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Clinical and functional outcomes of proximal femoral nailing in proximal femur fractures: a prospective study of 100 cases

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ABSTRACT

Background: Intertrochanteric fractures are common in elderly osteoporotic patients and carry high morbidity and mortality if not treated adequately. Proximal femoral nailing (PFN) has been developed to overcome limitations of extramedullary fixation devices. Objectives were to evaluate functional and radiological outcomes of PFN in proximal femur fractures.
Methods: A prospective study of 100 patients with intertrochanteric femur fractures was conducted between March 2022 and July 2024. Patients were treated with PFN and followed up for 6-18 months. Functional outcome was assessed using the Harris hip score (HHS).
Results: The mean patient age was 648. years (28-95 years). Left-sided fractures (57%) were more common than right (43%). 68% fractures were unstable (Evan's classification). Average interval from injury to surgery was 42 days, mean operative time 85 minutes. At one-year follow-up, 66% had excellent, 19% good, 10% fair, and 5% poor outcomes (mean HHS: 8882.). Complications occurred in 15% cases. No non-union was observed.
Conclusions: PFN is a reliable fixation method for intertrochanteric fractures, offering stable fixation, early mobilization, and favorable functional outcomes with minimal complications.

Keywords: Proximal femur fracture, PFN, Harris hip score, Intertrochanteric fracture, Orthopaedic trauma

INTRODUCTION

Intertrochanteric fractures occur in the region between the greater and lesser trochanters of the proximal femur, occasionally extending into the subtrochanteric region. Deforming muscle forces will usually produce shortening, external rotation, and varus positioning at the fracture.[1]

Intertrochanteric femur fractures account for nearly 50% of proximal femur fractures and their incidence is rising with aging population and osteoporosis.[1,2]

Intertrochanteric femur fractures most commonly occur in elderly individuals as a result of low energy trauma. The 90% of cases are elderly people with history of slip and accidental fall in the floor. Most fractures result from a direct impact to the greater trochanteric area.[3,4]

Traditional conservative management has been associated with prolonged immobilization, complications(bed sores, urinary tract infections, respiratory tract infections, joint stiffness) and high mortality.[5] Literature says that about 15 to 20% of elderly patients with inter-trochanteric fractures dies within one year of injury if no appropriate treatment

is given.[6] Intramedullary fixation devices such as PFN provide biomechanical advantages including load sharing, minimal soft tissue dissection, and early mobilization.[7,8] Clinical reports by Evans confirmed these biomechanical advantages.[9]

Aim and objectives

Aim and objectives were to evaluate the functional and radiological outcomes of intertrochanteric fractures managed with PFN and assess with HHS.

METHODS

This prospective study was conducted in the department of orthopaedics, Narendra Modi medical college and Sheth L. G. general hospital, Ahmedabad, Gujarat, India from March 2022 to July 2024. A total of 100 patients with intertrochanteric femur fractures were included.

All patients underwent PFN fixation.

Inclusion criteria

Patients with age>18 years, intertrochanteric fractures with/without subtrochanteric extension, implant used proximal femoral nail, minimum follow-up of 6 months were included from the study.

Exclusion criteria

Patients with pathological or open fractures, age <18 years, medically unfit patients for surgery were excluded from the study.

Sampling

Convenience sampling of one hundred consecutive patients.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft excel 2019) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA).

Quantitative variables were described as means and standard deviations or median and interquartile range based on their distribution.

Qualitative variables were presented as count and percentages. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Ethical approval

Approved by institutional ethics committee. Informed consent obtained from all participants.

RESULTS

The demographic profile, clinical characteristics, and outcomes of study participants are summarized in tables and figures below.

Table 1: Age distribution.

Age group (in years)	N (%)
18-39	4 (4)
40-59	20 (20)
60-79	70 (70)
>80	6 (6)

Gender distribution

In our study, 38 patients were male (38%) and 62 patients were female (62%).

Mechanism of injury

In our study, common cause was domestic fall at home (72%) followed by road traffic accidents (28%) due to osteoporosis in elderly patients).

Table 2: Mechanism of injury in our study,

Mode of injury	N	Percentage (%)
Domestic fall (DF)	72	72
Road traffic accident	28	28

Femoral neck shaft angle difference

In majority of cases 71 patients there was no difference in femoral neck shaft angle between normal side and post-operative side x-ray 25. Patients had more than 1º of increase in neck shaft angle fixation i.e. coxa valgus and 4 patients had more than 1º of decrease in neck shaft angle due to varus collapse i.e. coxa varus.

Union

The average time of radiological union in our study was 12 weeks with minimum of 8 weeks and maximum of 18 weeks. The mean time of full weight bearing walking was 10 weeks with minimum of 7 weeks and maximum of 15 weeks. Full weight bearing is started only after seeing radiological union in 3 cortices.

Complications

In our study, 5 patients got infected, superficial infection occurred in four patients which was resolved by local debridement and antibiotics while deeper infection occurred in one patient which required debridement and removal of implant after union4. patient had varus collapse out of which one was associated with limb length discrepancy (2 cm). Lag screw back-out was seen in 5 patients after 2 months post operative while 2 patients after

4 months. One patient Z effect occurred with proximal screw penetrating in while other distal screw back-out.

Table 3: Complications encountered during the study.

