Original Article

DOI: 10.17354/ijss/2015/554

# Primary Intramedullary Nailing in Open (Grade-I and Grade-II) Tibial Fractures: A Functional Outcome

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## Abstract

**Background:** Tibia shaft fractures have always been a challenge to the orthopedic fraternity; particularly if it is associated with soft tissue trauma, being prone to various complications such as infection, delayed union, malunion, and non-union. There are differences of opinion regarding the use of intramedullary implants in open fractures of tibia shaft.

**Aims of Study:** To evaluate the overall functional outcome in the management of open (Gustilo–Anderson-Type I and II) fractures of tibia shaft when treated by intramedullary interlock nailing.

**Materials and Methods:** A prospective study was done on 34 patients, who attended emergency at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, a tertiary care hospital. All patients were managed by thorough debridement and intramedullary interlock nailing (Gustilo–Anderson Type I and Type II). Wounds were loosely stitched or left open for secondary closure. In some cases, lateral skin release or split thickness skin grafting was required.

**Results:** Average union time in our series was 16.4 weeks. Out of total 34 patients of open tibia shaft fractures (Gustilo–Anderson Type I and II) treated by primary interlock nailing, 26 patients (76.5%) showed union by the end of 14 weeks. Infection occurred in 3 patients (8.8%). 6 patients (17.6%) required skin grafting. 3 patients (8.8%) had delayed union and 5 patients (14.7%) required bone grafting because of non-union, which took approximately 32-weeks period in the union after nailing. According to Karlström and Olerud scoring, functional outcome was excellent in 21 patients (61.7%), good in 8 patients (23.5%) patients, and satisfactory in 5 patients (14.7%).

**Conclusion:** We can conclude that primary intramedullary interlock nailing is a good option for open (Gustilo–Anderson Type I and Type II) fractures, meticulous debridement, early soft tissue coverage, and stable fixation is conducive to faster healing of fracture and good rehabilitation and early return to normal routine work.

**Key words:** Open fractures, Intramedullary interlock nailing, Tibia, Gustilo–Anderson

## INTRODUCTION

With the increasing number of motor vehicular accidents on the roads, tibial fractures are very common, particularly with two wheeler (motor bike) accidents. The tibial shaft is one of the most common sites of open fractures. Approximately 63% open fractures are involving tibia.[1] Many problems arise when tibial fractures are associated with soft tissue trauma. Soft tissue trauma is directly proportional to the energy dissipated in the collision. Associated soft tissue trauma invites many complications such as nonunion, delayed union and infection etc.

Management of open fractures, particularly in the tibia, has always been a challenge to the orthopedic fraternity. Surgeons were very much reluctant to use intramedullary implants in open fractures of the tibia for a long but with the advent of high-class antibiotics and meticulous debridement technique, stabilization of fractures, and soft tissue cover[2,3] many orthopedic surgeons are now using intramedullary interlock nailing as a primary method of fixation in open fractures of tibia-Grade-I and II (Gustilo–Anderson classification). Ultimate functional

Access this article online

www.ijss-sn.com

Month of Submission : 09-2015
Month of Peer Review : 10-2015
Month of Acceptance : 11-2015
Month of Publishing : 12-2015

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outcome depends on timely union and joint movements preservation.

### Aims of Study

The aim of our study was to analyze the functional outcome and incidence of complications such as non-union, delayed union infections (superficial/deep) and compartment syndrome in our series of 34 patients of tibia fracture (open Grade I and II) treated by Interlock nailing of tibia.

## MATERIALS AND METHODS

This study is based on patients who attended the emergency at SRMS Institute of Medical Sciences, Bareilly, Uttar Pradesh, India, between May 2012 to December 2014. All fresh cases of Open tibia fractures - Grade I and II, treated in the Department of Orthopedics at SRMIMS by intramedullary-interlocking nail, were taken up for study. Simple fractures and Grade-III open fractures were not included in the study.

- Patients were taken to O.T. at earliest possible. All fractures were fixed by intramedullary interlock tibial nailing. There were 12 Type I and 22 patients of Type II as per Gustilo–Anderson classification. Associated injuries were treated as per standard methods
- We used a medial incision approximately 1.0 cm medial to tibial tuberosity and 1.0-1.5 cm distal to joint line for the insertion of the interlocking nail. The nail was statically locked by two proximal and two distal bolts. The wound was stitched loosely after making margins fresh to facilitate the drainage, if at all.

