Tibia is the most commonly fractured long bone in the body due to its anatomical location and vulnerability to trauma. The treatment has always been a challenge for orthopaedic surgeons because of the particular local anatomic characteristic, high degree of comminution and associated soft tissue trauma, which contribute to high rate of complications after open surgical intervention.

The different treatment options include Close reduction and Plaster of Paris cast, Open

Reduction and Internal Fixation with plate & screws, External fixation and intra-medullary devices. P.O.P cast was associated with high incidence of ankle stiffness.¹ Plating have high incidence of infection, nonunion and fixation failure.² External fixation resulted in pin tract infection and at times Osteomyelitis.³ Close interlocking nailing was developed that reduces

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the post-operative infection⁴, promote early union⁵, and regain early activity.⁶ Intramedullary nail is now commonly used in the management of closed tibial shaft fractures and is considered to be the treatment of choice in closed tibial diaphyseal fractures.⁷ Published series on this subject is extensive with well documented high rates of union associated with low incidence of complications.^{5,7,8}

Mal-union and mal-rotation has got much lower rate than for other forms of treatment. These encouraging results have lead to the widespread use of reamed interlocking nail for the treatment of closed tibial fractures.

Interlocking nails act as an internal splint, serving as load shearing devices and provide bone graft to the fracture site. It provides strength that does not allow the stress to exceed beyond the critical amount which can disrupt the fracture site. Interlocking nails allow the movement of the adjacent joints so rehabilitation is concurrent with treatment and stress shearing is minimal.

Material and methods:

This study was conducted on 32 patients with closed tibial fractures admitted through accident and emergency department of Khyber Teaching Hospital Peshawar, from Jun 2007 to December 2008.

All the patients were evaluated in the accident and emergency department for any life threatening conditions as per ATLS protocol. The fractures were splinted to reduce pain and prevent further soft tissue trauma. Antero-posterior and lateral radiograph including knee and ankle joints were obtained in all cases.

Patients with closed tibial shaft fracture and age above 18 years were included in the study, while patients with open fracture and pathological fracture were excluded from the study.

Written and informed consent was obtained from all patients. Detail history specially about the mechanism of injury was asked, meticulous physical examination and relevant investigations

including HbsAg and anti HCV were done. Intramedullary nailing was performed as follow

Nailing Technique:

All the patients were operated under GA on an ordinary operation table and C-arm with pneumatic tourniquet over the mid thigh and knee hanging down at the end of the table. A vertical mid line incision from the lower pole of the patella to the tibial tuberosity was given. Patellar tendon was retracted with self-retaining retractor. Entry made in the mid line 1.5 cm below the joint line with the help of a curved awl. Once the medullary canal was entered, an olive tipped guide wire was passed in the medullary canal. Close reduction was performed and the guide wire was negotiated into the distal fragment. Grating of the bone is experienced when the guide wire passed through the distal fragment and was confirmed under the C arm in both the planes.

After successful introduction of the guide wire, tibia was reamed with the help of a flexible reamer over the olive tipped guide wire. The olive tipped guide wire was exchanged with the help of Teflon sleeve, with a non tipped guide wire, with out losing the reduction.

The nail length was assessed by subtracting the length of exposed guide wire from the total length of guide wire.

The required nail is then mounted on the insertion assembly and the nail is then passed over the guide wire without hammering. The last part required gentle hammering. When the nail has successfully been passed in the distal fragment, the guide wire was removed.

All the nuts on the jig were tightened. The traction on the limb was reduced and the foot thrust to push the distal fragment proximally to compress the fracture site. The distal locking screws were then passed with free hand technique, and the proximal screw was passed via assembly.

The wound was closed without drain. The knee was manipulated to full range of motion. Patient

Table 1: Type of Fracture According to Winquist Classification

Winquist Type	Number of Patients	Percentage
I	3	10.0%
II	10	33.3%
III	17	56.7%

was put on Intravenous antibiotic and analgesic.

Range of motion exercises were started on 1st post operative day and the patient was mobilized with help of crutches with touch down weight bearing.

Patients were discharged on 3rd post-op. day and called for review after 2 weeks. Patients were then called for subsequent visit at an interval of 1 month till healing was completed.

At each follow up visit, the patients were evaluated for union, infection, Range of motion of knee and ankle, deformity and any implant problems and the findings were documented on preformed Proforma. 2 patients were lost to follow up and the study was completed on 30 patients

Results:

Out of 30 patients 27 (90.0%) were males and 3 (10.0%) were female, with a mean age of 35 years (18-65 years). Right side was involved in 17 (56.7%) and left side in 13 (43.3%) patients. Most of the fractures were either segmental or sufficiently comminuted. The fractures were classified according to Winquist and Hansen classification, and are given in Table-1.

Twenty fractures were due to Road traffic accident, 8 were due to fall from a significant height and 2 were due to sports injuries. Mechanism of injury is given in fig-1. Twenty five fractures were isolated and 5 were associated with fracture of either ipsilateral or contralateral femur, which was also treated with static interlocking nail.

