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## Functional outcome of inter trochanteric fractures of femur in adults treated with short proximal femoral nails

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### Abstract

**Background & Aim:** Intertrochanteric fractures in adults are common fractures & osteoporosis leads to significant complications associated with the fractures, prolonged immobilization, high morbidity & mortality. Hence the aim of the study was to see the effectiveness of Short Intramedullary Proximal Femoral Nail in these types of fractures.

**Material & Methods:** In the current study total 30 patients were followed who presented at the tertiary level centre for Orthopaedics. Average age of the study group patients was 62 years. The patients selected between the duration total six months & were followed up for total 12 months. Patients regularly followed till radiological union & evaluated with harris hip score for functional outcome. The main focus given in the proper technical operative steps & strict guarded mobilization.

**Results:** Partial weight bearing allowed in 20% of patients at 4 weeks post operatively & in 80% of patients after 4 weeks. Average radiological union time was 2.5 months. 73.33% fractures unite in between 8-16 weeks duration. Three patients had some varus fracture union. One patient had upper screw cutout from the head & later on superior screw removed after union. One patient had avascular necrosis of head of the femur early changes (Ficat Arlet stage 1) at the end of 6 month. One patient has wound gaping with superficial skin & subcutaneous infection. One patient had nonunion implant failure & revision surgery performed. 80% of patients had good to excellent harris hip score. Average operative time was 55 minutes.

**Conclusion:** The short proximal femoral nail allows surgeon for easier insertion of the nail (only proximal reaming) & Minimal blood loss all leads to less complications. Good knowledge & application of proper surgical technique intraoperatively is important. Careful patient & fracture selection & early guarded vigilant mobilization are crucial factors for good management of intertrochanteric fractures.

**Keywords:** Intertrochanteric, short, functional, nail, fractures

### 1. Introduction

Intertrochanteric Femur fractures are very common femur fractures & especially in the elderly. Treatment of intertrochanteric fractures remains controversial with senile life style & high expectancy of life. Osteoporosis, advanced age, female gender & postmenopausal osteoporosis with history of only trivial fall & increasing road traffic accidents all leads to increasing incidence of intertrochanteric fractures. With the rich blood supply at the proximal femoral region intertrochanteric fractures rarely goes into nonunion but malunion is common. The ancient conservative method is now no longer acceptable.

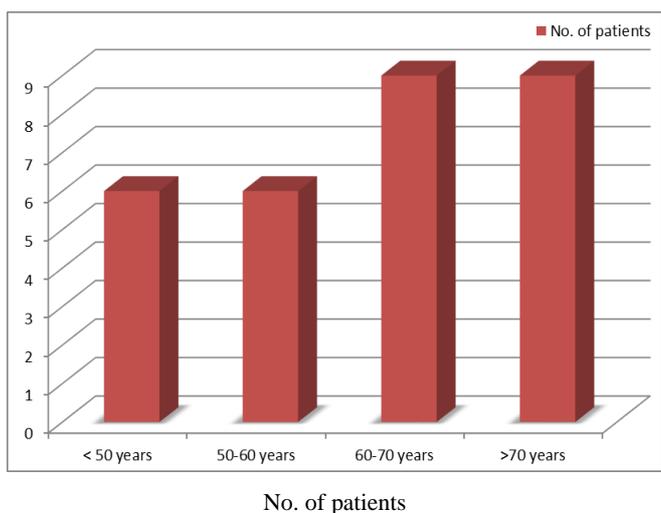
There are different methods of fixation prevails, differentiated in plating & nailing. Since long time there are many fixation methods like different designs of hip plate fixation devices, different designs of intramedullary nail fixation devices, multiple enders nail etc. & many have been also evaluated traditionally with conservative method. With short lever arm, intramedullary device, minimally invasive fracture handling, short duration of surgery & sturdy implant all leads the intramedullary device more trustworthy as far as these biomechanically & structurally more challengeable fractures. Proper selection of implant, good reduction of fracture and proper surgical technique minimize the risk of failure, re intervention, morbidity & mortality.

Proximal femoral (PFN) intramedullary nails have given promising results for fixation of intertrochanteric fractures. Especially short PFN can give good outcome with all the advantages of long PFN along with short surgery time & reduced implant cost. There are some evidence that short PFN may leads to increased thigh pain & stress at the nail tip making patient vulnerable to periimplant stress fractures. In Our study we have evaluated the functional outcome of short proximal femoral nail (PFN).

