Original Article

DOI: 10.17354/ijss/2016/131

Surgical Management of Isolated Tibial Shaft Fractures with Closed Intramedullary Interlocking Nail

Kadiri Venkata Ranganath[1], H S Arun[2], S Hariprasad[3]

[1]Junior Resident, Department of Orthopaedics, Sri Devaraj Urs Medical College & Research Centre, Kolar, Karnataka, India, [2]Professor & Head, Department of Orthopaedics, Sri Devaraj Urs Medical College & Research Centre, Kolar, Karnataka, India, [3]Assistant Professor, Department of Orthopaedics, Sri Devaraj Urs Medical College & Research Centre, Kolar, Karnataka, India

Abstract

Background: Tibial diaphyseal fractures are one of the most common long bone fractures encountered by most of the orthopedic surgeons. The tibial shaft fractures with intact fibula had difficulties in the orthopedic treatment of leg fractures such as reduction of the tibial and an unusually high rate of varus malunion, delayed union, and non-union. Fractures of tibial diaphysis associated with an intact fibula have always interested orthopedic surgeons; there has been debate as to whether the intact fibula was associated with an improved or worse prognosis.

Materials and Methods: A total of 30 patients with isolated tibial diaphyseal fractures (21 closed fractures, 4 Type I open fractures, and 5 Type II open fractures) were operated with closed intramedullary interlocking nailing. This prospective study was done over a period of 2 ½ years with regular follow-up.

Results: Postoperatively following 6 months, excellent functional results were obtained in 70% of cases. Good functional results were obtained in 14%, fair functional results in 3%, and poor functional results in 13%. According to Johner and Wruh's criteria, the percentage of union rate in our study was 87%. The time for union ranged from 4 to 9 months with an average of 5 months, 17 fractures healed before 5 months (20 weeks), 7 fractures healed between 5 and 8 months (20 to 32 weeks), and 4 fractures had gone into non-union.

Conclusion: Intramedullary interlocking nailing is the reliable and effective treatment for undisplaced and minimally displaced closed isolated tibial shaft fractures, also in open Type I tibial shaft fractures. Closed minimal and undisplaced fractures have united well. Displaced, comminuted fractures of tibial shaft with intact fibula are prone to delayed union and non-union. Intramedullary interlocking nailing minimizes the hospital stay and reduces the economic burden and enhances the early return to work.

Key words: Fibula intact, Intramedullary nailing, Tibial shaft fracture

INTRODUCTION

The management of tibial diaphyseal fractures has always held a particular interest for orthopedic surgeons. Not only are they relatively common but also they are often difficult to treat. The subcutaneous location of the anteromedial surface of the tibia means that severe bone and soft tissue injury are not infrequent, and there is a high incidence of open fractures compared with other long bones.[1]

When the fibula remains intact, a tibio fibular length discrepancy develops and causes altered strain patterns in the tibia and fibula. These may lead to delayed union, non-union, or malunion of the tibia with the sequelae of joint disturbances. The lower incidence of complications in patients <20 years old may be due to the greater compliance of their fibulae and soft tissues.[2] The main difficulties encountered in the orthopedic treatment of leg fractures with intact fibula are reduction of the tibial and an unusually high rate of varus malunion, and non-unions. Nailing is a reliable technique for treatment of tibial shaft fractures with an intact fibula.[3] Fractures of

Access this article online

www.ijss-sn.com

Month of Submission : 01-2015
Month of Peer Review : 02-2016
Month of Acceptance : 02-2016
Month of Publishing : 03-2016

Corresponding Author: Dr. Kadiri Venkata Ranganath, Department of Orthopaedics, Sri Devaraj Urs Medical College & Research Centre, Tamaka, Kolar, Karnataka, India. E-mail: drkvranganath@gmail.com

tibial diaphysis associated with an intact fibula have always interested orthopedic surgeons. There has been debate as to whether the intact fibula was associated with an improved or worse prognosis.[4,5] Displacement of more than 50% of the width of the tibia at the fracture site was a significant cause of delayed union or non-union. Reduction was difficult to maintain in fractures with more than 50% initial displacement and that comminution delayed fracture healing. Fractures with more than 50% comminution are considered unstable and usually are associated with high-energy trauma. The treatment of displaced isolated fractures of the tibial shaft with closed intramedullary nailing with reaming provides functional results that are superior to those obtained with use of a cast.[6]

