Original Article

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Treatment Results Of Spiral and Oblique Distal One-Third Tibia-Fibula Fractures With Interlocking Nails and Poller Screw

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Abstract:

Distal tibia fibula fracture near ankle joint is difficult to manage. Because of poor soft tissue coverage and blood supply these fractures often goes in nonunion and soft tissue problems. This study is to evaluate clinical outcome in distal tibia fibula fracture treated with interlocking nail and supplemented with poller screw.

Material And Methods

34 patients with spiral and oblique fractures of distal tibia fibula within 4 cm of ankle joint were treated with intramedullary nail with supplementary poller screw between March 2012 and Febuarury 2014 with minimum follow up of fifteen months. The type of fractures based on AO classification A1 (n=14), A2 (n=5), A3 (n=9), B1 (n=4), and C1 (n=2).

Results And Conclusions

All fractures united with a mean union time of 14.7±3.21 weeks. Results were evaluated for angulation, shortness and ankle function .Using Iowa score outcome was excellent to good in 88% cases. No major complication occurred. We conclude that tibia interlocking nailing along with poller screw is reliable method for distal tibia fibula fracture, with this technique there is less complication such as shortening or angulation, better stability and early mobilization can be achieved

Keywords: *Distal tibia, Poller screw,interlock nail, spiral fracture*

Introduction

Distal third of tibia-fibula spiral and oblique fractures are common fractures of long bones [1].Most of them are high-velocity injuries [2].Treatment of these fractures is more complicated than the shaft injuries [3,4].A number of treatment options are there including plating or external fixation with standard devices or with an Ilizarov ring fixator [5]. According to Canale locked intramedullary nailing can be used for unstable fractures located seven cms below the knee joint to four cms above the ankle joint [6]. Some studies have suggested interlocking nailing as treatment option in these fracture, but no one has made any unequivocal conclusion about the indication to be followed [7]. There is theoretical risk of nail failure or fracture propagation into the ankle joint [8].Since distal fragments are small with wide medullary cavity and muscle forces acting on it , intramedullary nailing of these fractures is associated with an increase occurrence of malalignment, particularly in the coronal plane [9, 10]. Krettek et al. described the clinical use of poller screws, as a tool for the prevention of coronal deformities of proximal and distal third fractures of tibia during intramedullary nailing [11, 12].This study was conducted to elucidate the role of tibial interlocking nails along with poller screw in spiral and oblique fracture of distal tibia within 4cm of ankle joint ,with or without minimum extension into the joint.

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Material And Method

From March 2013 to Febuarury 2014 a prospective study was carried out having thirty four patients (1male : 0.4 female) with a mean age of 41.5 years (range21 to 60) having spiral or long oblique fractures of distal tibia within 4 cm above the ankle joint line ,were treated with intra medullary nail and poller screw. Most fractures were extra-articular but some were combined with a longitudinal extension of the fracture line into the ankle joint with minimum displacement. Those comminuted pilon fractures with extensive articular involvement and simple transverse fracture were excluded. Both open and closed fractures were included in the study.The minimum follow-up was15 months (range 12 months to 24 months).The mean distance from the articular surface was 2.8cm (95%LCL2.3cm and 95%UCL 3.2cm). The mean length of the fracture was 73 ± 60 mm (40 to 290). These were calculated using the X-ray radiographs with the computer based digitized system with magnification error of 10% which was deducted.The mechanisms of injury varied, fractures were sustained in road traffic accidents (21 patients, 61.76 %), domestic falls (10 patients, 29.4%), twisting injuries (3

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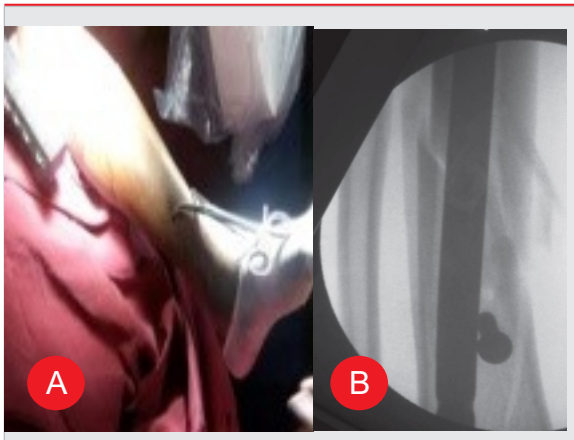

Fig.1A. Percutaneous reduction with pinpoint reduction forcep. B Alignment restored as the nail is introduced

