

Original Research Article

Functional and radiological outcome of expert tibia nailing in proximal tibia fractures

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ABSTRACT

Background: Previously treatment of choice for proximal tibia fracture was internal fixation by plate. Presently, expert tibia nail is widely used in treating proximal tibia fracture. Expert tibia nailing system has features like multi directional locking options in the distal and proximal part of the nail, in addition to the standard static and dynamic locking options present in IMIL Nail. Purpose of study is to evaluate the outcome of expert tibia nail in proximal tibia fracture.

Methods: We retrospectively, reviewed thirty patients having proximal tibia fracture with age more than 18 years treated with expert tibia nail and were followed up averagely for 12 months between May2016 to May2018. All patients were compared in terms of intraoperative and postoperative parameters and functionally assessed using the Johner and Wruhs criteria at 3 weeks, 3 months, 6 months and 12 months.

Results: Functional outcome was measured by Johner and Wruhs criteria of 30 patients showed 20 excellent, 8 good, 2 patients had fair results. Average time unprotected full weight bearing walking was 7.2 weeks. Average time taken for radiological union was 18.2 weeks.

Conclusions: Expert tibial Interlocking Nail is good treatment option for proximal tibia fracture.

Keywords: Expert tibial nail, Proximal tibial fractures, Johner and Wruhs criteria

INTRODUCTION

Presently in orthopedics practice the proximal tibia fracture is most common fracture seen by orthopedic surgeons. High energy trauma leading injury to knee the proximal tibia fracture most common with soft tissue injury. These fractures are challenges for orthopedic surgeons. Treatment of this fracture is difficult because of the unstable fracture region, difficulty in reduction fixation and severely disturbed blood supply.¹ Open fractures are common in proximal tibia due to its subcutaneous position than any other long bone. Edwin Smith Papyrus in their study done in 1500 BC reported treatment for proximal tibia fracture and stated that

proximal tibia has precarious blood supply with heavy muscles mass around it.²

In treatment of proximal tibia fracture good results have been reported with both conservative and surgical methods. Early mobilization with functional exercises and walking activities are important. Conservative management of tibia had complication like immobilization for long time and this turn the tendency of patient toward surgical management. The available operative treatment for proximal tibia fractures are external fixators, plate internal fixation and intramedullary nailing. Two hinge joints present below and above proximal tibia does not allow any type of

rotation deformity. External fixators used in open fracture have high intensity of loosening and delayed union which further involves infection from pin, is common. Along plate is requires forfixation of such a fracture by plate and screw which lead to long incision which directly increase the risk of infection and compartment syndrome. The expert tibia nail gives stable fixation and early mobilization which further result in early restoration of function without use of plaster. The rate of union in proximal tibia fractures is more due osteosynthesis initiated by expert tibia nail by interfragmentary compression due to its intramedullary support.³

In treatment of proximal tibia fracture, poor result in past leads to introduction of new implants expert tibial nail. These new implants gave advantage over primary tibia IMIL nail that the interlocking bolts can be introduced just below the tibia plateau, to treat every proximal tibial fracture.

The expert tibial nail was devised in 2005 and its used in tibia fracture was started. These nail has multiplanar locking options at its proximal end and also at distal end which result in stabilization fixation. The expert tibial nail system (ETNS) was devised for management of all type Schatzker fracture even pilon fractures. In expert tibia nail there are three different locking options, with locking screws, for stabilization of small fragment in proximal tibia and the antero-medio-lateral (ML) locking options gives compression at fracture site and secondary for dynamisation. Upto 7 mm compression at the fracture is possible in ETNS by putting one distal locking screw and one proximal dynamic locking screw. Thus we conducted a study to evaluate the effectiveness of expert tibia nail in proximal tibia fractures in view of faster rehabilitation, soft tissue complications and malalignment in metaphyseal, diaphyseal and intraarticular fractures of tibia.

