Interlocking Intra-medullary Nailing For Distal Metaphyseal Tibia Fractures

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Abstract:
Introduction: Tibia is one of the most common bones to sustain injury and fracture. The blood supply to distal part of tibia is precarious due to its subcutaneous nature. Thus complications like non union, delayed union and infections are very common in these fractures and thus management of these fractures is very controversial. The aim of this study was to evaluate the outcome of interlocking intramedullary nailing in the treatment of extra-articular distal tibial fractures.

Materials & Method: 31 patients with mean of age 41 years with extra-articular distal tibia fractures both closed and compound were treated with simple tibia interlocking nail or tip locking tibia interlocking nail. Clinical diagnosis included AO/OTA type A1, A2 and A3 fractures, and Grade I, II and IIA open tibial fractures by Gustilo and Anderson classification. Patients were assessed clinically and radiographically with Klemm and Borner classification with mean follow up period of 8 months and results graded as excellent, good, fair and poor.

Results: Among 31 patients 3 patients were loss to follow up, 23 patients achieved union within 14-20 weeks, 3 patients had delayed union with mean union time of about 32 weeks. Superficial infection was seen in 3 grade II compound cases.

Functional outcome was excellent in 21 patients, good in 5 patients and fair in 3 patients.

Conclusion: Intra-medullary interlocking nail is a reliable and satisfactory method for treatment of fractures of distal one third of tibia with good functional results and high union rates with low complications.

Keywords: Distal tibia metaphyseal fractures, interlocking nail.

Introduction

Tibia is one of the most common bones to sustain injury and fracture because of its superficial nature. The blood supply to distal part of tibia is precarious. Thus complications like non union, delayed union and infections are very common in these fractures also there is difficulty in reduction maintenance and thus management of these fractures is very controversial. Various treatment modalities commonly used for management are cast application, external fixation application, open plating and minimally invasive plate osteosynthesis; but none of these treatment modality is considered gold standard for management of these fractures.

Cast treatment of tibial fractures requires prolonged immobilization, which is associated with subsequent knee and ankle stiffness, also maintenance of fracture reduction is difficult and the requires regular follow up with radiographs(1,2). Functional bracing is another alternative but still faces problems of ankle stiffness & difficulty in maintaining reduction(1,2). External fixation application may lead to ankle stiffness(3,4). Ring fixator allows early mobilization, but requires technical expertise and there is high risk of pin-track infections, septic arthritis, malalignment(5). Open plating provides stability, but causes extensive soft-tissue damage thus causing further de-vascularization of the underlying tibia leading to infection and delayed union(5,6). Minimally invasive plate osteosynthesis address most of these issues, but still is complicated with wound infection and premature removal of hardware(7,8).

Although intramedullary interlocking nailing is most commonly used method for management of tibial diaphyseal fractures, it is not very frequently used for management of fractures of distal tibia(9). Interlocking intramedullary nail has many advantages over the other modalities of treatment like it does not require special expertise as most of the surgeons are familiar with this technique. It also spares the extrasseous blood supply and the fracture hematoma as fracture site is not opened thus reducing risk of infection and facilitating early union, it is a load-sharing implant thus allows early mobilization and weight bearing(10). All these theoretical advantages make intramedullary interlocking nail a better modality for treatment of distal tibia fractures. The purpose of this study is to evaluate the results of intramedullary interlocking nail in distal tibial fractures.

Materials and Methods

Skeletally mature patients with no medical contraindication for anesthesia and who were willing to
participate in the study with extra-articular distal 1/3rd tibia fractures with or without fibula fracture were included in the study. Skeletally immature patients, patients with ipsilateral other bone fracture and patients having tibia fracture in more proximal location were excluded from the study. These patients were treated with reamed simple interlocking or tip locking tibia nail with two distal interlocking screws(Fig 1). Fracture of fibula was fixed with rush nail in cases where it was at the same level or below the level of tibia fracture. Blocking screws and primary bone grafting was not used. Post operatively patients were kept in supine position & limb elevated on BB splint. Knee & ankle mobilization started from 2nd post operative day. Mobilization with walker without weight bearing on operated limb from 3rd day. Patient was kept non weight bearing till 6 wks and partial weight bearing was started from 6 wks. Complete weight bearing was allowed after 12 wks. Patients were assessed clinically and radio-graphically with Klemm and Borner classification(11) with mean follow up period of 10 months (6-12 months) and results graded as excellent, good, fair and poor.