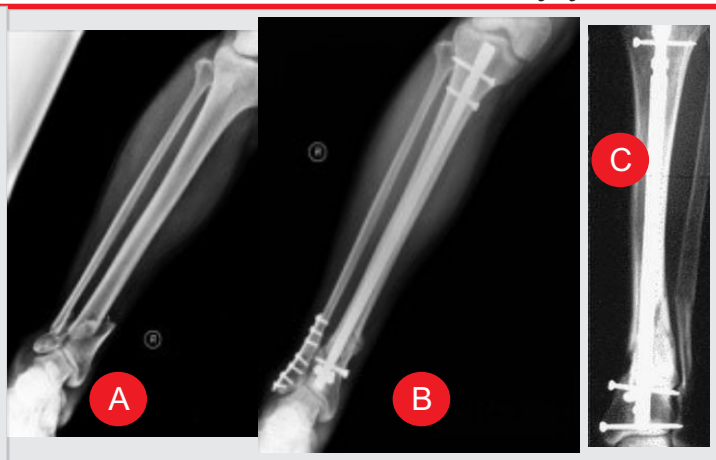

Figure 2. A- Radiographs showing anteroposterior views of freshly displaced distal one third shaft tibia fracture. B Fractured treated by nailing with Poller screw which is used as tool for obtaining reduction and alignment. C alignment and callus formation at 4 months.

patients, 8%), 4 patients (11%) suffered from multiple injuries, all the rest (88%) suffered from isolated distal tibial and fibula fractures.

Fractures were categorized according to the AO classification 14 (41.1%) fractures A1type, 5 (14.7%) were A2 type, 9 (26.4%) fractures-A3 type, 4 (11.7%) were -B1type and 2 (5%) fractures were C1 type. Concomitant involvement of the medial malleolus was noted in 3 (8%) fractures, and 20 (58.8%) cases were associated with distal fibula fracture within 7cms of joint. Five (14.7%) were open fractures and were classified by the Gustilo system. All patients suffering from an open fracture underwent debridement, followed by immediate stabilization of the fracture, within an average of 3 h (range2 to 5 h) from the time of injury. Closed fractures were treated by means of reduction and application of a splint, followed by operative treatment within 48 hours unless severe swelling or fracture blisters were present. The average overall time from the moment of injury to the operative fixation of the closed fractures was three days.

Pre operative planning. X-ray of the injured leg in AP and lateral views was taken. The fracture tendency for valgus or varus and antecurvatum or recurvatum malalignment was noted. The angle of malalignment was measured.

The patient selected was treated with stainless nails with a high bend of 11 degree near its proximal tip. Appropriate length of the nail was measured in the contra lateral leg, from the tibial tuberosity to medial malleolus. Intra-operatively the patient was positioned on fracture table with knee kept in a semi-extended position on a well-padded knee rest. Close reduction of the fracture was performed under an image intensifier and the alignment was kept by maintaing traction and fixed percutaneously with pinpoint reduction forceps (Fig 1A). Temporary poller wires were fixed on the opposite side of the apex of deformity in both antero posterior and lateral views under image intensifier guidance. A para-patellar tendon approach was used and entry point was made, then guide wire was passes central to the distal subchondral plate, the intramedullary canal was reamed till appropriate fit of the reamer in the canal was achieved. During reaming, the alignment of the fracture was maintained and checked repeatedly with the image intensifier. After the canal was well-prepared, a proper nail size was selected with a diameter one mm narrower than that of the final reamer and stainless nail was inserted. Poller wires were then exchanged with permanent cortical screws to maintain the reduction after inserting the nail (Fig. 1B). Single poller screw was used on the concave side of the deformity close to the fracture in the short fragment between the cortex and the nail, under image intensifier. When two poller screws were placed, the second screw was on the convex side of deformity near the end of the nail in the short fragment. After insertion of nail and poller screw into distal fragment two locking screw inserted medial to lateral and one screw anterior to posterior by free hand method then two proximal locking screws inserted with help of zig. Locking was only done after achieving the alignment and confirmed in both coronal and sagittal plane with image intensifier.

The poller screw was used to maintain correct alignment and to improve the stability of bone implant complex. In 21 cases single poller screw was used, and in 13 cases two poller screw were used. Cortical screws of 3.5 or 4.5 mm were used as poller screw [Fig 3].

Additional cancellous screw fixation was performed when the fracture line extended into the articular surface of the tibio-talar joint.

