

*“ Evaluation of the use of expert tibia
nailing in proximal tibia fractures ”*

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Abstract

Background: For a very long period, open reduction and internal fixation with a plate was the preferred therapy for proximal tibia fractures. Recently, proximal tibia fractures are often treated with expert tibial nail since it has numerous distal and proximal interlocking alternatives. At the distal end, there are four locking choices and five at the proximal end in different lines. As well as it is a less invasive procedure, wound-related problems and post-surgery care duration than plating. Expert tibial nail style helps to achieve stable fixation with interlocking screws. In this study, the effectiveness of expert tibial nail in treating proximal tibia fractures was examined.

Aim of the study: to evaluate the postoperative radiological and functional results of using expert tibial nail in the treatment of proximal tibia fractures.

Patients: In this study, twenty patients (fourteen males and six females) with upper third tibia fracture were operated by expert interlocking tibial nail at universal health insurance hospitals of Port Said City.

Methods: Between August 2021 and August 2022, we prospectively analyzed our cases of proximal third tibia fractures in patients aged 18 to 60 who underwent closed reduction and internal fixation with expert interlocking tibial nail and were observed for at least six months. Each patient was evaluated in term of postoperative radiological and functional outcomes.

Results: Patients had no complications were 13 (65%) however, 4 (20%) of the patients had anterior knee pain, 1 (5%) of the patients had infection, 1 (5%) of the patients had DVT and 1 (5%) of the patients had delayed union. Patients were evaluated radiologically for fracture union and alignment, as well as clinically for the knee & ankle joints' range of motion, knee pain, and atrophy of the muscle utilizing the Modified Klemm and Borner Scoring System. The excellent patients results were 13 (65%) and 5 (25%) of patients were good. While only one patient was fair, and one patient was poor.

Conclusion: For the management of proximal third tibia fractures, expert tibia nailing is a good therapeutic option because it offers strong angular stability and appropriate fixation, leading to early rehabilitation and union with great functional success and fewer problems. In cases where the surrounding soft tissue is affected, it is also a safer treatment option.

Keywords: Expert tibial nail, Upper third tibia fractures, Poller screws, Modified Klemm and Borner scoring system.

Introduction

Due to road traffic collisions and other high-energy trauma, the most often fractured long bone is the tibia. Because of its location, anatomical shape, and minimal soft tissue coverage anteromedially, it is frequently injured.⁽¹⁾ Conservative care, as well as surgical treatment with osteosynthesis using an intramedullary nail, plates and screws, or external fixation, are some of the options for treating tibial fractures.⁽²⁾ The closed reduction and internal fixation by intramedullary nailing is desirable optional treatment when a stable fixation with early function restoration is desired.⁽³⁾ Expert tibial nailing (ETN) is a less invasive procedure than plating with minimal wound-related problems, discomfort, infections and post-surgery care duration. Cosmetically, nailing is superior, with the option to dynamize, no periosteal stripping, less soft tissue harm, and a shorter hospital stay.⁽³⁾ The ETN is a modification of the traditional tibial intramedullary interlocking nail, created specifically for metaphyseal fractures. When compared to traditional intramedullary nail and plate osteosynthesis, the ETN provides more biomechanical stability.⁽⁴⁾ ETN is indicated for all metaphyseal tibial fractures since it has numerous distal and proximal interlocking alternatives. At the distal end, there are four locking choices and five at the proximal end in different planes. ETN style helps to achieve stable fixation with interlocking screws.⁽⁴⁾ The complications related to proximal tibia fractures with use of ETN included shortening, malunion (valgus, varus, procurvatum), knee stiffness and infection.⁽⁵⁾ The poller screw is a blocking screw that tightens the medullary canal and permits the intramedullary nail to be centralised in the proximal wide metaphyseal region of the tibia. It maintains fixation of intramedullary nailing and alignment of fractures.⁽⁶⁾ ETN contraindications include bedridden patient with poor general condition, flexion of the knee of less than 90 degrees, infection in the area of nail insertion.⁽⁷⁾

