Does Nailing Distal Tibia Metaphyseal Fracture with Modified Interlocking Nail Produce Acceptable Outcome?

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ABSTRACT

Objective: To determine the functional results of distal tibia metaphyseal fractures treated with modified (shortened) interlocking nail and K wire fixation of the fibula.

Methods: This descriptive study was conducted in Trimax Hospital Karachi from 20th June 2017 to 20th June 2020. All adults patients with distal tibia (5cm) and fibula (≤10cm) meeting the inclusion criteria were operated with modified (distal one centimeter of the standard nail was cut) interlocking nail in the tibia and K wire in the fibula. Functional results were assessed at 6th month with the American Orthopaedic Foot & Ankle Society (AOFAS) questionnaire score and graded as excellent, good, fair and poor. Comparison of AOFAS scores in both gender, sides and fracture types was done and *P* value was calculated for statistical significance. $P < 0.05$ was considered significant.

Results: The total number of patients in our study were 60. The mean age of our patients was 33±11.5 years. Male patients were 51(85%) and female 9(15%).Right tibia fibula was fractured in 49(81.6%) and left in 11(18.3%). The average union time was 15±4 weeks (range 13 to 18 weeks) As per AOFAS questionnaire score 36(60%) patients had excellent outcome,13 (21.6%) good and 11(18.3%) had fair outcome. No significant difference was found in AOFAS scores with regard to gender, sides and type of fractures (P>0.05).

Conclusion: Majority of the patients treated with modified (shortened) interlocking nail tibia and K wire fixation fibula achieved excellent and good functional outcome. We therefore recommend this treatment protocol for all patients with distal tibia and fibula fractures.

Keywords: AOFAS, Tibia, Fibula, Interlocking nail.

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INTRODUCTION

Distal tibia fractures account for 10% of the lower limb fractures.[1] These fractures can be treated conservatively with casting or operatively with minimally invasive or open locking plate, Ilizarov ring fixator and interlocking nail.[2] Due to reduced risk of infection and better functional outcome interlocking nail is preferred over other implants for treating distal tibial metaphyseal fractures.[3]However distal tibia metaphyseal fractures within 5 centimeter of the ankle joint are difficult to treat with standard interlocking nail because of the short distal fracture segment where two distal locking screws are not possible to pass and to stabilize the fracture.[4,5] The implant of choice among the intramedullary devices to treat distal tibial metaphyseal fracture is the multidirectional, shortened Distal Locking Nail(DLN) but it is expensive and not readily available.[6,7] As an alternative to the appropriate intra medullary implant many surgeons cut the distal one centimeter of the standard interlocking tibia and the shortened nail then permits the placement of two distal locking

screws and provide equivalent fracture stability to that of standard interlocking nail for more proximal fractures. [8] Many studies have shown promising results with the use of these modified or shortened interlocking nails for treating distal tibial metaphyseal fractures.[9,10]

The objective of our study was to determine the functional results of distal tibia metaphyseal fractures treated with modified(shortened) interlocking nail and K wire fixation of the fibula.We hypothesized that shortened interlocking nail will produced acceptable functional results and can be used as an alternative to the Distal Locking Nail(DLN).

METHODS

We conducted this descriptive study in Trimax Hospital Karachi from 20th June 2017 to 20th June 2020. All adults patients of either gender and age with closed extra articular distal tibia(5cm) and fibula(≤10cm) presented within a week of sustaining the fractures were included in this study. Patients with previous ankle surgeries, segmental fractures, pathological fractures, compartment syndrome and polytrauma patients requiring surgical intervention for other fractures, thorax, abdomen and pelvis were excluded. In the included subjects complete history, clinical examinations and relevant investigations were ordered. The study protocol was approved by the Ethical Review Board(ERB) and informed written consent for surgery and publication was obtained from all the study participants.The fractures were classified as per AO classification[11] and only extra articular(43A1,43A2 and 43A3) fractures were included.

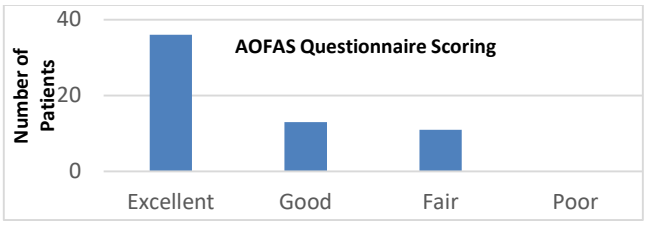
All the surgeries were performed by the same team of surgical team under general or spinal anaesthesia following the same surgical procedure of closed antegrade tibia interlocking nail. Fibula was stabilized first with an appropriate size K wire passed closely from tip of fibula in a retrograde fashion under image intensifier. The locally made standard tibia interlocking nail(®Esmico) was modified by cutting a portion just distal to the distal locking hole with a saw manually. After reaming an appropriate length and diameter modified nail was used for stabilizing the tibia.The tibia interlocking nail was locked in a static mode by passing two distal locking screws and one proximal locking screws in comminuted fractures. In case of transverse fractures only distal locking was done.(fig I-III)

