



## TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOMES OF INTRAMEDULLARY OSTEOSYNTHESIS OF SUBTROCHANTERIC FEMUR FRACTURES IN ADULTS WITH LONG PROXIMAL FEMORAL NAIL

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### ABSTRACT

**Background:** The subtrochanteric fractures accounts for 10-34% of hip fractures. Operative treatment is gold standard in adults in view of anatomical location, deforming forces & vascularity issues. Intramedullary device are less invasive, more biological & mechanically stable whereas extramedullary methods achieves better anatomical reduction but at the expense of vascularity. However, there is still no consensus over the methodology for being the best for these fractures.

**Objective:** To evaluate clinical, functional and radiological outcomes of intramedullary osteosynthesis of subtrochanteric femur fractures in adults with long PFN.

**Methods:** A prospective randomized control study was conducted on total 30 patients of subtrochanteric fractures and treated with long proximal femoral nail (PFN). All the patients were followed up for a maximum of 24 weeks. Outcomes were observed & analysed such as tip apex distance, duration of surgery, complications, functional and radiological outcomes.

**Results:** The average age of patients was 43.6 years  $\pm$  13.26. Left sided fracture were more than right sided fracture. The most common type of fracture as per AO-ASIF classification was 32-C3 (53.33%). In 21 patients compression screw used was 95mm or above. Derotation screw of size 85mm or above were inserted in 19 patients. Mean TAD of compression screw and derotation screw was 11.59 and 13.81 respectively. Closed reductions was achieved in 27 patients. Mean surgical time was 157 minutes. Mean radiological union time of fracture was 14.16 weeks. Mean Harris hip score at 24 weeks was 84.56.

**Conclusions:** It is concluded that intramedullary fixation by long PFN is a sound and effective modality for the subtrochanteric fractures. Subchondral fixation of both proximal screws probably has led to better stable fixation with hundred percent union rates and no implant failure.

**KEYWORDS :** Subtrochanteric, Long Proximal Femoral nail, Tip Apex Distance, Functional and radiological outcome

### INTRODUCTION:

The subtrochanteric region of the femur is considered 5 cm below lesser trochanter, consists primarily of cortical bone. Young patients are involved in high energy trauma & older patients involved in low energy trauma. The goals of therapy for subtrochanteric fractures include anatomic alignment, stable fixation, early mobilization and effective rehabilitation.<sup>2</sup> Subtrochanteric fractures of the femur presents a challenge for treating surgeon because of the deforming forces at fracture site, varying degrees of proximal comminution and precarious blood supply. Various fixation options include intramedullary(IM) and extramedullary(EM) implants.<sup>1</sup> Theoretically, IM fixation has been preferred option than EM fixation. IM fixation controls concentric collapse of the fracture fragments which facilitates & hastens fracture healing and early weight bearing can be done as per fracture fixation & anatomy. With the advent of minimally invasive surgery, biological plating and locking compression plate (LCP) have shown equally good results. There is still no consensus over the methodology (IM/EM) for being the best for these fractures.<sup>10</sup>

The main purpose of our study was to evaluate clinical, functional and radiological outcomes of intramedullary osteosynthesis in subtrochanteric femur fractures in adults with long PFN.

### Methods:

**Methodology:** The present prospective study was carried on 30 patients at Maharaja Agrasen Medical College, Agroha, Hisar in patients of subtrochanteric fractures attending emergency and out-patient department from February 2020 to September 2021. The study was duly approved by the Institutional Ethics Committee before starting the study.

**Inclusion Criteria:** Patients with subtrochanteric fracture, age above 18 years, ambulatory before injury & fit for anaesthesia.

**Exclusion Criteria:** Patients with pathological fractures due to

metastasis, tumours except osteoporosis, open fractures, medically unfit for anaesthesia, patients with psychiatric illness, chronic neuromuscular disorders and trauma duration more than 2 weeks.

Fractures were classified using AO-ASIF classification.<sup>3</sup> All cases were operated on fracture table with standard approach for long PFN. Five days intravenous antibiotics and appropriate analgesic were given. Hip and knee physiotherapy started on 2nd postoperative day. Partial and full weight bearing was started as early as patients' tolerance and nature of fracture. Each patient is followed up and assessed clinically, functionally and radiological at 4, 12, 18 and 24 weeks. Harris hip score (HHS) was calculated for functional outcome. Radiological assessment was done for medial cortical continuity or comminution, mal-alignment, complications like screw cut out, implant breakage and fracture union. Depending on these criteria, results were observed and compared with other studies.

