

Intramedullary Interlocking Nail in Distal One Third Tibia Fracture: A Retrospective Study in Tertiary Care Center

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ABSTRACT

AIM: To assess functional outcome of intramedullary interlocking nail in distal tibia fracture where distal locking screw is applied after inserting proximal locking screw.

PATIENTS AND METHOD: This is a retrospective study which was conducted in Universal college of medical sciences. This study was started one year back and last case was followed for one year. All thirty three cases with distal tibia extraarticular fracture 42A1 and 43A3, according to AO classification, within 7 cm from the ankle plafond of skeletally mature person presented in emergency along with Gustillo Anderson (GA) I, II, IIIa and fibula fracture are included in the study. Intraarticular fracture, GAIIB and lost follow up cases were excluded from the study. Proximal interlocking screws

are placed at first followed by distal interlocking screw. Mechanism of injury, age, sex, union time, foot function index, secondary procedure, complications, deformities are analyzed in the study.

RESULTS: All patients were retrospectively analyzed. We could not find any significant relation between post operative malalignment and better foot function index ($p = 0.975$). Early union may not improve overall foot function index ($p = 0.202$). Automobile accident is the commonest mode of injury (48.5%) followed by automobile pedestrian (39.4%). Postoperative malalignment consist of coronal (3%), sagittal (3%) and shortening (3%). Infection is one of the commonest complication found in our study (6.1%).

Key words: Intramedullary nail; Proximal locking; Alignment

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INTRODUCTION

Distal tibia fracture is one of the challenging fractures presented in the emergency department. The goal of the treatment is to provide stable fixation with minimal soft tissue injury. Various methods are involved in the treatment of this fracture Casting, nailing, plating, external fixator are well known methods of treatment. Plates can be inserted via open reduction internal fixation and minimally invasive technique. The open technique provides stability but requires extensive dissection. Minimally invasive plate technique may have a complication of hardware problem^[1]. External fixator is associated with ankle stiffness^[2]. Intramedullary nailing is one of the popular method of treatment of distal one third tibia fracture but it is not devoid of postoperative complication if not done properly^[3]. It is technically demanding procedure and its role in the treatment of distal metaphyseal fractures has not been well defined^[4].

It is difficult to reduce and hold fracture perfectly during free

hand distal locking because of the short distal segment. As a result, malalignment after distal locking is inevitable. There are few advantages of distal locking followed by proximal locking. The propose of the study is to analyze the fate of proximal locking followed by distal locking in the treatment of distal tibia fracture with intramedullary interlocking nail.

METHODOLOGY

This is a retrospective study which was conducted in Universal college of medical sciences, Bhairahwa, Nepal. This study was started one year back and last case was followed for 1 year. All thirty three cases with distal tibia extraarticular fracture 42A1 and 43A3, according to AO classification, within 7 cm from the ankle plafond of skeletally mature person presented in emergency along with Gustillo Anderson(GA) I, II, IIIa were included in the study^[5,6]. Antero posterior and lateral radiographs were taken in emergency room. Intraarticular fractures, GAIIB and lost to follow up cases were excluded from the study. If early nailing was not possible because of severe swelling we would rather prefer Bohler Braun splint to immobilize the limb than ankle spanning fixator due to cost factor. After swelling disappeared, patient was taken to operating room. Under spinal anaesthesia and supine position, leg was hung from the table. We have inserted Kirschner wire in fibula fracture before tibia fixation by closed means under image intensifier except in few cases where open reduction and internal fixation was performed because of inadequate reduction.

Five centimeter incision was given just distal to patella extended to upper border of tibial tuberosity. Bone awl was used to make entry portal. Guidewire was inserted after reducing the fracture and reaming was done by flexible reamer.

Nail was attached with zig and inserted inside the medullary canal which was guided by guide wire. Initially proximal locking was done. We detached zig from the nail then, leg was extended and distal locking was done by free hand technique under c-arm. We have used percutaneous clamp, manipulation by hand for the maintenance of fracture reduction. We could not use unicortical plate, schanz pin, femoral distractor as a reduction tool. We have examined syndesmotic injury by applying external external rotation force of the foot in dorsiflexion position. Syndesmotic injury was addressed with open reduction and internal fixation with plate and screw in fibula. Otherwise Kirschner wire which acts as intramedullary device was applied in fibula fracture within 7 cm from ankle plafond before fixation of tibia. Kirschner wire was replaced by plate and screw in syndesmotic injury.

Weight bearing was not allowed until three cortical union was seen on anteroposterior and lateral radiographs. Suture was removed on 13th postoperative day. Fracture union was defined as radiographic evidence of bridging cortical bone on at least three cortices combined with the patient's ability to bear full weight on the extremity^[1]. Malalignment was defined as $\geq 5^\circ$ of angulation in any plane^[2]. Foot function index was used for assessment of functional outcome. low score indicates better function^[7]. Dynamization was done for delayed union.

Data analysis

The required sample size was obtained by calculating standardized width which was 0.9, with 99% confidence interval. Statistical analysis was performed by using a statistical package for Social Sciences (SPSS-20). Continuous variables were stated as the mean, standard deviation, and categorical variables as percentages and

Table 1 Patient variables in the study group.

