

## Study of Ender's Nailing in Lower Fourth Fractures of Tibia in Adults

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### ABSTRACT

**Background:** Ender's nailing in lower fourth tibia fracture preserves periosteal and endosteal blood supply & fracture haematoma, which increases chances of fracture union. There is minimal risk of infection. It provides dynamically controlled motion. Stacking of the canal & splaying of nails provides reasonable axial & rotational stability. **Methodology:** This is a study of 20 patients of lower fourth extra-articular closed tibial fractures treated with Ender's nailing. Age was ranging from 20 to 62 yrs. 14 males & 6 female patients were there. Fracture was transverse in 5 patients, short spiral in 5 patients, and oblique in 8 patients & comminuted in 2 patients. Fibula was intact in 5 patients, was fractured at middle or upper third region in 7 patients and at lower third region in 8 patients. 3.5 Ender's nails were used in all patients, four nails in 16 patients & three nails in 4 patients. Average surgery time was 50 minutes, average blood loss was 35 cc. No patients had post-operative wound infection. All patients were immobilized for various time periods. **Results:** Average union time was 16 wks. There were 3 delayed unions. Eventually all fractures united without 2<sup>nd</sup> surgical intervention. In 5 patients there was significant proximal migration of nails, causing slight knee discomfort. Nails were removed after solid fracture union in those cases. Between 1 & 2 cm shortening was found in two patients more than 5<sup>0</sup> varus-valgus or antecurvatum-recurvatum deformity was found in two patients, but not having any symptomatic problem. **Conclusion:** Ender's nailing is a good alternative in lower fourth tibia fractures. It gives increased chances of fracture union with minimal risk of infection. 2<sup>nd</sup> surgery of bone grafting or dynamization of I/L nails is not required. The implants are inexpensive & procedure is simple. But a brief period of post-operative immobilization is required.

**Key Words:** Lower fourth tibial fractures, Ender's nailing, closed reduction.

### Introduction:

Interlocking nailing and plating are most commonly used methods for the treatment of lower fourth tibia fractures in adults. But in interlocking nailing sometimes there is difficulty in getting perfect reduction in lower fourth fractures, many times fracture line extends lower, causing difficulty in passing two distal locking screws or not getting good purchase of screws. In plating<sup>1</sup> stripping of periosteum or muscle attachments<sup>2</sup> can cause damage to the capillary bed, decreasing blood flow at the fracture site delaying fracture union<sup>3,4,5,6</sup> & there is increased chance of infection. In view of above difficulties closed antegrade Ender's nailing was attempted in that type of fractures.

As a method of fixation Ender's nail<sup>7,8,9</sup> provides following features: The technique of insertion being closed, fracture hematoma is preserved with very minimal risk of infection. Insertion without intramedullary reaming does not disrupt endosteal blood supply to the diaphysis<sup>4,5,6</sup>, the

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flexible nails<sup>7</sup> provide dynamic controlled motion, which stimulates periosteal callus formation. Stacking of the canal provides axial stability and the three point fixation produced by each nail affords rotational control. The nails are load sharing implants. The implants are inexpensive, the instrumentation is simple and inventory small. The technique is relatively easy once mastered and provides a consistent swift fixation. Now I describe my experience with the use of Ender's nails in lower fourth extra-articular tibial fractures in adults.

### Materials and Methods:

This is a study of 20 patients of lower fourth extra-articular tibial fractures treated with Ender's nailing in adults. All were closed fractures. Age was ranging from 20 to 62 yrs., average age was 43 years. 20-30 yrs.- 2 patients, 30-40 yrs.- 6 patients, 40-50 yrs.- 7 patients & 50-62 yrs.- 5 patients were there. 14 males and 6 females were there.

Cause of fracture was Road traffic accident in 12 patients, fall from height in 4 patients and domestic fall in 4 patients 12 were right sided & 8 left sided fractures. Out of 20 patients one pt. was having ipsilateral undisplaced fracture medial malleolus, one was having same sided fracture Colle's, one same sided fracture of clavicle and one pt. was having opposite sided fracture 2<sup>nd</sup> & 3<sup>rd</sup> MT foot. Two patients were anemic, two with HT, one with IHD and one having DM.

Fracture was transverse in 5 patients, short spiral in 5 patients, oblique in 8 patients and comminuted in 2 patients. Fracture line (undisplaced) was extending near to subchondral region in 4 patients Fibula was intact in 5 patients, it was fractured at middle or upper third region in 7 pts and was fractured at lower third region in 8 patients On admission patients were given above knee slab, elevation & NSAID started till pt. investigated for surgery. Correct length of nail is measured from opposite leg, length is taken from the tip of tibial tuberosity to the tip of medial malleolus & subtract 2.5 cm or from the tip of tibial tuberosity to ankle joint line & subtract 1 cm from it.

Pt. is taken on fracture table, with calcaneal S.T. pin traction is given to achieve reduction. Nails are introduced in antegrade (proximal to distal) direction. First hole is made in the medial tibial condyle (sometimes lateral first) 2.5 cm distal to the articular surface. Entry point is confirmed with IITV. The owl is advanced into the proximal medullary canal. The nail is given slight bending at the tip & slight general bending (less as compared to Ender's nailing in femur), then introduced into the proximal tibia, reduction checked under IITV and then the nail is introduced across the fracture site into the distal fragment under IITV guidance. At this stage the reduction may not be perfect but it gets corrected by rotating the nail at times, and at other times by introducing other nails. The nail is pushed up to subchondral region. The second nail is introduced similarly from lateral aspect. Further two (sometimes one) nails introduced one from each side. Proximal end of the nails must not protrude much from hole, otherwise later on with slight proximal migration it may cause problem at knee. We used 3.5 Ender's nails in all cases. Four nails in 16 patients and three nails in 4 patients. In all patients close procedure was done.

