

Intramedullary interlocking nailing in type II and type III open fractures of tibia – a clinical study

¹Dr.Neelangowda V P Patil, ²Dr.Padmananda.G.A, ³Dr.Giridhar Kumar
⁴Dr.Srikanth

Department Of Orthopaedics,Mysore Medical College and Research Institute.Mysore.Karnataka State,India .

Abstract:

Purpose: Controversies exists between primary nailing and external fixator application as treatment of choice for severely open fractures. This study was conducted to assess the outcome of Intramedullary nailing in compound tibia fracture and evaluate its complication

Methods: Between 2006 and 2011 a total of 40 cases of open tibial shaft fractures classified according to Gustillo and Anderson classification, were operated with primary Intramedullary Interlocking nail. There were 25 type II and 15 type III open fractures. Proper wound debridement done with Care taken to give adequate soft tissue coverage for wound.

Results: The patients were followed for period of 16- 36 months and were evaluated according to Katenjians criteria. We had good to excellent results in 67.5% of cases (27cases of total 40 cases). Poor results found in 25% of type II, 33.3%of type IIIA and 40% of type IIIB fracture. Important complication included deep infection and nonunion in 6 cases, limb shortening 5 cases, delayed union 8 cases.

Conclusion: primary IL nailing can be used as treatment with minimum complications in open tibia fracture fractures when done with proper soft tissue management and wound care.

I. Introduction:

Management of open tibial fractures continues to be a major therapeutic problem and challenge to orthopaedic surgeons

Three goals must be met for the successful treatment of open fractures of tibia; the prevention of infection, the achievement of bones union and the restoration of function.

Immobilization in a plaster cast has been used most commonly in the past but it does not always maintain the length of the tibia and if leaves the wound relatively inaccessible¹.

Open reduction and internal fixation with Plate & Screw has yielded unacceptably high rates of infection.^{2,3}

External fixation, considered the treatment of choice by many Orthopaedic surgeons has the disadvantages of the bulky frames and frequent pin tract infection, non union and malunion.^{4,5,6}

With improvement in soft tissue care and wound coverage technique number of patients going for limb amputations has reduced^{7, 8, and 9}

The Intramedullary nailing locked or unlocked has become an attractive option since image intensifier has made closed Intramedullary nailing possible. Nail is a load shearing device and is stiff to both axial and torsion forces. Closed nailing involves least disturbance of soft tissue, fracture hematoma and natural process of bone healing as compared to other forms of internal fixation.^{10, 11 ;12,14 15 and 16}

The locking of Intramedullary nails to major proximal and distal fragments decreases the prevalence of malunion and of comminuted fracture. The rate of infection after treatment of open tibial fractures with IL nailing has been relatively high causing most investigators to discourage the use of this technique for grade II & III open fracture.^{17 18, 19 20 and 21} With availability of new generation antibiotics and improved wound care infection rate are reduced. This led to design a trial to study the results of closed interlocking (IL) nailing in the treatment of open fractures with proper wound closure technique.

II. Materials and methods

The proposed study is a hospital based prospective study. It was done between 2006 and 2011. 40 patients of type II (n=24) and type III (n=16) open tibial fractures were operated with a mean follow up 1 ½ year (16-36). The cases which fulfilled the below mentioned criteria were taken up for the study.

Inclusion criteria: Age more than 18 years, Shaft fracture within 4 cm distal to the tibial tuberosity to 4 cm proximal to the ankle joint, open fracture type II, IIIA IIIB according to Gustillo-Anderson classification.

Exclusion criteria: Age less than 18 years, Associated intraarticular extension fractures of proximal/distal tibia Closed fractures, and Gustilo type I and IIIC fractures.

On admission patients were taken up for emergency irrigation and debridement of open fracture. Thorough wound wash done using normal saline and debridement of all dead and devitalized tissue done (Figure 1). For comminuted fracture all loose bone pieces removed accepting the possible shortening. Swabs were taken from the wound and were sent for culture and sensitivity for those cases with suspicions of contamination and those reported to hospital late (>24Hrs). All cases were given IV antibiotics (ceftriaxone with sulbactam +amikacin) for 10 days from day of admission and also IV metronidazole given for 3days. A severity of the open tibial fractures determined for the subsequent wound care and antibiotic treatment. Routine investigations were done. All patients evaluated clinically and radiologically to assess for any other injuries. Patients were operated as early as possible, once the general condition of the patients was stable and fit for surgery (range from 12-48 hr, following admissions). Closed intramedullary interlocking nailing without reaming was done under image intensifier. Both midline Trans patellar (n=35) and antero-medial patellar incision were used as per surgeon preference. Static locking for comminuted fracture and dynamic for stable fracture was done. Locking was done in all cases.