### RESULTS:

The average age of patients was 43.6 years. Males patients (83.3%) predominated the study. Left sided fracture were more than right side. Most common cause of fracture was high energy trauma. The most common type of fracture was 32C3. Close reduction of fracture was attempted in all 30 patients but succeeded in 27 patients. Out of 27, in 23 patients reduction was achieved directly by fracture table & manual manipulation and in remaining 4, indirect closed minimally invasive reduction was done by back of Stienmann pin through stab incision (3 patients) or Schanz pin as a joystick in distal fragment (1 patient). However, remaining 3 patients were managed by mini open reduction methods aided by Hohmann lever, bone hook and/or reduction clamps. In 21 patients compression screw used was 95mm or above. Derotation screw of size 85mm or above were inserted in 19 patients. Mean TAD of compression screw and derotation screw was 11.59 and 13.81 respectively. Mean surgical time was 157 minutes. All fractures united radiologically in average duration of 14.16 weeks (Table 1 showing all significant parameters). Mean Harris hip score at 24 weeks was 84.56.

Table 2 showing functional outcome at 24 weeks. In any patient no screw complications (cut out, breakage, migration) and implant breakage was observed. Table 3 show post op complication in which Six patients presented with limb shortening. Delayed union was seen in one patient for which dynamisation was done at 12 weeks and united at 18 weeks. Superficial infection was there in three patient for which dressing and intravenous antibiotics was given. There was one patient who presented with DVT got relieved after thrombolytic therapy.

**Table 1: Final Parameters At 24 Weeks Follow Up**

Parameter	Results
Duration of surgery (minutes)	157
Closed reduction	27
Mini open reduction	3
Post reduction medial contact	17
Post reduction medial comminution	13
Tip apex distance of compression screw(cm)	11.59
Tip apex distance of derotation screw (cm)	13.8
Nonunion	0
Union in weeks	14.16
Harris hip score	84.56

**Table 2: Functional Outcome By Modified Harris Hip Score**

Outcome	Number of patients
Excellent (>89)	11
Good (80-89)	11
Fair (70-80)	8
Poor (<70)	0

**Table 3: Postoperative Complications**

Complications	No of patients
Superficial infection	3
Deep vein thrombosis	1
Shortening (<1cm)	6
Delayed union	1
Screw migration (Z effect, Reverse Z effect) & cut through	0
Implant breakage	0

#### DISCUSSION:

The subtrochanteric anatomy is closely associated with clinical treatment. Vascular supply contributes to fracture healing. Demographic parameters are assessed and found to be insignificant. As per AO classification in our study, 32C3 was the most predominant fracture. These 32C3 fracture corresponded to severely comminuted fracture in Russell-Taylor classification and Seinsheimer classification which have been used by different studies.<sup>4,5,6,7,9</sup>

The mean operative time was 157 minutes which was little longer than reports by others.<sup>5,8</sup> This was due to zeal & effort to achieve adequate close reduction (27 patients in our study). In four cases, guide wire was negotiated by minimally invasive closed indirect methods and in 3 cases by mini open reduction to achieve adequate reduction. The closed methods lead to preservation of the fracture hematoma and soft tissue envelope around the fracture site which aids in fracture healing. Zhou et al reduced fractures predominantly by open reduction methods and had lower union rates.<sup>7</sup> All fractures in our study united in mean duration of union is 14.17 weeks. It highlights that the balance of vascularity & biology of fracture by closed & minimally invasive methods and stability of fracture in an anatomical position & maintenance of stable alignment by an appropriate implant.

In present study, there was medial cortical contact post reduction in 17 patients & medial comminution in 13 patients was seen. No significant difference in union time in these two sets of patients but better early functional outcomes were seen in patients with medial cortical contact. In 21 patients Compression Screw used was 95mm or above. Derotation Screw of size 85mm or above were inserted in 19 patients. In present study, in none of patient the value of TAD was more than 20 mm for Compression Screw (mean TAD=11.59) and 25 mm for Derotation Screw (mean TAD=13.81). There were no cases of screw complication. Yadav et al correlated their more TAD with reverse Z effect.<sup>9</sup> We conclude that keeping TAD minimum gives better strong stability for early union. It further reduces, minimizes or abolishes screw complication (breakage, migration or cut through).

Delayed union was seen for which dynamisation was done and also united. Superficial infection was seen in three patient and went on to

heal. There were no case of varus deformity as reported in other studies.<sup>6,9</sup>

In our study, excellent results were seen in 11 patients as per HHS (Table 2) & none of the patient had poor result. Functional outcomes in our study are comparable or better than other studies.<sup>6,7</sup>

#### CONCLUSION:

Intramedullary fixation by long PFN is a sound and effective modality for the subtrochanteric fractures. Subchondral fixation of both screws probably has led to better stable fixation for hundred percent union rates and no implant complication. Higher percentage of closed reduction have met with high union rates. Fractures having severe comminution with no medial contact, also united in similar time period, proves the value of vascularity, biology & soft tissue envelope. Long term studies are required, in terms of larger number of patients and long duration of follow up, to know the status of consolidating united bone and fate & effect of the implant.

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**Conflict Of Interest:** None declared

**Ethical Approval:** The study was approved by the institutional ethics committee

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