



Original Research Article

## Role of Primary Intramedullary Interlocking Nail in Compound Gustilo-III A Tibia Fracture in Developing World

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### ABSTRACT

**Objective:** The decision of internal fixation in Gustilo's Type IIIA becomes a formidable challenge in patients reaching late. The purpose of the present study was to find out results of intramedullary interlocking nailing in these patients. **Materials and Methods:** Twenty five compound IIIA fractures, which were internally fixed within 24h after injury, were included in the present analysis. Follow-up ranged from 12 to 24 months. Mean follow-up was 18 months. **Result:** Superficial infection was found in 12 patients and deep infection was found in 6 patients. Non-union was found in 2 cases. Functional evaluation using Katenjian's criteria showed 60% (15) fractures have good to excellent results. **Conclusion:** Up gradation of the infrastructure is needed in the developing country to obtain satisfactory results of interlocking nailing in Gustilo's Type IIIA fracture tibia in emergency department, strict protocol such as aggressive debridement, prophylactic antibiotic coverage, and timely bone grafting is utmost importance in dealing these fractures. The primary coverage of the wound is discouraged.

**Keywords:** interlocking nail, Gustilo type IIIA fractures, tibia fracture

### INTRODUCTION

The goal of surgery after such a high velocity of trauma is to bring patient back to its preinjury status. Many factors like contamination of wound, bone or skin loss and nerve or tendon injuries often associated with Gustilo's compound Type III fractures make this a challenging task. The incidence of infection in cases of intramedullary nailing after external fixator removal is noted to be high. <sup>[1]</sup> The external fixator does solve the problem to a great extent, but it often leads to malunion, <sup>[2,3]</sup> delayed union, loss of reduction and pin track

infection. Good to excellent results with primary internal fixation in compound fracture following strict protocol have been described. <sup>[3-6]</sup>

The available literature on the subject of internal fixation in compound fractures has not specifically mentioned the exact delay in operation since the time of injury. Only a few articles <sup>[3-8]</sup> which exclusively deal with internal fixation in compound Type III fractures are available.

Tibia is the most common bone in the body to suffer compound fractures. The ideal method of treatment for these injuries

remains controversial. Even after advances, compound fractures of tibia pose a challenge to the orthopaedic surgeons and thus their management. Compound fracture tibia requires the widest experience, the greatest wisdom, and the nicest of the clinical judgement in order to achieve functions. That is why Sir John Charnley long back spoke rightly that “we have still a long way to go before the best method of treatment of fracture shaft of tibia can be stated with finality”. Since the advent of intramedullary fixation it has undergone several modifications specially the advent of locking which has widened the rather limited indications of unlocked nailing. When operative fixation is indicated locked intramedullary nail at present appears to be an attractive surgical option, as it is the only operative modality closest to the safe yet rewarding and time honoured conservative treatment. The intramedullary interlocking nail can be solid or hollow type and can be used either in static or dynamic mode, may be reamed or unreamed, but however the ideal technique remains a matter of controversy. We present here a clinical study for evaluation of results of interlocking nail in compound fracture shaft of tibia type IIIA in 25 cases. Unfortunately, in developing countries due to lack of healthcare facilities, ignorance and poverty, patients often reach the hospital late after the few initial precious hours have passed.

## **MATERIALS AND METHODS**

This is a prospective study of 25 cases of compound fracture tibia Gustilo IIIA treated with interlocking nail over a period of 3 years, from 2009 to 2012, only after taking permission from the concerned ethical committee of the institution. After resuscitation of the patient in the emergency first aid room, the wound was managed by thorough washing, lavage using 3-6 litres of normal saline and injured leg was splinted in

a long leg splint. Intravenous antibiotics given and after ruling out other system injuries patient were sent for x rays. A hemodynamically stable patient with compound fracture type IIIA was kept for standard interlocking nail.

### **Criteria for selection of patients are;**

All patients with age 18 years and above with isolated fresh compound Gustilo IIIA of tibia shaft fracture were taken up for interlocking nailing as primary treatment.

All fracture patterns with compound Gustilo IIIA were included in this study.

### **Operative procedure**

The interlocking nailing was carried on under general or spinal anaesthesia and the position of the patient was spine on normal operation table with knee flexed 90 degree and hip flexed 45 degree on fracture table. Before putting the nail wound was thoroughly debrided and wound lavage was done by separate set of instruments. All instruments and draping used were discarded before putting the nail. An image intensifier was used to access the reduction, to check position of guide wire and nail and for locking. An insertion point in line with medullary cavity was made after giving midline incision at tibial plateau splitting patellar tendon in middle. After doing reduction and passing guide wire to distal fragment with the help of image intensifier, the proximal fragment was reamed only upto the area where soft tissue cover was adequate. The nail was inserted through the entry portal over the guide wire in the medullary canal and position and length of nail was checked with image intensifier.

