Closed Interlocking Tibial Nailing without using an Image Intensifier

Sohail Iqbal Sheikh, Muhammadullah, Arab Khan, Javed Iqbal

ABSTRACT

Introduction: Internal fixation with interlocking nails is commonly performed using an image intensifier which is expensive and is not readily available in most resource-poor countries of the world.
Objective: The aim of this study was to achieve internal fixation with interlocking nail without the use of an image intensifier and to study the mean union time and complications in these patients.
Study Design: It was a quasi-experimental study.
Place and Duration of Study: This study was carried out at Railway General Hospital (RGH), Rawalpindi over duration of two years from January 2010 till December 2011.
Materials and Methods: 22 closed tibial shaft fractures were fixed with interlocking intramedullary nails without using an image intensifier.
Results: The study included 22 closed tibial shaft fractures. The mean age of the patients was 39.4±9.97 years and the range was 2255 years. There were 8 females and 14 males. Postoperative plain radiographs confirmed that all of the cases had satisfactory positioning of the inserted nails and interlocking screws. The mean union time was 13.8±4.2 weeks. Two cases of delayed union were seen (union occurred at 24 and 28 weeks). One case of infection occurred and presented with an infrapatellar abscess. Shortening of 12 mm and valgus deformity occurred in one case due to loosening of distal screw.
Conclusion: Internal fixation with interlocking of tibial shaft fractures can be achieved successfully without an image intensifier.

Key Words: *Tibial Fracture, Interlocking, Intramedullary Nails*

Introduction

The tibia is commonly fractured bone frequently caused by high-energy trauma leading to the complications and major disabilities.[1] Surgeons have employed different types of intramedullary nails over past 500 years. Today, the intramedullary interlocking tibial nailing is the leading modality of treatment because of its biomechanical advantage over the other modalities.[2] This procedure is done in the advanced centers under the image intensifier.[3,4,5] However, there is no facility of C- arm image intensifier in the operation theatre at most of the tertiary level hospitals in Pakistan. Most of the peripheral hospitals do not even have portable X- ray facility. The purpose of this study was to study the success rate of intramedullary nailing of tibial shaft fractures without the aid of image intensifier. Tanna et al reported a method for locked tibial nailing without image intensifier in 1994, using hollow tubular nails with no slit and anteroposterior holes for the locking screws.[6]

With newly designed interlocking nails, it is now feasible to achieve interlocking nail insertion without the aid of an intraoperative image intensifier, simply by the use of an external jig and slot finder eg the SIGN (Surgical Implant Generation Network) system. Successful interlocking nailing using such method should not only improve the quality of fracture care, but should also lead to a reduction of exposure to intra-operative ionizing radiation.[7,8,9] SIGN nail is not freely available in our

Correspondence:
Prof. Dr Sohail Iqbal Sheikh
Head of Orthopedics Department
Islamic International Medical College
Pakistan Railway General Hospital, Rawalpindi

region and if available it is expensive, so we started doing interlocking nailing of tibia with ordinary tibial interlocking instruments which are freely available and inexpensive. This work, which describes my experience in using this method, is expected to contribute to knowledge in our sub region, since there is a paucity of literature on this subject matter. This work will also help to introduce this mode of treating fractures in resource-poor regions of the world, where image intensifiers are not widely available.