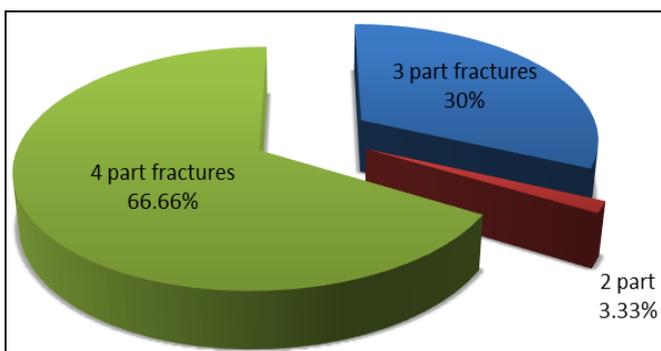
**2. Material & Methods**

In the current study total 30 patients were followed who presented at Gujarat Adani Institute of Medical Sciences, Bhuj, Kutch, Gujarat, India; the tertiary level centre for Orthopaedics between the duration of August 2019 to January 2020 (total six months) & were followed up till July end 2020(total 12 months). All the patients were operated by senior orthopaedic surgeons.

In the current study 6 patients were of <50 years of age,6 patients were 50-60 years of age,9 were 60-70 years, 9 were >70 years.30 years was the minimum age where as 95 was the maximum age. Average age was 62 years.17 patients female & 13 patients male.25 patients had trivial fall at home history while 5 patients had accident & trauma history. All the patients have injury & first hospital consultation duration was less than 48 hours. Diabetes, Hypertension, COPD, Benign Prostatic Hypertrophy & Dementia were common associated comorbidities.



The fractures were diagnosed by AP & LAT hip Xrays & PBH –AP Xrays. Fractures were classified accordingly the Boyd & Griffin’s [21] classification. According to that 20 patients (66.66%) had 4 part fractures, 9 patients (30%) had 3 part fractures & 1 patient (3.33%) had 2 part fractures.



Boyd & Griffin's classification

In the current study all the patients have been treated by short proximal femoral nail. All the fractures reduced by closed reduction method under IITV guidance & fracture traction table. Intraoperatively 27 patients (90%) given spinal anesthesia where as 3 patients (10%) given general anesthesia. Average operative time was 55 minutes (minimum 40 minutes & maximum 90 minutes). Average blood loss intraoperatively was approximately 4-5 mops. (Roughly A mop is 50 ml.)

**2.1 Surgical Steps**

Limb was painted and draped under sterile condition. A 5-7cm incision was taken above the tip of the greater trochanter & reached deeply upto the gluteus medius muscle. Entry point taken with awl/guide pin over a protector sleeve on the tip of the greater trochanter AP and lateral position .After Guide wire insertion Reaming of the proximal femur is done up to the proximal part of the nail to be introduced. Nail is fixed on the jig and the alignment is checked. Then the nail is inserted into the femur. The position of the holes for the proximal screws is checked in the C-arm for the depth of the nail.

Guide pins for the screws: Guide wires for the screws are inserted via the jig and the drill sleeve. The ideal position of the guide wires is parallel and in the lower half of the neck in AP views, in a single line in the center of the neck in the lateral views upto 5 mm from the tip of the femoral head. Drilling done over the guide wire generally upto neck or in some dense bone in young patients till the guide wire tip (depending upon the radiological osteoporotic findings of the trabeculae).First the 8mm hip screw is inserted after reaming over the distal one and then the 6mm neck screw. The tip of the screw should be 5mm away from the subchondral bone.

In our micro points of the surgical method the insertion of the screws have been the crucial technical point for the purchase of bone in osteoporosis. Drilling of the upper guide pin avoided till lower screw inserted fully so that to prevent rotation of the hip fragment intraoperatively. The upper screw tip kept 10-15 mm shorter than the distal point of lower screw in the head of the femur under guidance of IITV in the AP view so, that z effect & possible screw cutout can be prevented as per the literature. The distal tip screw was put by the zig only & that had achieved short surgical time. Only proximal reaming was done with the hard proximal femoral reamer. After valgus curve of short PFN reached while inserting the nail by only manual pressure the slow hammering done over the nail to engage snugly into the fracture fragments without distorting them by the valgus curve the proximal end of the nail. On table maximum compression of the fracture achieved by good purchase of screw tip in the head of the femur, releasing the traction manually at the foot end while tightening the terminal 2 cm part of the screws & tightening the lower screw first. Terminal 5 mm tightening of both the screws were done simultaneously to avoid slight possible varus by lower screw. The patients kept hospitalized till day 5 post operatively (first Check dressing on day 3 & second on day 5).1 patient had 7 day post operative hospitalization because of uncontrolled diabetes, which was lateron controlled after guarded non weight bearing ambulation in the hospital. Edge of the bed sitting allowed & possible in all the patients in our study second post operative day along with static & dynamic quadriceps strengthening exercises encouraged. After the discharge suture removal did on day 14 post operatively in our cases.