31 patients with mean of age 41 years (19 to 79 years) including 28 males and 3 females with extra-articular distal tibia fractures both closed (18 patients) and open(13 patients) were treated with simple tibia interlocking nail or tip locking tibia interlocking nail. Clinical diagnosis included according to AO/OTA classification, 16 patients in type A1, 9 patients in type A2 and 6 patients in A3 fractures (Table 1) and according to Gustilo and Anderson classification 18 patients had closed fracture, 8 patients had grade I open, 4 patients had grade II open, and 1 patient had grade III A open fracture (Table 2). The various mechanisms of injury included road traffic accident (23 patients), fall from a height (4 patients), fall from standing height (3 patients) and a direct trauma due to assault (one patient). Clinical union is defined as no pain at fracture site, ability of patient of full weight bearing & RUST score of >/= 10. Klemm & Borner classification(11).

Excellent result
- Full ankle & knee motion.
- No muscle atrophy.
- Normal radiological consolidation.

Good result
- Minimum loss of ankle & knee motion
- Less than 2 cm of muscle atrophy
- Less than 5 degrees of axial deviation

Poor result
- Moderate (25%) loss of ankle & knee motion.
- More than 2 cm muscle atrophy.
- Axial deviation between 5- 40 degree.

Observations and Results
Among 31 patients 3 patients were loss to follow up and 28 patients were available for evaluation. The mean follow up period was 10 months (ranging from 6-12 months). The mean period of clinical union was 14 weeks ranging from 12 weeks to 20 weeks, radiological union took little longer i.e mean 18 weeks (14 weeks to 24 weeks). According to Klemm and Borner classification; excellent results were obtained in 20 cases, good in 5 and poor in 3 patients (Table 3). Patients with isolated tibia closed A1 type fractures had better outcome & most of the patients had excellent results (Fig 2 and 3).

Three patients had delayed union with mean union time...
of about 32 weeks and 2 patients had non union for which revision surgery in the form of nail revision with bone grafting was done for atrophic non union and exchange nailing was done for hypertrophic non union. Four patients had knee stiffness and 3 had stiffness in ankle joint but all the patients’ regained acceptable mobility after aggressive physiotherapy. Superficial infection was seen in two grade II and one grade III A compound cases which resolved with the course of antibiotics. None of the patients suffered from neurovascular injury or compartment syndrome.

### Discussion

Intramedullary nailing of open and closed tibial shaft fractures is most commonly used procedure which is associated with high rates of radiographic and clinical union (9), but the use of this procedure is not widely accepted for distal tibia fractures (12). Because fractures of distal tibia may represent a different injury, they have been excluded from reports on intramedullary nailing of tibial shaft fractures. Percutaneous plate osteosynthesis is an excellent alternative for the treatment of these distal fractures as it allows reduction and stable fixation of short distal segment (7, 8) but cannot be used for patients with noncontiguous proximal tibial fractures or proximal extension of the fracture. Thus interlocking intramedullary nail can be advantageous in the above situations.

In the largest series of distal metaphyseal fractures treated with locked intramedullary nailing, Robinson et al. reported a 100% union rate. Their series included both extra-articular tibial fractures and tibial fractures with extension into the ankle joint (13). Also Sean et al in their study concluded that intramedullary nailing is a safe and effective technique for the treatment of distal metaphyseal tibial fractures. It avoids the additional soft-tissue dissection associated with traditional open procedures as well as the complications associated with external fixators. Alignment can be well maintained despite the short distal tibial segment, and a simple articular fracture or fracture extension is not a contraindication to intramedullary fixation (10).

### References
