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ORIGINAL PAPER

Immediate Unreamed Nailing Versus Delayed Nailing in Compound Tibial Shaft Fracture

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ABSTRACT

***Introduction:** Tibia is largely covered with thin soft tissue envelope, hence high chance of open fracture and exposure of bone. **Method**: We conducted a prospective, randomized control trial study on 52 patients of open grade IIIA and IIIB (Gustilo and Anderson classification) fractures regarding immediate unreamed interlocking nail in 26 patients and external fixation followed by interlocking nail (delayed nailing) in remaining half of the patients distributed as par randomisation plan and the outcome was measured. **Results**: In open Type IIIA fractures, union occurred after 18.09 and 26.5 weeks after immediate and delayed nailing group respectively while in IIIB union was achieved at 24.7week and 47.2weeks respectively. We obtained excellent results in 73.07% patients after immediate nailing and 53.84% after delayed nailing. **Conclusion:** Un-reamed solid intramedullary interlocked nailing provides excellent results in function as well as union, especially in GA Type II fracture. Immediate nailing led to earlier union in this study. Statistically significant differences were found in case of union rate and full weight bearing in favour of immediate nailing. Overall, the results were better in the immediate nailing group.*

***Keywords:** Interlocking Nailing, External Fixation, Compound Fracture*

INTRODUCTION

Evidence favours the use of interlocking nails in fixation of fractures of Tibia. Less duration of hospital stay, early mobilization and better functional outcome are the potential advantages of this technique which impart edges over others .However subcutaneous location and poor soft tissue coverage leads to frequent occurrence of open fractures and poor vascularity adds on delayed union, nonunion and infection. All these factors make the management of Tibial diaphyseal fractures not only difficult but also of particular interest to orthopaedic surgeons. Principle of management of these surgical emergencies imbibes the functional preservation with aggressive wound debridement, definitive fracture stabilization with internal or external fixation and delayed wound closure. With this background, we undertook this Randomized control trial with Grade IIIA and IIIB open fractures of the diaphysis of the tibia, who were treated with either immediate un-reamed Tibial interlocking nail (here after immediate nailing) or external fixator followed by un-reamed Tibial interlocking nail (here after delayed nailing). Sincere efforts were made to evaluate the effect of these treatment modalities in Tibial diaphyseal fractures with regards to treatment outcomes such as union time, rate and functional results as per defined outcome variables. We hope that this work would throw some light on this controversial and resource consuming problem as well as its management in our setup.

METHODS

Present study was conducted at department of Orthopaedics, Gauhati Medical College and Hospital, Guwahati from July 2012 to September 2013. 52 skeletally mature patients suffering from Tibial diaphyseal fractures were selected for the study and well informed written consent was taken. Only those patients who had valid consent, age >18 years, open grade IIIA& IIIB open Tibial diaphyseal fractures (4 cm distal to tibial tuberosity and 4 cm proximal to ankle joint), duration of injury <24 Hrs, competent neurological and vascular status of the affected limb,

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ipsilateral hip, knee, ankle and contralateral lower limb in functionally good enough so as not to exert a serious adverse effect on the rehabilitation process were included in the study. Initial care and work up of the patient was done regarding pre-operative preparation, antibiotics and anaesthesia. All patients received analgesic, Tetglob 500 I.U. and IV antibiotics. Patients were taken into operation theatre for emergency irrigation with normal saline and debridement of open fracture. Swab was taken from wound and was sent for culture and sensitivity. Fracture stabilization was done as per randomization plan either as solid intramedullary locking nail or external fixator. 13 fractures of type IIIA and13 of IIIB were fixed with immediate solid nail while, 12 and 14 no. of cases were stabilized with external fixation which later on was converted to intramedullary lock nail after wound healing. A severity of the open fractures determined the subsequent wound care and antibiotic treatment. Wounds were dealt with help of plastic surgeon. If the wound was clean and we were satisfied with our debridement primary closure was done without putting skin under tension. If the viability was of doubtful, second look after 24 hours was done. Patients were taken up for repeat debridement till satisfaction. Early closure (n= 5 and 5 in open grade IIIA, and IIIB respectively) of wound was defined when performed within 72 hours while late (n= 10, 06 each in open grade IIIA, and IIIB) in immediate nailing group. In delayed nailing group wound closure were done either primary closure, split skin graft (SSG), fasciocutaneous flap, free flap or delayed primary closure. Standard post-operative protocol was done with early mobilization in both group and follow up as per protocol. Criteria for Union at fracture site was defined as bridging callus in a minimum of three cortices on anteroposterior and lateral radiographs combined with a lack of tenderness at the fracture site or unassisted weight bearing. Delayed union was defined when the fracture did not show any signs of healing for 2 months even after dynamisation was performed along with clinical symptoms like pain and difficulty on bearing weight (Bhandari et al.[1] Nonunion was defined when 9 months had passed after the surgery and no progressive signs of union were seen for 3 consecutive months. The functional results were evaluated using the Johner and Wruh criteria. Statistical analysis was done using suitable bio-statistical technique on each variable in the same patient and between two treatment groups. Statistical screening of treatment effect was measured by relative risk reduction, absolute risk reduction with adjustment for a small sample size and confounders in the study. Paired t test and other appropriate tests were applied to check for presence of significant difference in outcome variable in two groups. The software Instat Graph pad was used in the analysis. P value less than 0.5 was considered to be significant.

