A comparative study of Locking Plate Versus Shortened Interlocking nail for treating extra-articular distal Tibia fractures.

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ABSTRACT

Objective: To compare the functional and radiological results of locking plate versus shortened interlocking nail for treating extra-articular distal tibia fractures.

Methods: This randomized trial was conducted in Department of Orthopaedics, Lahore General Hospital from 25th June 2017 to 25th July 2019.All patients of distal tibia fractures fulfilling the inclusion criteria were randomly and equally divided into group A(shortened interlocking nail) and group B(anatomically contoured distal tibial locking plate). Post operatively functional outcome was determined by assessing ankle and knee range of motion. Radiological union was assessed through callus formation on X ray AP and Lateral view. The time of radiological union and range of motion in both groups were compared and chi square test was applied to note any statistical significance with P value of < 0.05 was considered significant.

Results: Total 24 patients were equally divided into two groups A and B with 12 patients in each group. The mean age of group A was 22.5 years(range 20 to 34.5 years) while group B had mean age 31 years(range 22 to 35 years).In group A all the patients were male. Group B had 1(8.3%) female patient. Majority (91.6%, n=11) of patients in group A regained normal range of motion of ankle and knee at final follow up. In group B the normal ankle range of motion was noted in 8(66.6%) patients. Nonunion was documented in 1(8.3%) patient in group A and 3(25%) patients in group B. The functional and radiological outcome was significantly better in interlocking nail group than locking plate group (P value of < 0.05).

Conclusion: Extra articular distal tibia fractures treated with shortened intramedullary nail produced better functional and radiological results than locking plate. Shortened intramedullary nail should be the treatment of first choice to treat these fractures.

Keywords: Anatomical locking compression plate, Distal tibia fractures, Intramedullary interlocking nail, Shortened intramedullary interlocking nail.

This article may be cited as: Basit MA, Ijaz A, Khan MZ, Hussain R, Shiraz HM, Rehman MK, et al. A comparative study of Locking Plate Versus Shortened Interlocking nail for treating extra-articular distal Tibia fractures. J Pak Ortho Assoc.2019;31(4):157-162.

INTRODUCTION

Fracture tibia constitutes 3 to 10% of all fractures and 1% of overall lower limb fractures.[1,2]Majority of these fractures are caused by high energy trauma such as motor vehicle accidents.[3] Most of the victims of tibial fractures are male patients with the age range of 25 to 50 years.[4] Various treatment options are present to treat tibia fractures but the two major complications of tibia fracture treatment are infection

and nonunion.[5] Due to the unprotected and subcutaneous location of tibia, these fractures are often associated with sever soft tissue damage and improper surgical intervention could lead to chronic osteomyelitis and useless limb. [6,7] The first and conventional treatment option for close tibia fracture is plaster cast but the surgeon must be vigilant to see blisters and to note any impending compartment syndrome due to improper cast. Moreover prolonged immobilization in plater cast leads to lower patient compliance for this option. The most frequently used surgical methods to treat closed tibia fractures are conventional dynamic plating, interlocking nailing, locking plates and anatomically contoured locking plating.[8]

Due to the higher union rate and minimal complications intramedullary nailing is the method of choice to treat tibial fractures in our center but distal tibial fractures closed to the ankle joint are difficult to treat with traditional standard interlocking nails. For these fractures traditional nail has to be modified by cutting the 1.5 cm of the tip of the nail so that nail is inserted far distal to the fracture and locking distal to the fracture is achieved.[9,10] The anatomically contoured distal tibial locking plates are low profile side specific plates which are best fitted at distal tibia and medial malleolus. They respect the bone vascularity and restore the normal anatomy without causing difficulty in wound closure and skin problems.[11,12]

Extra articular distal tibial fractures (6 cm from tibial plafond) are treated in our unit according to the individual surgeon preference usually with shortened interlocking nail or contoured locking plating. In this study we compared the functional and radiological results of locking plate versus shortened interlocking nail for treating extra-articular distal tibia fractures. We hypothesized that shortened interlocking nails are better than plating functionally and radiologically. The results of our study would help to formulate standard guidelines for treating these fractures in our unit.

