Original Research Article

A Study to evaluate the use of Steinmann pin as Poller screw for diameta physeal fracture of distal tibia to avoid angular deformity

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Abstract

Introduction: There are several important technical points that need to be observed when using an intra medullarynail to fix diametaphyseal fractures of distal tibia, mainly the angular deformity. **Objective:** We aimed to describe a technique using 4.0-mm Steinmann pin which act like Poller screws, in conjunction with intra medullary nails to obtain alignment of diametaphyseal fractures of the distal tibia, and present our results. **Methods:** 25 distal tibial diametaphyseal fractures who were treated with this technique were identified. **Results:** There was no case of non-union or malunion at the last follow-up. all patients had postoperative fracture angulation that was less than 5° degrees in the coronal and sagittalplanes. **Conclusion:** Steinmann pin function essentially as a Poller screw for centralization of the nail and help to ensure reduction. Locking the nail in different directions, appropriate reduction can be maintained until the boneheals and there is no need for additional fixation material.

Keywords: Pollerscrews; Diametaphyseal fractures;Intramedullary nailing, ST pin

Introduction

Intramedullary nailing is an accepted treatment method for tibial shaft fractures. However, misalignment can occur with intra medullarynailing of distal tibialdiameta physeal fractures [1,2,3,4,5]. Such misalignment occurs because of technical difficulties in achieving satisfactory fracture reduction and biomechanical stability secondary to the differences between the diaphyseal and metaphyseal diameter of the intramedullary canal [6,5].

Several important technical points must be taken into account when using an intramedullary nail tofix distal tibial diametaphyseal fractures. The use of Poller screws may help to achieve satisfactory fracture reduction and biomechanical stability. Kretteke*t al* first described placing Poller screws around an intramedullarynail to obtain satisfactory alignment and provide additional stability [2]. Biewener*et al* described the "palisade method" for the treatment of distal tibial diameta physeal fractures [1]. They placed K wires sequentially to guide an intramedullary nail with a good central position into a distal short fragment. After proximal and distal fixation of the nailin different planes, the K wires were removed. Because of the improvements in nails that can belocked proximally and distally in a multi planar fashion, we believe that there is now no need to place Poller screws for the prevention of reduction loss. Indeed, modern nailing systems allow the nailsto be locked in different planes to better stabilize the fracture site [7]. We here in report a technique using provisional 4.0 mm ST pin that similarly to Poller screws in the treatment of distal tibial diameta-physeal fractures and present our ou tcomes using this technique.

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Materials and Methods

Over the period from December 2014 to September 2017, 25 intramedullary nailings were performed for diametaphyseal fractures distal tibiain the department of orthopaedics and traumatology, GMC Bhopal and Hamidia Hospital. the study was prospective study in which 5 patients were lost to follow-up. 20 patients who were treated with both a intramedullary nail and provisional ST pin were identified.

Inclusion criteria: distal tibia fracture presented with in 3 days of injury, age within 20-70

Exclusion criteria: intraarticular distal tibia fracture, <20 and >70, pathological fractures, associated other fractures. 16 of the patients were men and 4 were women. The mean age was 43 (20-70). The mechanisms of injury were motor vehicle accidents (*n* = 16), falls (*n* = 4). When classified according to the Orthopaedic Trauma Association classification [8], 12 distal tibial diameta physeal fractures were type 42 B1 and 8 weretype 43 A1. Knee and ankle range of motion exercises was started at postoperative first day and weight bearing was allowed after 6 weeks of follow-up

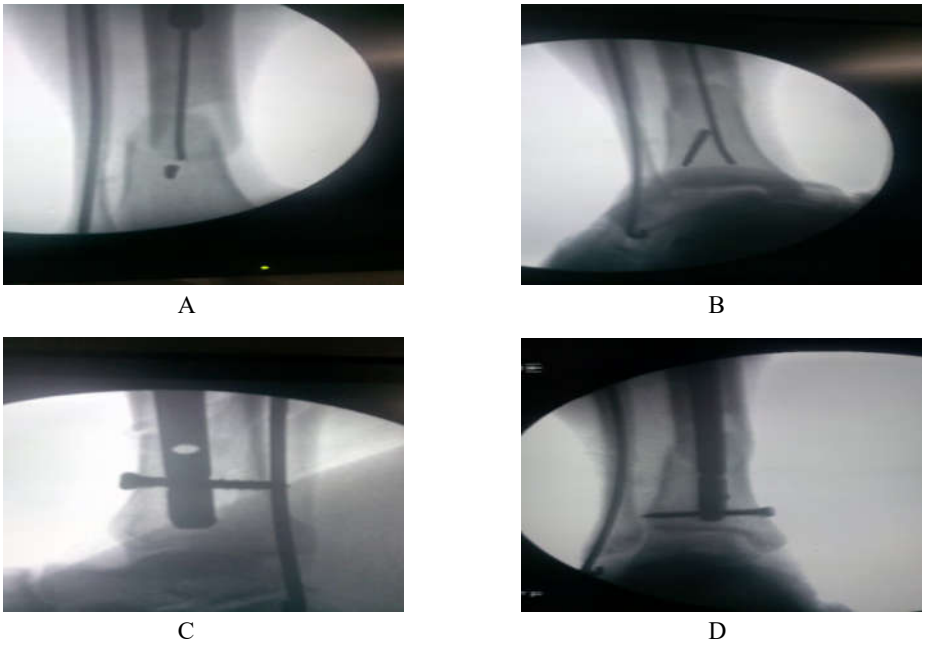
Surgical case with technical tips for tibial nailing- The patient was positioned supine on a radiolucent table, tourniquet was used. The patient'sknee was flexed over the free end of the table. 4.0-mm ST pin was placed free hand into the proximal portion of the distal fracture fragment before nail insertion.