Variables	IMIL	P value
Age	42.36 ± 16.326	
Sex		
Male	20 (60.6%)	
Female	13 (39.4%)	
Causes		
Fall	2/33 (6.1%)	
Sports	2/33 (6.1%)	
Automobile-pedestrian	13/33 (39.4%)	
Motor cycle accident	16/33 (48.5%)	
Malalignment (yes/no)		
Coronal	1/33 (3%)	
Sagittal	1/33 (3%)	
Shortening	1/33 (3%)	
Fibula fracture		
Nail	31/33 (93.9%)	
Plate	2/33 (6.1%)	
Union time	28.36 ± 9.226 (12week-45week)	
Complication (yes/no)		
Deep infection	2/33 (6.1%)	
Delayed union	1/33 (3%)	
Nonunion	1/33 (3%)	
Amputation	1/33 (3%)	
Anterior knee pain	1/33 (3%)	
Secondary intervention (yes/no)	2/33 (6.1%)	
Foot function index	26.67 ± 6.972	
Union time vs foot function index		0.202
Postoperative malalignment vs foot function index		0.975

frequency distribution.

Paired T-test after normality testing is used to assess union time versus foot function index and chi-square for postoperative malalignment versus union time. A value of $p < 0.05$ was considered statistically significant.

RESULT

The mean age of patients was 42.36 ± 16.326 years (Table 1). Male comprises 60.6% and female 39.4%. Motor cycle accident was the major cause of fracture (48.5%) followed by automobile pedestrian (39.4%), sports (6.1%), fall (6.1%). We have seen coronal (3%), and sagittal (3%) malalignment and one case of shortening (3%). We inserted Kirshner wire in fibula fracture (93.9%) except in those cases where ankle mortise was unstable. Unstable ankle mortise was addressed with plate and screw.

The average time for union is 28.36 ± 9.226 (Range: 12-45) weeks. Deep infection is the commonest complication in this study (6.1%). Other complications are delayed union, (3%) nonunion (3%), amputation (3%), and anterior knee pain (3%). We have done dynamization in few cases (6.1%) as a secondary procedure. Their healing was uneventful.

The average foot function index is 26.67 ± 6.972. Union time does not directly related to foot function post index ($p = 0.202$). We have not seen any significance between postoperative malalignment and foot function index ($p = 0.975$).

Lost to followup were not included in the study. A patient develops



Figure 1 IMIL (Proximal locking followed by distal locking technique) A, B, C.

gangrene few days after nailing then below knee amputation was done.

DISCUSSION

Intramedullary nailing has been well accepted technique in the treatment distal tibia fracture. Malalignment of the distal fragment is

a known complication of nailing in the distal one third tibia fracture^[8]. Because it may difficult to control distal segment, we have locked proximal interlocking screw first, following that, jig is removed and distal inter locking screw is placed without much manipulation in extended position. we got perfect alignment postoperatively. Proximal locking helps to keep the nail from backing out into the knee if it loosens or the fracture telescopes^[9]. This procedure is performed where compression is not required at the fracture site. Anatomical reduction may lead to early union time and better foot function index. We have found very few cases of malalignment but these fracture were within acceptable limit (Figure 1A, B, C). We do not observe statistically significant result that interlink malalignment, union time and foot function index.

Agathangelidis F *et al* in vitro study showed that, when using the Expert tibial nail for unstable distal tibial fractures, the classic configuration of two parallel distal screws could provide the necessary stability under partial weight-bearing conditions^[10]. We have also procured postoperative stability using two parallel screw by free hand technique, though distal jig is also available which decreases operative time and radiation exposure^[11].

Nork *et al* has performed reamed nailing in distal one third fracture with simple articular extension. Substantial involvement of articular surface poses difficulty in Nailing^[2]. we have not incorporated fracture with articular involvement in our study but reaming is done before nail placement.

Paul M. Morin *et al*^[12] has observed that, fibular plating in addition to tibial intramedullary fixation of distal third tibia and fibula fractures leads to slightly increased resistance to torsional forces. This small improvement may not be clinically relevant^[12]. We have used plating in where syndesmotic injury is suspected, otherwise we fixed with Kirschner wire which acts as an intramedullary nail and reduction tool for tibia fracture. Ghithens and bishop suggested that stability which comes with distal multidirectional locking of tibia nail and suggest that fibular fixation in distal tibia fractures may not be necessary unless the ankle mortise is unstable or fibular fixation is being used as a reduction tool^[13].

One of the important part of fracture fixation is proper maintenance

of reduction. Various methods are implicated in such procedure like clamps, distractor, schanz pin, or if, blocking screw. We tried to preserve fracture haematoma and fixed the fracture without opening the fracture site by simple manipulation unless acceptable reduction is achieved. Open reduction and internal fixation was done in those cases where reduction was not acceptable. Same principle is applied in length stable fibula fracture^[2].

Neil J et al used open technique of intramedullary nailing with distal locking first because this process help to control the nail and able to check drill in proper position via guide wire^[14]. Compression is achieved via distal locking first and back slapping. It is commonly used method in tibial shaft fracture^[15]. but distraction is not the common problem in distal one third rather coronal, saggital and shortening are commonly seen. If compression requires, it is better to have distal locking first.

Dynamization was done in delayed union. Polat *et al* uses foot function index for the assessment of functional outcome^[1]. Though we have found less number of malalignment cases by doing proximal locking first, it does not affect foot function index ($p = 0.975$). It may be due to union time depends on various other factors. We could not find any significant difference in foot function index as compared with union time ($p = 0.202$).

We have less number of cases and this study is retrospective, more randomized trials should be done to analyze this technique.

CONCLUSION

Our study does not show any benefit by doing proximal locking statistically although we have found few number of cases of malalignment by doing such technique. We need few comparative studies to analyze the benefit of such procedure. Overall outcome does not change by doing initial proximal locking in distal one third tibia fracture.

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