

## Original Research Article

# To study outcome of surgical management of distal 3rd and proximal 3rd fractures of tibia in adults using expert tibial nails

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## ABSTRACT

**Background:** Tibia is most commonly fractured long bone. Within few years population of India and number of vehicles has increased very much. This has lead to manifold increase in not only rate of tibia fracture but also in complexity of fracture. Using interlocking nail in tibial fracture with short proximal and distal fragment render it unstable leading to frequent loss of reduction causing malunion. Multidirectional interlocking screws ensure that alignment can be well maintained and stability preserved in short proximal or distal tibial segments.

**Methods:** A prospective, non randomized study was conducted comprising of 30 patients of proximal and distal 1/3rd fracture of tibia in, Department of Orthopaedics, Bokaro General Hospital. The method used for fracture fixation was open/closed reduction and internal fixation with expert tibial nail. The duration of study was June 2013 to June 2016. The data thus obtained was evaluated in terms of mode of injury, associated injury, fracture pattern, etc. Also outcome was measured and complication were evaluated and treated. Functional outcome was evaluated using hospital for special surgery (HSS) knee score.

**Results:** All 30 patient were followed up successfully during period of 3 years. The mean duration of radiological union in this study was 20.6 weeks, though it ranged from 18 to 26 weeks. 8 patients developed some complication in form of superficial infection, malunion etc but none of the patient had non-union of fractured bone. On the basis of hospital for special surgery (HSS) knee score 13 patients had excellent results; 9 had good results, 05 had fair results and 3 had poor result. Mean HSS knee score was 82.3 (SD 15.3) after 3 years of follow up.

**Conclusions:** Expert tibial interlocking nail is good treatment option for distal and proximal 1/3 fracture of tibia especially in non intra-articular fracture. It can be used in simple intra-articular fracture but additional hardware is required.

**Keywords:** Expert tibial nail, Tibial fractures, Fracture fixation, Early mobilization, Lysholm knee scoring scale

## INTRODUCTION

Fractures of tibia shaft are increasing due to industrialization, growing population and high velocity trauma.<sup>1</sup> Descriptions of the treatment of tibial fractures are included in the Edwin Smith Papyrus, an ancient Egyptian medical text dating back to at least 1500 to

1600 BC.<sup>2</sup> Prior to the modern era of antibiotics and sterile surgical techniques open tibial fractures not infrequently resulted in amputation or death. Because of its subcutaneous position, the tibia is more commonly fractured, and more often sustains an open fracture, than any other long bone. The blood supply to the tibia is more precarious than that of bones enclosed by heavy muscles.<sup>3</sup>

The presence of hinge joints at the knee and the ankle allows no adjustment for rotary deformity after fracture, and special care is necessary during reduction to correct such deformity. Delayed union, nonunion, and infection are relatively common complications of tibial shaft fractures.<sup>4,5</sup> Although the preferred method of surgical fixation varies geographically and by surgeon age and training, the vast majority of adult tibial fractures are treated operatively in the modern developed world.<sup>6</sup> Multiple studies have demonstrated that nonoperative management is associated with poorer results when compared to IM nails with reference to nonunion, malunion, return to work, outcome scores, or time to union.<sup>7</sup>

IM nailing is the most common treatment of tibial diaphyseal fractures.<sup>8</sup> An international survey indicated that surgeons preferred nail fixation for 96% of closed fractures and lower grade open fractures. This practice trend is supported by multiple prospective randomized trials and a systematic review of the literature that supports the outcome of nail fixation over closed treatment.<sup>9</sup>

The appeal of immediate knee and ankle motion with less frequent follow-up, often coupled with immediately being allowed to weight bear makes tibial nailing desirable to many patients and clinicians particularly as the outcomes of RCTs have favored operative fixation over closed treatment in terms of nonunion, malunion, complications, and time to return to work.

The expert tibial nail was introduced worldwide in 2005 as a universal intramedullary implant for tibial fractures. The numerous multiplanar locking options at the proximal and distal end allow for secure stabilization of metaphyseal fragments. Certain intraarticular tibial fractures can be addressed by intramedullary nailing in combination with other implants. Results from the prospective clinical evaluation compare favorably to the use of standard nails. In the proximal metaphysis spongy bone screws achieve an optimized purchase in the cancellous bone. Multidirectional interlocking screws ensure that alignment can be well maintained and stability preserved in short proximal or distal tibial segments. The end cap achieves angular stability between the proximal oblique screw and the nail. These changes in implant design enhance the stability of the bone-nail construct and reduce the risk for secondary malalignment.<sup>10,11</sup>

## METHODS

A prospective, non-randomized study was conducted comprising of 30 patients of proximal and distal 1/3rd fracture of tibia in Orthopaedics Department, Bokaro General Hospital. The method used for fracture fixation was open/closed reduction and internal fixation with expert tibial nail. The duration of study was June 2013 to June 2016. Information on gender, age, injury

mechanism, side, fracture classification with associated injuries, etc was recorded for these patient. The inclusion and exclusion criteria are mentioned below as given in Table 1.