In the patients of delayed wound healing, skin grafting was performed. Later range of motion (ROM) exercises for knee and ankle were started on the 3-4$^{th}$ post-operative day. Walking with crutches or walker started after a week or 10 days with partial weight bearing. Patients were followed up every 4 weeks. The assessment was done as regards the union, delayed union, non-union, infection-superficial/deep, and stiffness at ankle and knee. Full weight bearing was started as soon as minimal callus formation was visible on X-ray. Functional outcome was evaluated using criteria suggested by Karlström and Olerud.[4]

## RESULTS

The majority of patients were in the younger age group 20-40 years. Mainly males were the victims of roadside accidents. Less common were domestic injuries due to fall. Right side tibia was more commonly fractured. Out of 34 cases, 12 were Type I and 22 were Type II (Gustilo–Anderson classification).[5] 26 patients (76.5%) had a union at the fracture site by the end of the 14-weeks period after nailing [Figure 1]. 3 patients (8.8%) patients developed a deep infection, 5 patients (14.5%) landed into non-union [Figure 2]. Bone grafting was required in all cases of non-union, which ultimately showed union by the end of 32 weeks time. 2 patients had a superficial infection which was managed conservatively by dressing and antibiotics. 3 patients (8.8%) showed the signs of delayed union which took 24-26 weeks time in union [Figure 3]. 5 patients required skin grafting to cover the wound after granulation. There was no mortality as such. No case of limb length discrepancy. Wounds of injury healed within 2-3 weeks period. In 8 patients, dynamization was done at 6 weeks by the proximal screw [Figures 1-3].

## DISCUSSION

For a long time use of implants nail or plate in open fractures of tibia, has been a matter of controversy because of very high rate of infection, nonunion, and delayed union. Tibia being a subcutaneous bone, is always prone to damage or loss of skin cover. The outcome is variable depending on the degree of soft tissue trauma, contamination, fracture geometry, and the comminution. On the surface, use of plates and screws further devitalizes the soft tissue and has been found to be associated with high vulnerability for infection.[6] Use of POP cast is again associated with higher chances of delayed union and malunion. External fixators have been used extensively for the management of open fractures of the tibia, to facilitate the wound care. Though, it has been associated with pin track infection, deep infection, delayed healing of fracture and is very cumbersome to the patient to wear. Sometimes replacing the external fixator with Nail or plate, after healing of the wound, still remains a potential danger for deep infection, in spite of adequate antibiotic coverage, due to pintract infection. The majority of cases were young adults in the third and fourth decade of life, comparable to other study series – Keating,[7] Freedman and Johnson,[8] and Whitelaw *et al.*[9] This is because of their outdoor activities and exposure to roadside traffic. The majority of fractures were due to roadside accidents, resulting from poor road conditions and lack of awareness regarding traffic rules and regulations among the general population.

But, with the current trend of intramedullary nailing in open Grade I and Grade II fractures (Gustilo–Anderson classification) patient can be made ambulatory soon after 3-5 days, post-operatively. Our main aim of this study was to evaluate the functional outcome and various complications in treating the open fractures of tibia (Grade I and Grade II) with intramedullary interlock nailing. The overall incidence of infection was (8.8%). All these were Grade II fractures.

Kessler *et al.*[10] advocated against reamed nailing in open

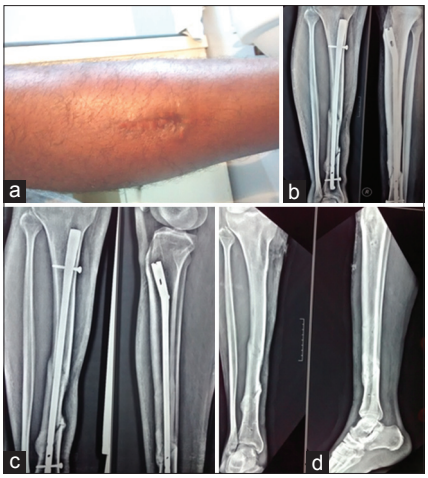


**Figure 1: (a) Injury wound healed in 3 weeks time, (b) post-operative 8 weeks, (c) post-operative at 14 weeks, (d) nail removed after 2 years**