Minimally displaced tibial fracture in the presence of an intact fibula has a good prognosis. Initial force may be great enough to break the tibia and tear local soft tissues, the fibula is protected from fracture by its innate flexibility and the significant compliance of its proximal and distal ligaments.[7-9] He further stated that roentgenograms often do not reveal the true magnitude of the displacement sustained at the moment of violence and that therefore this fracture pattern can indeed be subject to complications.[5,10] Isolated tibial shaft fractures with intact fibulae are more prone for complications such as delayed and non-union.[11] Intramedullary nailing will remain the treatment of choice for diaphyseal fractures. However, modern plates are become less invasive it is associated with more soft tissue stripping and potential devascularisation.[12]

The aim of this prospective study was to assess the outcome of isolated tibial shaft fractures treated with an intramedullary interlocking nail.

MATERIALS AND METHODS

A total of 30 patients with isolated tibial diaphyseal fractures (closed fractures, Type I open fractures, and Type II open fractures) were operated with closed intramedullary interlocking nailing in the Department of Orthopaedics, R.L.J Hospital attached to Sri Devaraj Urs Medical College and Research Centre, Kolar, Karnataka, during the period from July 2013 to December 2015. This prospective study was done over a period of 2 ½ years with regular follow-up.

Inclusion Criteria

1. Closed tibial fractures with intact fibula
2. Open fractures of tibia with intact fibula, Type I, Type II, and Type IIIA as classified by Gustillo–Anderson grading
3. Tibial fractures in the age group above 18 years.

Exclusion Criteria

1. Open diaphyseal fractures of tibia Type III B, C (Gustillo–Anderson)
2. Tibial fractures with intra articular extensions
3. Pathological fractures.

On admission general condition of the patient was assessed with regards to hypovolemia, associated orthopedic or systemic injuries and resuscitative measures taken accordingly. Patients were selected on the basis of history, clinical examination, radiography, and inclusion criteria. X-ray of full length of tibia antero-posterior and lateral view was taken. All fractures were treated with a closed intramedullary interlocking nail. Follow-up and assessment were performed using Johner and Wruh's criteria at the end of 6 months.

Preoperatively, the length of the nail is calculated by tibial tubercle-medial malleolar distance (TMD). The TMD is determined by measuring the length between the highest (most prominent) points on the medial malleolus and the tibial tubercle. The TMD is an easy, inexpensive, and accurate method of pre-operative determination of correct nail length. The diameter of the nail is assessed by measuring the tibia at its narrowest point, which is best appreciated on lateral radiographs. Accordingly, a stock of interlocking nails 2 cm above and below the measured length and 1 mm above and below the required diameter were kept.

The patient was operated under spinal anesthesia. The patient was placed in supine position over a radiolucent fracture table. The injured leg was positioned freely, with the knee flexed in 90° over the edge of the operating table vertical patellar tendon splitting incision of about 5 cm long was made over the skin extending from center of the inferior pole of the patella to tibial tuberosity. The curved bone awl was used to breach the proximal tibial cortex in a curved manner. After widening the medullary canal of proximal third, a ball tipped guide wire was passed into the medullary canal of proximal fragment and fracture fragment reduced under image intensifier. Its containment within the tibia was confirmed in antero-posterior and lateral view. Medullary canal was reamed starting from 8 mm reamer size to 0.5 to 1 mm larger than the diameter measured using radiographs. Then, ball tipped guide wire was exchanged with smooth guide wire using a medullary tube. This was followed by passing an assembled nail into the medullary canal over the smooth guide wire. Proximal locking was done first followed by distal locking, wound sutured in layers and skin closed with staples; sterile dressing and compression bandage was applied. The patient was started on the active knee, ankle, and toe mobilization after over come from anesthesia. The patient

was allowed non-weight bearing crutch walking/walker on next post-operative day if associated injuries permit, general condition, and tolerance of the patient. Skin sutures were removed on 14 the post-operative day. Partial weight bearing and with crutch walking/walker was commenced immediately, depending on the type of fracture, rigidity of fixation, and associated injuries. Further follow-up was done at 6, 12, 18, and 24 weeks; and each patient was assessed clinically and radiographically according to the Standard Performa.

