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5 years follow up outcome of extra articular distal shaft of tibia fracture treated by interlock nail

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Abstract

Aims: To Study the outcome of distal tibia fractures by interlock nailing for a long time duration.

Methods and Material: 36 patients with distal tibia fractures, within 6cms of ankle joint and not involving articular surface were studied who were treated with interlock nailing from the period of July 2012 upto September 2014. Regular radiographs and measurement of Ankle range of movement was done. Last follow up was at least 5 years from date of surgery.

Results: Out of the 36 patients accessed, 34 patients had union. 2 patients had deep infection which required implant removal and external fixator as mode of treatment, which eventually united. 16 patients (44.44%) required implant removal at mean duration of 3.2 years.

Conclusions: Various methods of treatment of distal tibia fractures can be used in different conditions and closed reduction, internal fixation with interlock nailing is the treatment of choice for these fractures. Choice of implant, plate or nail, does not change outcome for implant removal re-surgery in long term follow-up.

Keywords: Distal Tibia, Extra Articular, Interlock Nail

Introduction

Distal tibial metaphyseal fractures are difficult to manage and pose significant challenge to most orthopedic surgeons^[1]. The mechanism of injury and prognosis are different from pilon fractures² and their proximity to ankle joint makes surgical treatment complicated^[2]. Most of these fractures are associated with fracture displacement, comminution and injury to soft tissue envelope¹. Most fractures at this site need to be fixed because non-operative treatment results in loss of reduction and subsequent malunion and nonunion. Currently, surgeons have a variety of options and implants in their armamentarium for the treatment of these fractures.

The Options Include:

1. Intramedullary interlocking nail and bolts with nail or with a shortened tibial nail^[3,4].
2. Conventional plating with dynamic compression plate (DCP).
3. Locking compression plate using minimally invasive plate osteosynthesis (MIPO).
4. Polyaxial locking plate using minimally invasive plate osteosynthesis^[5].
5. External fixation.
6. Closed reduction and cast.

Material and Methods

All the patients admitted from July 2012 to September 2014 with lower fourth shaft tibia fractures were taken in the study. These patients were called for follow up at our hospital after at least 5 years from date of surgery. Approximately 40 Adult patients, with fracture within 6 cms of ankle joint not involving the joint, were followed up prospectively during this period. Previous records of surgery which were obtained from medical records department were accessed and fracture patterns seen on x-rays and patients were included into study for whom surgical intervention in form of interlock nail was done.

Antero-posterior and lateral radiographs of the affected leg along with ankle and knee were assessed and the fracture patterns were classified based on the AO/OTA classification of fractures, 12 patients had A1 type, 11 patients had A2 type and 13 patients had A3 type

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fracture pattern.

It was found that patients with open fractures were graded using the Gustilo Anderson classification for open fractures. 5 patients had open fractures, which were classified on basis of Gustilo Anderson Classification. 3 were open grade I, 1 patient was Open Grade II, 1 patient was Open Grade IIIB. Antibiotics were started immediately for all patients. Injection cefuroxime 750mg intravenous thrice daily and injection Amikacin 750mg intravenous once daily and Inj Metronidazole 100mg intravenous thrice daily were the antibiotics. Single dose of tetanus toxoid was given. After obtaining the necessary radiographs, Type I and II open fractures were treated by cleaning of the wound with copious amount of normal saline, and Hydrogen peroxide, followed by painting of the skin around the wound with Povidine iodine and sterile dressing was done. The limb was then immobilized in an above knee Plaster of Paris slab till definite fixation was done. In the Type III fracture, patient was taken for emergency wound debridement and Joint Spanning External Fixator was applied primarily and secondarily after soft tissue healed, nailing as definitive fixation was planned.

Nailing was done within 24 hours of injury in all the patients except 1 with open grade IIIB fracture which required external fixator for stabilization and rotational flap for wound coverage. This patient was subjected to nailing 3 weeks after external fixator was done. During the operative procedure, patient was placed supine on radiolucent table. Midline incision to expose patellar tendon from inferior pole of patella to tibial tuberosity. Patellar tendon can be split or can be retracted. With help of a curved awl, entry is made from Anterior Edge of tibia plateau. It is centered in AP view and in direction of canal in lateral view. Ball tip guide wire is passed in distal fragment. Provisional reduction while passing the guide wire is held by insertion of calcaneal Steinman pin for traction or percutaneously by a ball point reduction forceps, all the patients had closed reduction being done. Gradual reaming starting from 8.0mm in increments of 0.5 mm are done upto 11.5 mm. The thickness of the nail is determined by the first clatter of reamer at isthmus and 1.0 to 1.5mm more of reaming is done. Length of nail is inserted at after measuring with another nail outside. Exchange of ball tip with simple guide wire is done. Nail is inserted gradually maintaining the reduction. Proximal Locking is done through aiming arm mount on insertion handle using a 3.2mm drill bit for 3.5mm Proximal Interlock Bolt. For distal lock, Free Hand technique was used by 3.0 mm Steinmann Pin. 14 patients had 8.0mm Tibia Interlock Nail, 10 had 9.0mm Tibia Interlock Nail and 12 patients had 10.0mm Tibia Interlock Nail implanted. Length of Nail ranged from 290 mm upto 400mm. Post operative plaster cast below knee plaster slab was given for a period of 4 weeks followed by removal of slab and gentle ankle mobilisation. Partial weight bearing was started after 4 weeks and full weight bearing was allowed as tolerated by the patient.