METHODS

This randomized trial was conducted in Department of Orthopaedics, Lahore General Hospital from 25th June 2017 to 25th July 2019.The study was approved by the Ethical committee of our hospital. All adults patients of either gender with closed distal tibia fractures (6 cm from tibial plafond) presenting within a week were included in our study. Pathological fractures, fracture fibula needing surgery, patients with compartment syndrome and other skeletal or soft tissues injuries requiring surgery were excluded from study. Informed consent was taken from the study participant. All patients presenting to Accident and Emergency or Outpatient Department of our hospital with distal tibia fractures were assessed with x-ray. Complete history and clinical examination was done. All patients were randomly divided through lottery method into group A(shortened interlocking nail) and group B(anatomically contoured distal tibial locking plate) applied through minimally invasive plate osteosynthesis (MIPO).A uniform standard protocol of interlocking nail and plating was adopted for all the patients. The portion of interlocking nail distal to the most distal locking screw was cut (shortened intramedullary nail). All the surgeries were performed under general or spinal anaesthesia under tourniquet control on radiolucent table. Pre-operative intravenous antibiotics (Cefuroxime) was administered to all the patients before tourniquet inflation. The shortened interlocking nail was inserted closely with a jig assembly(Fig I) and statically locked with two proximal screws and three distal screws(2 screws from medial to lateral and 1 screw in anteroposterior direction).The distal tibial locking plate was inserted through mini incisions(MIPO) from distal to proximal and screws inserted under image intensifier.(Fig II)Patients were advised ankle and knee range of motion exercises on first post-operative day. Follow up visits were scheduled at 2 weeks,4th week and 6th week initially and then monthly for 9 months. In each visit range of motion of ankle and knee was assessed and fracture union was evaluated. At 6th week X ray AP and lateral view was advised. The outcome evaluation was blinded (done by another senior non-operating consultant). Partial weight bearing was allowed at 6th week. Full weight bearing was allowed once sufficient callous was noted on x-rays. (usually at 12th to 16th week) Fractures were termed non unions if no radiological signs of callous was present at 9th month and weight bearing was painful. All the data collected was analyzed with SPSS version 19. The important quantitative variables were represented as mean while qualitative as frequencies and percentages. Comparison of time of union and range of ankle and knee motion in both groups were compared and chi square test was applied to note any statistical significance with P value of < 0.05 was considered significant. Data presented in graph where necessary. The study has been reported in accordance to Consolidated Standards of Reporting Trials (CONSORT 2010) guidelines.[13]

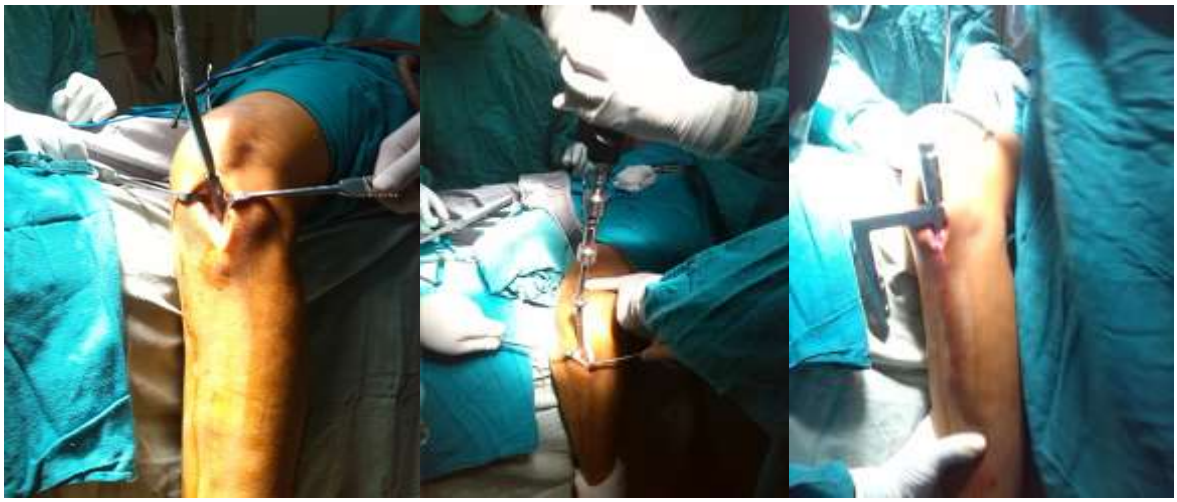


Fig I: Steps of Insertion of Shortened Intramedullary Interlocking Nail with jig assembly