Patients

In this study, twenty patients (fourteen males and six females) with upper third tibia fracture were operated by expert interlocking tibial nail between August 2021 to August 2022 at universal health insurance hospitals of Port Said City. 38 years old was the average age, and 27.12 kg/m² was the mean BMI. Ten patients (50%) were smokers, while six patients (30%) were hypertensive and four patients (20%) were diabetics. Fifteen patients (75%) were due to RTA, three patients (15%) resulting from falling of the height and two patients (10%) were due to sports trauma. Patients with intra-articular fracture or pre-existing tibial shaft deformity or skeletally immature were excluded from the study.

Methods

Full history and clinical examination were done for all patients, then followed by radiological assessment. AP and lateral views of the traumatized leg with knee and ankle joints visualization were taken to assess the level of fracture and type of fracture according to AO

classification. IV fluids were administered for hemodynamically unstable patients. A careful neurovascular assessment and an emergent fracture reduction were performed. Anti-inflammatory drugs and analgesia were given. A head to toes secondary assessment was done. Distal perfusion and the patient's level of pain and analgesia requirements were reassessed after admission. All routine laboratory investigations were done. Over a radiolucent operating table, the patient was positioned in the supine position. The fractured limb was positioned freely, with at least a ninety-degree flexion of the knee. The image intensifier was introduced from the contralateral side. No tourniquet was used. A longitudinal skin incision from inferior pole of patella extending distally 3-5 cm towards tibial tubercle was made. Paratenon was opened as a separate layer to facilitate closure. The entry point was made visible by splitting the patellar tendon vertically at its midpoint. In the AP view, the entry site was situated medially to the lateral tubercle of the intercondylar spine along the axis of the medullary canal. In the lateral view, just below the anterior edge of the tibial plateau. The medullary canal was opened by cannulated awl around 8-10 cm. The tip of the awl was pressed into the cortex at the site of entry directed posteriorly. Then the awl was gradually rotated to align to the center of the canal on the AP and lateral views. After widening the medullary canal, the guidewire was passed into the medullary canal of proximal segment, and by manual traction the fracture fragments were reduced under C-arm. After reduction, the tip of the guide wire was moved to pass in the distal fragment up to 0.5-1cm above the ankle joint under C-arm. The wire tip was placed into the center of the plafond on both AP and lateral views. Reaming process started with 8 mm flexible reamer and diameter was increased sequentially by 0.5 mm until cortical chatter occurred confirmed by diaphyseal fitting on C-arm. A radiographic ruler, provided with the nail instruments was used to determine accurate nail length. With the fracture reduced, the distance from the nail entry site to one cm above the ankle joint was measured. The nail diameter was one mm smaller than the last reamer. With adequate reduction and sufficient over-reaming, the cannulated nail was inserted over the guide wire by hand with rotational movements, or with gentle hammering. The poller screws were used in some cases to maintain fixation of intramedullary nail and alignment of fracture. Distal locking 5 mm screws were inserted. Then proximal 5 mm locking screws were inserted using a system guide and the required length of the locking screw was determined by the depth gauge. Three or four screws were inserted proximally depending on the stability of the construct and the fracture pattern. Post-operative x-rays were taken for both AP and Lateral views to check for reduction, nail and screw positioning, and alignment of the limbs. Elevation of the limbs and use of a crepe bandage for two to three days post-surgery to reduce limb edema and decrease wound problems. Ankle and knee mobilisation exercises were encouraged as soon as the patient is able on the day of surgery, and early mobilisation began on the first postoperative day with non-weight bearing walking. At three weeks partial weight bearing was started then increased to full weight bearing as the patient's tolerance and radiographic union status. Patients were followed after two weeks then 6, 12, 24 weeks, or when the patient had a complaint. All patients were followed for at least six months. Patients were evaluated radiologically for fracture union and alignment, as well as clinically for the knee & ankle joints' range of motion, knee pain, deformity, and atrophy of the muscle grade at each follow-up appointment. On a regular basis, functional and radiological evaluation were offered for all patients, utilizing the Modified Klemm and Borner Scoring System.⁽³⁾ All collected data was

filtered. Each variable was coded to facilitate the transfer of data. These codes were entered into computer through Statistical Package for Social Science (SPSS) version 20.

