ORIGINAL ARTICLE

OPEN ACCESS

Tibial Shaft Fractures: Interlocking Nail Versus Plating

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ABSTRACT

Objective — *To evaluate and compare the treatment results of tibial shaft fractures treated by two different methods, interlocking nail and plating.*

Study design — *Randomized controlled trial.*

Place & Duration of study — *Department of Orthopaedics & Traumatology, Lady Reading Hospital Peshawar, from February 2014 to February 2017.*

Methodology — *A total of 50 patients with closed tibial shaft fractures were randomly assigned to two equal groups (one treated with closed interlocking nail and the other with plating). Postoperative results were assessed at one year follow up with Ekeland and Thoresen criteria and graded as excellent, good, fair and poor. Complications like infection, delayed union, nonunion and knee pain were assessed and compared for each groups.*

Results — *Mean age of interlock group was 36±10.6 year and plating group 35.1±9.9 year. Plating achieved excellent results in 72% patients while interlocking in 44% (p value = 0.04). Postoperative infection, delayed union, knee pain and screw breakage were 20%, 24%,11% and 20% (p value = 0.05) respectively in interlocking nail group but none in plating group.*

Conclusions — *Tibial shaft fractures treated with plating gave excellent results with minimal postoperative complications than interlocking nail. We therefore recommend plating as a treatment of choice for treating such fractures.*

Key words — *Dynamic compression plating, Interlocking nail, Tibia shaft fracture.*

INTRODUCTION:

Tibial shaft fractures constitute approximately 26 per 100,000 population per year, usually due to high energy trauma such as motor vehicle accidents, with males more commonly affected than females.[1] Managing these fractures is a challenge because the soft tissues around tibial shaft and its blood supply is inadequate and therefore chances of infection and nonunion in these fractures are higher.[2,3]

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Tibial shaft fractures are treated either non operatively or operatively with interlocking nails, plates and external fixators.[4] Although tibial shaft fractures treated by casting has the lowest infection rate, chances of delayed union, nonunion, malunion and joint stiffness are more.[5] Dynamic Compression Plating (DCP) is easy to perform even with minimal instruments, has a small learning curve and provides direct compression at the fracture side and reduces the fracture perfectly, but skin necrosis, infection and delayed weight bearing are the main complications.[3,6]

Closed interlocking nail preserves the soft tissues around tibia, acts as a load sharing implant and allows early weight bearing and fracture healing with peripheral callus formation.[4] Greater skills, radiation exposure and costly instruments are required for interlocking nail.[6] Moreover nail or screw breakage, delayed union, nonunion, mal union and knee joint

problems have been reported with interlocking nail.[7] External fixator is usually done in open tibial fractures.[6]

Due to the lack of adequate randomized controlled trials and absence of consensus on the preferred treatment of closed tibial shaft fractures, this study was conducted to compare the outcome of interlocking nail and plating.

METHODOLOGY:

Patients of either gender, aged16 year and above, with closed tibial shaft fractures (AO 42 type A1, A2, A3; [8] 10cm from knee joint and 10 cm from ankle joint) who presented within seven days of sustaining the fracture admitted through OPD or Accident and Emergency Department, and willing for at least one year regular follow up, were included in the study. AO 42 type B and C tibial fractures, pathological fractures, open tibial fractures, bilateral tibial fractures, compartment syndrome, neurovascular injury and patients requiring fixation of fibula or polytrauma patients requiring fixation of other bones or patients needing abdominal, neurosurgical, urological and thoracic interventions, were excluded from the study. "A**"** group comprised of interlocking nail whereas "B" group constituted plating, allotted through lottery method. Informed written consent was taken from all the participants of the study. The study protocol was approved by the Ethical Review Board of the hospital.

Complete history and physical examination were done. X-ray tibia fibula AP and lateral views including ankle and knee joint, was taken. All the patients were operated under general/spinal anesthesia with either reamed close static interlocking nail (one proximal locking screw and two distal locking screws) under image intensifier in hanging limb position through central patellar split incision or plating (narrow DCP 4.5 mm on anteromedial surface with at least 8 cortices above the fracture and 8 below the fracture) by standard surgical technique adopted in each case. Tourniquet was not used in either case. Patients were discharged home on second postoperative day unless pain, temperature or some other complication required further hospital stay. Second generation (cefuroxime) antibiotics was given for five days postoperatively to all the patients.

Every patient had first postoperative review visit at two weeks when wound was examined and stitches were removed and monthly visit thereafter for at least one year. Every patient was advised active ankle, knee and quadriceps exercises. In each visit pain, signs of wound infection, radiological union of fracture, malalignment, knee and ankle motion, limb swelling, weight bearing and implant failure or any other complications were noted in each group and managed accordingly. Fracture was declared either as healed when visible callus noted on at least three or four cortices on AP and lateral X-rays or delayed union when no such healing noticed after three months and nonunion when no healing observed on x-rays after six months post operatively.[10]

Dynamization (removal of proximal or distal screws) was done in case of delayed union in interlocking group. The results were assessed through Ekeland and Thoresen criteria at final follow up.[9] Data was analyzed by using a statistical software SPSS version 18. Mean ± standard deviation was calculated for continuous variables like age and operative time. Frequency and percentages were calculated for categorical variables like gender and outcome. All the results were presented in the form of tables and graphs. Chi-square test was used for comparison of outcome response. A p value less than 0.05 was considered significant.