METHODS

General data

From May 2016 to May 2018, there were 30 cases were included in study with proximal tibial fractures treated expert tibial nailing in our department. All 30 patients were treated with Expert tibia Nail. There were 20 male and 10 female included in the study. Patient age between 18-65 was included in study. Nature of trauma in 24 patients was by road traffic accident, 6 patients had fall of heavy object. Fracture type among all patients, 8 patients had Gustilo Anderson type 1, 7 patients had Gustilo Anderson type 2 and 15 patients were close fractures. 8 patients had associated injury like two patients had clavicle fractures, three had ribs fractures, one had distal radius fracture, one had humerus fracture and one had scapula fracture. Inclusion criteria was patients age between 18-65, extraarticular fractures of the proximal tibia (AO 41 A2/A3), partial articular fractures of proximal tibia (AO 41 B1,B2,B3), patients all type of

Schatzker fractures, with intra articular proximal tibia fracture (AO type C1). Exclusion criteria were fractures with associated neurovascular injury (Gustilo Anderson type 3b and type 3c), associated severe head injury (initial Glasgow Coma Scale <8), infection in the nail's insertion area, infection of the tibial cavity, complex articular fractures of the proximal or distal tibia with joint depression. (AO type 41 C2, C3). The required approval was from college Ethical committee. Written consent to study participate in study was taken from each patient.

Preoperative management

All patients underwent tibia fibula x-ray in AP and lateral view to know the type of fracture and region involved. X-ray included both knee and ankle joint. All routine investigation required for surgery was done. Three dimensional CT scan was done if required. Diameter of tibia at isthmus and length of tibia was measured. Above knee POP slab was advised. Patients with open fracture were debrided immediately and tag sutures were taken followed by slab. For all patients severity of open fracture and swelling of soft tissue was assessed. Ice packs and elevation was given for patients in ward. In case of swellings present patient was operated once swelling subsides, till then patient was in slab with strict bed rest.

Operation method

Patient lies in supine position, spinal anesthesia was given. Tourniquet pressure was adjusted to average be 280 mmHg. Wooden board was used and knee flexion angle about 100 degree was kept. A 5 cm long incision was taken from lower pole of patella to tibial tuberosity, first skin was incised followed by patellar tendon. Entry point was center between two condyle and 1mm inferior to tibial crest. Entry in medullary canal was done with help of entry awl. After that proper guide was selected was introduce with help of C-arm. In AP and lateral view images were check. Force traction was applied to reduce the fracture and to achieve tibial length. After reduction guide wire was pass in distal fragment. Intramedullary reaming was done. ETN was inserted in tibia of proper size over guide wire for proper position. Distal locking multidirectional locking was done. Reduction was recheck with C-arm X-rays and proximal locking device was connected and proximal locking was done in traction pressure reduction position. Once again C-arm used and reduction checked. Position in which locking to be done is check. Lastly wash was given on incision site and closure done layer by layer. In case intraarticular fracture of proximal tibia fracture two cannulated screw inserted in tibial plateau after reduction of fracture, in such a position it does not interfere with entry of nail and oblique locking options was used of ETN.

Postoperative management

First-generation cephalosporin were given routinely for 48 hrs. The operated limb was elevated. Physiotherapy

started on same day knee bending and quadriceps strengthening. After POD 2, knee joint CPM functional exercise and crutch-assisted non-weight-bearing walking were implemented, followed by active knee and ankle joint functional exercises. Patients were followed-up monthly for three months and then at 6 months and at 12 months. Each time patient visited both imaging and clinical examination was conducted to assess the fracture union and functional recovery.

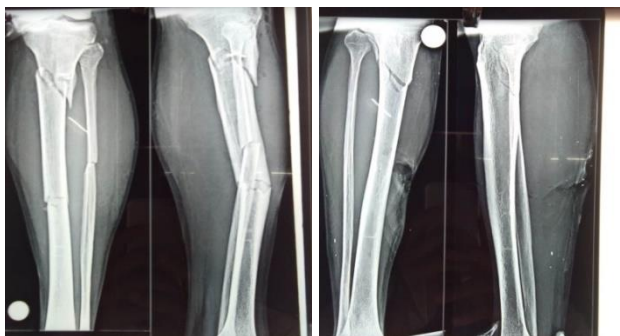


Figure 1: Pre-operative X-rays: Case 1 (a) Pre-operative X-ray AP; (b) pre-operative X-ray lateral; Case 2 (c) pre-operative X-rays AP; (d) pre-operative X-rays lateral.