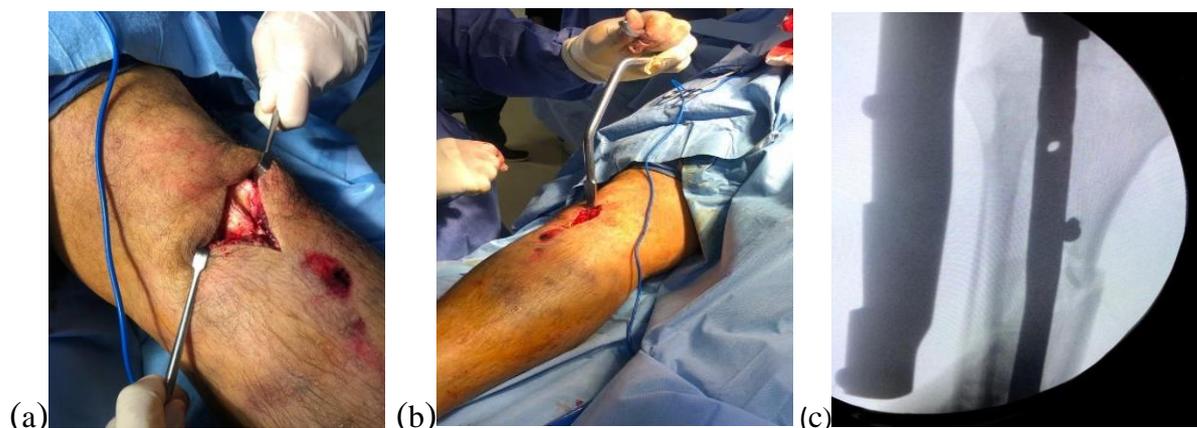


Figure 1: a.showing patellar tendon incision. b.showing the position of the awl at the entry point. c.showing lateral view of the posterior poller screw that maintained the reduction.

Results

Of the studied patients fourteen were males (70%) and six were females (30%), with the mean age 38.45 ± 10.21 years and a range of 22 – 60 years. The mean BMI was 27.12 ± 3.54 kg/m². Ten patients (50%) were smokers, while six (30%) were hypertensive and four (20%) were diabetics. Fifteen (75%) patients were due to RTA, three (15%) patients were due to fall from height and two (10%) patients were due to sports trauma. Right side injuries were present in 65% of the cases and 35% were on the left. In 85% of the patients, the fracture was closed, while 15% had open fracture. Moreover, 70% of the patients suffered from fracture in both tibia and fibula and in only 6 patients had only tibia been fractured. There were thirteen (65%) patients had proximal fractures only and seven (35%) associated with segmental fracture. Most of the patients were class 41-A2 (65%) followed by class 42-C2 (25%) while 10% of the patients were class 42-C3. Four patients (20%) waited till the second day, whereas sixteen (80%) had surgery the first day. Mean operative time was 92.71 ± 12.43 minute and mean hospital stay was 4.21 ± 1.54 days. Mean time for protected full weight bearing was 4.11 weeks, while mean time for non-protected full weight bearing was 7.34 weeks. Meanwhile time for clinical union was 13.75 weeks while time for radiological union was 17.25 weeks. Thirteen (65%) patients had no complications however, four (20%) patients had anterior knee pain, one (5%) patient had infection, one (5%) patient had DVT and one (5%) patient had delayed union. Patients were evaluated radiologically for fracture union and alignment, as well as clinically for the knee and ankle joints' range of motion, knee pain and muscle atrophy utilizing the Modified Klemm and Borner Scoring System.⁽³⁾ The score was excellent in thirteen (65%) of patients and five (25%) of patients were good. While only one patient (5%) was fair and one patient (5%) was poor.