RESULTS:

A total of 50 patients were divided equally and randomly into two groups A and B comprising of 25 patients each. Group A was treated with interlocking nail while group B with plating. The mean age of group A patients was 36 ± 10.6 year. There were 16 (64%) males and 9 (36%) females. Right side was involved in 17 (68%) patients while left in 8 (37%) patients. Road traffic accident was the cause of fracture in 17 (68%) patients while 8 (32%) patients had a fracture due to fall in group A. The upper end of tibia was fractured in 8 (32%) patients, middle in 12 (48%) and lower end in 5 (20%) patients in group A. The type of fractures were AO 42 A1 in 6 (24%) patients, A2 in 8 (32%),and A3 in 11 (44%) patients. Intact fibula was present in 8 (32%) patients.

The mean age of group B patients was 35.1±9.9 year with 19 (76%) males and 6 (24%) females. Right tibia was fractured in 16 (64%) patients and left in 9 (36%). Majority (n=19 – 76%) of patients had motor vehicle accidents while 6 (24%) had a history of fall. Upper tibia was fractured in 8 (32%) patients, middle in 10 (40%) and lower in 7 (28%) patients. The fracture was A1 in 8 (32%), A2 in 8 (32%) and A3 in 9 (36%) patients. Fibula was intact in 5 (20%) patients. Majority (n=16 – 64%) of interlocking nails were done under spinal anesthesia while only 9 (36%) patients received general anesthesia for their surgery.

In plating group general and spinal anaesthesia

was given to 13 (52%) and 12 (48%) patients respectively. The mean operating time of interlocking was 75 minutes while plating took 43 minutes. Majority (n=17 – 68%) of interlock patients had partial weight bearing at 4 week postoperatively while only 2 (8%) plating patients had partial weight bearing at 4 week (p= 0.00001). Full weight bearing at 6 weeks was noted for all (n=25) interlocking patients. Only 11 (44%) patients in the plating group could tolerate full weight bearing (p=0.0001).The average hospital stay of interlocking nail group was 3 days while for plating group it was 5 days. Postoperatively outcome results at the end of one year follow up is shown in table I. Plating gave excellent results in 72% patients while interlocking in 44% and this was statistically significant (p=0.04). Fair and poor results were not recorded for any group.

Majority (n=11 -44%) of plates used were of 10 holes, followed by 8 holes (n=10 – 44%) and 9 (n=4 -16%) hole narrow DCP. Similarly in majority (n=15 – 60%) of patients 10 mm diameter nail was used while 7 mm nail and 11 mm nail were used in 7 (28%) and 3 (12%) patients respectively. The length of tibial nail used was 28 cm (n=11 – 44%), 30 cm (n=8 – 32%) and 32 cm (n=6 – 24%). The interlocking nail had the smaller wound size than plating (p=0.001).

Five (20%) interlocking nails were infected, three (12%) at distal screw sites and two (8%) at proximal screw site and were treated with appropriate antibiotics according to culture and sensitivity reports and they healed. The complications noted in each group is shown in table II. Delayed union was reported in 6 (24%) patients. It was treated with dynamization by removing distal locking screw in 4 (16%) and proximal locking screw in 2 (8%) patients. Nonunion in 2 (8%) patients was treated with the removal of interlocking nail and, plating with bone grafting. The fracture in both cases was transverse and in the mid shaft. Proximal locking screw was broken in 4 (16%) patients while distal in 7 (28%), however healing occurred in all cases. No neurovascular injury or mortality occurred in this series.

DISCUSSION:

In our study excellent results were achieved in majority(n=18 -72%) of tibial fractures fixed with plating while interlocking nail reported excellent results in 44% (n=11) and this was statistically significant. Fair and poor results were not reported in any group. In a comparative study by Sahni, Interlocking nail yielded excellent results in 25%, good in 23.3% and fair in 1.6% patients while plating achieved excellent, good and fair results in 16.6%, 25%, and 8.3% respectively.[3] They concluded that interlocking nail should be the implant of choice for diaphyseal fractures while proximal and distal tibial fractures should be fixed with plating. Patients of interlocking nails were mobilized earlier than plating but distal locking screw were technically demanding

Table I: Postoperative Outcome Results Assessed By Ekeland and Thoresen Criteria

Results	Interlocking Nail	Plating	Total	p value
	Patients (%)	Patients (%)	Patients (%)	
Excellent	11 (44%)	18 (72%)	29 (58%)	0.04*
Good	14 (56%)	07 (28%)	21 (42%)	0.04*
Fair	--	--	--	
Poor	--	--	--	
Total	25 (100%)	25 (100%)	50 (100%)	