American Orthopaedic Foot and Ankle Score (AOFAS) was used to determine the outcome of patients which assess the outcome on basis of pain alignment and mobility status of the patient. Union was defined radiographically when mature callous was seen in 3 out of 4 cortices in perpendicular Xray planes and patient had no pain on independent weight bearing on the affected limb. All the fractures united well with an average time to union of 15.3 weeks. There were no cases of malunion in frontal plane (Varus/Valgus) $>5^\circ$, in sagittal plane (recurvatum/procurvatum) $>10^\circ$ and torsional deformity. There were 2 cases of non union due to deep infection which

required implant removal and external fixator for stabilisation.

Results

Between July 2013 to September 2014, 40 patients with extra articular lower 4th shaft tibia fractures were treated with Interlock Nail. 36 patients were regularly followed up, upto at least 5 years of long term follow up. The included 27 Male and 9 Female patients. Mean age was 40 years (Range 18-70 years). 32 were due to high energy fractures related to road traffic accidents and 4 were low energy trauma. 5 cases were open tibia fractures 29 patients had fibula fracture out of which 26 were treated with closed reduction and rush nailing and 3 were treated with open reduction and plating. Mean follow up duration was 5.3 Years (range 60-69months). Mean time for Radiological union was 15.3 weeks. Mean AOFAScore was 97 at a mean follow up of 20 weeks and 99 at 5 years follow up. There was 1 case of superficial infection which were controlled by use of IV antibiotics and rest. Deep infection, defined as culture positive swab from deep tissue was positive in 2 patients (both open fractures) which required implant removal and external fixator as mode of treatment. The most common disadvantage was ankle stiffness seen in few patients at 2-3 months of follow up which gradually improved and was insignificant at 6 months follow up and at 5 years follow up. Approximately 16 patients (44.44 %) required implant removal at mean follow up of 3.2 years, majority of these are due to skin impingement of screws in distal tibia region.

Discussion

Fractures of distal tibia are among the most difficult fractures to treat effectively. The status of the soft tissues, the degree of comminution affect the long term clinical results. The goal of operative treatment is to obtain anatomic realignment of the bone while providing enough stability to allow early motion of ankle and knee joints. This should be accomplished using techniques that minimize osseous and soft tissue devascularisation in the hopes of decreasing the complications resulting from treatment and improve outcome.

The long lever arm of intramedullary nail with a short distal fragment and a wide metaphyseal region lead to decreased endosteal bone contact and decreased stability of implant and consequent malalignment.

In a biomechanical study Duda *et al.*, concluded that undreamed tibia nail in distal tibia fractures leads to extremely low axial and high shear strain. They concluded that undreamed nailing of distal tibia fractures without good fragment contact and fibula stabilization should be carefully reconsidered.

Average time for union was 15.3 weeks which is comparable to other studies (Table 1) which show an average between 14 weeks to 27 weeks. Many prospective [6, 7, 8, 9] and retrospective [10, 11, 12] studies comparing open plating and locked intramedullary nailing for distal tibia fractures have described similar results as regards infection, time to union (14–27 weeks) and rate of non-union (0–9 %) for both techniques. Nailing has the advantage of shorter operative duration and reduced wound problems, ORIF can restore alignment better than nailing that was associated with more malunion. Long term follow up should comparable results in both methods of treatment of distal tibia fractures.

16 patients (44.44%) undergoing implant removal surgery at a mean duration of 3.2 years from date of surgery, 12 due to skin impingement, 2 due to delayed infection (at 2 years, 3.2 years from date of surgery), 2 patients due chronic ankle pain

which got relieved after implant removal. The rate of surgery of implant removal is similar to patients undergoing plating for distal tibia fractures in other studies [6, 8, 9]. Hence, the

choice of implant does not have a significant role when patients concern is re-surgery for implant removal.

Table 1: Average time for union was 15.3 weeks which is comparable to other studies

Author	Treatment	Cases	Age	Time of Union (weeks)	DU/NU	Follow Up (Months)
Im and Tae [6]	Nail	34	42	18	3 NU (9%)	24
	Plate	30	40	20	2 NU (7%)	
Yang <i>et al.</i> [12]	Nail	13	48.2	22.6	0	33
Jannssen <i>et al.</i> [10]	Nail	12	40.7	21	0	72
	Plate	12	43.3	19	0	54
Gao <i>et al.</i> [9]	Nail	44	42.2	17.7	0	12
	Plate	41	44.2	17.6	0	12
Vallier <i>et al.</i> [7]	Nail	56	38.1	NR	4 NU (7%)	19.9
	Plate	48	38.5	NR	2 NU (4%)	
Mauffery <i>et al.</i> [8]	Nail	12	50	21.3	1 DU (8%)	12
	Plate	12	33	NR	3 DU (25%)	12
Li <i>et al.</i> [11]	Nail	23	37	NR	0	24.7
	Plate	23	39	23.1	0	25.8
This Study	Nail	36	40	15.3	0	11

Conclusion

Tibia Interlock Nail is one of the best modes of treatment for distal tibia fractures. It can be performed even in cases of severe comminution and patients with poor skin condition. Outcome of treatment by nailing is excellent in all cases. A

significant number of patients undergo re surgery for implant removal because of skin impingement in subcutaneous plane at distal tibia, which is similar to patients treated with plating in other study.



Fig 1: X-Ray

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