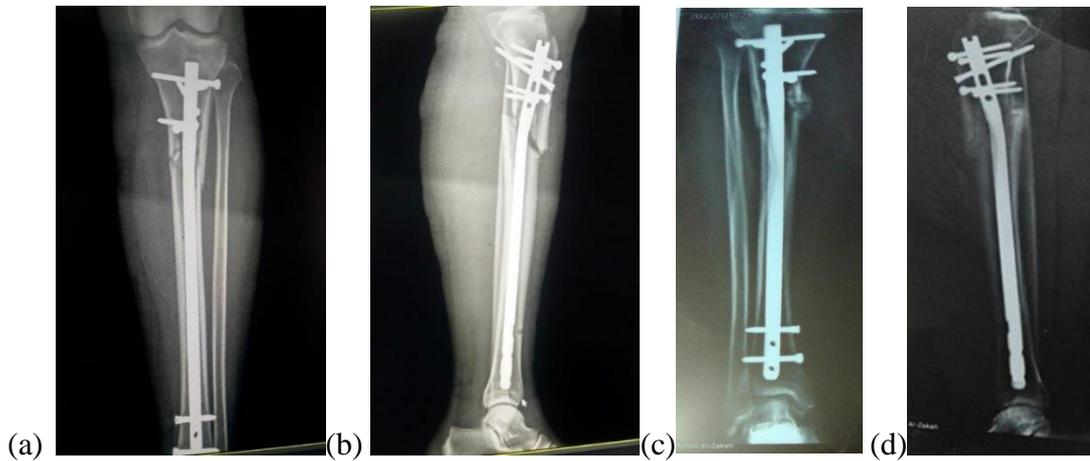


Figure 2: a and b showing immediate post-operative x-rays. c and d showing seven months post-operative follow up x-rays.

Discussion

Tibia is the most ordinarily fractured long bone in the body with a yearly occurrence of two tibial shaft fractures for each 1000 people. The most common age of patients with tibial shaft fractures is around 37 years and adolescent guys are accounted for to have the most elevated frequency. Tibial fractures are treated either conservatively, or operatively with intramedullary nails, plate and screws, or external fixation. Intramedullary nailing (IMN) has numerous advantages for fracture fixation, including its potential for minimally invasive exposure, biologically friendly implant insertion, longer implants to span more complex fractures, and load-sharing fixation to allow earlier weight bearing. Intramedullary nailing offers an alluring treatment and evade the difficulties related with plating as ulceration of skin overlying plate. Anyway, there are a few issues in treatment of fractured tibia with traditional intramedullary interlocking nailing like trouble in controlling cracks of proximal and distal third tibia and comminuted metaphyseal fractures.⁽⁸⁾ These weaknesses of traditional interlocking nail in overseeing proximal third cracks have been overwhelmed by the presentation of expert tibial nail because of adjustments in usable methods, its structure and locking screws headway. So, tibial nail configuration permits a good control in proximal tibial fragments through several interlocking holes to each end of the nail. Interlocking screws with multidirectional option ensure that the arrangement may be maintained and the solidity protected even with a short proximal portion.⁽⁹⁾ The Expert Tibial Nail System has multidirectional securing alternatives proximally & distally through the nail, five locking options proximally (one anteroposterior, two oblique and two medial to lateral holes choices) and four locking options distally (two medial to lateral and two anteroposterior).⁽¹⁰⁾ The major goal of this study was to assess the use of expert tibial nail in the treatment of proximal tibia fractures in terms of postoperative radiological and functional outcomes. This prospective interventional study included 20 cases of both genders starting from 2021 to 2022. Cases admitted to universal health insurance hospitals of Port Said City. Of the studied patients 14 were males (70%) and only six were females (30%), with mean age was 38.45 ± 10.21 years and range 22 – 60 years and mean BMI was 27.12 ± 3.54 kg/m². Our results were in agreement with study of Mashhour et al ⁽¹¹⁾ as they reported that the study population's mean

