ORIGINAL ARTICLE

A STUDY OF THE MANAGEMENT OF OPEN FRACTURES OF TIBIA BY UNREAMED INTERLOCKING NAIL

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ABSTRACT: AIMS AND OBJECTIVES: To evaluate the results of closed interlocking intramedullary nailing without reaming in the treatment of open fractures of the tibial shaft and study the difficulties (complications) encountered during the operative study. To compare the efficacy of interlocking intramedullary nailing without reaming in treating open fractures of tibia, Time required for the union of fracture, Range of motion of ankle and knee joint, Rate of malunion and mal rotation and Pain at the knee joint. **RESULTS:** The average age of patient is 32 years,83.33% are males, road traffic accidents account for majority(79.16%),right side involved in 58.33%,gustillo type II and type I compound fractures are common, full range of movements is seen in 66.67% by 12 weeks and union occurred in 95.83% by 9 months. Thirteen (54.17%) patients had excellent results, six (25%) patients had good results, four (16.67%) patients had fair results and one (4.16) patient had poor result. **CONCLUSION:** Unreamed interlocking intramedullary nailing with the help of image intensifier seems feasible in open diaphyseal fractures of tibia with the advantages of minimal blood loss, low risk of infection, early mobilisation, earlier soft tissue coverage, Promotes early union,minimal hospital stay and early returns to activities.

KEYWORDS: Tibia, unreamed, open fractures, interlocking nail.

INTRODUCTION: Tibial diaphyseal fractures are the most common type of long-bone fracture encountered by most orthopaedic surgeons. The management of tibial diaphyseal fractures has always held a particular interest for orthopaedic surgeons. Not only are these fractures relatively common, but they are often difficult to treat. The subcutaneous location of the antero-medial surface of the tibia means that severe bone and soft tissue injury is not infrequent, and there is a high incidence of open fractures compared with other long bones. Furthermore the blood supply of tibia is more precarious than that of bones enclosed by heavy muscles.

Among the various modalities of treatment such as conservative gentle manipulation and use of short leg or long leg cast, open reduction and internal fixation with plates and screws, intramedullary fixation and external fixation techniques, surgeon should be capable of using all these techniques and must weigh advantages and disadvantages of each one and adapt the best possible treatment. The best treatment should be determined by a thoughtful analysis of morphology of the fracture, the amount of energy imparted to the extremity, the mechanical characteristics of the bone, and the age and general conditions of the patient and most

importantly the status of the soft tissues (The skin, muscle and associated neurologic and vascular structures of the leg).

Three goals must be met for the successful treatment of open fractures of tibia. 1. Prevention of infection 2. Achieve bony union 3.To Restore the function. These goals are interdependent and usually are achieved in the chronologic order given.

Immobilization in a plaster cast has been used most commonly in the past but it does not always maintain the length of the tibia and it leaves the wound relatively inaccessible.[1] Open reduction and internal fixation with plates and screws has yielded unacceptably high rates of infection. This method may be selected with more severe or local injuries, associated displaced intraarticular fractures of knee and ankle.

External fixation, considered the treatment of choice by many truamatologists, has the disadvantages of the bulky frames and frequent pin track infections, nonunions, and malunion. Closed nailing involves least disturbance of soft tissue, fracture hematoma and natural process of bone healing as compared to other forms of internal fixation.

Until recently, however all interlocking intramedullary nailing involved reaming, which destroys the blood supply.[2] 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.

This led us to design a trial, to study the results of closed interlocking intramedullary nailing without reaming in the treatment of open tibial fractures.

MATERIALS AND METHODS: In the present study, 24 patients who had open fractures of tibial shaft were treated with wound debridement and interlocking intramedullary nailing without reaming during the period from July 2009 to May 2011 were included. All the cases were fresh fractures and were traumatic in nature.

