

Original Article

Fixation of Tibial Shaft Fracture by Interlocking Nail without Proximal Screws

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Abstract:

Tibia is the most commonly fractured long bone. In adults it takes 4 to 6 months to heal depending on the severity of injury and method of treatment. Rate of complications are also high. Locked intramedullary nailing is the preferred treatment for tibial shaft fractures. When locked proximally and distally, removal of one set of screws, especially in transverse and short oblique fractures are required for dynamization before weight bearing. Fail to do this timely, many of these patients present with nonunion and implant failure. The purpose of the study was to enhance healing of tibial shaft fracture by early weight bearing, at the same time minimizing the complications and early return to work. Stable open type- I, II & closed tibial shaft fractures from the isthmus to 4 cm above the distal articular surface of the tibia were fixed by locking nail without proximal screws. This prospective study was done from June 2009 to July 2014 on 410 patients treated at several hospitals of Faridpur city. All the operations were done in closed method without any C-Arm monitoring. Patients were allowed to move with crutch and controlled partial weight bearing within two to four weeks of operation. All patients were followed up for five years. In most cases the nail were removed in one to two years. Early weight bearing causes compression and intermittent micro movements at the fracture site. The fractures heal as early as in eight to twelve weeks and no nonunion or implant failure were encountered. Knee pain was complained by 41 patients (10%), disappeared after removal of the nail. Superficial infection developed in 8 cases (1.95%), controlled in 2 to 3 weeks and deep infections were encountered in 8 cases (1.95%) with delaying union but eradicated spontaneously as the fracture healed. Deep infection occurs only in open fractures. Although five years period is not enough to comment about development of secondary osteoarthritis, we encountered no such cases till now. So, closed reduction and internal fixation (CRIF) of stable open type-I, II & closed tibial shaft fractures from the isthmus to 4 cm above the distal articular surface of the tibia by interlocking nailing with distal locking screws only, allows early controlled weight bearing, thereby early fracture healing and less chance of implant failure.

Key words: Stable fracture, Tibial isthmus, Interlocking nail, Zig.

Introduction:

Tibia is a weight bearing partially subcutaneous major long bone, very vulnerable to trauma. It is the most commonly fractured long bone. Complications like delayed union, nonunion, infection and secondary osteoarthritis are relatively common. There are many modalities of treatment. Return to previous anatomy is not always possible. The goals of treatment of fracture

tibia are to obtain a healed well-aligned fracture, pain-free weight bearing and functional range of motion of the knee and ankle joints. In this regard less than 5 degrees of varus-valgus angulations, less than 10 degrees of anteroposterior angulations, less than 10 degrees of rotation, and less than 15 mm of shortening are acceptable¹. Prognosis depends on (1) the amount of initial displacement, (2) the degree of comminution, (3) whether infection has developed, and (4) the severity of the soft-tissue injury excluding infection^{2,3}. The indications for operative and non-operative treatment of tibial shaft fractures in adult continue to be refined. 'Closed reduction and casting' is a good option of treatment for stable, low-energy tibial fractures, but it requires a good deal of patience and time from the physician and a cooperative patient. The individual's functional demands also must be considered when planning treatment. Locked intramedullary nailing is the preferred treatment for tibial shaft fractures. Varieties of interlocking tibial nails are available for fixation of tibial shaft fracture. When locked proximally and distally, removal of one set of screws,

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especially in cases of transverse and short oblique fractures are required for dynamization before weight bearing, usually in 8 to 12 weeks. Fail to do this timely before weight bearing, many of these patients present to the surgeon with nonunion and implant failure. Management of these cases of nonunion with implant failure by exchange nailing or by any other method is very difficult and botheration for orthopaedic surgeons. Our poor illiterate young patients are usually noncompliant and neglect timely dynamization. Lack of operation theater facilities in our public hospitals is another cause. So, the nuisance fate of nonunion and implant failure are common. To overcome these problems and to allow early weight bearing, we fixed open Gustilo and Anderson type-I, II & closed tibial shaft fractures of these categories from the isthmus to 4 cm above the distal articular surface of the tibia by reamed interlocking nail with distal locking screws only⁴. This allows controlled weight bearing as early as in two to four weeks according to the stability of the fracture fixation. Early ambulation and movements prevent joint stiffness, muscle wasting and localized osteoporosis. Early weight bearing causes compression and intermittent micro movements at the fracture site. These bring about fracture healing as early as in eight to twelve weeks. In closed method fracture haematoma is not disturbed, rather the reamed medullary cancellous bone spells at the fracture site acts as bone graft to facilitate healing. As there is no obligation of dynamization patients do not require second time hospitalization and operation theater facility. Chances of implant failure, malunion and nonunion are also minimum.