Material and Methods

This quasi-experimental study was conducted over duration of two years from January 2010 to December 2011 in the Orthopedic Unit of Railway General Hospital (RGH) Rawalpindi. The study was conducted after approval from the hospital ethical committee.Tibial shaft fracture patients presenting to the emergency department were recruited into the study by consecutive non-probability sampling and an informed consent was taken. Anteroposterior (AP) and lateral view radiographs of tibial shaft incorporating the entire length of the lower leg from knee to ankle were obtained. Closed tibial shaft fractures with significant malrotation (=10 degrees of rotation in any plane), malalignment (angulated =10 degrees), and displacement (=5 mm of displacement) were opted for operative management by interlocking nailing. Open fractures or severely comminuted fractures were excluded. Moreover fractures with evidence of neurovascular injury, compartment syndrome and fractures with dislocation of the knee or ankle were excluded. Closed, well-aligned, no displaced tibial shaft fractures were treated with a long leg cast and also were not included in our study. Patients were operated under spinal anesthesia. The interlocking nails were inserted as follows; under tourniquet the patient is placed supine and the leg of the patient hangs downwards over the edge of the table making 90 degrees of flexion at knee joint. A skin incision is made over patellar tendon and the patellar tendon is split longitudinally. Hole is made in upper end of tibia with bone awl, after this guide wire is inserted into the medullary cavity. One assistant pulls distal end of fracture downwards and guide wire is pushed through distal end of fracture. Grating feeling is appreciated while guide wire passes into distal fragment and stability is confirmed. Reaming of medullary cavity is done in increasing numbers. After this, size of nail is measured by putting nail over leg from tibial tuberosity to just above ankle. Then another nail of similar size is kept aside. One of the nails is inserted into medullary cavity after attaching it to proximal jig of tibial interlocking nail. Second nail is placed outside the tibia closed to skin and drill bit is passed through jig and then it passes through nail placed outside and then through skin and is drilled into bone. This is checked by passing guide wire through medullary cavity. The drill bit is retrieved and guide wire is passed distally till the lower end of nail. Then upper end of guide wire is marked with help of artery forceps. Another hole is drilled through distal I/L hole by passing drill bit through distal hole in the nail placed over skin, then it is drilled into the inner nail which is confirmed by pushing guide wire, if the

artery forceps mark is lying away from jig, it confirms that the drill is in the hole of inner nail. Then screw is passed, guide wire is removed and screw through upper hole is passed. Finally wound is closed. All patients had a similar preoperative regimen of intravenous Cephradine continued for 5 days postoperatively. Early physiotherapy of all involved joints, as well as early weight bearing, was encouraged. No cast or brace was applied. Analysis of the outcome of treatment with respect to the time of fracture union and the presence of complications was performed. Fracture union was assessed clinically and radiologically at 6 weeks and 3 months, and then subsequently at monthly intervals. The fracture was considered to have united when there was no pain or tenderness, when there was no abnormal movement at the fracture site and when bridging callus was visible on a plain radiograph. A fracture was considered to have normal union if there was osseous union in four months or less and delayed union if the fracture healed between four and eight months post operatively. A fracture that had not healed by eight months was considered to have a non-union. All of our patients were followed-up for at least 12 months. Data was entered into a proforma and was analyzed using SPSS 12.

Results

The study included 22 closed tibial shaft fractures. The mean age of the patients was 39.4±9.97 years and the range was 2255 years. There were 8 (36.4%) females and 14 (63.6%) males. Postoperative plain radiographs confirmed that all of the cases had satisfactory positioning of the inserted nails and interlocking screws. The mean union time was 13.8±4.2 weeks. Two (9.1%) cases of delayed union were seen (union occurred at 24 and 28 weeks). This was in comminuted fractures of distal one third of tibia. One case (4.5%) of infection occurred nine months after union and presented with an infrapatellar abscess, which did not communicate with the knee joint. This was drained and the nail removed. Shortening of 12 mm and valgus deformity occurred in one (4.5%) due to loosening of distal screw.