The inclusion criteria includes Age more than 18 years, Shaft fractures within 7cms distal to the tibial tuberosity to 7cm proximal to the ankle joint in tibia in which the medullary canal was large enough to accept a minimum 8mm nail, Fresh fractures and Open fractures type I, II, IIIA and IIIB according to Gustilo Anderson classification.The exclusion criteria includes age less than 18 years, Associated intraarticular fractures of proximal /distal tibia,closed fractures and gustilo type IIIC fractures and patients with associated head injury, chest and abdominal trauma necessitating delay in primary and immediate fixation.

The soft tissue injuries are classified according to the system of Gustilo et.al. Ten wounds were type I, twelve wounds were type II, and two were type IIIA.

On admission a thorough clinical examination was performed including detailed history relating to age, sex, occupation, mode of injury, past and associated medical illness. The general condition of the patient was assessed with regards to hypovolemia, associated orthopaedic or other systemic injuries and resuscitative measures were taken accordingly. All patients received analgesics in the form I.M injections, tetanus immunoglobulin 500 I.U intramuscularly and I.V. antibiotics. Patients were taken to the emergency operating room for irrigation and debridement of the open fracture. Swabs were taken from the wound and were sent for culture and sensitivity, thorough saline wash was given and primary closure was done for the wounds presenting within

6 hours of trauma and which were clean. A sterile dressing was given for wounds and limb was immobilized in the form of above knee plaster of Paris slab. Limb elevation over a pillow was given for all the patients.

All patients were evaluated clinically and radiographically to assess for any other injuries. Radiographs were taken in two planes, AP and Lateral views. I.V antibiotics, cephalosporins and aminoglycosides were started for all the patients, patients were operated as early as possible, once the general condition of the patients was stable and fit for surgery.

Preoperatively the length of the nail was calculated from measurement taken from tibial tubercle to tip of the medial malleolus clinically and medullary canal was measured at the isthmus from the radiographs. Unreamed interlocking is done for all the patients.

RESULTS: The present study includes 24 open fractures of the tibial shaft surgically treated with interlocking intramedullary nailing without reaming from July 2009 to May 2011. The patients have been followed up for at least 6 - 10 months. All these patients were available for follow up.

In the present study majority of the patients were from age group 21 -40 years with average of 32 years, the youngest patient was 18 years old and the oldest patient was of 66 years. Majority of the patients were twenty males at about 83.33% and only four (16.67%) were females. Right tibial fracture constituted majority of the patients. Fourteen patients (58.33%) were having right tibial fractures

The commonest cause was high energy trauma accounting for 22 cases and 2 cases were caused by fall from height. Amongst high energy trauma the major cause of fracture was pedestrian automobile accidents which were twelve (50%) followed by motor cycle accidents which were seven (29.16%).

In the present study majority of the open fractures of the tibia were Gustilo type II (50%) and type I (41.66). Majority of the fractures occurred at middle distal third of tibia (45.83%).The predominant tibial fracture pattern was communited (41.66).In nineteen cases (79.16%) fracture was fixed with lesser diameter hollow tubular nails without reaming and in remaining five cases solid unreamed tibial nail (AO) was used. In 62.50% of the cases 8 mm diameter nails was used. Our mean operation time was 90 minutes. (Range 60 min. to 120 min).

Thirteen patients were commenced to protective full weight bearing by 8 weeks postoperatively (54.17%), in our study most of the patients were commenced to protective full weight bearing by 12 weeks postoperatively (87.50%). Dynamisation of the nails were done in three (12.50%) patients usually between 8- 12 weeks. Skin grafting was done in three cases (12.50%). In one case fasciocutaneous flap was done.

In the present study, twenty three of the twenty four fractures united (95.83%) by 9 months. The time for union ranged from 3-9months with an average of 26 weeks, nineteen (79.17%) fractures healed before 26 weeks, four fractures healed between 27 -36 weeks, one fracture united within 1 year after the injury.In sixteen patients (66.67%) full range of knee motion was achieved at 12 weeks. Less than 20 % of restriction of flexion was observed in five cases (20.83%). 20 - 25 % of restriction of flexion was observed in two cases (8.33%). In one case (4.16) less than 75% of knee motion was achieved.

