Case Series

The Outcome of Unreamed Interlocking Nail for the Management of Open Fractures of Tibial Shaft: An Observational Case Series

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Abstract

Objective: This observational case series was designed to see of early debridement and unreamed interlocking nail have emerged as a better modality in the management of open fractures of the shaft of the tibia.

Materials and Methods: This descriptive case series study was conducted at the Department of orthopedics, Wah general Hospital Rawalpindi for a period of 6 months. Through non-probability purposive sampling, 60 cases of open fracture of the tibia were included. Unreamed interlocking nail was inserted in all the sixty patients and each nail was statically locked with one screw proximally and one screw distally. Patients were followed regularly i.e. on the 1st then 10th, 20th, 30th post-operative day then monthly for 9 months in OPD, and data for union and infection were recorded.

Results: The mean age for all patients was 32.82 ± 8.87 years. There were 49 (81.7%) male and 11 (18.3%) female patients involved in this study. There were 27 (45%) patients who presented with Gustilo Anderson type I fracture, 23 (38.3%) had Gustilo Anderson type II and 10 (16.7%) had Gustilo Anderson type IIIA. We observed that there were 17 (28.3%) patients who had a transverse fracture, 22 (36.7%) had an oblique fracture, 8 (13.3%) had a spiral fracture and 13 (21.7%) had comminuted fracture. Union occurred within 5 months in 50 (83.3%) patients, 9 (15%) showed delayed union while 1 (1.7%) patient had non-union after a course of follow-up. Infection was also observed in follow-up in only 8 (13.3%) cases while 52 (86.7%) cases did not show any sign of infection.

Conclusion: Unreamed interlocking nailing is quite enough to manage the patients presenting with an open tibial fracture in terms of a higher union rate with low infection and non-union rate.

Keywords: Open tibial fracture, unreamed interlocking nailing, Gustilo Anderson type, union, non-union, infection.

Introduction

The tibia is one of the most common bones to sustain open injury because of its superficial nature and is also the most commonly fractured long bone in the body.[1] High-speed drive with motor vehicles, motorcycles, and the growing popularity of extreme sports contribute to the increasing occurrence of tibial shaft fracture in modern society.[2]

The direction and magnitude of the force determine the geometry and type (i.e. close or open) of fractures. Twisting force results in spiral fracture of the tibia and fibula at different levels. An angular force leads to a transverse fracture of both bones at the same level. Indirect injuries are usually low energy and the open fractures are from within, while direct injuries are high energy and result in open fractures from without.[3]

Open fractures of the tibia shaft are limb-threatening and potentially life-threatening emergencies. Optimal treatment involves appropriate initial evaluation and administration of antibiotics, urgent operative debridement, and skeletal stabilization (usually by interlocking nailing, dynamic compression plate, or external fixator). Repeated soft tissue debridement may be required followed by soft tissue coverage.[4] Immane controversy lies in the treatment of open fracture of the shaft of the tibia. Precarious blood supply and the lack of soft tissue cover of the shaft of the tibia make these fractures vulnerable to get complicated into nonunion and infections.[5]

Open tibial shaft fractures have traditionally been treated with external fixation and repeated wound debridement.[6] But with external fixation there are some drawbacks i.e. it is associated with pin track infection, delayed union, nonunion, malunion, and ankle joint stiffness.[7] In the presence of an external fixator if we have to perform soft tissue procedure its pins may act as an obstacle. An external fixator is either Uniplanar AO/ASIF type fixator or a multiplanar Ilizarov ring fixator. Uniplanar fixator offers less stability and the patient is unable to bear weight. While ring Fixator gives good stability but multiple pins are problematic (pin tract infection) and hinders soft tissue care and procedures.[8]

Early debridement and unreamed interlocking nail has emerged as a better modality in managing the open fractures of the shaft of the tibia.[9] It has got the better result as compared to other conventional techniques in this regard, as unreamed nailing preserves the endosteal blood supply and therefore improves fracture union ratio and decreases the rate of infection. In the presence of interlocking nail soft tissue procedure can be easily performed.[10]

A study was carried out in India by using unreamed interlocking nails in open fractures of the tibia which showed that the average time for the union was 28.3 weeks and union rate was 89.3%, delayed union in 10.7% and infections rate is 10.7%.[11]

Literature from international studies suggests that unreamed interlocking nail has got excellent results for the management of shaft of tibia fractures. The rationale of my study was to find out the effectiveness of unreamed interlocking nail management of open fractures in terms of infection, union rate in our setup.