Discussion

The most common cause of morbidity and mortality in the most productive period of life worldwide are road traffic accidents causing fractures.[10] It is not surprising, therefore, that these fractures occur mostly in people aged between 20 and 50 years. The sex ratio distribution of 1.75:1 for male:female is also in keeping with other reports[11] and further emphasizes the greater vulnerability of males to trauma. The availability of the appropriate treatment modality could be of utmost concern to any practicing orthopaedic surgeon in most resource-poor countries of the world, including the Indian subcontinent. The use of interlocking nails for fractures of long bones has increased and indeed has become the gold standard for care of unstable long bone fractures. However, its main drawbacks are cost and the need for a reliable intraoperative image intensifier support.[12,13] There are now nails that can be locked with the aid of external jigs.[14] In our study, 100% of the fractures were fixed without the use of an image intensifier with the satisfactory placement of nails and screws in all cases. Complications were few and mild. Infection could have been avoided

by improving the aseptic technique. Delayed union occurred in the distal third fracture of a tibia with severely comminuted fracture line. The blood supply to this region is very precarious and could be associated with an increase in the incidence of non-union. There was no case of nail or screw

Table-I: Complications after closed Tibial Nailing

Complication	Number (%)
Delayed union	2 (9.1%)
Non union	None
Infection (infrapatellar abscess)	1 (4.5%)
Deformity (Shortening of 12 mm and valgus deformity)	1 (4.5%)
Nail or screw breakage	None

breakage in this study, however screw loosening resulted in valgus deformity and shortening in one case.Our results are in agreement with other works.[15,16,17] Only few studies were available for comparison. Ikem et al15 recorded two cases of superficial wound infection, two cases of delayed union and a case of screw loosening Giri.[16] in 2007 reported the success of distal locking in the intramedullary nailing of tibial shaft fractures with the aid of distal aiming device, where the distal hole was directly visualized after proper drilling. The union time in an average was 4 months. Giri.[17] in 2008 in another study reported that after using interlocking nails for fractures of tibial shaft the complication was distal screw loosening leading to valgus deformity and shortening in one case. However, no local study is available for comparison.The exclusion of an image intensifier automatically eliminates the harmful effect of an increased dose of radiation to both the orthopaedic surgeon and the patient. Radiation times were recorded to average about eight seconds, the longest time being 36 seconds in the study by Court et al during interlocking nailing of tibial fractures.3 It has the added advantage of reduced cost to the patient whilst, at the same time, ensuring high-quality fracture care.

Conclusion

We conclude that internal fixation with interlocking of tibial shaft fractures can be achieved successfully without an image intensifier. However, proficiency in the use

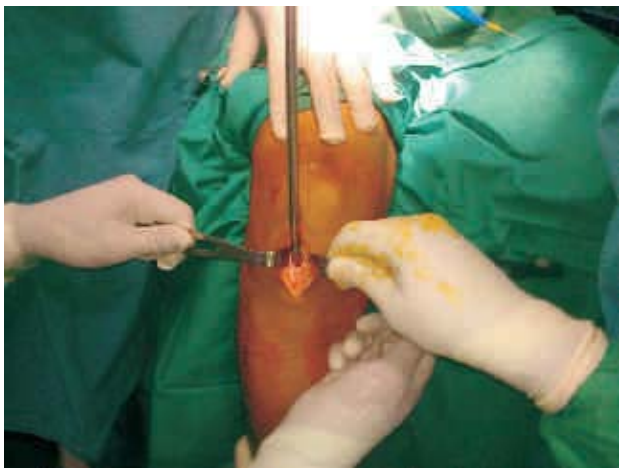

Figure 1- Reaming of medullary cavity after insertion of guide wire

Figure 2- Measurement of the length of the nail and the site of holes

Figure 3- Drilling of the hole in the distal interlocking hole

Figure 4- Insertion of the nail into the medullary cavity of tibia over the guide wire