In seventeen patients full range of ankle motion was achieved (70.83%). More than 75% of ankle motion was achieved in four patients (16.67%); in one case less than 50% of ankle motion was seen (4.16%)

In the present study one valgus angulation was noted with less than 7.5^{o}. In one patient anterior angulation less than 7.5^{o} was noted. Shortening less than 1 cm was seen in two patients. Two patients developed superficial infections, one in Gustilo type II and one in type IIIA. The two infections were healed with oral antibiotics. One patient developed deep infection in Gustilo type II fracture. He was treated for 6 weeks with I.V. antibiotics. Locking screws were broken in two (8.33%) of the twenty four tibiae, but the breakage did not result in the loss of reduction**.** Knee pain was noticed in 2 cases.

DISCUSSION: Fractures of the tibial diaphysis constitute a spectrum of injuries that result in a loss of the normal unrestricted load-bearing capacity of the leg.

Intramedullary nailing without reaming is less damaging to the endosteal blood supply. This is especially important in the treatment of open fractures in which the outer cortical blood supply may be damaged by periosteal stripping. Therefore, unreamed interlocking intramedullary nailing combines the most desirable features of external skeletal fixation and of non-locking nailing without reaming. Length, alignment and rotation are controlled, the soft tissues are easily accessible and some endosteal blood supply is preserved. These factors should lower the rates of infection and malunions and expand the use of intramedullary nails to fractures near the metaphysis and to those with more severe communition and soft tissue injury.

In the current series 24 cases of open fractures of shaft of the tibial were treated by closed unreamed interlocking intramedullary nailing over a period of two years. They were followed up for an average of 6-10 months. The purpose of this study was to evaluate the end results of treatment in these patients.

In the present study most of the patients were in age group of 21 - 40 years, which is most active period of life. The average age was 32 years. The incidence is consistent with other study conducted by Whittle, Russell, and Taylor in the series of fifty patients which showed the average was 34 years.[3] The average age was 30 years as in the study conducted by Joshi et al on sixty cases of open fractures of tibia.[4]

In the present study there were twenty male and four female patients showing male preponderance, which may be due to more outdoor activity of males. The sex distribution in the study conducted by Whittle, Russell, and Taylor were thirty four men and thirteen women.

Majority of the cases sustained fractures from road traffic accidents (91.66) and two patients sustained fracture after a fall as also reported by Sarmiento.[5] Among Road traffic accidents, pedestrian –automobile accidents 12 cases (50 %) was most common mode of injury in present series. In the series reported by Whittle, Russell, and Taylor most of the fractures were caused by high energy trauma and twenty three out of fifty (46%) were caused by pedestrian – automobile accidents.[3] In other series reported by Singer et al 54.16% fractures were due to motor vehicle accidents.[6]

In several reported series as well as in our series, the open fractures of shaft of the tibia treated with unreamed interlocking intramedullary nailing have given excellent results. In the

current series nineteen (79.17%) fractures united within 26 weeks of injury and other four cases (16.67%) united by 36 weeks, which is comparable with the other series as well. The delay in union was noticed in 1 patient with severe communition and extensive soft tissue injury.

In the series reported by Whittle, Russell, and Taylor the average time to union was seven months and four had delayed union.[3] In the series conducted by Joshi et al forty four of fifty six fractures healed within 32 weeks and six had delayed union.[4]

In the current series, there was one deep infection (4.16%) in type II open fracture. In the series reported by Whittle, Russell, and Taylor there was incidence of four deep infections among fifty patients (8%) and in the series by Joshi et al the incidence was 10%.[3] Tornetta et al found incidence of 7% in nail group.[7] The incidence of deep infection (4.16%) compares favourably with other series reporting rate of 2.4% to 11.6%. The infection rate using unreamed locked nails is favourable compared with external fixation (6-14% deep infection rates) and other methods.

