

Locking the Flexible Nails in an Unsolved Problem of open Tibia Fractures. A Novel Method!

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Abstract:

Introduction: The comminuted open diaphysis fractures of tibia with soft tissue loss in high energy trauma are a challenging problem to the traumatologist. The problem remains in the selection of implant, method of fixation; primary and definite. The problem becomes more complicated in osteoporotic bone with bone loss, proximal and distal comminution.

The Ender nail; flexible, unreamed nail is a 'conventional wisdom' in open fracture. The strength of flexible nail is always considered as its major disadvantage but can be overcome by stacking of the unreamed flexible ender nail in mid diaphysis. The addition of external fixator gives rotary/ linear stability and avoids cast application. The ender nail is done with mini incision, no risk of compartment syndrome and is possible to give soft tissue cover with external fixation for dressings. We propose to use 2 implants; external fixator and unreamed flexible Enders nails. The aim is to evaluate this novel method.

Materials and methods: Between 2008 and 2012, 20 patients of type 3A/B open tibia shaft fracture between 18 yrs to 60 yrs age were treated with External fixator and Enders nails as an index surgery. All external fixators were dynamised at 4 weeks and were removed between 8 to 12 weeks. Patients were assessed for union, deformity with Johner -Wruhs Score. Correlation between fracture type and deformity due to this method and its impact on outcome was studied.

Results: 17 patients had middle 3rd shaft fracture. Union was seen between 10 to 20 weeks, (average 15.4) Total 9 patients had deformity i.e. 45%. Three patients had Anteroposterior angulation i.e. 15 % (Average 6.6 degrees). Varus valgus angulation observed in 8 patients i.e. 40% (average 8.12 degrees). Shortening in 7 patients of 5mm.

Normal walking was seen in 15 patient's i.e. 75% while 5 patients had mild limp i.e. 25%

13 (65%) had excellent outcome while 5 (25%) had good and 2 (10%) had fair outcome. No patient had deep infection or implant breakage. All fractures united with index surgery and none required additional procedures like bone grafting, fibulectomy or exchange nailing.

Conclusion: Overall study shows 90% patients with Excellent or good outcome. Ender nail is solid but flexible nail, easy to introduce and pass through comminuted fracture (anti or retrograde) to stack the medullary canal to achieve the stability and axial length without destroying intramedullary blood supply.

The external fixation adds to angular stability, making it dynamic osteosynthesis. We hope this technique can be useful in open tibia fractures as it is easy, small learning curve and low cost implant. It has good things of both implants viz. external fixator and solid unreamed nail with dynamisation facility.

This method gives a proper choice at least when patients access to modern and expensive alternative is limited.

Key Words: Open tibia fractures, External fixation, Flexible nails

Introduction

Open tibia diaphysis fractures with extensive tissue loss in a high energy trauma are a challenging problem(1). Many alternatives for treatment of these fractures are available these days. External fixator, closed intramedullary nailing as primary or secondary procedure is advocated for these fractures. Now a days even MIPPO plating is also advised for such complicated fractures(2).

But still problem remains in selection of implant, method of fixation primary and definite as these fractures are fraught

with complications like delayed union, malunion, nonunion and infection. They may also require additional procedures like bone grafting, exchange nailing or even amputation in chronic osteomyelitis. This burdens patient with lot of financial losses and loss of work(3).

External fixation is good as damage control as it is easy and allows soft tissue healing and plastic surgery procedures. It reduces chances of infection but nonunion chances are more. Few studies advise unreamed solid nails as primary procedure with encouraging results. But it is advised secondary procedure when wounds are healed, that means additional surgery and increased cost to patient(4).

Hence we propose to use 2 implants at same time i.e. external fixator and unreamed flexible Enders nails. The aim of this study is to evaluate this novel easy method radiologically and functionally.

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Figure 1: case1 Preop photo Young male with farm injury due to tractor. Open type 3 B fracture Tibia shaft



Figure 2: Preop X ray Displaced Comminuted Tibia Fracture U/3rd – M/3rd Jun



Figure 3: Immediate Post Op Xray Unilateral Uniplaner External Fixator with 2 rods and one Ender nail

Material & Methods

Between 2008 and 2012, 20 patients of type 3A/B open tibia shaft fracture between 18 yrs to 60 yrs age group were treated with External fixator and Enders nails after debridement as an index surgery. External fixator was unilateral and uniplanar with 2 rods which allows dynamisation. Enders nails were of sizes 3, 3.5, 4, 4.5mm which were selected according to canal size. Numbers of nails were selected depending on stability and canal size. Wound coverage was done by plastic surgeons with flaps and skin grafts. All external fixators were dynamised at 4weeks interval and were removed between 8 to 12 weeks depending on radiological union. Enders nails were left in situ till radiological union. Patients were reviewed every 4weeks and were assessed for union, deformity and functional outcome by Johner & Wruhs Score. End point was radiological union, ability to walk and squat. Correlation between fracture type and deformity due to this method and its impact on outcome was also studied.