Table II: Postoperative Complications

S. No	Complication	Interlocking Nail	Plating	p value
1	Infection	5 (20%)	00	0.01*
2	Delayed union	6 (24%)	00	0.009*
3	Non union	2 (8%)	00	0.14
4	Knee pain	11 (44%)	00	0.0001*
5	Screw breakage	5 (20%)	00	0.01*

and knee pain was reported in interlocking nails in his study. In their study 25% patient had grade I fractures and a follow up period was of three years while we had all closed fractures and a follow up period of one year. Haung et al[11] compared both modalities of treatment by treating 35 tibial shaft fractures with interlocking nail and 45 with plating and concluded that plating is appropriate for non communited tibial shaft fractures and interlocking nail should be the implant of choice for communited tibial shaft fractures.[11] Similarly another study compared 26 interlocking nail tibia and 19 plating with a follow up period of 23 months and concluded that plating of tibial diaphyseal fractures achieved satisfactory results in non communited fractures while for communited shaft fractures interlocking nail was the best device as it preserved periosteal blood supply and thus had a few complications.[12]

Al-Musawi compared 21 interlocking nails with 25 plating and came to the conclusion that both can be used effectively to treat tibial shaft fractures but distal third tibial fractures must had fibula fixation or cast immobilization.[4] Saied and Ostovar in a randomized controlled trial of 69 tibial shaft fractures with intact fibula treated with either interlocking nail or plating and followed up to one year, concluded that both implants are suitable to fix non communited closed tibial shaft fractures but interlocking nail required further procedures to achieve union and were associated more frequently with knee and limb pain than plating.[13] Madadi concluded after treating 147 patients with interlocking nail and 132 with plating in his retrospective observational study that interlocking nail should be the implant of first choice for spiral, communited and segmental tibial shaft fractures and plating for the transverse and oblique fractures.[14]

Interlocking nail patients had a statistically significant advantage over plating patients in earlier partial and complete weight bearing in our study. This finding was confirmed by other studies as well.[3,6] However interlocking nail took longer surgical time to complete than plating in our study and in other studies.[3,15] The infection rate in our study was 20% in interlocking nail group and none in the plating group and which was statistically significant. This might be due to the longer surgical time taken by the interlocking nail and hanging position of the limb during surgery. Shen reported 2.7% infection rate in interlocking tibia and 2% infection in plating.[15] Madadi documented 9% infection rate in interlocking and 12% in plating while Al-Musaw reported 14.2% infection in interlocking nail and 12% in plating.[4, 14] Delayed union at12th week was observed in 6 (24%) patients of interlocking nail and none in plating and this was statistically significant. However all were treated successfully with dynamization or removed distal locking screw in 4 (16%) and proximal locking screw in 2 (8%). Nonunion at 24th week in interlocking nail was 8% (n=2) in our study and none in plating but this was not significant. The nonunion in both cases were treated with plating and bone grafting. In literature 10-18% nonunion in interlocking nail and 8-10% in plating tibia have been reported.[14,15]

A very important complication documented in our study was knee pain in 44% (n=11) patients of interlocking nail but none in plating. This was statistically significant. The frequency of knee pain reported by Al-Musawai was 85.7% after interlocking nail and 8% after plating.[4] Saied and Ostovar documented that 39.4% patients experienced knee pain after interlocking nail.[13] This higher frequency of knee pain in interlocking nail might be the reason of early nail removal after union in these patients.[16,17] But since our follow up period was short therefore we were not able to remove interlocking nail in such patients rather we prescribed simple analgesics for knee pain.

A small sample size and a shorter follow up period were the limitations of our study. A longer follow up period might help us in deciding which group would need removal of implant after healing and frequency of any refracture among the groups.

CONCLUSIONS:

Plating of simple tibial shaft fractures produced excellent postoperative results in majority of patients than interlocking nail. The frequency of postoperative infection, delayed union, nonunion and knee pain were more frequent with interlocking nail than plating. Moreover plating is technically easy to perform with short operating time and no need of image intensifier or radiolucent table. We therefore recommend plating as treatment of choice for treating closed tibial shaft fractures.

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Author's Contributions:

Faaiz Ali Shah:	Concept & design of the study, data collection and interpretation
Waqar Alam:	Drafted the article
Mian Amjad Ali:	Revised article critically for important intellectual content & Final approval of the study.

Conflict of Interest:

The authors declare that they have no conflict of interest.

Source of Funding:

None

How to cite this article:

Shah FA, Alam W, Ali MA. Tibial shaft fractures: Interlocking nail versus plating. J Surg Pakistan. 2017;22(1):3-7. Doi:http://-dx.doi.org/10.21699/jsp.22.1.2.