Materials and methods:

This prospective study was carried out on 410 patients in two government hospitals and three private hospitals of Faridpur city during the period of June 2009 to July 2014 (Table-I). Mature patients with stable (transverse fractures, short oblique fractures, short spiral fractures and fractures with less than 50% comminution) open Gustilo-Andersson type-I, II & closed tibial shaft fractures from the isthmus to 4 cm above the distal articular surface of the tibia were included in this study. Where closed method failed and proximal locking screws were required for stabilization were excluded from the study. Open Gustilo-Andersson type-III, Polytrauma and multiple fracture patients, in whom early ambulation were not possible were also excluded from this study.

After admission and resuscitation of the patient, initially the injured limb was immobilized in a plaster of Paris splint after reduction. The operations were done within 6 hours to 14 days of admission in closed method under spinal block anaesthesia on a simple

operating table without any C-Arm, Manmann and modern flexible reamer. Anteriorly bend at proximal end and maximally distally placed lateral to medial holes short tip stainless steel locking nail were used (Fig-1). The nail was introduced and locked with the help of zig (Fig-1). The limb was immobilized in plaster of Paris slab for 2 weeks only. Patients were allowed to move with crutch support from the end of second week and controlled partial weight bearing was started. Patients were followed up clinically and radiologically for a period of 5 years; fortnightly for three months, monthly for six months and yearly up to five years. In most cases the nail were removed in one to two years.

Table-I: 410 patients in 5 hospital of Faridpur city.

Name of institute	Number of patients(n=410)
Faridpur Medical College Hospital	210
Faridpur General Hospital	58
Faridpur Islamic Bank Community Hospital	30
Faridpur Samarita Hospital	52
Faridpur Desh Clinic, Faridpur.	60



Fig. 1: Locking nail fixed with zig.

Results:

This prospective study on 410 adult patients of trauma in several hospital of Faridpur city (Table-I) reveals that males (369, 90%) are more vulnerable to tibial shaft fractures than females (41,10%) (Table-II). Most of the patients (298, 72.68%) were of working age group (18 to 57 years) (Table-II). Road traffic accident (260, 71.21%) was the leading cause followed by sports injury (79, 19.75%) (Table-III). In radiograph faint callus was observed around the fracture within three to four weeks in most patients (Figure 2 & 3). Consolidation (union) completed in eight to twelve weeks in 98.05% of patients (Fig-4 & 5). Union delayed in 1.95% cases, who developed deep infection and most of these were Gustilo-Anderson type- I & II open fractures. No nonunion or implant failure were

encountered. Sedentary workers returned to their office after two weeks of operation and physical laborers after three to four months. Knee pain was complained by 10%(41) patients, disappeared after removal of the nail. Superficial infection developed in 1.95%(8) cases, controlled in two to three weeks with appropriate antibiotics. Deep infections were encountered in 1.95%(8) cases, They showed delaying union but eradicated spontaneously as the fracture healed, usually in four to six months (Table-IV). All the patients returned to their previous job in 3 to 4 months and in most of the cases nail was removed after one to two

Table-II: Distribution of patients according to age group and sex. (n=410)

Age (Yrs)	Male	Female
18-47	174	14
48-57	124	18
58-77	62	09
78-97	09	00
Total	369	41

Table-III: Distribution of patients according to causes of injuries.

Causes of fracture	Total
RTA	292
Sports injury	81
Fall from height	10
Fall on slippery ground	18
Assault	09