RESULTS

Data were collected based on detailed patient evaluation with respect to history, clinical examination, and radiological evaluation. The post-operative evaluation was done both clinically and radiologically. All 30 patients were available for follow-up. Period of follow-up was 6-8 months.

Detailed analysis of function results of patients were done at end 6 months on the basis of following criteria by Johner and Wruh's, 21 out 30 patients had excellent results which correspond to around 70%, 4 patients had good results around 14%, 3 patient had fair results around 3%, and 4 patients had poor results around 13%.

The majority of patients are from age group 18 to 39 years (73.3%). The youngest patient was 19-year-old, and oldest patient was 58-year-old. The majority of non-union cases were elderly with open Type II fractures; these patients are also having co-morbidities of diabetes mellitus and hypo-proteinuria. 90% of the patients are males and 10% patients are females.

In our study, right tibial shaft fractures constitute 63% and left are 37%. There was 21 closed fracture out of 30 cases (70%), 4 open Type I fractures (13%), and 5 open Type II fractures (17%). Road traffic accident was the major cause for tibial fracture and it constituted 90% of cases. Second common mode of injury was fall from height and it was 7%, and the third type was an assault which was 3%. Most of the cases are middle one-third fractures (73%). Next common level of fracture in the tibia in our study is lower one-third (20%), and upper one-third is 7%.

In our study, only two had associated injuries of which one had opposite side metatarsal fracture which was fixed with k-wire, another had rib fracture treated conservatively. Rest 28 patients had no associated injuries.

In our study, most of the cases are mobilized (partial weight bearing with crutch walking) on next day after the operation. Majority of the patients, 21 out of 30 (70%) started partial