In the current series, two cases of malunion occurred (8.33%). In the series reported by Whittle, Russell, and Taylor there was there was no malunions.[3]

Santoro et al found a non-union rate of 3% in 33 patients, a malunion rate of 9% an infection rate of 3%, nail breakage in 65 and two screws that broke.[8]

In the current series the implants failed infrequently, and locking screws were broken in one case (4.16 %), but the breakage did not result in a loss of reduction On the basis of this study, we now recommend dynamisation of most statically locked nails at 8-12 weeks if callus is not evident to promote fracture union and to avoid fracture of the inter locking screws. Our results were comparable with other series of studies.

In the current series, sixteen patients had (66.67%) full range of knee motion, in seventeen patients (70.83%) full range of ankle motion at 12 weeks of injury. In the study conducted by Whittle, Russell, and Taylor the flexion at knee was averaged 139^0 and motion at ankle averaged 16^0 of dorsiflexion and 38^0 degrees of planter flexion.[3] These results are comparable with other series of studies.

In the current series two patients (8.33%) noticed anterior knee pain. We advocated techniques of using a more lateral entry point and hyperflexing the knee during nail insertion to reduce the incidence of anterior knee pain. In the series reported by Joshi et al 17.85% patients had anterior knee pain and series reported by Court Brown et al reported 36% incidence of anterior knee pain.[4,9] Results were analysed based on johner and wruh's criteria.[10] Based on this, thirteen (54.17%) patients had excellent results, six (25%) patients had good results, four (16.67%) patients had fair results and one (4.16) patient had poor result.

CONCLUSION: In the study conducted on 24 cases of open tibia fractures treated by unreamed interlocking nail, we found unreamed interlocking intramedullary nailing with the help of image intensifier seems feasible in open diaphyseal fractures of tibia with the advantages of minimal blood loss, low risk of infection, early mobilisation of the patient which helps in healing of the fracture and prevents joint stiffness and promotes early union as it does not disturb the vascularity at the fracture site.

Earlier soft tissue coverage was possible. Strict adherence to technical principles during nailing will prevent some of the complications. There is minimal hospital stay and early return to work.

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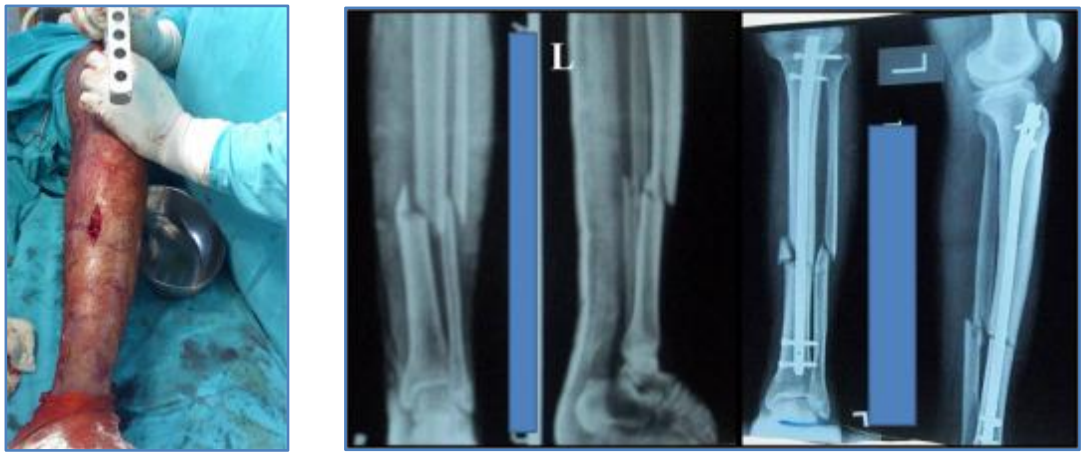

Fig. 1: clinical photograph of compound fracture tibia

Fig. 2: preoperative and 26 weeks postoperative radiographs

Fig. 3: preoperative and 24 weeks postoperative radiographs

Fig. 4: postoperative weight bearing clinical photograph

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