**Figure 2: Post-operative at 24 weeks (non-union)**

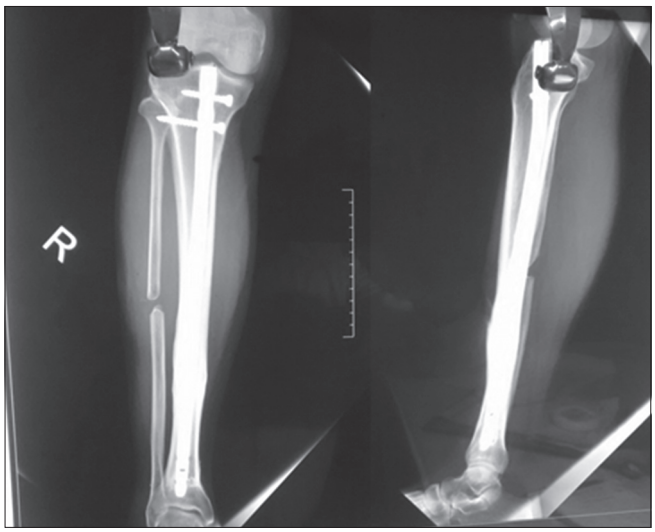


**Figure 3: Open fracture tibia-united after 24 weeks (delayed union)**

fractures of tibia shaft because there is minimal soft tissue coverage surrounding tibia, particularly in lower 1/3. This soft tissue envelope is disturbed with open injury and further reaming the medullary cavity can geopardize the endosteal vascularity. Delayed primary closure was done in 11 cases and split thickness skin graft was done in 5 cases to cover the wound after granulation. Walking with walking frame usually started within 3-5 days. ROM exercises at ankle/knee were begun on the 2-3rd day of nailing. The average time for the union was 14.8 weeks. Edge and Denham[11] reported average union time 26 weeks in open fractures, treated conservatively by plaster application. Cliffard *et al.*[12] reported an average time of union 24 weeks in patients of open fracture of tibia treated by plating. Keating reported an average union time 24 weeks with intramedullary nailing in open fractures of tibia. In our series, functional outcome was excellent in 61.7% cases good in 23.5% and satisfactory in 14.7% of the patients treated by intramedullary interlock nailing.

Sargeant *et al.*[13] suggested that cortical necrosis is less likely with a loosely fitted nail, rather than a snugly fitted reamed, thicker nail. Reaming is supposed to spread the contamination to inside the medullary cavity. In 80% of our cases, we have used 8 mm diameter nail without reaming. Minimal endosteal contact of unreamed nails may concentrate the stresses at the screw hole junction which could be responsible for screw breakage or nail failure. Hahn *et al.*[14] suggested that all screw holes should be filled up with bolts to avoid the concentration of stresses at screw hole junctions. In our study, we have used two proximal and two distal screws to lock. There was no case of screw breakage/nail breakage in our series. Blick *et al.*[15] reported 9.1% incidence of compartment syndrome in open fractures because trauma to musculature may elevate the compartment pressure. In our study, there was no case of compartment syndrome. We did not require fasciotomy in any case. Court-Brown *et al.*[16] reported 36% incidence of anterior Knee pain. In our series, only 20.3% patients complained of mild anterior knee pain, particularly in whom the proximal end of the nail was prominent and palpable.

Joshi *et al.*[17] reported 14.3% incidence of Knee stiffness, in a similar study. In our series, we recorded restriction of knee and ankle movements in 5 cases (6.8%). We started knee and ankle exercise on the 2nd/3rd post-operative day. So, very less number of patients reported knee and ankle stiffness. Use of external fixator has been emphasized very much in the past for initial management of open fractures, but it was found with a high rate of pin tract infection (16%) and moreover, it required a second surgery for definitive fixation. So, it is not advisable now Maurer *et al.*[18]

## CONCLUSION

After analysis of results of intramedullary interlock nailing in the study group, we concluded that it is an effective and safe method for treating open fractures (Gustilo–Anderson Grade I and II). Maximum number of patients treated by intramedullary, interlocking nail of tibia had excellent functional outcome and very fewer complications, Average time of union was lower in the study, as compared to conservative management and patients treated by plating but one should always keep in mind the grade of injury, soft tissue coverage, and contamination of the wound, while opting for intramedullary nailing in open fractures of tibia.

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**How to cite this article:** Kaushik SK, Khan A, Gupta U, Pathania VP. Primary Intramedullary Nailing in Open (Grade-I and Grade-II) Tibial Fractures: A Functional Outcome. Int J Sci Stud 2015;3(9):52-55.

**Source of Support:** Nil, **Conflict of Interest:** None declared.