Results

Age distribution was between 20 to 60 years and was

universal according to konglomorov test. There were 14 male patients out of 20 and 6 were females. 12 patients had right side tibia fracture and 8 had left side. 17 patients had middle 3rd shaft fracture while 2 had distal 3rd and 1 had proximal 1rd fracture. There were 7 fractures of bending wedge (35%) and 7 with oblique fracture type (35%). One had transverse fracture and 2 had spiral fracture while 3 had segmental fracture with displacement. Radiological union was seen between 10 weeks to 20 weeks. Average union time was 15.4 weeks. Total 9 patients had deformity i.e 45% Three patients had Anteroposterior angulation i.e. 15% Average angulation was 6.6degrees. Varus valgus angulation was seen in 8patients i.e.40% with average angulation being 8.12degrees.Out of these 8 patients, 4 had varus deformity of 5degrees and was seen in each patients of spiral/oblique/bending wedge and segmental fracture. The other 4 patients had valgus deformity between 10-15 degrees and all 4 were of bending wedge type laterally. Shortening was seen in 7 patients of 5mm. out of 7patients, 4 had valgus deformity in bending wedge. 2 had oblique fracture and one was with spiral fracture.



Figure 4: Six weeks Xray Fracture consolidation after Dynamisation of External Fixator

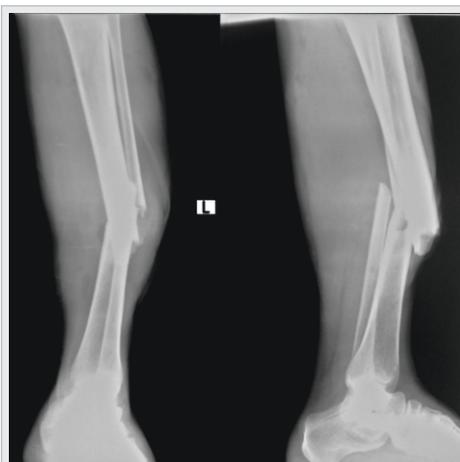


Figure 5: one year F/U xray Fracture united without infection and Deformity

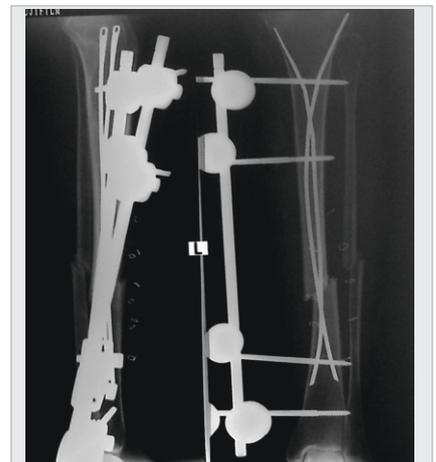


Figure 6: case2 Preop Xray 55 yr female with road accident, open type2 fracture middle 3rd tibia/Fibula



Figure 7: Immediate postop Xray Unilateral uniplaner External fixator with 2 ender nails.



Figure 8: Clinical photo Wound of leg after debridement ready for SSG



Figure 9: clinical photo after union Wound healed without any deformity and infection

Normal walking was seen in 15 patients i.e.75% while 5 patients had mild limp i.e.25% out of 5 patients who had limp, 3 patients had bending wedge with valgus deformity. One patient with limp had segmental fracture and another was having proximal 3rd fracture.

On Johner & Wruchs grading, 13 (65%) had excellent outcome while 5(25%) had good and 2(10%) had fair outcome. None of the patient had poor outcome. Fair outcome was seen in patients with valgus deformity and shortening in bending wedge fracture.

Oblique fractures treated with this method had average union time of 13.7weeks while spiral fractures united in average 11weeks. One transverse fracture in study united at 12weeks. Bending wedge fractures united at 17.4 weeks while segmental fractures united at 20 weeks.

No patient in this study had deep infection or implant breakage. All fractures united with index surgery and none required any additional procedures like bone grafting, fibulectomy or exchange nailing.

Discussion

Type 3A & B open tibial diaphysis fracture requires prompt treatment to achieve best possible results. These fractures are fraught with complications like delayed union, malunion, nonunion and infection which requires additional procedures like bone grafting, fibulectomy, exchange nailing or even amputation in chronic osteomyelitis(5). This in turn costs a lot to patient and society in terms of financial burden and loss of work hours.

