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 February 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 4 cm of ankle joint, with or without minimum extension into the joint.

Material And Method
From March 2013 to February 2014 a prospective study was carried out having thirty four patients (1 male : 0.4 female) with a mean age of 41.5 years (range 21 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 was 15 months (range 12 months to 24 months). The mean distance from the articular surface was 2.8 cm (95%LCL 2.3 cm and 95%UCL 3.2 cm). 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...
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 A1 type, 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 7 cms 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 (range 2 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 maintaining 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 passed
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 convex 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
plate 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° of antero-posterior angulation, less than 5° 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°. 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 villier 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 sagittal 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.

References

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Conflict of Interest: Nil
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