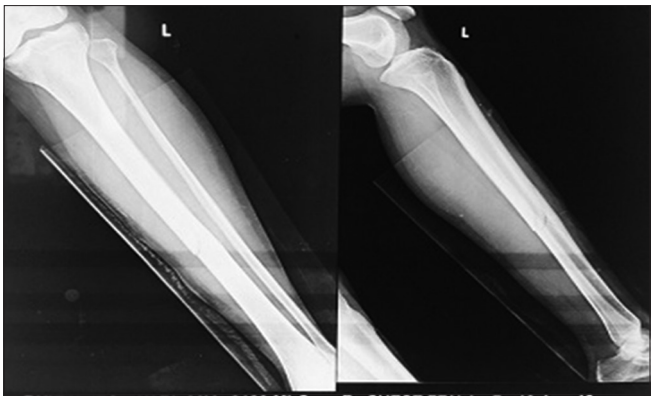

Figure 1: Case 1: Post-operative X-ray with IMIL nail

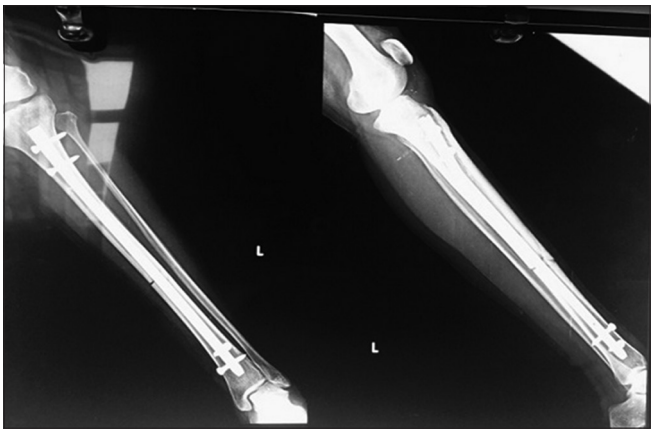

Figure 2: Case 1: Pre-operative X-ray isolated tibial shaft #

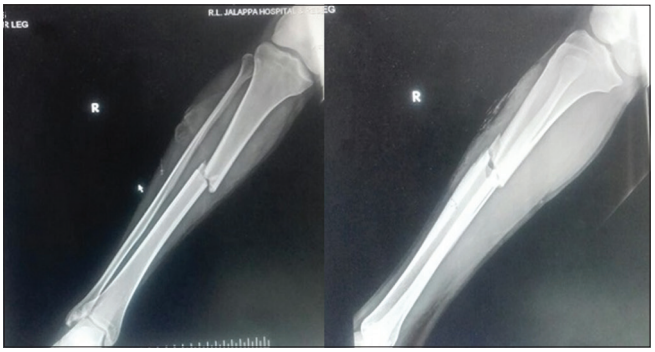

Figure 3: Case 2: Pre-operative X-ray isolated tibial shaft #

Figure 4: Case 2: Post-operative X-ray with IMIL nail

weight bearing with help of walker within 5 days from date of surgery, 5 patients out of 30 (17%) started partial weight bearing between 5 and 10 days because of pain at operated site, 4 patients out of 30 (13%) started partial weight bearing after 10 days because of stability of fracture (comminuted) and patient non-compliance. Most of the patients 27 (90%) in our study commenced protective full weight bearing (FWB) between 8 and 14 weeks. Four patients (10%) commenced FWB after 14 weeks. In these 2 patients, there were no signs of union radiologically and clinically. So, FWB was delayed. Two patients had a deep infection with infected non-union.

Union is defined as the presence of bridging callus on three or more cortices of radiographic views and the ability of the patient to bear full weight on the injured extremity. 26 of 30 fractures had united, so the percentage of union rate in our study was 87%. The time for union ranged from 4 to 9 months with an average of 5 months. 17 fractures healed before 5 months (20 weeks), 7 fractures healed between 5 and 8 months (20-32 weeks). Four fractures failed to unite after 9 months. Delayed union was defined when there was no adequate callus formation even after 20-24 weeks and patients inability or difficulty in partial or FWB. In our study, 7 out of 30 cases went for delayed union which is around 23%. All delayed union were managed successfully with secondary dynamization and bone marrow injection.

Two patients developed a superficial infection. This healed with oral antibiotics; four patients developed deep infection and treated with antibiotics based on pus culture sensitivity. All four fractures had gone into non-union. In our study, 4 patients had poor results. These 4 patients were Type II open fractures treated with primary intramedullary nailing. The open fracture had led to the chance of infection which has gone into non-union and along with fracture pattern.

In our study, 8 out of 30 patients (26%) developed anterior knee pain. In our study cause for knee pain was unclear. However, the probable causes were nail prominence above the proximal tibial cortex, damage to the infrapatellar nerve.

DISCUSSION

Our study highlights the importance of intramedullary nailing for the treatment of isolated tibial shaft fractures in the midst of various other modalities of treatment which include functional cast bracing, external fixation, internal fixation of plates and screws.

In current series, 30 cases of fracture of shaft of the tibia were treated by closed reamed interlocking intramedullary nailing. They were followed up for an average of 6 months. The purpose of this study was to evaluate the end results of treatment of these patients. These cases were of different age groups, occurred in both sexes; and the fracture was of different types and at different levels. The interlocking nail restores length, alignment, controls rotation, preserves periosteal blood supply, some amount of endosteal blood supply, biological osteosynthesis and reduces the rate of infections and malunion. The advantage of locking screws over conventional methods is that it reduces the rate of malunion, prevents loss of alignment, angulation, and shortening which are commonly found in a plaster cast or functional brace.