**Table 1: Showing inclusion and exclusion criteria's taken in the present study.**

Inclusion criteria	Exclusion criteria
Adult patients above age 18 years.	Patients aged less than 18 years.
Proximal and distal third tibial metaphyseal fractures.	Patients medically unfit for surgery.
Patients with open fracture tibia- Gustilo-Anderson type I and type II.	Patient not giving consent for procedure.
Knee flexion more than 90 degree.	Knee flexion less than 90 degree.
	Patient with knee arthroplasty of affected limb.

## Surgical procedure

Standard intramedullary surgical procedure was used. Patient was placed supine with knee folded to 90 degree. Patellar tendon splitting approach was used. Entry point was made with awl under c-arm guidance. For proximal tibial fracture entry point was made in line with lateral tibial spine and for distal third fracture entry point was made in line with medial tibial spine.<sup>12</sup> Blocking screw was used whenever needed. At least 4 proximal screw were used in proximal third fracture and 3 distal screw were used for distal third fracture. For intra-articular fragment some additional hardware like cannulated screw were used.

## Post-operative care

Active and passive knee exercises with non-weight bearing were given as soon as patient started tolerating pain. Toe touch weight bearing was given after 4 weeks and full weight bearing was given as soon as there is radiological evidence of callus.

## Outcome measures

All patients were followed up clinically for a mean of 3 years (range from 18 to 26 months). The clinical evaluation was performed using the Hospital for Special Surgery (HSS) knee score<sup>17</sup>. The assessment included a record of the patient's pain level, range of movement at the knee, muscle strength, instability, flexion deformity, and functional level. Each patient's affected range of movement was compared with the contralateral knee. The HSS results were classified as excellent (>85), good (70–84), fair (60–69), or poor (<60).

### Statistical tool

Statistical testing was done with statistical package of social science system version SPSS 17.0. continuous variables were presented as mean $\pm$ SD. Categorical variables are presented as absolute numbers and percentage.

## RESULTS

We studied 30 patients with 30 fractures of tibia. Of these 18 patients were males and 12 patients were females. Also of these 26 patient were having fracture in distal 1/3<sup>rd</sup> tibia and 4 patient were having fracture of proximal 1/3<sup>rd</sup> tibia. The mean age was 37.2 years ranging from 20 to 68 years. 28 of the fractures were caused by high energy trauma like road traffic accidents and fall from height while 2 fractures were due to low energy trauma like a simple fall. 17 patients had fracture of right tibia while 13 of left side.

**Table 2: Gender distribution and average age.**

Gender	Number of patients (n =30)	Percentage	Average age
Male	18	60	36
Female	12	40	39
Total	30	100	37.2

**Table 3: Relationship between age and grade of injury.**

Age group	Low energy trauma	High energy trauma
20-30	0	12
31-40	0	8
41-50	0	4
51-60	0	4
>60	2	0
Total	2	28

28 patients were treated with closed reduction and internal fixation while 2 patient was treated with open reduction and closed fixation (only in open fracture). The average interval between admission and operation was 6.8 days (range 2 to 12 days). Though majority of the patient in this study who were operated early  $\leq 7$  days had an apparently better functional outcome than those who had a delayed surgery  $\geq 7$  days, it was statistically not significant ( $p=0.389$ ).

Average duration of surgery was 95 minutes with shortest duration being 60 minutes and longest being 135 minutes. The expert tibial nail (based on the length of leg) of 320 mm length and radius of 11 mm were most commonly used.

