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Abstract: Background: Fracture tibia is common and many modalities for the treatment are available the most recent one is intramedullary nails with closed and reamed method; however other modalities like casting are still used. **Objectives:** To evaluate the complications of closed interlocking intramedullary nailing in closed diaphyseal fractures of tibia regarding the infection rate, time for union, malalignment and knee joint pain and stiffness. **Design:** Prospective study. **Setting and Timing:** Department of orthopedic surgery in Al-Azhar university Hospitals from Dec. 2014- Dec. 2016. **Patient and Methods:** All the patients admitted to the emergency department of the hospital and operated within 72 hours. The study is based on 30 patients including males and females having closed tibial diaphyseal fractures of skeletally mature persons (closed proximal and distal physes). **Results:** The thirty five (30) patients, were followed for a period of one year. The mean time for union was 17.4 weeks. Union rate was 90 %, delayed union in two patients (6.6 %). Non union in one patient (3.3%). Infection was noticed in three patients (10%). Knee joint pain in 8 patients (26.6%) all of them of mild grade and easily ignored. In addition to common peroneal nerve injury in 1 patient (3.3 %). **Conclusion:** From the study we concluded that closed intramedullary nailing of closed tibia diaphyseal fractures is advantageous because of early mobility, low risk of infection, good union rate, low risk of malalignment and low risk of significant knee joint pain.

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I. Introduction

Tibial shaft fractures are the most common long bone fractures in adults and are usually caused by high-energy trauma. The management of tibial diaphyseal fractures has always been a challenge on account of its subcutaneous location (**Chaurasia**), associated severe soft tissue injuries and many of these being open fractures.

Nicoll 1974 stated that, "Fractures of the tibia are important for two reasons: (1) they are common, and (2) they are controversial, and anything which is common and controversial must be important". In this Study attempt has been made to critically evaluate the outcome of closed intramedullary interlocked nailing in tibial fractures in relation to union, functional healing and the complications of the procedure (**Court-Brown 1990, et al**).

This procedure has two advantages, that it controls the rotational stability of fracture fragments, Better correction of angulation deformity, Minimal damage to soft tissue envelope of bone thereby preserving blood supply of the bone, Minimal blood loss, Can be used not only in the mid shaft fractures but also in more proximal and distal fractures (**Melcher Michael 1993, W. Chapman Meges P. Panagiotopoulos E**), Widely accepted as primary method of fixation in grade I open fractures (**Zucman**

J. & Maurer P 1968). However, this method of treating tibial fractures is not free of complications viz.

General complications:

Deep Vein Thrombosis (**Court-Brown C.M 1992**), Pulmonary Embolism, Pneumonia, Infections etc.

Local complications:

Infection, delayed union, nonunion, neurovascular injury, compartmental syndrome etc.

2. Materials and Methods

In this study we have included cases of closed/open grade-I tibial shaft fractures in adults, treated by closed intramedullary interlocked nailing at Al Azhar university hospitals from December 2014 till December 2016, 30 cases was followed.

All the cases were followed up till the union of fracture was achieved. They were evaluated clinically, radiologically and functionally.

The data thus collected was tabulated and analyzed to draw the conclusions. Cases were selected keeping in view the following criteria:

Inclusion criteria:

1. Patients from either sex of above 16 years.
2. Isolated fracture tibia or polytraumatized patients.

3. Closed or open Gustilo grade-I, fractures of both bones leg.
4. All those fractures of tibia which are 7cm distal to knee and 4cm proximal to the ankle joint.
5. Unilateral or bilateral tibial fractures.

Exclusion criteria:

1. Patient less than 16 years of age.
3. Fractures proximal to 7cm of tibia or Distal to 4cm of tibia.

Open fractures were classified according to the classification of Gustilo and Anderson. Other investigations done included a complete blood count with, Pothrombin time, Activated partial thromboplastin time, urine examination, blood urea, Serum creatinine, liver functions, random blood sugar, blood grouping and matching and chest X-ray. Any other investigation as deemed necessary was carried out.

Management:

Immediately after admission, the patients were given appropriate dose of analgesic to relieve pain and injured limb was immobilized and elevated in above knee Plaster of Paris (POP) posterior slab.

All the patients were operated as early as possible depending upon the local/general condition of the patients. All the patients were given a broad-spectrum antibiotic, mostly a third generation cephalosporin preoperatively and repeated after 8-12 hours postoperatively.

Operative Technique

The patients were operated upon using general or regional anesthesia as deemed appropriate by the anesthetist. A tourniquet was applied over the thigh and pressure raised to 350 mm Hg. Para patellar or splitting of patellar tendon was done but mostly transtendinous, reaming was done mostly in all cases.