Longitudinal traction and direct force, as needed, were applied manually to the limbto obtain provisional reduction during passage of the guide wire. Reaming was performed over the guide wire.

A tibial nail of the appropriate length and diameter was inserted over the guide wire. The nail was advanced gently. Fluoroscopic imaging confirmed appropriate alignment of the fracturesite. Two proximal locking screws were placed from mediallateral and from anteromedial to posterolateral. Distally, the nail was locked with two screws incoronal and sagittal plane.

Results

The average follow-up was 21,4 (10-30) months. There was no case of non-union or malunion at the last follow up. all patients had postoperative fracture angulation that was less than 5° degreesin the coronal and sagittal planes. All patients achieved union and maintained the alignment of their fractures.



A B C D

Figure

A: distracted fragments of distal tibia fracture with guide wire in the proximal segment
B: guide wire directed by ST Pin in the distal fragment , thus aligning the fracture and obtaining reduction
C: after nail insertion in lateral view
D: after nail insertion in AP view.

Table 1: Outcome of patients

Complications	Patients
Angular deformity 0^0	12
Angular deformity $>0^0$ but $<5^0$	8
Malunion/ nonunion	None

No non-union, no malunion
No angular deformity > 5^0

Discussion

Although improvements in surgical techniques and implant designs have extended the indications fornailing to metaphyseal fractures of the proximaltibia, distal tibia, and distal femur, concerns about the nailing of these fractures remain. The reported incidence of malalignment is 8.0% to 16.2% for distal tibial fractures [9,10]. Ricci *et al* reported a 10% malalignment rate after treatment of distal-third femoral fractures with retrograde nailing [11].

The use of intramedullary nails alone for the treatment of diametaphyseal fractures is insufficient. Thus, many other reduction techniques have been described together with the use of intramedullarynails to ensure fracture reduction. Donalds and Seligson used "block screws" adjacent to the Küntscher nail to treat tibial fractures, which are predisposed to bending [12]. Krettek*et al* described block screws in their clinical application of tibial and femoral fracture treatment, calling the block screws "Poller screws," as a tool to prevent axial deformities during intramedullary nailing [13,3]. Treatment of diametaphyseal fractures requires careful preoperative assessment. Regardless of the intra operative technique used for treatment, the cause of the deformity should be well understood and the surgery planned accordingly [14]. Stedtfeld*et al* designed a model to show the causes of angulation and reduction loss in diameta physeal fractures and to determine the precise placement for Poller screws, which they termed "transmedullarysupport screws." [6].

They showed that nailing at the diametaphysealjunction produced malalignment ofthe short fragment. If not well understood, incorrect placement of a Poller screw can worsen the alignment of the fracture. In such a situation, changing the position of the screw can be challenging because of additional bone and soft tissue damage, and itmay prolong the surgery. We used ST pin similar to K wires as indicated by Stedtfeld*et al* [16].

The ST pin or K wires essentially function asPoller screws for centralization of the nail and helpto ensure reduction. In this way, we can avoid potential damage and the risks of iatrogenic fractures with Poller screws, including increased stress on the fracture line, screw breakage, reamer damage, andn unnecessary soft tissue dissection [1,14]. Shahulhameed*et al* recently presented their technique using a Steinman pin as an initial step in Pollerscrew placement for the treatment of tibial and femoralmetaphyseal fractures [15]. The authors used Steinmanpins for centralization of the nail and replaced them with Poller screws during the last step of the surgery, after locking the nail. Biewener*et al* describedthe "palisade method" for treatment of distaltibial diameta physeal fractures [1]. They placed the K wires sequentially to guide an intramedullary nail with a good central position into a distal short fragment. After proximal and distal fixation of the nail, the K wires were removed to prevent loss of reduction. The authors concluded that the K wires couldact as a guide to position the nail in a central positionand that reduction could be prevented by locking the screws even in the most distal tibial fractures.

Currently available nailing techniques allow for distal locking, even with a short metaphyseal fragmentor intra-articular extension. In our experience, appropriate reduction can be achieved and maintained by locking the nail in different directions. Işık*et al* recently reported the results of 34 distal tibial diameta physeal fractures treated with intra medullary nails [16]. They showed that when fixation was performed in distal-third tibial fractures by placing two static screws distal and proximal to the intramedullary nail following adequate reduction, the angulations that developed during the period until union were not significant interms of causing deformity. We treated all patients with < 5° angulation. However, multiple distal fixationmay not be sufficient for primary stabilization of distal osteoporotic, small-fragment fractures and for patients with poor bone quality.

Poller screws maybe needed in these patients to improve primary stability. Our study by Dr Deepak et al was limited by the small number of patients and by the fact that it was not a controlled prospective study. The absence of data on the effects of multi directional distal locking on primary stability is another issue.

Larger-scale studies with patient and control groups are needed to address this. According to our study, the location of the ST pin can be readily changed if the location is disliked and quickly replaced in any location. They essentially function as Poller screws for centralization of the nail and help to ensure reduction.

Strength of the study- The study adds to our existing knowledge that ST pin can be used as poller screw to redirect the guide wire in correct position with additional benefit of dynamic nature of ST pin, which can change direction when desired.

Conclusion

In our experience, by locking the nail in at least two different directions for tibial distal diameta physeal fractures appropriate reduction can be maintained until the boneheals. There is no need for additional fixation material. ST pin acts as poller screw to achieve reduction and avoid angular deformity.

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