External fixator is one of the treatment options for open tibia fractures which is easy, allows soft tissue cover and easy dressings. It is minimal invasive and less surgical time is required. It also has minimal blood loss and gives rotational stability. But it has less control over fracture fragments. It is unable to control delayed deformity and angulations & has high rate of complications like pin tract infection, delayed union, nonunion, malunion which limits durability of frame construct.

A staged treatment protocol for open fractures is also advocated with external fixator working as damage control followed by definitive fixation at second stage. But it adds to hospital stay, additional surgery and implant along with increased cost of treatment(6).

ORIF with plates and screws requires soft tissue stripping and it devitalizes bone. It takes longer union time and can have complications like wound breakdown, infection, loosening and infected nonunion(7).

Intramedullary interlocking nailing is also commonly used which is biological osteosynthesis. There have been proponents and opponents of reamed and unreamed nailing. In closed tibia fractures, reamed nailing was associated with statistically significantly shorter time to union in two trials: In patients with either open or closed fractures (82% were closed), the reamed group healed more quickly (16.7 weeks) than the unreamed group (25.7 weeks) ($P=.004$) [Larsen]. In those with closed fractures only, the mean time to union was also longer for patients treated with the unreamed nail (22.8 weeks) compared with those treated with reamed nails (15.4 weeks) ($P<.01$)[Court-Brown](8).

In patients with open fractures average time to union ranged from 28–34 weeks and 21–35 weeks in the reamed and unreamed groups, respectively ($P>.05$) [Keating]. Though there were no statistically significant differences among the fracture groups, it may be still wise to use unreamed nails in open fractures which is traditional teaching.

Ender nails are flexible unreamed nails which are easy to introduce and manipulate which gives 3 point fixation, being unlocked it allows for early weight bearing i.e. dynamisation. But they are rotationally unstable. Unreamed nails do not damage endosteal blood supply which is conventional wisdom in open fractures.

In a study by Sakaki MH et al compared Unreamed locked IM nails versus Ender pins; No significant differences were found between groups. Union occurred in 90% of IM nail patients and 96% of Ender pin patients. Johner-Wruhs scores were excellent/good in 70% of IM nailing and 54%

of Ender pin patients and walking quality was normal in 80% of IM nailing and 75% of Ender pin patients(10). One RCT was identified making comparison between External fixation versus plate fixation (CoE II). External fixation was associated with a no significant increase in risk of malunion. Plate fixation had significantly higher rates of reoperation as compared with external fixation, NNT = 2; thus, for every two open tibia shaft fractures treated with external fixation compared with a plate, one reoperation will be prevented. Risk of wound infection and implant failure also favored external fixation, although the relative risk was not statistically significant(11).

Dynamisation is essential for union and preventing hardware breakage. Dynamisation also allows early weight bearing and early return to work.

In our study we had 100% union rate with average time to union being 15.4 weeks. Different fracture types had different union types. Oblique fractures which were 35% of our study numbers united with average 13.7 weeks while spiral fractures unite at 11 weeks. Bending wedge fractures which constitute 35%, united at 17.4 weeks and segmental fractures united at average 20 weeks.

More significantly, we did not had any patient of nonunion or infection. Couple of patients had pin loosening but deep infection was not seen in any patient. Rather due to Enders nail, major bone fragments had stability and 3 point fixation which did not allow pin movement. Hence we were able to maintain frames for longer time and all patients could be dynamised on external fixator which improved

chances of union.

Nine patients had deformity or angulation. Three patients had anteroposterior angulation of average 6.6 degrees while 8 patients had average 8.6 degrees of varus lagus angulation. Out of 9 patients who had deformity, only 2 had fair functional outcome while 7 had excellent or good outcome.

Only 22% patients with deformity had fair outcome while 78% had excellent or good functional result. Even 75% patients had normal walking and 25% had mild limp.

Overall study shows 90% patients with Excellent or good functional outcome while only 19% had fair outcome. No patients had infection or nonunion and did not require additional procedure which is biggest advantage of this method. This clearly reflects on less hospital stay and no additional financial burden on families.

This method is dynamic osteosynthesis as it allows good reduction and maintains reduction till union. It prevents rotational malalignment and gives stability till union while taking care of infection and wounds. So this minimal surgical trauma and stable but flexible fixation allows micromotion and prompt healing. It is also cost effective as implant cost is average Rs 5000/-

We hope this technique can be useful in open tibia fractures as it is easy, small learning curve and low cost implant. It has good things of both implants viz. external fixator and solid unreamed nail with dynamisation facility.

This method gives a proper choice at least when patients access to modern and expensive alternative is limited.

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