Length was measured by placing radiopaque ruler. Rotational alignment was evaluated by aligning the iliac crest, patella, and the second ray of foot. Distal locking was done using free hand technique in some cases but the routine was through the system device and proximal locking was done through the jig attached to the nail insertion device under fluoroscopy control. All wounds were closed and antiseptic dressing was done.

Post-operative Care

The leg was elevated an above knee POP posterior slab Dressing of surgical wound and drain removal (if any) was done 48 hours after surgery, A post-operative radiograph was taken for documentation, Partial weight bearing was started when there was clinical evidence of fracture healing, usually about 3 weeks, Full weight bearing was started when there was radiological evidence of fracture union, usually about 3-4 months, During each visit the patients were evaluated both subjectively and

objectively, using **the (Karlstorm and Olerud) 36-point clinical grading system and radiological evaluation of leg.** This system evaluated the patients both subjectively and objectively and thus gave a comprehensive picture of the patient's condition.

3. Results

An overall result of excellent, good, acceptable or poor was determined according to the following criteria:

Excellent-Score of 3 in all the factors listed above.

Good- Score of 2 or more in all the factors listed above.

Acceptable- Score of 1 in one factor and scores of 2 or 3 in all other factors.

Poor- Score of 1 in more than one factor.

A total of 30 cases of closed and open grade-I tibial shaft fractures were operated. The present study is based on observations obtained in 30 cases. The mean age of patients was 41.5 Yrs. Transverse fracture was the most common occurring in 18 (60.0%) patients followed by Oblique fractures in 8 (26.66%) patients. 24 patients (80%) sustained closed tibial shaft fractures while 6 patients sustained an open grade I fracture.

Reaming was done in 27 (90 %) patients while unreamed tibial nail was put in 3 patients.12 mm size nail was used in most (20/30) patients. Dynamic locking was done in 24 (80%) patients and static locking was done in 6 patients. No patients had valgus or varus deformity radiologically of more than 10 degrees. Most (86.66%) patients needed no immobilization. 3 patients had an above knee POP slab while 1 patient had a below knee slab. Most patients (25) started partial weight bearing within 9 weeks post-surgery followed by 2 patients between 9-12 weeks and another 3 patients after 12 weeks post-surgery.

The average interval between surgery and partial weight bearing was 9.06 weeks (3 to 32 weeks). Most patients (25) started full weight bearing within 24 weeks after surgery. 4 patient started full weight bearing between 24 to 36 weeks and only one patient on account of old age started full weight bearing after 36 weeks. Dynamization was done in 4 patients. 27 patients had complete union while 2 had delayed union and only 1 had nonunion.

According to **(Karlstrom and Olerud)** functional scoring system all patients had excellent results of pain evaluation. 27 patients had a score of 3 and only 3 patients had a score of 2 with regards to previous sports activity. 21 patients had a score of 3, 7 patients had a score of 2 and only 2 patients had a score of 1 with regards to walking capacity. 17 patients had a score of 3, 10 patients had a score of 2

and only 3 patients had a score of 1. With regards to work limitation.

No patient had any obvious deformity at follow up. No patient had any limb length discrepancy at follow up. 90 % patients had less than 10 degrees loss of knee motion while only 2 had between 10-20 degrees loss of motion.

All patients had almost full range of ankle movement. All patients had almost full range of subtalar motion. 27(90%) patients had at least 135 degrees range of movement, 3 (10%) patients at least 100 degrees range of movement and no patient had less than 100 degrees range of motion at the knee joint.

Most patients had bony union radiologically by 17 weeks and another 5 between 24-36 weeks. Only 3 patients had infection at proximal insertion site at follow up. One patient had a broken implant at 24 weeks when full weight bearing was started. He was later managed with an above knee cast with implant left in situ. The bone united at 6 months later. The proximal part of the broken nail was removed thereafter. One patient required secondary surgery for surgical complications in the form of nail exchange with larger diameter nail and bone grafting for nonunion. According to Karlstrom & Olerud functional scoring system 21 patients had excellent overall functional results, 6 had good results, 2 had acceptable results only one patient had poor result on account of her old age and poor health condition. 2 patients had acceptable results on account of poor patient compliance to follow postoperative physiotherapy.

4. Discussion

Tibial shaft fractures are the most common long bone fractures in adults and are usually caused by high-energy trauma (**Campbell's Operative**

Orthopaedic, Chaurasia B.D and Clinical Oriented Anatomy). Moreover, its location and the fact that its anteromedial border is subcutaneous render the bone susceptible to injury.

Operative treatment of tibial shaft fractures (**Costa, et al**) is disputed because impressive results are achieved by closed reduction, casting and functional bracing of these fractures as shown by (**Sarmiento et. al**). However with cast treatment, loss of reduction which subsequently introduces malunion and nonunion is not uncommon (**Abbas Hallaj Karldani**).