Figure 2: Immediate post-operative X -ray: Case 1 (a) post-operative X-ray in AP; (b) post-operative X-ray in lateral; Case 2 (c) post-operative X-ray in AP; (d) post-operative X-ray in lateral.



Figure 3: Post-operative X-ray at 1 month; Case 1 (a) post-operative X-ray in AP; (b) post-operative X-ray in lateral; Case 2 (c) post-operative X-ray in AP (d) post-operative X-ray in lateral.

Statistical analysis

It was done by using MS excel to calculate mean, standard deviation and percentage. The graphical study method from MS Excel was used.

RESULTS

All patient 30 were followed up. There were 20 male and 10 female. The time was 18-24 months (average 12 months). The mean for age of the 30 patients was 38.46 years (Table 1).

Table 1: Gender distribution and average age.

Gender	Number of patients	Percentage (%)	Average age
Male	20	66.66	40.6
Female	10	33.33	34.2
Total	30	100	38.46

The parameters like blood loss, operating time, unaided full weight bearing, fracture union time, functional outcome measured by Johner and Wruchs criteria were assessed. About 80% of patients who had proximal tibia fracture had road traffic accident and 20% patients had fall of heavy object on knee (Table 2).

Table 2: Mode of injury.

	Count	Percentage (%)
RTA	24	80
Fall of heavy object	6	20
Total	30	100

In 29 cases (95%) associated fibula was fracture and only in one patient fibula was intact (5%). 15 patients (50%) had close fracture and 15 patients (50%) had open fractures. Type of fractures graded according to AO classification (Table 3).

Table 3: Type of fractures according to AO.

Type A patients	Type B patients	Type C patients
A1 -8	B1 -3	C1 -2
A2 -5	B2 -2	C2 -0
A3 -8	B3 -2	C3 -0

Average blood loss was 68.46. Mean intraoperative time was 96.83 mins (Table 4).

Table 4: Time for surgery.

Time requires for surgery	No. of patients	Percentage (%)
More than 95	13	43
Less than 95	17	56

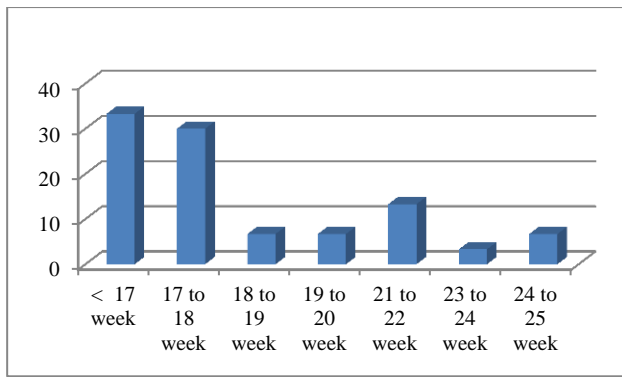


Figure 4: Radiological union.

Reduction was achieved closed in 28 patients (94%) and was open in two cases (6%) for ETN. Average time protected full weight bearing walking was 3.2 week and patient started walking full weight bearing without support at 7.2 weeks. No of sign of nonunion or delayed union were seen 100% union rate was achieved without dynamization. Average time taken by patients for fracture step to reduces that is for clinical union was 12.4 weeks and time required to see the union on X-ray had is radiological union was 18.2 weeks (Figure 4).