All fractures were treated within 1st week after injury and allowed early mobilization. Patients were followed up for a period of 1 year and were evaluated for union (both clinically and radiologically), range of motion of knee and ankle

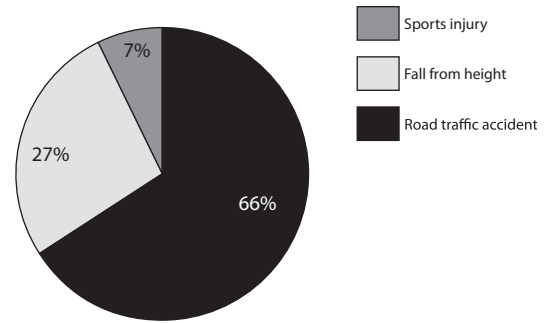


Figure 1: Mechanism of injury

joint, infection, malrotation and implant problem.

Union was achieved in all patients without the need for bone grafting. 25 (83.3%) fractures united in 16-20 weeks (avg 16.5 weeks), while 5 (16.7%) united in average time of 12.5 weeks. The mean time to union was 16.5 weeks in patients with segmental or comminuted fractures and 12.5 weeks in patients with simple injuries. 26 (86.7%) fractures were statically locked, while 4 (13.3%) fractures were dynamically locked with the proximal or distal screw. Five fractures were dynamized by removing either the proximal or distal screw between 6 & 9 weeks.

Two (6.7%) patients developed superficial infections at the site of either the proximal or distal screws site. One patient who developed infection at the site of proximal screw after 6 months was due to staph-Aureus on culture, the other after 9 months at distal screw site was again due to staph-Aureus. Both patients were treated with drainage and antibiotic.

All the patients had full range of motion of the knee joint (139 degree of flexion on average). While the ankle showed that 28 (93.3%) patients had full range of motion while 2 (6.7%) patients had 15-20 degree limitation of either dorsiflexion or plantarflexion due to the original trauma to the foot. Breakage of the nail was not observed in any patient, however 2 patients (6.7%) had breakage of the proximal screw and in 2 patients (6.7%) distal screw breakage occurred. Nothing was done and the fractures united uneventfully.

Discussion:

Although closed diaphyseal fracture of the tibia can be treated non operatively^{9,10} but there are numerous indications for operative treatment. The preferred method of operative treatment is controversial but reamed interlocking intramedullary nail for closed tibial diaphyseal fracture is a popular technique because of reported good results with relatively low complication rate in clinical operative series.¹¹⁻¹⁸

A review of the literature on the subject shows that many authors use union and infection rates as their outcome criteria and have ignored other important factors such as range of motion of the above and below joints, implant problem, and any deformity.

We have achieved 100% union without the need for any other procedure like bone grafting. The mean time to achieve union in our study was 16.5 weeks in those patients who had comminuted or segmental fractures of the tibia, which is comparable to the studies of Court-Brown⁵ at al, Larsen¹⁹ at al and Lin²⁰ at al who achieve union in 16.7 weeks, 15.4 weeks and 17.4 weeks respectively. In 5 (16.7%) cases in which the fracture was dynamized between 6 to 9 weeks, union was achieved in the same period of time.

The infection rate in our series was low and occurred late. One patient had developed infection in the region of the tuberosity secondary to trauma and was superficial. It was drained and treated with IV antibiotics. The other patient who developed infection after 9 months in the region of distal screw, which was removed, curetted and treated with antibiotics. *Staphylococcus aureus* was the causative organism in both the cases. None of the patient affects the final outcome.

Full range of knee motion was achieved in all the patients while in 2 patients (6.6%) the ankle had a reduced range of motion by 15-20 degree which was secondary to the original trauma to the foot. Bonneville²¹ at al, also found normal range of motion of both knee and ankle joint. The good range of motion in our series was due

to the availability of well equipped physiotherapy department. The major advantage of interlocking nailing appears to lie in the increased mobility that it allows. Patient does not require a cast, joint movement and patient mobilization is therefore facilitated. The increased mobility provided by closed nailing facilitates early return to full activities.

None of our patients have any rotational deformity as we inserted the proximal and distal screw carefully. If both the proximal and distal screws are inserted properly it virtually abolishes shortening and angular & rotational deformities. No Doubt, anterior knee pain is the main problem associated with closed intra medullary nailing especially in our society where the patients kneel 5 times a day for prayer. This problem can be avoided if trauma to the patellar tendon is kept to the minimum during hammering. Proper skin closure without any tension also avoids the chances of hyper-trophic scar formation and thus reduces the anterior knee pain. In our study 18 (60.0%) patients have anterior knee pain which was comparable to the studies of Bonneville²¹ at al and Vaisto²² at al that have anterior knee pain in 50% and 67% patients respectively.

We observed screw breakage in 4 patients (13.3%). In 2 patients the proximal screws were broken and in 2 the distal screws failure occurred. No specific action was taken and the breakage did not compromise the final outcome. The increased prevalence of the failure of the locking screws in association with nail inserted without reaming has been reported by other Authors¹⁶.

Conclusion:

We concluded that closed intramedullary nailing for closed diaphyseal fracture of the tibia is a safe and rewarding technique which carries a high rate of union with a relatively low complications rate and early return to activities.

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