Proximal locking was done with the help of insertion handle while as distal locking was done with free hand technique.

### **Post operatively**

Quadriceps exercises, knee bending exercises and ankle movements were started soon after the patient was comfortable. Intravenous antibiotics were continued as

per hospital protocol for a period of 5-7 days and compound wound was dressed separately on alternate days. Wound culture and sensitivity was sent in patients where there were signs and symptoms of wound infection. Antibiotics were given accordingly. Partial Weight bearing were started as per fracture pattern, associated injuries and progress of fracture healing. Full weight bearing was started when there was radiological and clinical evidence of union. Dynamisation was done where there was gap at the fracture site and fracture was axially stable and was done between 12-16 weeks otherwise secondary bone grafting was done. Patients were followed every 4 weeks till a minimum period of 12months to 24 months.

### Evaluation of results

In this study, Katenjian<sup>[4]</sup> criteria, that include degree of pain, range of motion and consider gait while assessing result of lower extremity, have been used. Outcome was divided into Excellent (no pain with normal range of motion in the joint), Good (occasional pain with >75% joint motion and normal gait), Fair (pain with ordinary activities, joint motion >50% and walking with limp) and Poor (constant pain, joint motion <50%, deformity and need of cane/crutch for walking). Deep infection was defined as purulent discharge from the tissue contiguous with the fracture site, which occurred in 6 cases. Average time required to achieve union for the tibia 18 weeks (12-24) weeks.

Delayed union was found common in treating such fractures. Of the 25 patients 18 (72%) united after 13 weeks and 2 (8%) patients went into non union and were treated by exchange nailing and bone grafting. Dynamisation was done only in those cases which were axially stable.

Overall n=15 (60%) showed good to excellent results in our series which was

comparable with the results found in the literature.

### OBSERVATION & RESULT

In our study 32% (n= 8) patients were in age group of 21-30 years and 44% (n=11) were in between 31-40 years. In our study most of the fractures occurred in males 88% (n=22) compared to female 3(12%). Road traffic accident as a mode of injury were responsible for most of fractures 72% (n=18) followed by fall in 16% (n=4) cases and direct blow in 12% (n=3) cases. Most of the fractures were comminuted 52% (n=13) cases, followed by transverse 24% (n=6) cases, spiral fracture 8% (n=2) cases and segmental 8% (n=2) cases as shown in table I. In our series tibial shaft fractures were in middle third in 36% (n= 9) cases, lower third in 44% (n=11) cases and upper third in 20% (n=5) cases. Right side leg fractures 64% (n=16) were more common than left side 36% (n=9).

Table I showing pattern of fracture

Fracture pattern	No. Of patients	%age
Comminuted fracture	13	52
Transverse	6	24
Spiral	2	8
Segmental	4	16
Total	25	100

Post-operative complication in our cases were superficial infection in 48% (n=12) deep infection in 24% (n=6), 20% (n=5) patient had anterior knee pain and 80 % (n=20) of delayed union and pain at screw site 32 % (n=8) implant failure in 8% (n=2) cases which were initially associated with bone loss as shown in table III.

24% (n=6) of patients were bearing partial weight in 1<sup>st</sup> week, 28% (n=7) patients in 2<sup>nd</sup> week and 40% (n=10) patients at the end of 3rd week and 8% (n=2) were bearing partial weight after 4 weeks. In our study 20% (n=5) cases united in 10-12 weeks, 12% (n=3) cases united in 13-16 weeks, 48% (n=12) cases united in

17- 20 weeks and 12% (n=3) cases after 20 weeks as mentioned in table II.

Table II showing time taken for union

	No. Of patients	%age
10-12 weeks	5	20
13-16 weeks	3	12
17-20 weeks	12	48
After 20 weeks	3	12
Non union	2	8
Total	25	100

In 8% (n=2) cases fracture failed to unite and patient presented to us with non-union

and were revised with exchange nail and bone grafting. In our series 28% (n=7) required bone grafting which was done between 12-14 weeks of follow up.