Materials and Methods

This descriptive case series study was conducted at the Department of Orthopedic Surgery, WGH Hospital, Rawalpindi from July-December 2020. A sample size of 60 cases is calculated with a 95% confidence level, 8% margin of error, and took an expected percentage of infection i.e. 10.7% in open fractures. All adult patients both males and females of age ≥18 years having open fractures of the tibia i.e. (Open Type I, Type II, Type IIIA and IIIB according to Gustilo Anderson classification) within 12 hours of injuries were included in this study, and the patients with malignant disease, having co-morbidities like Diabetes, Chronic renal failure (CRF) or chronic liver disease (CLD), having pathological fractures or on steroid therapy or chemotherapy were excluded from this study.

All 60 patients who full filled the inclusion criteria were included through non-probability, purposive sampling. Data were obtained using a Performa. Patients were explained about the risks and informed and written consent was taken. Procedures were performed by a single surgeon. After thorough debridement under anesthesia, an unreamed interlocking nail was inserted in all the sixty patients and each nail was statically locked with one screw proximally and one screw distally.

After operation 3rd generation cephalosporin was given to each patient for 1 week and daily dressing of wound was done in each patient. So that incidence of infection can be reduced. Patients were followed regularly on 1st then 10th, 20th, 30th post-operative day then monthly for 9 months in OPD, and data for union and infection were recorded. This data was collected in a specially designed Performa. Data entered and analyzed through SPSS version 17. Data was stratified for age, fracture geometry (transverse, spiral oblique,

comminuted), and type of open fracture (according to Gustillo Anderson classification Type 1, Type II, Type IIIA and IIIB) to address effect modifiers.

Results

There were 60 patients with an open tibial fracture who were included in this study. The mean age of all patients was 32.82 ± 8.87years. There were 49 (81.7%) male and 11 (18.3%) female patients with a Male-to-female ratio of 4.5:1.

There were 27 (45%) patients who presented with Gustilo Anderson type I fracture, 23 (38.3%) had Gustilo Anderson type II and 10 (16.7%) had Gustilo Anderson type IIIA. We observed that there were 17 (28.3%) patients who had a transverse fracture, 22 (36.7%) had an oblique fracture, 8 (13.3%) had a spiral fracture and 13 (21.7%) had comminuted fracture.

After the analysis of the data, it was noted that union occurred within 5 months in 50 (83.3%) patients, 9 (15%) showed delayed union while 1 (1.7%) patient had non-union as shown in Table 1.

Table 1: Distribution of Union rate seen radiographically in all operated patients

Postoperative Outcome		*Frequency*	*% age*
Union / Callous formation	Union	50	83.3%
	Delayed Union	9	15.0%
	Non-Union	1	1.70%
	Total	60	100%

Postoperative infection was observed in 8 (13.3%) cases while 52 (86.7%) cases did not show any sign of infection. (Table 2)

Table 2: Distribution of Infection rate among all the operated patients

Postoperative outcome		*Frequency*	*% age*
Infection	Yes	8	13.3%
	No	52	86.7%
	Total	60	100%

Discussion

Fractures of the shaft of the tibial shaft have a high incidence of 17–21 in 100,000 populations and are 2% among all fractures, and among other long bones, it is 36.7% in adults. As the tibia is subcutaneous with less muscle mass so more than 15 percent of fractures are open and are the most common bone among long bones which fractured openly due to high energy injury(44.4%). [12, 13]

As the tibia has less blood supply and got mostly contamination when fractured so it's always an emergency from a treatment point of view, tibial fractures have very high rates regarding infection, nonunion, malunion, and compartment syndrome.[14, 15]