Passive ankle and knee exercises were started on the first post operative day by physiotherapist. After discharge patients were advised follow up visits in OPD at 2nd week initially and then monthly for 8 months. Partial weight bearing was started on the appearance of callus usually at 6 to 8 week and full weight bearing at 16th to 20th week. In each visit radiological assessment of fracture callus was noted. Failure of callus formation on serial xrays at 12th week warranted dynamization in static nails by removing locking screw proximally. The clinical outcome at 6th month was assessed with AOFAS questionnaire scoring[12] by one of the senior Orthopaedic surgeon of our hospital who was not part of this study. The AOFAS score was graded excellent(95-100),good(75-94),fair(51-74) and poor(0-50)

Data was analyzed using SPSS version 23. Frequency and percentages were calculated for quantitative variables while qualitative variables were represented as mean and standard deviation. Comparison of AOFAS scores in both gender, sides and fracture types was done and *P* value was calculated for statistical significance. $P < 0.05$ was considered significant. Data was represented in graph where necessary.

RESULTS

We included 60 patients with mean age of 33±11.5 years. Majority(85%,n=51) were male while females were only 9(15%).Right tibia fibula was the predominant side fractured in 49(81.6%) and left in 11(18.3%). Road traffic accident was responsible for 51(85%) fractures and fall in 9(15%) fractures. As per AO classification majority(58.3%,n=35) of the fractures were 43A1 followed by 43A2(30%,n=18) and 43A3(11.6%,n=7). The average union time was 15±4 weeks(range 13 to 18 weeks). As per AOFAS questionnaire majority of our patients(81.6%,n=49) had excellent and good functional outcome as shown in graph I. No poor outcome was documented. No significant difference was found in AOFAS scores with regard to gender, sides and type of fractures($P>0.05$). Dynamization was done in 5(8.3%) patients and achieved union ultimately. Superficial surgical site infection was noted in 3(5%) patients and treated with dressings and antibiotics. No malunion, nonunion and implant failure was reported.



Graph I: Functional outcome as per AOFAS questionnaire scoring.

Fig I: Preoperative radiograph showing distal tibia fibula fractures.

Figure II: Postoperative radiographs showing interlocking nail tibia and K wire fibula.

Figure III: postoperative radiograph showing healing of fractures.

DISCUSSION

In our study 36(60%) patients had excellent outcome, 13(21.6%) had good and 11(18.3%) had fair functional outcome. Fan CY and colleague[13] treated 20 patients of distal tibia metaphyseal fracture with shortened Russel-Taylor interlocking nail for tibia.All the fractures achieved union at an average union time of 17.2 weeks. They noted excellent functional outcome in 17(85%) and good in 3(15%) patients as per Iowa rating scale. This study however included patients with a mean age of 48.1 years, intra articular fractures and 5(8.3%) patients had open tibia fractures whereas the mean age of our patients was 33±11.5 and we did not include intra articular fractures or open tibia fractures. In our study we fixed all fibular fractures with closed retrograde K wire while Fan CY fixed only 4(20%) fibular fractures. We believe that fixing fibula tends to prevent malalignment of distal tibial fractures and helps in fracture reduction and maintaining axis of the tibia. We are supported by Schmidt[14] and Mosheiff[15] who strongly favored concomitant fibula fracture fixation. Megas[16] treated 14 patients of acute tibia fractures and 4 non union distal tibia with shortened interlocking nail tibia(Grosse and Kempf).All fractures united with a mean healing time of 16 weeks. The mean Iowa ankle score was 87 in acute fractures and 82 in non union cases. Similar to our study Megas fixed all fibular fractures within 10 centimeter of the ankle joint. Dogra[10] claimed that his study was the first in English literature to present the results of 15 patients who were treated with shortened interlocking nail.(Grosse and Kempf/Russell Taylor Delta). In his study 3(20%) fractures were open and 2(13.3%) had inta articular extension and 12(80%) patients achieved union primarily while 3(15%) patients had

secondary surgeries to achieve ultimate union. The mean follow up period was 4.7 years while the mean Iowa score was 83.

In one local study Naveed and Khan[17] documented 100% union rate in 35 patients who were treated with shortened interlocking nail. Another local study by Basit[18] compared 12 patients treated with shortened interlocking nails and 12 with anatomically contoured distal locking plate and reported significantly better functional and radiological outcome in shortened interlocking nails than in locking plate($p< 0.05$).Contrary to Basit, Yang and Tzeng[19] compared 13 patients with shortened interlocking nail and 14 with plating and noted significantly earlier union time in interlocking group than plating group($P < 0.05$).However the radiological and functional outcome of both the groups were similar except valgus deformity was larger in interlocking group than plating group. These authors concluded that both interlocking nail and plating were equally effective to treat distal tibia fractures.

Our study had few limitations.Our sample size was small.The design of our study was descriptive and our follow up period was short.Further well designed large sample size studies with adequate follow up are recommended to confirm our results.

CONCLUSION

Majority of the patients treated with modified(shortened) interlocking nail tibia and K wire fixation fibula achieved excellent and good functional outcome. It is a reliable and effective treatment option with minimal complications. We therefore recommend this treatment protocol for all patients with distal tibia and fibula fractures. We suggest that local manufacturers must be supported to redesign shortened tibial nails which can fix distal metaphyeal fractures without cutting the distal end of standard tibia interlocking nail.

Conflict of Interest: None
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