Table III showing complications

	No. Of patients	%age
Superficial infection	12	48
Deep infection	6	24
Anterior knee pain	5	20
Delayed union	20	80

Case no 1]



Figure 3 Preoperative clinical photograph



Figure 2 Immediate postoperative clinical photograph



Figure 4 Radiograph showing union



Figure 5 Radiograph showing union



Figure 6 Clinical photo showing range of motion



Figure 7 Clinical photo weight bearing

Case no. 2



Figure 1 Preoperative clinical photograph



Figure 2 Immediate post-operative photo



Figure 3 Immediate post-operative photo



Figure 4 Radiographs showing union

## DISCUSSION

Many orthopedic surgeons reported acceptable results of immediate open reduction and internal fixation for Gustilo IIIA compound fractures. However, the issue is still controversial, particularly in those fractures which are presenting late. Mc Graw *et al.* [1] noted high rate of infection if nailing was done after removal of fixator. Katezian, [4] Zadic [6] and Yokoyama *et al.* [7] believed there are definitive advantages of primary internal fixation provided infection could be prevented by careful and radical debridement and use of antibiotics.

High rates of infection 24% (n=6) was seen in our series of compound Type IIIA fractures against reported previously in the literature [2,3,8,10-12] ranged from 4.4-9.09% for Type IIIA fractures.

Authors feel the reasons for high rates of infection are delayed presentation to the hospital, poor socioeconomic status, lack of primary healthcare facilities at or near the

site of trauma and lack of adequate infrastructure in the tertiary care centres.

Antibiotics were continued for 12-14 days in our series, the rationale being that wound heals by this time. However, recent reports [13] have shown that antibiotics given for three to five days are just as effective in preventing wound infection and have the advantage that if infection develops, it will manifest while the patient is still in the hospital.

Of the 6 cases which got deep infection, fixation was performed after golden period of 6 hours of injury and in all of them primary closure was provided after debridement in the same sitting. Though the number of cases was inadequate for statistical analysis, authors feel primary closure should be avoided even in slightest doubt, especially when fixation is delayed and this is in consistence with Gustilo *et al.* [2,15] Blick *et al.* [16] Byrd *et al.* [17] and Patzkins *et al.* [22] who support serial debridement and early (3-15 days) soft tissue coverage.





Though the grade of compounding did not influence the decision whether to ream or not the authors feel, excessive reaming in compound fractures must be discouraged, as it renders the endosteal surface ischemic and causes further disruption of medullary blood supply in a bone already denuded of periosteum.<sup>[3]</sup> Chapman<sup>[19,20]</sup> stated that reamed nailing carries an unacceptably high rate of infection. However, Lowe *et al.*,<sup>[21]</sup> concluded that reamed nail provides better fixation decreasing incidence of malunion and also reduces the need of bone grafting.

The maximum number 76% (n=19) patient in our study were from the young and active stage of life 21-40 years and it was comparable to other series like Bone *et al*<sup>[23]</sup> (1986) (av. Age 31 years), Hanley<sup>[26]</sup>

(1989) average age of 33 years and Alho *et al*(1990) have median age of 35 years in his series. Wiss<sup>[24]</sup> (1986) reported 81 (75%) males and 27(25%) females out of 108 patients while as in our study out of 25 cases 22 (88%) were males and 3(12%) were females. During the study it was found that the road traffic accident were the common cause of fracture shaft of tibia n=18 (72%) and 4 (16%) were due to fall while as in Wiss (1986) series of patients 84% of the fracture was due to automobile accidents. In our study results of type and morphology of fractures were comparable to results of Hooper *et al* (1991). In our study the results of level of fracture, side involved, associated injuries and postoperative complications were comparable to the other studies like Puno *et al*<sup>[25]</sup> (1986), Hooper *et al* and Bone *et al*.

case no 4



Figure 1 Immediate post operative photo



Figure 2 Immediate post operative radiograph



Figure 3 Radiograph showing bone uniting



Figure 4 Photo showing range of motion



Figure 5 Weight bearing

**CONCLUSION**

Since the sample size in our study is too less to draw any statistically significant conclusion. After having obtained 60% good to excellent results, the authors strongly feel

that internal fixation can be safely undertaken within 24h of injury in compound type IIIA tibia fractures in developing country like ours provided the infrastructure is present and strict guidelines

are followed. Metallic internal fixation, if judiciously performed gives parallel or superior results than external fixator device or delayed internal fixation after removal of external fixator system.

Meticulous and repeated debridement and wide spectrum appropriate antibiotics at the beginning is the key to successful management of the open fractures.

Internal fixation reduces hospital stay, achieves better anatomical and functional results and it does not hamper early rehabilitation.

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