age was 35 years old and that the standard deviation was 14 years. Only 30% of the studied population were females, with 70% of the population being males. Similarly, Anil et al ⁽¹²⁾ found that the age range of 19 to 65 years, with a combined average age of 38 years, had the highest prevalence of extraarticular proximal tibial fractures. Males were affected more frequently than females, and male to female ratio was 13:8. Young men participate more in outdoor, productive, high-energy activities, which makes them more susceptible to this fracture than older men. The current study showed that 15 (75%) of patients were due to RTA, 3 (15%) of patients were due to fall from height and 2 (10%) of patients were due to sports trauma. 65% of the patients had injury on the right limb and 35% were on the left. In accordance with our results study of Anil et al ⁽¹²⁾ as they reported that traffic accident then fall from height were the two most common mode of trauma. Also, in the study of Tijoriwala et al ⁽¹⁴⁾ the most common mechanism of injury by (75%) was the road traffic accident. However, both the right and left sides were equally affected. In the study in our hands, 85% of the patients had closed fracture while 15% had open fracture. Moreover, 70% of the patients suffered from fracture in both tibia and fibula and in only 6 patients had only tibia been fractured. There were thirteen (65%) patients had proximal fractures only and seven (35%) associated with segmental fractures. While in the study of Kadam et al ⁽¹⁵⁾ only in one patient the fibula was intact (5%), whereas 29 cases (95%) had related fibula fractures. A closed fracture occurred in 15 patients (50%) and an open fracture occurred in 15 patients (50%). However, in the study of Manikandan and Palanikumar⁽¹³⁾ seventeen patients had proximal tibial fractures and three had segmental fractures. In the study in our hands, mean time for protected full weight bearing was 4.11 weeks, while mean time for non-protected full weight bearing was 7.34 weeks. Meanwhile period for radiological union was 17.25 weeks. Our results were in line with study of Kadam et al ⁽¹⁵⁾ as they stated that the patient began full weight bearing walking without support at 7.2 weeks and that the average duration for protected full weight bearing walking was 3.2 weeks. Without dynamization, a 100% union rate was attained with no case of nonunion or delayed union. Patients typically required 18.2 weeks to view the union on an X-ray. Manikandan and Palanikumar ⁽¹³⁾ demonstrated that all cases achieved union at the end of study for a period of one year with good functional outcome. The present study showed that Thirteen (65%) patients had no complications however, four (20%) patients had anterior knee pain, one (5%) patient had infection, one (5%) patient had DVT and one (5%) patient had delayed union. Our results were supported by study of Tijoriwala et al ⁽¹⁴⁾ as they noted that 25% of the patients in that trial experienced anterior knee pain as the most typical acute complication. All of these patients also experienced mild limitations in knee joint range of motion. 15% of nailing patients experienced a superficial wound infection that was treated with a normal dressing. Infections in superficial wounds occurred in 30% of plating patients, of whom 20% recovered with simple dressings and 10% required debridement under anaesthesia. In 10% and 5% of patients, respectively, the fracture did not heal after plating and nailing. Our results showed that 13 (65%) of patients were excellent, and 5 (25%) of patients were good, While only one patient was fair, and one patient was poor. In accordance with our results, study of Kadam et al ⁽¹⁵⁾ as they reported that out of thirty cases the excellent results were twenty patients (66.67%), eight patients (26.67%) had a good score and only two patients (6.66%) with fair score. Also, Mohammad et al ⁽¹⁶⁾ revealed that 71.42% of patients fell into the excellent group, 17.85%

into the good group, 7.14% into the fair group, and 3.57% into the poor group, according to the Klemm and Borner Scoring system.

CONCLUSION

For the management of proximal third tibia fractures, expert tibia nailing is a good therapeutic option because it offers strong angular stability and appropriate fixation, leading to early rehabilitation and union with great functional success and fewer problems. In the event that the surrounding soft tissue is affected, it is also a safer treatment option.

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