Wound skin edges are excised considering possible micro necrosis of skin and underlying soft tissue, resulting in larger raw wound. For resultant wound, when wound were small (n=18) coverage was done by primary coverage with lateral release incision and split skin graft to raw area formed by release incision (Figure 2). When wound were large or soft tissue loss is severe perforator flap were used (Figure 3). Some times when the wounds which are small and clean (n=8) are treated with just stay sutures and allowed them to heal by secondary intention. Those wounds which are very large or contaminated and infected were treated with pedicle graft/cross leg flap/perforator flap on later date time ranging from 2 days to 15 days when and wherever necessary.

Antibiotics continued for cases as per culture sensitivity to control infection. And other surgeries performed are, bone grafting exchange nailing for delayed union (n=6), fibular osteotomy for intact fibula causing delayed/nonunion (n=4 cases of all type II) and dynamization (n=18).

All cases were mobilized with non weight bearing active knee movements on next day operation for most of the patient. Partial weight bearing was started on 11 to 20 days post operatively. In three cases, partial weight bearing was delayed for more than 30 days (7.5%).

Most of the patients were commenced to protective full weight bearing at 8-12 weeks post operatively (75%).

For all the patient regular clinical and radiographically assessment done for fracture union and for evaluation of complication. (Figure 4,5)

III. Results:

The present study includes 40 cases of open fractures of tibial shaft surgically treated with closed interlocking nailing done between years 2006 to 2011.

In our study majority of patient were from age group of 20-35(n=24) and 32 patients were male

Major cause of fracture in our study was Road traffic accident. Most of fractures were comminuted. Right tibial fracture was found in 28 cases and bilateral 2 cases. The fracture pattern were comminuted (n=22), segmental (n=6), spiral and oblique (n=12) fractures.

The patients were followed up for a mean period of one and half year (16-36 months) and were evaluated according to Katerjans criteria.^{18, 23} we had good to excellent results in (31 cases of total 40 cases). 18 of 24 in type II (75%), 7 out of 11 in type IIIA (66.6%) and 3 out of 5 in type IIIB fracture cases (60%). Poor results found in 25% of type II, 33.3% of type IIIA and 40% of type IIIB fractures.

Complication in our study included, deep infection and nonunion 6 cases, limb shortening 5 cases, malunion 4 cases, delayed union 8 cases, superficial infection 4 cases, and anterior knee pain/knee stiffness 3 cases.

IV. Discussion:

The management of compound tibia fracture still remains to be controversial as there is uncertainty in type of implant to be used and timing of surgery. Triad of complexity of fracture, soft tissue loss/damage due to high energy injury and infection make management more difficult.

There are many studies done which recommends IM nailing better option for the treatment of open tibia fracture, as it gives better control of length, angulations and rotation when locked. Many of these studies have given more importance to timing of surgery and soft tissue coverage. The study have shown good result in type I and II, fracture but controversy exist for type III fracture due to high rate of infected non union.

In our study we had few complications with type II fracture treated with IM nailing and also good functional outcome. Our results are comparable with other study had similar results in respect to type III A and type III B fractures but we had relatively better results in type II fracture.

Poor results in type II fracture is attributed to associated injuries (one case head injury, another case abdominal injury with pelvic fracture) which lead to delayed surgery and rehabilitation. In one case associated opposite tibia fracture which went for infection delayed union and in other cases went for infected nonunion

Type III fracture poor results are due to deep infection with nonunion (n=3), rotational flap failure (n=2) and limb shortening with nonunion in one case.

Though with deep infection in 2 cases still we had satisfactory union due to continued weight bearing in presence of stable fixation and control of infection with higher new generation proper antibiotics and also repeated wound debridement. Infection was eradicated in these cases after bony union and nail removal.

Type IIIB open fractures we did not have good results which are attributed to severe tissue damage, delayed surgery, infection and patient compliance. 2cases reported between 12-24 hr after injury 1 case reported at >24 hr. All these cases no thorough debridement done before admission, only wound washing and stay sutures with antibiotics coverage was done. These cases were treated with debridement and primary nailing with delayed wound coverage. These cases went for infected nonunion and are considered poor cases.

We had 5 cases with shorting due to removal of bone while debridement but fracture united satisfactorily. Four cases shortening was managed by shoe rise but in 1 case with shorting was more than 8 cm with non union which is considered as poor result was later treated with vascularised fibular graft by plastic surgeon.

V. Conclusion

In presence of 76% good results for type II fracture (19out of 25 cases) authors feel IM nailing is better choice of treatment irrespective of timing of surgery for type II compound tibia fracture. If thorough debridement and wound care was done, interlocking nailing can be used as treatment for type IIIA fracture. Similarly good results can be achieved with type IIIB open fractures with proper soft tissue coverage of the wound along with control of infection with proper and effective antibiotics. The limitation in our study was less number of type IIIB fracture for study to comment and compare with other study.

