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Original Research Article

Management of Compound Fracture TibiaUsing an Unreamed Interlocking Nail

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Abstract:

Background and Objectives: With increasing number of vehicles on the roads in India, complex trauma cases caused by traffic accidents have increased progressively. Fracture Tibia are among the commonest fractures sustained in road traffic accidents due to the subcutaneous nature of the tibia, they are frequently open and contaminated fractures. Due to the poor blood supply and poor soft tissue coverage these fractures arefrequently complicated by delayed union, malunion, non-union and infection. This study was conducted at the Department of Orthopaedics Adichunchanagiri institute of medical sciences to evaluate the results of interlocking intramedullary nailing using an unreamed nail in the treatment of the compound fractures of tibia. It was done to compare the advantage of using an interlocking intramedullary nailing without reaming in the treatment of compound fractures of tibia with various studies in terms of time required for union, rate of malunion and malrotation, infection and range of motion of knee and ankle.

Materials and Methods: This study was performed on 20 compound fractures of tibia with an unreamed interlocking intramedullary nail Department of Orthopaedics at NMCH Patna. All the cases selected were fresh fractures and mostly traumatic in nature. The procedure was done as early as possible and the secondary procedures of Dynamisation, skin grafting and musculocutaneous flap were done as and when needed.

Conclusions: It was concluded that early interlocking intra medullary nailing using anunreamed nail with immediate soft tissue coverage resulted in good fracture union andlow rates of complications compared to other modalities of treatment. It is cost effective with short hospital stay and facilitates earlier return to work. Over all morbidity is reduced and better patient satisfaction noted.

Keywords: Interlocking Intramedullary Nailing, Unreamed, Delayed Union, Nonunion, Dynamization.

Introduction

Tibial diaphyseal fractures are the commonest long bone fractures encounteredby most orthopaedic surgeon‟s .In an average population there are about 26 tibial diaphyseal fractures per 1 lakh population per year. Males are more commonly affected than females with male incidence being about 41 per 1 lakh per year, and female incidence about 12 per 1 lakh per year. There is a bimodal distribution of tibial fractures with a preponderance of young males. [1] Because of its very location i.e.: two third of the tibial surface is subcutaneous throughout most of its length, compound fractures are more common in tibia than in any other major long bone. Furthermore, the blood supply of tibia is more precarious than other long bones due to inadequate muscle coverage.

Tibial fractures may be associated with compartment syndrome, vascular or neural injury. The presence of hinge joints at the knee and the ankle, allows no adjustment for rotatory deformity after fracture. Because of the high prevalence of complications associated with these fractures, management is quite difficult, and the optimum method of treatment still is a subject of controversy. There are five principle causes of tibial diaphyseal fractures; direct blow, assaults, sports injuries, falls, motor vehicle accidents and gunshot injuries. 1 The important factors in prognosis are (1) amount of initial displacement (2) degree of communition (3) whether infection has developed and (4) severity of soft tissue injuryexcluding infection (5) duration of time lapsed for the initiation of treatment. [2] Every fracture is an individual problem, and the decision to treat it conservatively or by internal fixation should be based on a realistic assessment of the advantages and the hazards of each method in the circumstances of that particular case. This calls for a high degree of clinical judgement which is harder to acquire orto impart than technical virtuosity in the operating theatre [3]

Management of the fractured tibia requires the

widest experience, greatest wisdom and the best of clinical judgement in order to choose the most appropriate treatment for a particular pattern of injury. [4] Among the various modalities of treatment such as conservative gentle manipulation and use of short leg or long leg cast, open reduction and internal fixationwith plates and screws, intra medullary fixation (including Ender pins, intramedullary nails, and interlocking intramedullary nails with reaming or without reaming), and external fixation techniques like ring fixator, 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, the age and general conditionsof the patient and most importantly the status of the soft tissues (the skin, muscle, tendons, ligaments and associated neurologic and vascular structures of the leg). Three goals must be met for the successful treatment of open fractures of tibia.The prevention of infection, the achievement of bony union, maintains limb lengthand the restoration of function and prevention of deformity [5].