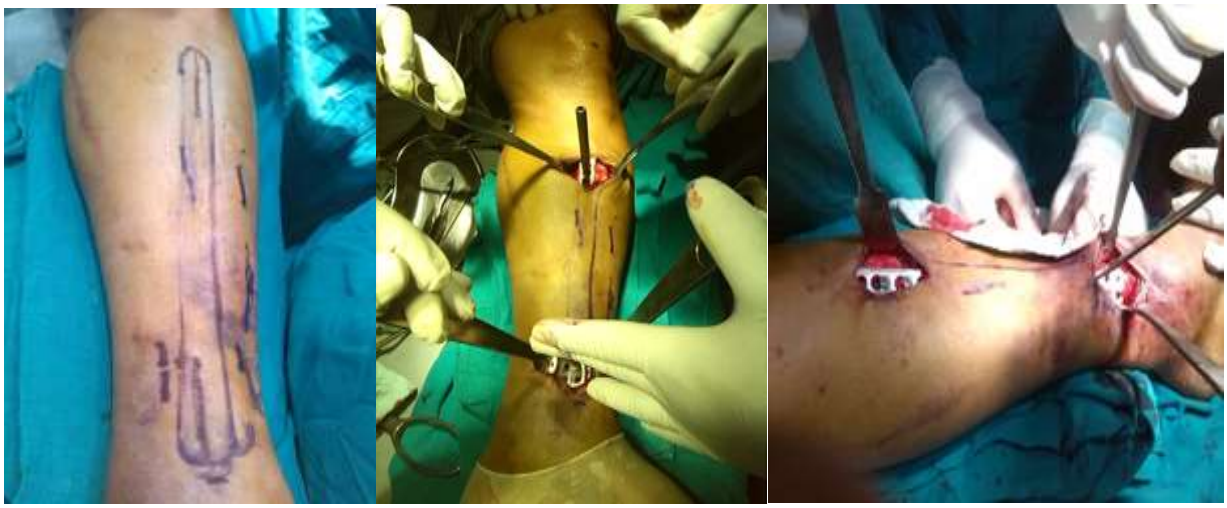
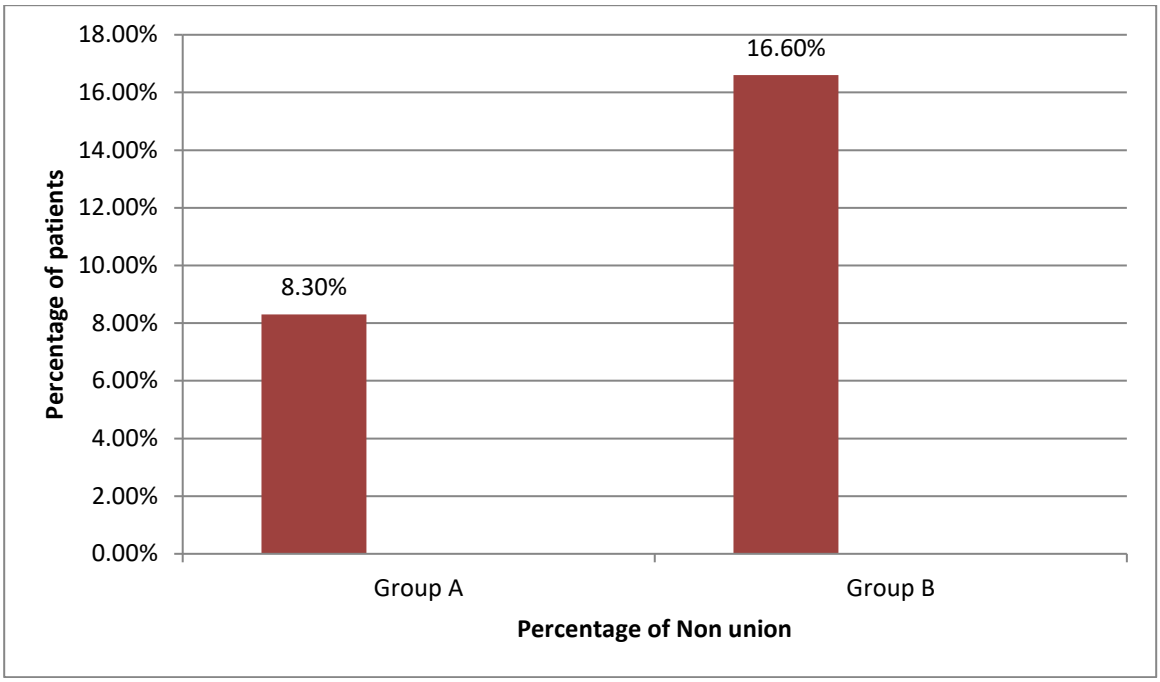


Fig II: Steps of application of distal tibial locking plate through MIPO.