RESULTS

In our study the youngest patient was of 18 years old and the oldest was 60 yrs. The mean age being 31.2 year (**Figure 1**). Most of the patients were in age group 21–30 years (40%) out of which 41 cases were male whereas 11 female.

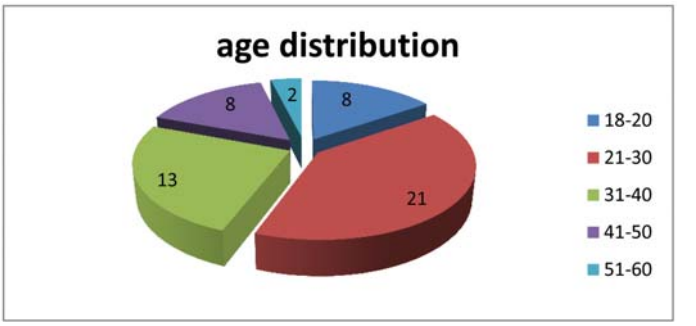

Figure 1 Pie diagram showing age distribution of patients

Road traffic accident (RTA) was the cause of injury in 29 cases (56%), followed by physical assault 11 (33%) and fall 07 (14%) as shown in **Figure 2**.

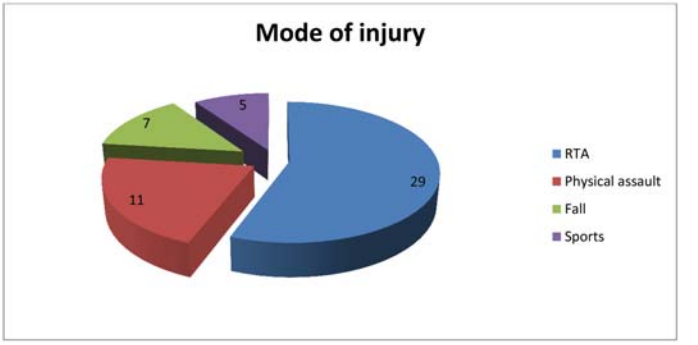

Figure 2 Pie diagram showing mode of injury

The right side affected more (n=34) than the left side (n=18). Most of the fractures were of AO type 42B3 (n= 15). The mean operative time was 65 minutes and average amount of blood loss was 130 ml. A fracture was designated as healed when there was obliteration of the fracture line in X-ray (Anderson et al 1975). All our fractures united by 28 weeks most of them by 12 weeks (n=24) followed by 16 weeks (n=14) and 20 weeks (n=11). The average time of union was 16.27 weeks in immediate nailing group. The mean duration of hospital stay was 16.4 days. Most of the patients got the range of motion between 100-134 degrees. The results were classified by Neers criteria at the end of 6 months. Functional result was excellent in 46.7 % (n =25), satisfactory in 43.3 % cases (n= 22) and unsatisfactory in 10 % (n= 5) while there were no failure cases. An Intra operative complication like difficult reduction was seen in 18 cases. 6 postoperative complications were noted as 3 superficial (**Figure 3**) and 3 deep infections.

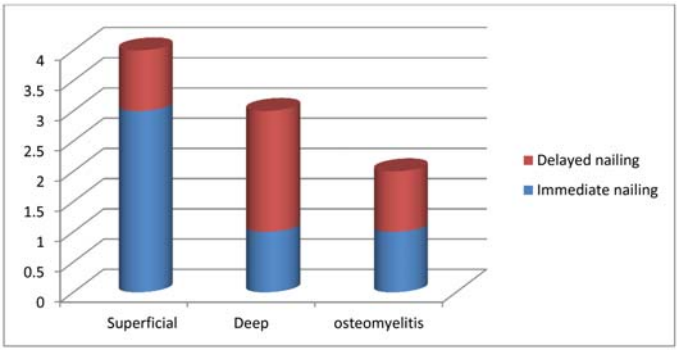

Figure 3 Bar diagram showing infection in Immediate and delayed nailing

In 2 cases the implant was removed (due to deep infection) after radiological union (28 weeks) at 5 months and 6 month interval.18 patients had mild pain on knee movement. We didn't get gross malunion to produce shortening or angular deformity.