Objectives

To compare the efficacy of interlocking intramedullary nailing without reaming intreating compound fractures of tibia with other standard similar studies in termsof:

- Time required for the union of fracture.
- Range of motion of ankle and knee joint.
- Rate of malunion and mal rotation

Materials and Methods

The present study was undertaken at the department of Orthopedics, at Nalanda Medical College and Hospital Patna, Bihar. This study involved both male and female patients with compound fractures of tibia, who presented to NMCH Patna. 20 patients who had compound fractures of tibial shaft were treated with wound debridement and interlocking intramedullary nailing without reaming during the period from 2015 to may 2019. All cases were fresh fractures and were traumatic in nature.

Most of the patients were brought to the casualty. Remaining cases were admitted through the outpatient department.

Inclusion Criteria

- The patient with injuries associated with compound fracture of tibia up tocompound GrIIIb.
- Age limit: 20 years to 70 years.
- Both males and females.

Exclusion Criteria

- Patients with head and chest injuries.
- Patients with pathological fractures.
- Patients with fractures lying proximal to tibial tuberosity.
- Patients with fractures within 5cm of the distal articular surface of tibia.

Twenty patients who had 20 fractures were available for evaluation. Theduration of follow-up ranged 18 months with 4 visits. There were 17 men and 3 women, ranging in age from 20 to 70 years old.13 right and 7 left tibiae were fractured. Most of the fractures were caused by high –velocity trauma.12 of the fractures were caused by motorcycle accidents, 4 by motor vehicle accidents, 4 pedestrian accidents. 2 patients had associated fractures.

The soft tissue injuries are classified according to the system of Gustilo et.al, 11 wounds were type II, 5 were type IIIA, and 4 were type IIIB. Location of the fracture, the tibia was divided into 5 zones of equal length; proximal third 2 fractures,3 fractures were in proximal middle third, 4 fractures were in middle third, 8 fractures were in middle distal third, 3 fractures were in distal third. The predominant tibial fracture patterns were transverse in 3, oblique in 7, and spiral in 2, and communited in 8 fractures. Patients were operated under spinal /general anesthesia .Patient is placed in Supine position over a C-Arm compatible operating table. The injured leg is positioned freely, with knee flexed 90o over the edge of operating table to relax the gastro soleus muscle and allow traction by gravity. The uninjured leg is placed in abduction, flexion and external rotation to ensure free movements of the image intensifier from A.P to lateral plane. The table is adjusted to comfortable operating height.

Figure 1: Bone awl parallel to the bone

Figure 2: Proximal reaming

Figure 3: Distal locking

Figure 4: After procedure

Results

The present study includes 20 compound fractures of the tibia surgicallytreated with closed interlocking intramedullary nailing. The patients have been followed up for at least 18 months with 4 visits (6 weeks, 3 months, 6 months and 12 months).

All these patients were available for follow up.

Majority of the patients were of bimodal distribution from age group 20-30 (30%) and age group 41-50 (30%), the youngest patient was 20 years old and the oldest patient was of 70 years .(table no.1)

Table 1: Age distribution of patients studied

Age in years	No. of patients	%
20-30	6	30.0
31-40	2	10.0
41-50	6	30.0
51-60	4	20.0
61-70	2	10.0
Total	20	100.0

Majority of the patients are male (85%) and only 15% were females. (Table no.2)

Table 2: Gender distribution of patients studied

Gender	No. of patients	%
Female	3	15.0
Male	17	85.0
Total	20	100.0

Right tibial fracture constituted majority of the patients. 13 patients (65%)were having right tibial fractures (table no.3)

Table 3: Side involved

Side	No. of patients	%
Left	7	35.0
Right	13	65.0
Total	20	100.0

Union was defined as the presence of bridging callus on two radiographic views and the ability of the patient to bear full weight on the injured extremity .19 of the 2 fractures united (95%). The time for union ranged from 3-9months with an average of 4-8months, 14 fractures healed before 20 weeks ,5 fractures healed between 21 -36 weeks ,1 fracture failed to unite 12 months after the injury.

Table 4: Union categories

Union	No. of patients	%
Less than 4 months	5	25.0
4-8 months	11	55.0
8-12 months	4	20.0
Non-union	1	5.0
Total	20	100.0

One of the important aspects of reduction and internal fixation with interlocking intramedullary nailing without reaming is the ability to mobilize the patient early. In 12 patients (60%) full range of knee motion was achieved at 12 weeks .More than 80 % of the knee motion was achieved in 6 cases (30%). In 1 case less than 75% of knee motion was achieved (table 13). In 16 patients full range ofankle motion was achieved (80%). More than 75% of ankle motion was achieved in 3 patients (15%); In 1 case less than 50% of ankle motion was seen (5%)

Table 5: Knee

Knee	No. of patients (n=20)	%
Normal	13	65.0
Abnormal	7	35.0
<75%	1	5.0
> 80%	4	20.0
<80%	2	10.0

2 patients developed superficial infections. One in gustilo type II, and one in type IIIB. All the 2 infections were healed with oral antibiotics. 1 patient developed deep infection in gustilo type II fracture. He was treated for 6 weeks with antibiotics administered I.V.