Total time taken for surgery was between 30 min. to 1 hour in 14 patients and between 1 and 1.5 hours in 6 patients, average being 50 minutes. Average blood loss was about 35 cc. No patients had post-operative wound infection. No patients had post-operative systemic or other local complications.

In 5 patients where fibula was intact we continued above knee slab for 3 weeks, then started intermittent non wt. bearing mobilization, In all other cases we have given above knee plaster after stitch removal on 11<sup>th</sup> post-operative day, which was continued up to 6 weeks. Post-operative (in comminuted fracture 8 weeks Post-operative). Partial wt. bearing was started at 6 weeks In 5 patients, 8 weeks in 8 patients, 10 weeks, in 5 patients & 12 weeks in 2 patients.

### Results:

During follow-up, status of union, functional evaluation and complication if any were assessed in the following manner: **1.** Patients were asked about any subjective complains like pain, swelling, range of movements, loss of function, weight bearing etc. **2.** Movements of knee, ankle and foot were checked. **3.** Standard antero-posterior and lateral X-rays were taken to assess the radiological union. (We considered the fracture united when the callus had matured and the fracture line was obliterated in at least three quarters of the bone circumference.) **4.** Any complication like infection, implant failure in any form was checked. **5.** Clinically tenderness and abnormal movements at fracture site were checked.

Time taken for fracture union was between 10 to 14 weeks in 6 patients, between 14 to 20 weeks in 11 patients and more than 20 weeks in 3 patients. All fractures united eventually without 2<sup>nd</sup> surgical intervention. Average union time was 16 weeks. There were 3 delayed unions. In 5 patients there were significant proximal migrations of nails causing slight discomfort at knee, but no one requiring any operative intervention before fracture union. In all those cases implants removed after solid fracture union occurred. In rest of the cases implants were kept in situ. No implant breakage found in any cases. There was no wound infection found in any cases. At final follow-up no pain or swelling found in 18 patients, occasional in 2 patients.

There was significant restriction of knee movement in 5 patients in which nails were slightly backed out, but after implant removal in that cases knee movements improved, only one pt. was having some residual knee stiffness. Some restrictions of ankle movements were found in one pt. at final follow-up. Shortening up to 1 cm was found in 2 patients & between 1 and 2 cm was found in 2 patients more than 5<sup>o</sup> varus-valgus or antecurvatum-recurvatum deformity was found in 2 patients, but were not causing symptomatic problem. No pt. had significant rotational deformity.

**Image 1-** AP & Lateral X-rays of Lower end of Tibia before Nailing



**Image 2-** AP & Lateral X-rays of Lower end of Tibia after Nailing



**Discussion:**

Two distinct fracture patterns were there<sup>10</sup>. Direct bending forces produced simple transverse & oblique tibial fractures with same level fibular fractures and no intra-articular extension. Torsional forces caused spiral fractures, usually with different level fibula fractures and many of those were having intra-articular extension.

According to literature<sup>10</sup> fibula is plated only if necessary for the stability of the ankle joint or if it is severely displaced along with intramedullary nailing of distal tibia fractures. Some investigators believe that plating same level fibula fractures helps prevent malalignment in distal tibial fractures treated with intramedullary nailing<sup>10</sup>. In our series of Ender's nailing we didn't fix fibula, but we have immobilized limb with either plaster slab or cast for longer time period, as union time is more in lower fourth fractures. In our series in two patients who had more than 5\* deformity, had started weight bearing earlier in spite of instruction. In two patients who had more than 1 cm shortening, were having comminuted tibial fractures. One pt. who had residual knee stiffness was having OA knee. One patient who had residual ankle stiffness, had not followed physiotherapy instructions properly.

We used four (sometimes three ) 3.5 Ender's nails in all patients instead of two or three 4.5 nails, as they are easier to introduce & chances of splintering bone near fracture is less with them. It is also advocated to lock the nails by inserting 3.5 cortical screws from the eyes of the nails to reduce back-out of nails. We have no experience regarding that.

To achieve and maintain proper reduction of fracture & to reduce nail back-out, maximum possible number of nails should be inserted. Also subchondral placement & fanning the nails in different directions at lower ends is important for that. Nails should be inserted from both medial & lateral sides. To reduce knee irritation by backed out nails, entry should be minimum 2.5 cm distal to knee joint articular surface. Medial & lateral entry points must be at slightly different levels to minimize weakening of proximal tibial bone.

**Conclusion:**

According to our study, Ender's nailing is a good alternative in lower fourth tibia fractures. As it is closed procedure, there is minimal risk of infection. As fracture hematoma is not drained & endosteal and periosteal blood supply is not disturbed, there is increased chances of fracture union. Second surgery of bone grafting or dynamization of I/L nail is not required. It gives dynamic controlled motion with reasonable axial & rotational stability. The implants are inexpensive & procedure is simple.

Patient's limb requires immobilization with either plaster slab or cast for longer time period. There are slightly increased chances of deformity or shortening of the limb, particularly when weight bearing started earlier. There is some knee discomfort in some patients, which requires implant removal after fracture unites. IITV is mandatory for this procedure.

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