After tibial fixation was done, fibular fracture within 7 cms above the joint were fixed either with nail or plate, 13(65%) fibula fractures are fixed with radius square nail and 7(35%) fractures were fixed with semitubular palte depending upon fracture configuration. Post-operatively active range of motion of knee joint started on day one and ankle moments were encouraged. Non

weight bearing started on post operative day two, partial weight bearing continued up from 4 to 8 weeks; thereafter full weight bearing started depending on clinical and radiological evidence of union. Radiographic evaluation with standard anteroposterior and lateral views of the tibia, as well as functional evaluation, were performed during every visit. The alignment was assessed by constructing longitudinal line from the midpoint of the medial and lateral cortices (on antero-posterior X-ray) for varus-valgus measurement, and from the midpoint of the anterior and posterior cortices (on lateral X-rays) for recurvatum-procurvatum measurement.

Discussion

Unstable distal tibia fractures management remains challenging. We treated these fracture with interlocking nails along with poller screws successfully in this series, which might extend its indication for such fracture treatment. Trafton's recommendation the acceptable 10^0 of antero-posterior angulation, less than 5^0 of varus-valgus malalignment, and 15mm of shortening [13]. In our series only one patient have 1.5cms shortening and two patients has coronal malalignment more than 5^0

Distal tibia metaphyseal fractures are usually result of high-energy trauma, and associated with soft tissue injury [14], as for anatomic aspect, vascularization in the lower end of tibia is poor, the screw plate damages the periosteal circulation – in the lower part of tibia it is the main source of vascularization, and for this reason, method of osteo-synthesis should not be applied [15]. According to Teeny PG [16] patients treated with open reduction internal fixation 50% them develop either wound complication, infection ,non union ,malunion or implant failure. Im and Tae [17] in their study comparison of open plate fixation and intramedullary nail in 64 patients of distal metaphyseal tibia fractures showed increased infective complications in the plate group.

Mario et al [18] applied percutaneous internal and hybrid external fixation device for tibial plafond fractures. All of the fractures united but the final alignment after union was not mentioned. In 2007 Bahtiyar Demiralp [1] treated 27 patients having distal tibia spiral and oblique fracture with circular external fixator and a duration of treatment 18.8 weeks. They reported pin tract infection in 5 (18.5%) and limited ankle movement in 3(11.1%). The main complications associated with external fixation are ankle stiffness, pin site infection and loosening [17]. In 2004 cheng-yu fan et al (7) concluded that interlocking nail is reliable and safe method for distal tibia fracture but does not mentioned about post operative varus-valgus deformities, but in 2011 vallier et al [19] said that intramedullary nailing for distal tibia fracture was associated with more malalignment versus nailing.

Poller screws reduces the width of the medullary canal, help maintain fixation of intramedullary nailing and alignment of fractures. Krettek et al [9] suggests that medial and lateral blocking screws can increase the primary stability of distal metaphyseal fractures after nailing and can be an effective tool for cases that exhibit malalignment. Poller screws act via a 3-point fixation principle to nullify the forces of muscle pull and narrow the cavity [20]. It improves the stability, acts as reduction tool, reduces the coronal malalignment when applied in anteroposterior direction and reduces the saggital malalignment when applied in mediolateral direction.

In distal tibia fractures treated with interlock nail distal locking screw provides stability in coronal and sagittal planes, Smucker et al [21] concluded that two parallel locking bolts being a better construct than perpendicular locking bolts. In our study we used minimum three locking bolts two in mediolateral direction and one in anteroposterior direction for better stability.

Fractures of the distal fibula are commonly associated with distal tibia fracture and studies suggests that distal fibula plating gives better tibia stability then intramedullary nailing alone and also it reduces the risk of malalignment [17]. In our study we fixed all the fracture of fibula which were within 7cms of joint line either with plate or intramedullary nailing depending upon the fracture, to prevent malalignment. As per our results we advice for fixation of distal fibula fracture within 7cm of ankle joint either by intramedullary nail or plate for better results.

Thus, this technique of using poller screw is easy and effective means of maintaining reduction and alignment in case of distal extraarticular metadiaphyseal tibial fractures. They are surgeon friendly, and do not need any special instruments. We had excellent to good results with IOWA scoring of 88%, with none of cases requiring bone grafting or exchange nailing..

Conclusion

We conclude that use of intramedullary nail with distal three locking bolt along with poller screw is an effective treatment of distal third spiral and oblique unstable fracture of tibia and fibula within 4cm of ankle joint .As with this method there is no soft tissue problems, less chances of infection, ankle stiffness, with minimal malalignment and more stability

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