The use of unreamed interlocking tibial nails for open fractures has gained wide acceptance. This technique has been reported to have reproducible better results with a low incidence of complications in Type I, Type II, and Type IIIA open fractures of the tibia. The use of unreamed nails in Type IIIB fractures continues to be a source of controversy.[16]

In this study, we included 60 patients with open tibial fractures. The mean age of all patients was 32.82 ± 8.87 years. In one study by, Clatworthy MG et al the mean age of patients presented with open tibial fracture was 29.25 ± 13.36 years.[17]

In our study, there were 49 (81.7%) male and 11 (18.3%) female patients involved. The male-to-female ratio was 4.5:1. The results of one study coincide with the distribution of gender in our study. Researchers found the male to female ratio as 2.5:1.[18] The prevalence of open tibial fracture in male was 13% and in the female the prevalence of open tibial fracture was 15%.[19]

According to our study, most patients presented with Gustilo Anderson type I [27 (45%)] and II fracture [23 (38.3%)] while only 10 (16.7%) had Gustilo Anderson type IIIA. But one study (By Ibeanusi SEB), showed that Gustilo and Anderson type III open injuries were the most frequent followed by type II injuries.[18]

On clinical examination of patients, we observed that most cases presented with an oblique fracture [22(36.7%)], 17 (28.3%) cases presented with transverse fracture, 13 (21.7%) had a comminuted fracture and 8 (13.3%) had a spiral fracture. While in a study by Joshi et al., the most common presentation of patients with open tibial fracture was transverse (62.5%), Comminuted (17.9%), and Oblique (10.7%) while spiral was present in the least patients (8.9%).[11]

After the analysis of the data, it was noted that union occurs with 5 months in 50 (83.3%) patients, 9 (15%) showed delayed union while 1 (1.7%) patient had non-union after a course of follow-up. In a study by Joshi et al., the union was observed 73.3% cases, delayed union in 10.7% cases, non-union was also observed in 10.7% cases that underwent unreamed interlocking nailing.[11]

Bonatus et al., the study showed 68% fractures union by 6 months, all fractures had united by 12 months and concluded that t unreamed interlocking

intramedullary nailing in Types I, II, IIIA, and IIIB open fractures of the shafts of the tibia is well supported.[17]

Despite thorough debridement and adequate soft tissue coverage, there was an overall infection in 8 (13.3%) cases. Joshi et al., study showed infection only in 10.7% of cases.[11] various series reported a 2% to 16% incidence of deep infection.[20,21,22] Bonatus et al., observed deep infections in 4.2% of cases.[17]

Gaebler et al. conducted a meta-analysis on unreamed interlocking nailing. Analysis showed 1.1% deep infections,9.2% delayed unions, and 2.6% nonunions and he concluded that fracture distraction of more than three millimeters should not be tolerated when stabilizing tibial fractures with unreamed, small-diameter nails as this increases the odds of having a delayed union by twelve times ($p < 0.001$) and a nonunion by four times ($p = 0.057$).[23]

Inan et al. concluded that the unreamed interlocking nailing technique had the disadvantage of posttraumatic osteomyelitis and delayed union that requires additional surgery.[24]

In our study, when data was stratified for different age groups, Gustilo Anderson type, and geometry of fracture. The highest rate of union and lowest rate of infection was observed in younger patients, whereas the highest rate of delayed union, nonunion, and infection was seen in elderly patients. There was also observed that among Gustilo Anderson type III open fracture nonunion and the infection rate was higher. As for as fracture geometry is concerned highest union rates were observed in spiral followed by oblique, transverse, and comminuted fracture respectively. The delayed union and nonunion rates were higher in comminuted fractures.

Conclusion

Results of this study showed that unreamed interlocking nailing is quite enough to manage the patients presenting with open tibial fracture as results of our study showed that there is a higher union rate with low infection and non-union rate. The key procedures to minimize deep infection are adequate debridement, early soft-tissue coverage, and adequate fixation.

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