Figure 2: Radiograph at 2 week

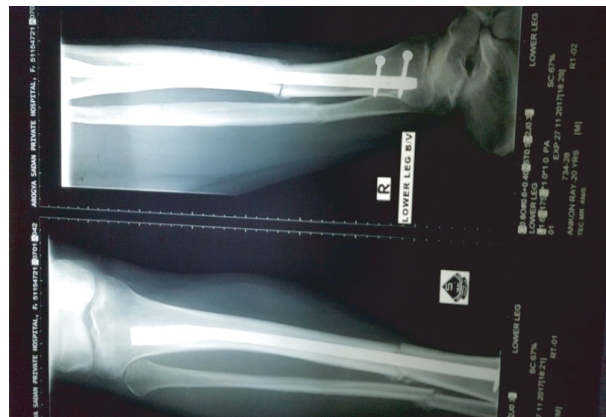


Figure 3: Radiograph at 4 week

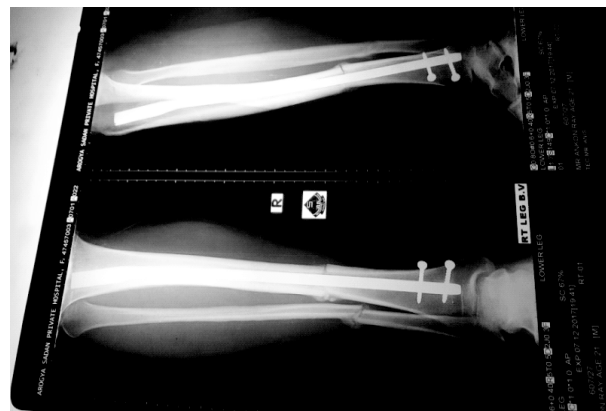


Figure 4: Radiograph at 8 week

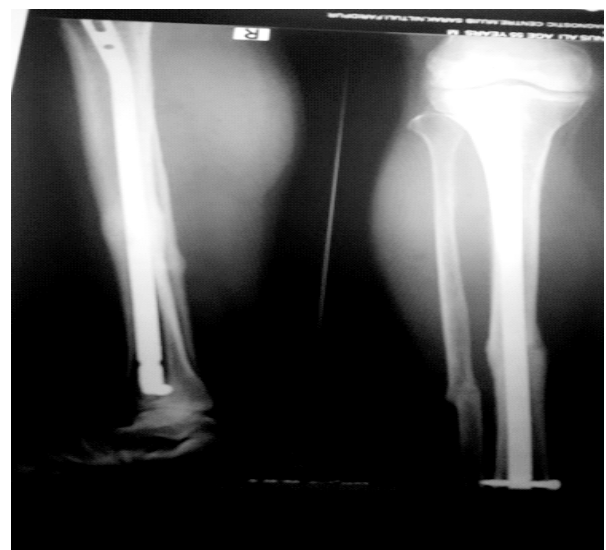


Figure 5: Radiograph at 12 week

Table - IV: Postoperative complications (n=410)

Complication	Number
Knee pain	41(10%)
Superficial infection	08(1.95%)
Deep infection causing delayed union	08(1.95%)
Total	57

Discussion:

Conservative method of closed reduction and immobilization of tibial fractures was the only treatment in ancient period, still in use for selected cases. It was reported that patients treated with nailing returned to work at an average of 4 months, and patients with casted fractures returned to work at an average of 6.5 months⁵. In conservative method painful stiffness of ankle and subtalar joint causes severe functional disability⁶⁻⁸. Again it is very time consuming and needs patient's compliance. Now a days, most of the patients and orthopaedic surgeons do not accept this time consuming method. Plating of tibial fractures often gets complicated by delayed union, nonunion, implant failure, soft-tissue sloughing and infection. "Percutaneous" plating was developed to obtain stable fixation, while preserving the fracture environment⁹. Most authors now recommend plating for tibial shaft fractures associated with displaced intraarticular fractures of the knee and ankle.

Locked intramedullary nailing currently is considered as the treatment of choice for most type I, type II, and type IIIA open and closed tibial shaft fractures. Intramedullary nailing preserves the soft-tissue sleeve around the fracture site and allow early motion of the adjacent joints. The ability to lock the nails proximally and distally provides control of length, alignment, and rotation in unstable fractures and permits stabilization of fractures located below the tibial tubercle or 3 to 4 cm proximal to the ankle joint. In cases of stable fractures dynamization by removing either proximal or distal set of screws is required before weight bearing, usually in 8 to 12 weeks. Fail to do this timely before weight bearing is a cause of nonunion and implant failure. Here we selected only the stable open Gustilo-Anderson type- I, II & closed tibial shaft fractures from the isthmus to 4 cm above the distal articular surface of the tibia for fixation by reamed nailing with distal locking screws only. By this the obligation of dynamization was avoided for our noncompliant patients. Load of these patients in ward and Operation Theater is also reduced. Due to this freedom from obligation of dynamization, controlled weight bearing was possible as early as in two to four weeks. We observed faint callus within three to four weeks and consolidation (union) completed in eight to twelve weeks in 98.05% of patients and delayed union occurred in 1.95% cases with deep infection. So, healing time is much less than 4 to 6 months as reported in most texts. Early weight bearing produces axial compression and micro movements at the fracture site, bring about faster healing of fracture. All the patients in our series able to do hard work in 3 to 4 months, although sedentary workers return to their office after two to four weeks of operation.

Reported rate of hardware failure in cases of fixation with ILN is 37% to 7% factors associated with implant failure were open fracture, severe comminution, and smaller diameter nails^{10,11}. Although severely comminuted and severe open fractures were out of our study, we think fail to do dynamization timely even in stable fractures is a cause of nonunion and implant failure. We avoid proximal locking screws, there was no question of dynamization and there was no implant failure in our series. Ultimately all the patients of our series returned to their previous job in 3 to 4 months without significant disability. Although 5 years period is not enough to comment about development of secondary osteoarthritis, we encountered no such cases till now.

Conclusion:

Closed reduction and internal fixation (CRIF) of stable open Gustilo-Anderson type- I, II & closed tibial shaft fractures from the isthmus to 4 cm above the distal articular surface of the tibia by reamed interlocking nail with distal locking screws only, allows early ambulation of the patients and early return to work; no obligation of dynamization, allows freedom of early controlled weight bearing and early fracture healing, reduce chance of implant failure. This procedure is practicable even in remote centers where there is no fracture table and C-Arm facilities.

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