The average age of all cases in this series was 34.7 years. The fracture is more common in the age group of 18-39 years. Active young individuals were the major sufferers. Working men with outdoor activities are majority. Road traffic accident is the major cause of injury.

Mid diaphyseal fractures were the most commonly involved site 22 (73.3%) cases out of 30.

The time for union ranged from 4 to 9 months with an average of 5 months. 17 fractures healed before 5 months (20 weeks), 7 out of 30 cases went for delayed union which is around 23%. All delayed union were managed successfully with secondary dynamization and bone marrow injection. In our series, a displaced and comminuted tibial fracture with an intact fibula seems to be a cause for delayed union and non-union. In fact, our study indicates that an intact fibula with comminution of tibial shaft fractures particularly in patients aged more than 20-year-old is frequently associated with delayed tibial union, non-union, and secondary pain.

CONCLUSIONS

Closed intramedullary interlocking nailing is an effective mode of treatment in isolated tibial shaft fractures in closed and open Type I injuries. Isolated tibial shaft fractures with undisplaced or minimal displaced fractures have united well; more displaced fractures have gone into delayed union.

Immediate post-operative partial weight bearing and subsequent FWB helps in fracture union. Open injuries with severe soft tissue injury were the main cause for non-union. The proximal end of nail prominence above cortex is the major cause for anterior knee pain.

Overall functional results are good with closed intramedullary interlocking nailing for tibial diaphyseal fractures. Intramedullary interlocking nails are the current choice of treatment for isolated tibial shaft fractures which are undisplaced or minimally displaced fractures as it shows better union rates and early mobilization.

REFERENCES

1. Court Brown CM. Rockwood and Green's Fractures in Adults. 5th ed., Vol. 2. Philadelphia, PA: Lippincott Williams; 2000. p. 1939.
2. Teitz CC, Carter DR, Frankel VH. Problems associated with tibial fractures with intact fibulae. J Bone Joint Surg Am 1980;62:770-6.
3. Bonnevialle P, Bellumore Y, Foucras L, Hézard L, Mansat M. Tibial fracture with intact fibula treated by reamed nailing. Rev Chir Orthop Reparatrice Appar Mot 2000;86:29-37.
4. Jackson RW, Macnab I. Fractures of the shaft of the tibia; a clinical and experimental study. Am J Surg 1959;97:543-57.
5. Nicoll EA. Fractures of the tibial shaft. A survey of 705 cases. J Bone Joint Surg Br 1964;46:373-87.
6. Bone LB, Sucato D, Stegemann PM, Rohrbacher BJ. Displaced isolated fractures of the tibial shaft treated with either a cast or intramedullary nailing. An outcome analysis of matched pairs of patients. J Bone Joint Surg Am 1997;79:1336-41.
7. Adler JB, Shaftan GW, Rabinowtiz JG, Herbsman H. Treatment of tibial fractures. J Trauma 1962;2:59-75.
8. Jergesen F. Plate and screw fixation of diaphyseal fractures of the tibia: Indications and operative technique. Surg Clin North Am 1961;41:1545-65.
9. Levy M. Peroneal nerve palsy due to superior dislocation of the head of the fibula and shortening of the tibia (Monteggia-like fracture dislocation of the calf). Acta Orthop Scand 1975;46:1020-5.
10. Charnley J. The Closed Treatment of Common Fractures. 3rd ed. Edinburg: Churchill Livingstone; 1961. p. 105.
11. Mohan NS, Jithuram J, Chandrashekar HS. Differential rates of delayed/non-union in management of tibial fractures with and without associated fibula facture. Indian J Appl Res 2014;4:478-80.
12. Cowie J, Court-Brown C. Focus on tibial fractures. J Bone Joint Surg 2012;p.1-4.

How to cite this article: Ranganath KV, Arun HS, Hariprasad S. Surgical Management of Isolated Tibial Shaft Fractures with Closed Intramedullary Interlocking Nail. Int J Sci Stud 2016;3(12):110-114.

Source of Support: Nil, **Conflict of Interest:** None declared.