**Table 4: Relationship between injury-surgery interval and functional score.**

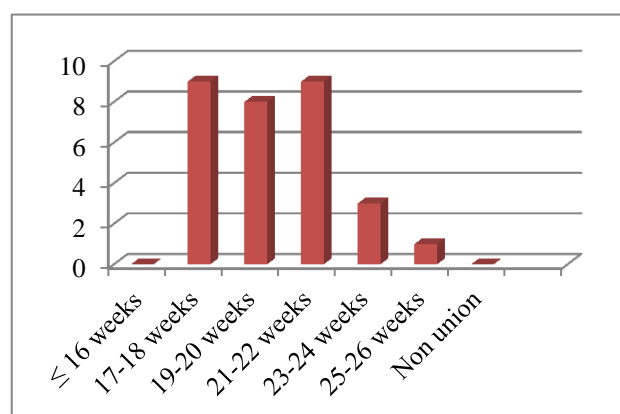
Injury – surgery interval (days)	No of patients	Functional outcome			
		Excellent	Good	Fair	Poor
$\leq 7$	17	10	6	1	0
$> 7$	13	8	3	1	1

**Table 5: Duration of surgery.**

Duration of surgery (min)	No of patients	Percentage
$\leq 90$	17	56.6
91-120	9	30
$> 120$	4	13.3

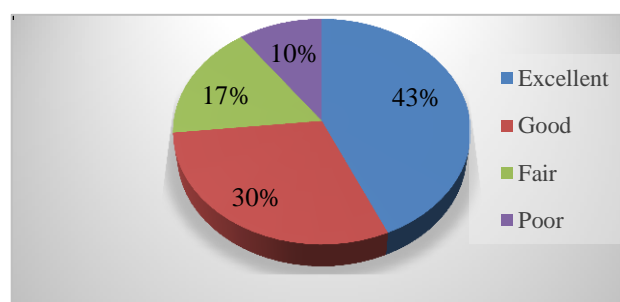
Mean = 95 min

The mean duration of radiological union was 20.6 weeks, though it ranged from 18 to 26 weeks (as shown in bar diagram below).



**Figure 1: Radiological union.**

On the basis of hospital for special surgery (HSS) knee score 13 (43%) patients had excellent results; 9 (30%) had good results, 05 (17%) had fair results and 3 (10%) had poor result. Mean HSS knee score was 82.3 after 3 years of follow up (as shown in pie chart above).



**Figure 2: Functional outcome using hospital severity score.**



**Figure 2: (a) Preoperative X-ray –AP; (b) Preoperative X-ray –LAT; (c) Postoperative X-ray AP and LAT; (d) 6 month follow up X-ray.**

## DISCUSSION

Tibia is most common fractured long bone mostly caused due to road traffic accident. With advancement in technology implant design has continuously changing from kuntschner nail to anatomical non locking nail with Herzog bend to locking nail to present expert tibial nail. Many studies has shown its better outcome as compared to previous locking nail.

In a study conducted by Trilica et al, between December 2005 and 2007, 41 patients with diaphyseal tibial fractures were treated with expert tibial nail.<sup>13</sup> This study proved that expert tibial nail provides sufficient stability of diaphyseal tibial fractures including those involving metaphysis.

In a study conducted by Hansen et al 181 patients with 186 tibial fractures were treated with expert tibial nail.<sup>14</sup> They showed that risk for valgus, varus or antecurvation malalignment of more than 5 degrees in any plane on radiographic long leg views was 4.3% for shaft fracture, 1.5% for distal fractures and 1.3% for proximal fractures.<sup>5</sup>

Attal et al conducted a study on 190 patients who were treated with expert tibial nail out of which 108 patients had tibial shaft fractures, 56 had distal fractures and 21 segmental fractures.<sup>15</sup> Non-union occurred in 9 cases after 1 year follow-up. Dynamisation was performed in 10 cases. Valgus or varus and recurvatum or antecurvatum malalignment of more than 5 degrees occurred in 13 cases. Stable reduction was achieved in 144 cases. In 4 complex fractures initial reduction went into malalignment. Two patients developed deep infection after third degree open fracture.

Ding-Chuan Zhu et al in his study showed that Compared with plate and screw fixation, ETN fixation has the advantages of fewer complications, shorter operation time, being less invasive, earlier postoperative rehabilitation and weight bearing, quicker fracture union and better functional recovery, thus being an effective way to treat two segmental tibial fractures.<sup>16</sup>

However use of expert tibial nail is more complicated as compared to normal tibial nail. Due to large medullary canal in proximal and distal third tibial there is frequent loss of reduction may requiring use of blocking screw.

## CONCLUSION

Treatment of proximal and distal third fracture of tibia by expert tibia nail shows excellent to good outcome in our study. Following ideal surgical guideline for expert tibial nail is recommended. Achieving reduction first followed by ideal portal for entry point is must. Early post-operative rehabilitation provides optimal outcome. However larger study with longer duration of study is needed for evaluation.

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