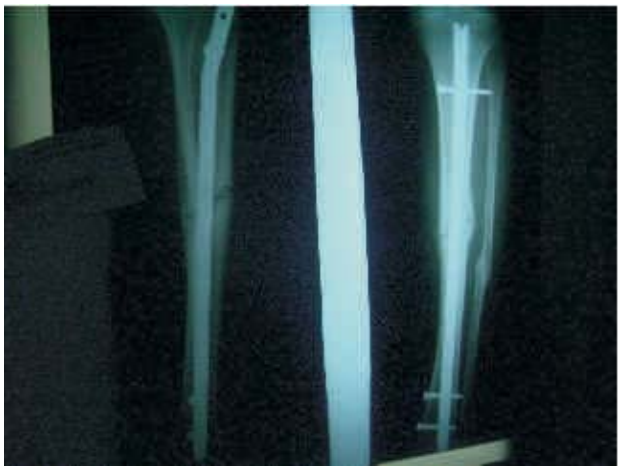

Figure 5- The healed fracture

of interlocking nail instrumentation without use of image intensifier will come with practice.

References

1. Schmidt AH, Finkemeier CG, Tornetta P. Treatment of closed tibial fractures. Instr Course Lect 2003;52:607.
2. Abdlslam KM, Bonnaire F. Experimental model for a new distal locking aiming device for solid intramedullary tibia nails. Injury 2003;34:3636.
3. Court-Brawn CM, Christie J, McQueen MM. Closed intramedullary tibial nailing: its use in closed and type I open fractures. J Bone Joint Surg 1990;72:60.
4. Muller ME, Allgower M, Schneider R, Willenegger H. Manual of internal fixation: techniques recommended by the AO-ASIF group. Third ed. Berlin, etc: Springer-Verlag, 1990:332-65.
5. Paige Whittle A, Russell TA, Taylor JC, Lavelle DG. Treatment of open fractures of the tibial shaft with the use of interlocking nailing without reaming. J BoneJoint Surg [Am] 1992; 74-A:1 162-71.
6. Tanna DD. Interlocking tibial nailing without an image intensifier. J Bone Joint Surg [Br] 1994;76:670.
7. Azer SN, Krause WR, Salman NN. Self-guiding interlocking intramedullary nail. Contemp Orthop 1992;25:228.
8. Shah RK, Moehring HD, Singh RP, Dhakal A. Surgical Implant Generation Network (SIGN) intramedullary nailing of open fractures of the tibia. Int Orthop 2004;28:1636.
9. Steriopoulos KA, Kontakis GM, Katonis PG, Galanakis IA, Dretakis EK. Placement of the distal locking screws of the femoral intramedullary nail without radiation. Arch Orthop Trauma Surg 1996;115:434.
10. Gaebler C, McQueen MM, Vécsei V, Court-Brown CM. Reamed versus minimally reamed nailing: A prospectively randomized study of 100 patients with closed fractures of the tibia. Injury 2011;42:17-21.
11. Madadi F, Eajazi A, Madadi F, Daftari Besheli L, Sadeghian R, Nasri Lari M. Adult tibial shaft fractures - different patterns, various treatments

and complications. Med Sci Monit 2011;17:640-5.
12. Xiang Z, Guo ZH. Minimally invasive treatment for bilateral tibia shaft fractures with interlocking intramedullary nails. Zhongguo Gu Shang 2009;22:58-9.
13. Vidyadhara S, Sharath KR. Prospective study of the clinico-radiological outcome of interlocked nailing in proximal third tibial shaftfractures. Injury 2006;37:536-42.
14. Ogunlusi JD, St Rose RS, Davids T. Interlocking nailing without imaging: the challenges of locating distal slots and how to overcome them in SIGN intramedullary nailing. Int Orthop 2010;34:891-5.
15. Ikem IC, Ogunlusi JD, Ine HR. Achieving interlocking nails without using an image intensifier. Int Orthop 2007;31:487-90.
16. Giri SK. Achieving distal locking without an image intensifier. Nepal Med Coll J 2007;9:275-7.
17. Giri SK, Adhikari BR, Gurung GB, Rc D, Bajracharya AR, Khatri K. Mini-open reduction and intramedullary interlocking nailing offracture shaft of tibia without an image intensifier. Nepal Med Coll J 2008;10:123-5.