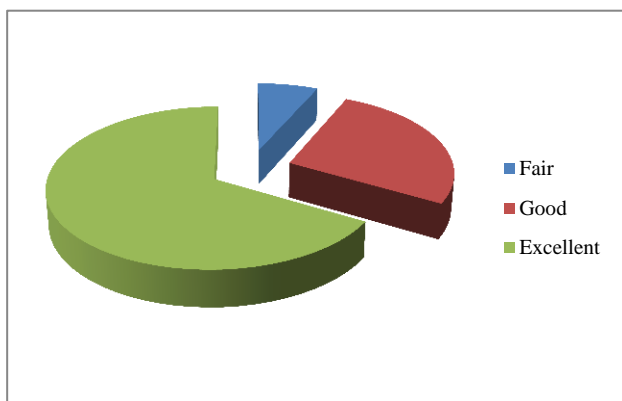


Figure 5: Johner and Wruhs's criteria.

Complication was seen in 5 patients, 1 patient had restricted knee movement, delayed union was present in two patients and infection in two patients. Johner and Wruhs criteria calculated at 12 months was used for functional outcome.³ There were 20 patients showing excellent results, 8 patients were showing good results, 2 patients with fair results (Figure 5).

DISCUSSION

Proximal tibia fractures continue to be problematic fractures for orthopedics surgeons and main problem among it is selection of method to treatment. The convention method of open reduction and internal fixation by plate causes long incision and open of fracture site which further causes long operative time, removal of periosteum this leads to delay union rate and increase the risk of delayed union, post-operative infection, flap

necrosis and plate breakage. Intramedullary nail provide better option than plate but IMIL nail did not proved satisfactory for fractures like proximal tibia fracture due to difficulty in reduction and comminution if present cause problem. These problem lead to introduction of ETN to overcome the shortening of plate and IMINL nail, with multi direction option for proximal and distal locking and had answer for proximal tibia fractures and also comminuted distal tibia fractures. We evaluated our study and compared with others study.

Mean age in our study was 37.4 years (range 20 to 60 years). Gregory and Sanders in their study on expert tibia nail reported mean age was 30 years while in study of Duwelius et al reported mean age was 40.5 years.^{4,5}

Majority of cases about 80% were due road traffic accident in our study. Gregory and Sanders reported similar result.⁴ Duwelius et al reported distal tibia was more common in road traffic accident than proximal tibia.⁵

Average duration of protected and unprotected full weight bearing was 3.2 weeks and 7.2 weeks respectively in our study. Hindley et al and Folleras et al reported the average duration of unprotected full weight bearing was 5.6 weeks and 7.4 weeks respectively.⁶

In proximal tibia fracture clinical union was seen in 12.4 weeks after the surgery and the time for radiological union was 18.2 weeks after surgery. Hansen et al in his study reported 181 patients with 186 tibial fractures treated with expert tibial nail. He reported that the chances of valgus, varus or antecurvation malalignment of greater than 5 degrees in any plane on radiographic was 4.3% for shaft fracture, 1.5% for intra-articular fracture fractures distally and 1.3% for intra-articular fracture proximally.⁷

Attal et al conducted a study with expert tibial nail and reported the occurrence of non-union was 9 patients during first 12 months. In 10 cases dynamization was done. Out of 144 patients 13 cases had complication like varus malalignment which measured 6° and varus malalignment which was more than 5°. Stable reduction was achieved in 144 cases.⁸

CONCLUSION

Our analysis on expert tibia interlocking nailing in proximal tibia fracture including intra-articular fractures is good and our study shows the advantages of ETN system. Changes in the design of the nail for improved proximal and distal locking enable it to use in almost all proximal tibia fractures. Nail designs also include locking options in three planes, which allow a better hold of fracture fragment in three plane and obtain a higher stability even in intra-articular fracture. We suggest that by analysis result in our study the ETN has advantages in intra-articular, metaphyseal and diaphyseal fractures over plate and IMIL nailing.

Limitations

Our study is not comparative study and the number of cases we included in our study were less and period of our retrospective study was short. Further studies are required see advantages associated with this new nailing system.

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Ethical approval: The study was approved by the institutional ethics committee

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