The objections to operative management have however been mainly related to plate osteosynthesis (**Johnson, et al**) because plating of the tibial shaft fracture may induce an unacceptably high risk of infection (**Alberts, et al**).

With the invention of the interlocked nail there was a great achievement in the nailing technique as the rotational stability could also be achieved (**Alho A et al**). Also the dynamization of the nail was not problem due to presence of slot for dynamic nail proximally (**Goran & Sven**). Recent emphasis has been given to treating these kinds of fractures with anatomical restoration of alignment, stable and rigid internal fixation with rotational stability and early weight bearing.

The aim of operative treatment is to obtain a proper anatomical alignment, early knee mobilization exercises early weight bearing even before the bony union is achieved (**Ekeland, et al**).

Reamed intramedullary nailing of the tibia for acute fractures offers significant benefits to the patients in the form of short hospital stay, early range of motion. and exercises and weight bearing without immobilization in plaster and thereby consequent good functional results in a majority of these controversial fractures (**Howard et al**).

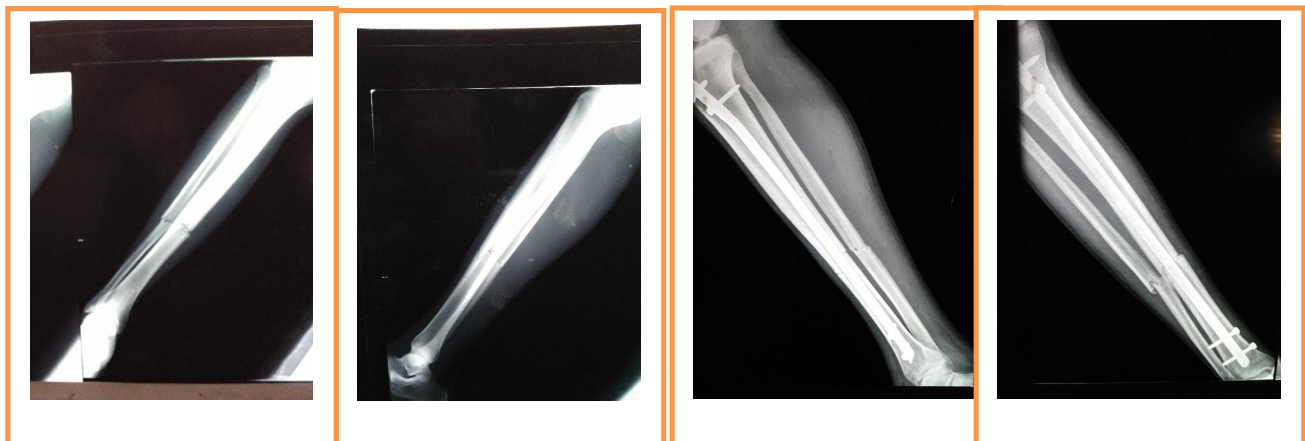


Fig. 1 a Pre-operative x rays

Fig 1 b 4 months post-operative

Summary and Conclusions

Patients in our study were mainly middle aged. Males dominated our study. The variables like age and sex did not influence the results significantly. High velocity road traffic accidents were the main cause of injury. Distal 1/3rd tibial shaft fractures were more common followed by middle 1/3rd, upper 1/3rd being the least common. Transverse fractures dominated the study followed by oblique and spiral fractures. The „classification“ variable did not demonstrate any statistical correlation with functional results.

No obvious correlation of days between injury and operation with outcome of results was seen. However delay in operation causes greater soft tissue swelling making the management more difficult. In comminuted fractures, rigid fixation like closed intramedullary interlocked nailing gave better functional results as it is a minimally invasive procedure which does not require opening of the fracture site thus haematoma is not drained. Moreover the length and rotation of the limb is maintained and at the same time there is angular correction. However, we also had our share of unsatisfactory results with regards to angulation deformity, delayed union, mal-union and non-union.

Knee pain was the commonest complication seen. Compared with a transtendinous approach, a paratendinous approach for nail insertion does not reduce the incidence of chronic anterior knee pain or functional impairment after intramedullary nailing of a tibial shaft fracture. In long term, anterior knee pain seems to disappear from many patients.

In the distal and proximal third there was some degree of angulation. So, the surgeon should be careful about the alignment while locking proximally and distally.

Finally we conclude that closed intramedullary interlocked nailing for acute tibial fractures gives excellent results in closed and grade-I open fractures if done judiciously and with proper technique. Moreover it offers significant benefits to the patient in the form of short hospital stay, early range of motion exercises, also partial weight bearing can be started early, so both function and healing of fracture goes side by side and thereby, consequent good functional results were achieved in a majority of these fractures.

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