Table 6: Infection

Infection	No. of patients	%
No	17	85.0
Deep	1	5.0
Superficial	2	10.0
Total	20	100.0

The end results of all 20 cases are summarized here. All the cases had a followup of 18 months with 4 visits (6 wks, 3 months, 6 months, 12 months)

Table 7: Results

Results	No. of patients	%
Excellent	11	55.0
Good	7	35.0
Fair	1	5.0
Poor	1	5.0
Total	20	100.0

Figure 5: Preoperative X ray

Figure 6: Wound – preoperative

Figure 7: Post operative X ray

Figure 8: Fracture union – 6 months

Discussion

The optimal management of compound tibial fractures continues to be a problem with several unanswered questions. These fractures, usually caused by high velocity injury, have multiple problems resulting from the poor soft tissue coverage, draining out of the fracture hematoma through the compound wound and limited vascular supply of the tibia, causing mal union, infection and sometimes resulting in amputation .Recent advances in wound coverage techniques and fixation have decreased the prevalence of these complications, but the optimum management of compound fractures of the tibia is still evolving.[6] There are two major factors related to the lesion that alter the final outcome oftibial shaft fractures. The first is the severity of the fracture, characterized according to Nicoll EA (3) by the degree of initial displacement, commination and soft tissue injury. Accordingly, the more severe the fracture, higher the rate of complications andlonger the periods of healing will be, whatever the method of fixation used. The second factor is the damage of the tibial blood supply .In compound fractures, not only is the endosteal circulation disrupted but there is also periosteal circulation disruption after severe soft tissue damage and periosteal stripping from thebone. This emphasizes the necessity to preserve as much as possible the vascularity ofthe endosteal vessels, using stabilization technique that avoid additional disruption of this blood supply. Johner R et al [7] reported non-union was twice as common and infection five times more likely when open fractures were treated with plating, so use of a plate isan unattractive treatment option. Of the various intramedullary devices available, the unreamed unlocked nails have produced good results in open tibial fractures but the implant did not adequately stabilize the communited or segmental fractures. In a randomized prospective study comparing external fixation with Ender's nails, Holbrook et al [8] evaluated twenty-eight open tibial fractures treated with external fixation and found a 14 percent rate of deep infection, a 21 percent rate of pin tract infection, and a 36 percent rate of malunions. For twenty-nine comparable open fractures treated with Ender nails, they reported a 7 percent rate of infection and a 21 percent rate of malunion. The major limitation of ender's nail fixation is lack of axial control. Interlocking intramedullary nailing with reaming solves the problem of malunions because it provides the ability to control length, angulation and rotation butare 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. Lottes JO[9] reported a 7.2 percent rate of infection after treatment of 256 opentibial fractures with the use of his nail without reaming. The 27 percent rate of malunions in the series, Swanson TV et al [10] demonstrates that malunions can be a

problem even for fractures that have been judged to be axially stable. In our series, 12 patients had (60%) full range of knee motion, in 16 patients (80%) full range of ankle motion at 14 weeks of injury. These results are comparable with other series of studies.

In our study one patient (5%) noticed pain at the knee joint. Patzakis MJ et al [11] recommends removal of nail after fracture healed to avoid the risk for reactivation of infection. In our series, no patient developed fat embolism, compartment syndrome, peroneal nerve palsy and reflex sympathetic dystrophy. At the end of the study each patient was individually asked regarding their opinion about the surgery and their return to premorbid status. 15 patients (75%) werepleased, 4 patients (20%) were satisfied and 1 patient (5%) was unhappy. [12]

Conclusion

Unreamed interlocking nailing with the help of an image intensifier seems agood option in compound fractures of tibia.

Promotes early fracture union as it does not further compromise vascularity of thefracture site.

Early mobilization of the patient helps in reducing fracture disease and reducessickness absenteeism.

Minimal loss of blood during the procedure.

Associated with low risk of infection.

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