Bibliography:

- [1]. Gustillo RB, Merkow RL, Templeman B. Current concept review: The management of open fracture. *JBJS* 1990; 72 A: 299-303
- [2]. Ruidi T, Webb JK, and Allgoer M; "Experience with the Dynamic Compression Plate (DCP) in 418 recent fractures of tibial shaft" 1976: *Injury*, 7:252-257.
- [3]. Bach AW, Hansen ST Jr. Plates versus external fixation in severe open tibial shaft fractures: A randomized trial. *Clin Orthop Relat Res* 1989; 241:89-94.
- [4]. Henley B, Chapman, J R. Agel J. et al: treatment of type II, IIIA and IIIB open fractures of tibial shaft; A prospective comparison of unreamed interlocking IM nails and half pin external fixation for grade II and III open fractures. *J Orthop Trauma* ; (1998)4:233-234.
- [5]. Tornetta P 3rd, Bergman M, Watnik N, Berkowitz G, Steuer J. Treatment of grade IIIB open tibial fractures: A prospective randomized comparison of external fixation and non-reamed locked nailing. *J Bone Joint Surg Br* 1994; 76:13-9.
- [6]. Wanson TV, Spiegel JD, Sutherland TB, Bray TJ, Chapman MW. A prospective evaluation of the Lottes nail versus external fixation in 100 open tibial fractures. *Orthop Trans* 1990; 14:716.
- [7]. Choudry U, Morin S, Karacor Z. Soft tissue coverage and outcome of Gustillo grade IIIB midshaft tibia fractures: a 15 year experience. *Plast Reconstr Surg Aug* 2008;122(2):479-85.
- [8]. Patzakis MJ, Wilkins J, Moore TM. Considerations in reducing the infection rate in open tibial fractures. *Clin Orthop Relat Res* 1983; 178:36-41.
- [9]. Davis AG. Primary closure of compound fracture wounds. *J Bone Joint Surg Am* 1948; 30:405-15
- [10]. Choudry U, Morin S, Karacor Z. Soft tissue coverage and outcome of Gustillo GRADE IIIB midshaft tibia fractures: a 15 year experience. *Plast Reconstr Surg Aug* 2008;122(2):479-85
- [11]. Hobrook JL, Swiontkowski MF, Sanders R. Treatment of open fractures of the tibial shaft: Ender nailing versus external fixation: A randomized, prospective comparison. *J Bone Joint Surg Am* 1989; 71:1231-9.
- [12]. Finkemeier CG, Schmidt AH, Kyle RF, Templeman DC, Varecka TF. A prospective, randomized study of intramedullary nails inserted with and without reaming for treatment of open and closed fractures of the tibial shaft. *J Orthop Trauma* 2000; 14:187-93.
- [13]. Chapman MW. The role of intramedullary fixation in open fracture. *Clin Orthop Relat Res* 1986; 212:26-34.
- [14]. Court Brown CM, McQueen MM, Quaba AA, Christie J. Locked IM nailing of open tibia fracture. *JBJS* 1991 NOV;73B(6):959-964.
- [15]. Keating JF, O'Brien BJ, Blachut PA et al. Locking Intramedullary nailing with and without reaming for open fracture of tibia shaft. *JBJS* 1997; 79 A: 334.
- [16]. Boyton, D.M, Schemeling J.G: Nonreamed Intramedullary nailing of open tibial fracture: *J Am Acad Orthop Surg*; (1994); Vol 2. No2:107-114
- [17]. Keating JF, O'Brien PI, Blachut PA, Meek RN, Broekhuysen HM, ET al. Reamed interlocking intramedullary nailing of open fracture tibia. *Clin Orthop* 1997; 338:182-189
- [18]. Vineet jain, Ayush agrawal, A Mehtani et al. primary Intramedullary nailing of open tibial fracture. *Indian journal of orthopaedics* 2005 ;39 (1):30-32
- [19]. Quamar Azwan, MKA Shrwani, Mazhar Abbas et al. internal fixation in type III compound fracture presenting after golden hour. *Indian journal of orthopaedics* 2007;41(3):204-208
- [20]. Bhandari M, Guyatt GH, Swiontkowski MF ET al. Treatment of open fractures of shaft of tibia. *JBJS Br* Jan 2001; 83(1):62-8.
- [21]. Blachut PA, Meek RN, O'Brien BJ. External fixation and delayed intramedullary nailing of open fractures of tibial shaft. A Sequential protocol. *JBJS Am* Jun 1990; 72(5):729-35.
- [22]. Stegemann, P, Lorio, M, Soriano R, Bone L: Management protocol for unreamed interlocking tibial nails for open tibial fracture. *J Orthop Trauma*; (1995); 9:117-120.
- [23]. Katenjian A Y, Shelton M L Primary internal fixation open fracture retrospective study of metallic internal fixation in fresh open fractures. *J Trauma* 1972; 12:756-63.