After that the patients were followed at every monthly postoperatively till union. Partial weight bearing allowed on some signs of Radiological union on regular follow up. Full weight bearing on complete radiological union signs on follow up & no tenderness on partial weight bearing at the hip. Partial weight bearing allowed with help of crutches or walker depending upon patients convenience. On every monthly follow up xrays of hip with femur A Pview & Lateral view taken of the operative site & Functional results evaluated with Harris Hip Score.

**3. Results**

Partial weight bearing allowed in 20% of patients at 4 weeks post operatively & in 80% of patients after 4 weeks. Reduction was acceptable in 90% of patients while in 10% of patients it is some compromise. Functional results were evaluated by harris hip score [20] at each follow up according to table 1. Full weight bearing was allowed according to the table 2. Average radiological union time was 2.5 months.

In our study 3 patients had some varus postoperatively but fortunately fracture united with it. One patient had upper screw cutout from the head & later on superior screw removed after union. One patient had avascular necrosis of head of the femur early changes (ficat arlet [19] stage 1) at the end of 6 month. One patient has wound gaping of screw insertion site with superficial skin & subcutaneous infection which was resolved by second generation cephalosporin oral antibiotics continued for five weeks with regular frequent OPD bases dressings. 3 patients had abductor weakness with some lurch on walking & have been advised regular home physiotherapy.

One patient (have hepatitis HBs Ag antigen positive & Pulmonary Tuberculosis on Antitubercular Drug) have done full weight bearing at 3 weeks post operatively against medical advice & came with varus nonunion with implant (Nail) broken failure from the screw holes with pain & non weight bearing. He was operated at first stage with total implant removal with continues irrigation & suction with antibiotics & IV antibiotics. The tissue culture report came negative. On second stage 10 days after the implant removal the fracture was fixed with DHS with some valgus. The fracture consequently united after 3 months of DHS fixation.



Fig 1: Preop. Xray Of patient 1



Fig 2: Post op. Xary of patient 1

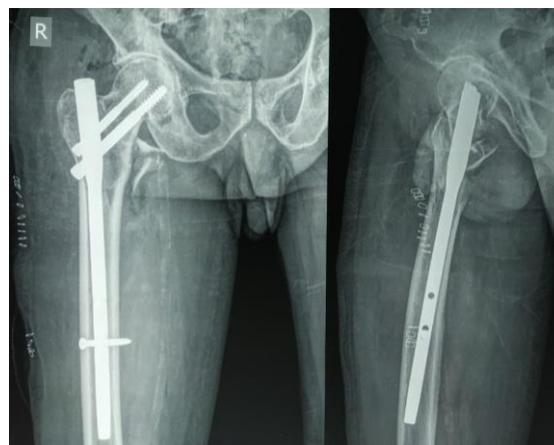


Fig 3: Postop. Xary Of patient 2

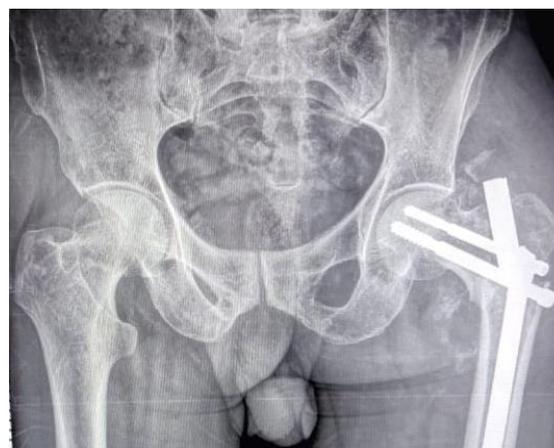


Fig 4: Patient 3, Nonunion with Implant Failure

Table 1: Harris Hip Score:

Results	Patients	Percentage%
Excellent	18	60%
Good	6	20%
Fair	5	16.66%
Poor	1	3.33%

Table 2: Full weight bearing:

Full weight bearing	No.of cases
4-8 weeks	3 (10%)
8-12 weeks	10(33.33%)
12-16 weeks	12(40%)
>16 weeks	5(16.66%)

Table 3: Complications

Complications	No. of patients
Screw z effect	0 (0%)
Screw cut out	1(3.33%)
Infection	1(3.33%)
Varus malunion	3(10%)
Wound complications	0(0%)
Implant fracture & nonunion	1(3.33%)
Peri implant femur shaft fracture	0(0%)
A Vascular Necrosis of head of femur	1(3.33%)



**Fig 5:** Clinical Photos of the patient at union.

#### 4. Discussion

Nearly half of the elderly fractures are intertrochanteric fractures [1] the elderly is a special and large group of people especially in developing country. Conservative treatment can achieve fracture union but risk of complications such as malunion, coxa vara, medialization of shaft, external rotation & shortening with limp. Fracture will cause heavy economic burden especially in the developing countries like India & only 30 percent will be able for normal life like before fracture [2] long term bed ridden, co-existence of diseases & bedsores all will lead to significant mortality post fractures [3] rapid control & optimization of co-existent diseases in this age group required early effective treatment & ambulation.

DHS can achieve favorable results and low rate of complications when used in the management of stable fractures [4]. Requirement of a relatively larger exposure which leads to more tissue trauma can cause intra- and post-operative varus collapse especially when used in unstable and reverse oblique fractures, ultimately leading to medialization of the shaft and deformity [5].

Proximal Femoral Nail found more stable for intertrochanteric fractures [15, 16] while other studies have shown higher complication rates with PFN [17, 18].

Excessive force application & Under reaming during nail insertion cause shaft of the femur fracture from tip of the nail in some cases. This is true when long less curved nail implants are used in patients having bowing of femur.

The femoral isthmus has not crossed in the current study group of the patients by the nail and no flexible reaming of medullary canal was done. Only proximal reaming with cannulated hand held reamer done.

Pu *et al.* [6] they observed some impingement in Chinese population. Based on their study they recommend that it is better to use longer nail to bypass the curvature or relatively shorter nail to prevent this complication especially in patients with excessive anterior bowing of femur.

In our study population no case of intra-operative femoral shaft fractures occurred during surgery. However Yaozeng *et al.* [7] reported 6 (5.6%) intra-operative femoral shaft fractures

in their series of 107 intertrochanteric fractures.

Screw cut-out incidences vary in literature. Domingo *et al.* [11] showed cut-out in 4/295 and Alyassari *et al.* [13] in 4/76, whereas Schipper *et al.* [10] found 11 failures in 211 patients. Tyllianakis *et al.* [9] had one failure due to screw cut-out out of 46 fractures while Simmermacher *et al.* [12] had one in 191 patients (both studies used AO/ASIF PFN). Boldin *et al.* [14] studied a sample size of 55 patients and found 3 'z effect', 2 'reverse z effect' and 2 screw cut-outs (attributed to smaller screw size in the neck).

Morihara *et al.* [8] did not report even a single cut-out of screws (not even Z effect) concluded that superior screw works as anti-rotation screw if 10-15 mm shorter than inferior screw avoid direct load on the superior screw leads to less chances of cut-out & z effect. The anatomical reduction and secure fixation of the patient on the operating table are absolutely vital for easy handling and good surgical result. In our study, every patient has been treated as closed reduction of fractures compared to the study by Boldin *et al.* (9% open reduction).

However longer study with this specific precautionary technique of nail insertion still can put more focus on the very long term output after united intertrochanteric fractures & patients. But as the other studies shown that after intertrochanteric fractures life expectancy is not more, our study has shown significant early rehabilitation & decreased morbidity in these common but potentially heavy morbid fractures.

#### 5. Conclusion

The short proximal femoral nail allows surgeon for easier insertion of the nail (only proximal reaming) & Minimal blood loss all leads to less complications. Short proximal femoral nail will allow good fixation of the intertrochanteric fractures with proper alignment of biomechanical forces. Being a minimally invasive technique it preserves fracture hematoma with less blood loss & early mobilization.

On the other side when intertrochanteric fractures leads to significant morbidity & mortality in adults & especially

elderly people with other comorbidities, these devices leads to significant increase in quality of life post fracture fixation in the patients. Good knowledge & application of proper surgical technique intraoperatively, careful patient & fracture selection & early guarded vigilant mobilization are crucial factors for good management of intertrochanteric fractures.

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