Figure 4 superficial infection

DISCUSSION

Fracture of the shaft of tibia is common injury and it continues to pose challenge for the orthopaedic surgeon. With an eventful history of both non-operative and operative treatment, the current opinion is still controversial. The results of various authors were compared with the findings of present study in **Table 1**.

Table 1 Results of various Authors

Authors	Criterion used	Procedure	Result (in %)	
Atul et al[2]	modified Ketenjian's	Primary	E-60; G-23.4; F-10P- 6.6	
Wani et al[3]	Johner and Wruh	Primary	E- 40. G- 50, F- 10	
Manas et al	modified Ketenjian's	Primary	E- 68, G- 24, F- 4, P -4	
	Johner and Wruh	Primary	E - 40, G – 50, F - 10, P - 0	
Jain et al[4]	-	Primary	E–65, G – 25, F-10	
Joshi et al[5]	modified Ketenjian's	Primary	E+G- 86, F- 11, P- 3	
Present study	Johner and Wruh	Immediate	E -73	G- 8
			F- 15	P- 4
		Delayed	E- 53	G- 38
			F- 0	P- 4

Davis performed the first immediate internal fixation following timely initial debridement of open fractures. McGraw et al[6] noted high rate of infection if nailing was done after removal of fixator. Katenzian[7], Riemer[8] and Yokoyama *et al*[9] believed there are definitive advantages of primary internal fixation provided infection could be prevented by careful and radical debridement and use of antibiotics. All immediately closed cases went for uneventful healing in immediate nailing except one with superficial infection **Figure 4** (8.33%) while 4 cases of deep infection (28.2%). This shows trend towards primary closure of compound wound. K Yokoyama et al[9] concluded that early skin closure within 1 week is the most important factor in preventing deep infections when treating open Tibial fractures. Fischer MD et al[10], Osterman PA et al[11], Gopal S et al[12], Hohmann E et al[13], Levin LS et al[14], have also documented significantly better outcomes with early closure (within 7 days). Siebenrock et al[15] reported average full weight bearing time in delayed nailing group to be 27 and 41 weeks respectively in open type II, IIIA, IIIB fractures ,which is comparable to our study. Our study showed that immediate nailing led to faster union compared to delayed nailing. Results of Reimer et al[8] union rate 7.6 months, Singer and Kellam[16] union rate 6.1 months, Schandelmaier et al[17] union rate 25.8±14 weeks, Hass et al[18] 6 months and Osterman PA et al[11] 23.5 weeks were also comparable to our study. Singh et al[19] found delayed union rate of 26.6%. In their study concluded that un-reamed interlocking with solid nail is a good mode of immediate internal fixation of compound fractures of tibia (grade I-IIIB) as it allows early weight bearing, minimizes the chances of infection and delayed union and has led to union in almost all the cases. We believe that the un-reamed smaller diameter nails failed to provide sufficient rotational stability. We agree with Blachut et al[20] that the nails inserted without reaming are usually smaller diameter nails which provide less stability. The weak link are the locking screws, that too the distal ones. Other authors have also reported similar problems in patients who were not allowed early weight-bearing.

CONCLUSION

Achievement of length, apposition, axial and rotational alignment provides excellent functional results following fractures of Tibial diaphysis. A proper pre-operative planning as well as intra-operative observance of basic surgical principles is essential for treating these fractures. A thorough knowledge of the concept features and procedure of intra-medullary interlocking nails as well as soft tissue coverage is required. Un-reamed solid intramedullary interlocked nailing provides excellent results in function as well as union, especially in GA Type II fracture. Immediate nailing led to earlier union in this study. Statistically significant differences were found in case of union rate and full weight bearing in favour of immediate nailing.

LIMITATIONS

A multi-centric randomized control trial , possibly triple blinded or at least double blinded in nature, involving a large number of patients with long term follow-up is clearly needed to bring the differences between the two techniques and making the study more significant.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Taken

Declarations: (1) The Article is original with the author(s) and does not infringe any copyright or violate any other right of any third parties; (2) The Article has not been published (whole or in part) elsewhere, and is not being considered for publication elsewhere in any form, except as provided herein; (3) All author(s) have contributed sufficiently in the Article to take public responsibility for it and (4) All author(s) have reviewed the final version of the above manuscript and approve it for publication.

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