RESULTS

The total number of patients in our study was 24 and which were equally divided into two groups A and B with 12 patients in each group. The mean age of group A was 22.5 years(range 20 to 34.5 years) while group B had mean age 31 years(range 22 to 35 years).In group A all the patients were male. Group B had 1(8.3%) female patient. Right tibia was predominantly fractured in both groups (75%, n=9 in group A and 66.6%, n=8 in group B). Majority (91.6%, n=11) of patients in group A regained normal range of motion of ankle and knee (maximum flexion and extension of ankle and knee) at final follow up. In group B the normal knee range of motion was observed but normal ankle range of motion was noted in 8(66.6%) patients. Majority (75%, n=9) of the group A had sufficient callous formation revealed on x-ray at 12th weeks and they were mobilized. In group B,5(41.6%) patients had callous evident on x-ray at 6 to 7 weeks post operatively. This difference was statistically significant (P value of < 0.05). Nonunion was documented in 1(8.3%) patient in group A and 3(25%) patients in group B as shown in graph I. The functional and radiological outcome was significantly better in interlocking nail group than locking plate group (P value of < 0.05). The nonunion of group A was treated with exchange nailing and bone grafting. The nonunion of group B was infective in 1(8.3) patient and non-infective in 2(16.6%) patients. They were treated with plate removal and bone grafting respectively. Superficial infection was reported in 1(8.3%) patients in group A and 3(25%) in group B. All were treated with local dressing and antibiotics.



Graph I: Percentage of nonunion in both groups.

DISCUSSION

The most common cause of tibia fracture is motor vehicle accidents[3] which is true in our series as all of our participants sustained tibia fracture due to motor vehicle accidents. The demographic analysis of our data revealed that majority (87.5%, n=21) of our patients were male and younger in age. Mauffrey[4] reported that 65% of his study participants were male but the age distribution was bimodal. An interesting analysis by Mir et al[5] showed that since younger patients are the usual victims of these fractures causing a huge financial expenses per year therefore optimal treatment must be ensured to avoid morbidity.

Each treatment option of tibia fracture has merits and demerits. Plaster cast immobilization is associated with prolonged immobilization and external fixator with pin tract infection.[14] Vallier[15] is of the opinion that respecting the vascularity and soft tissue envelope will enhance bone healing irrespective of the method of fixation. Although interlocking nailing is the ideal method to treat tibia diaphyseal fractures, extra articular distal tibial fractures are difficult to treat with traditional interlocking system because of the inability to pass locking screws in short distal fragment. Gorezyca and McKale[9] had demonstrated that insertion of distal locking screws were the most important factor influencing fracture healing of extra articular distal tibia fracture.Trafton[16] does not recommend interlocking nail for distal tibia because he was of the opinion that in distal tibial fractures the distal fragment is usually short and because of inadequate hold tends to angulate and ultimate nail failure. Kneifel[17] had documented an implant failure rate of up to 59% in his series. Luckily we had no implant failure in either group and this can be attribute to modification of our nail by cutting the most distal portion thus ensuring insertion of all three locking screws in short distal fragment.

We had achieved acceptable functional and radiological results in group B through MIPO but statistically inferior to group A. MIPO is preferred to conventional plating for treating distal tibial fractures because traditional platting causes more periosteal stripping and skin compromises causing higher chances of infection and non-union.[18] Iqbal[19] did a very interesting systemic review of plating versus intramedullary nailing to treat distal tibial fractures. He noted no significant clinical differences between the two techniques and he concluded that both techniques could be used in selected cases.Maffulli[20] observed that infection was the most common complication of plating particularly if an open fracture was fixed with plating. We documented superficial infection in 3(25%) patients in plating group which was resolved with local dressing and antibiotics. Egol[21] recommended plating for complex distal tibial

fractures because he observed an increased rate of malalignment of these fractures when treated with interlocking nail. (17% versus 50% respectively). Senthilkumar[22] treated closed and open (Gustilo Anderson type I and Type II) distal tibial fractures with locking plates and reported overall excellent outcome but noted shortening in 2 patients, joint stiffness in 2 and deep infection in 2 patients. Prasad[23] treated 147 distal tibial fractures and documented no case of non-union in his series. He strongly recommended intramedullary fixation of all distal tibial fractures. Prasad had used traditional interlocking nails to fixed tibial fractures. He utilized Olerud and Molander Scoring criteria to post operatively assessed the outcome and reported excellent and good outcome of his patients and no poor outcome in his series.

Our study had few limitations. First, our sample size was small. Second, our follow up was short. Third we could not analyse other possible causes of non-union and infection in our study sample. Fourth, we could not register our trial with a registering authority. We recommend further studies on this topic to address all such limitations.

CONCLUSION

Extra articular distal tibia fractures treated with shortened intramedullary nail produced better functional and radiological results than locking plate. Shortened intramedullary nail should be the treatment of first choice to treat these fractures. This technique had lesser complications. Patients had shorter rehabilitation period because they were mobilized earlier and returned quickly to their jobs.

Conflict of Interests: None
Grants/Funding: None

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