Complications	N	Percentages (%)
Infection	05	5
Screw back-out	07	7
Varus collapse	04	4
Non-union	00	0
Total	15	15

Functional outcome

Functional outcome was measured at around one year follow up with the help of HHS in which 66 patients had excellent and 19 patients had good outcome. Out of 100 patients only 15 patients had fair to poor outcome which was due to complication and lack of patient's compliance to physiotherapy. The average HHS in our study was 88.82 with minimum of 61 and maximum of 96.

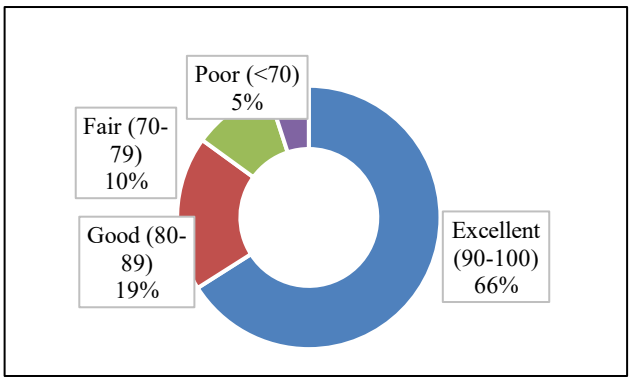


Figure 1: Functional outcome measured by HHS.

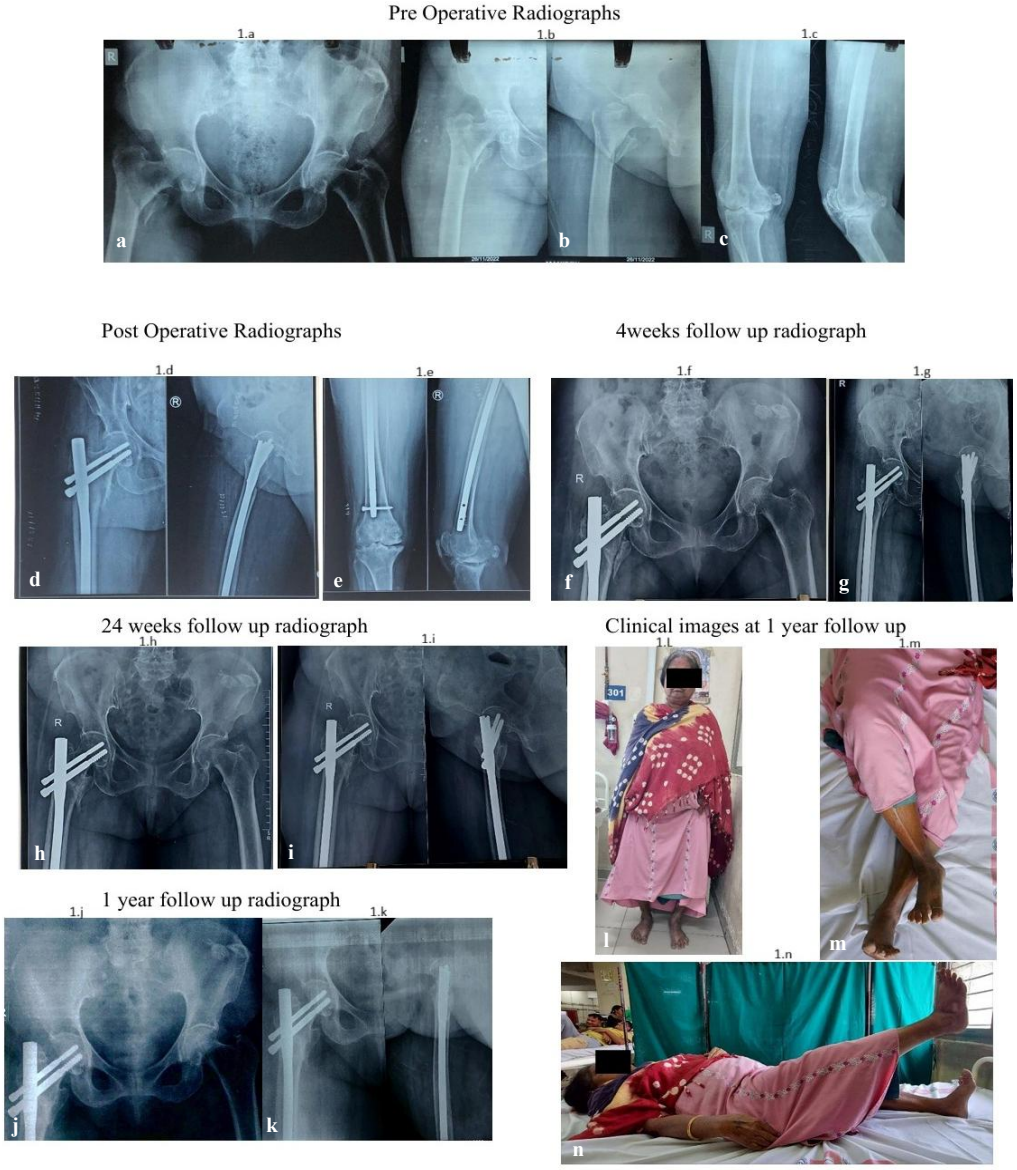


Figure 2 (a-n): Case 1, (a-c): Pre-operative X-ray, (d and e): immediate post-operative X-ray, (f-k): follow-up X-ray showing union and (l-n): clinical images at 1 year.



Figure 3 (a-m): Case 2, (a-c): pre-operative X-ray, (d and e): immediate post-operative X-ray, (f-i): follow-up X-ray showing union, (j-m): clinical images at 1 year.

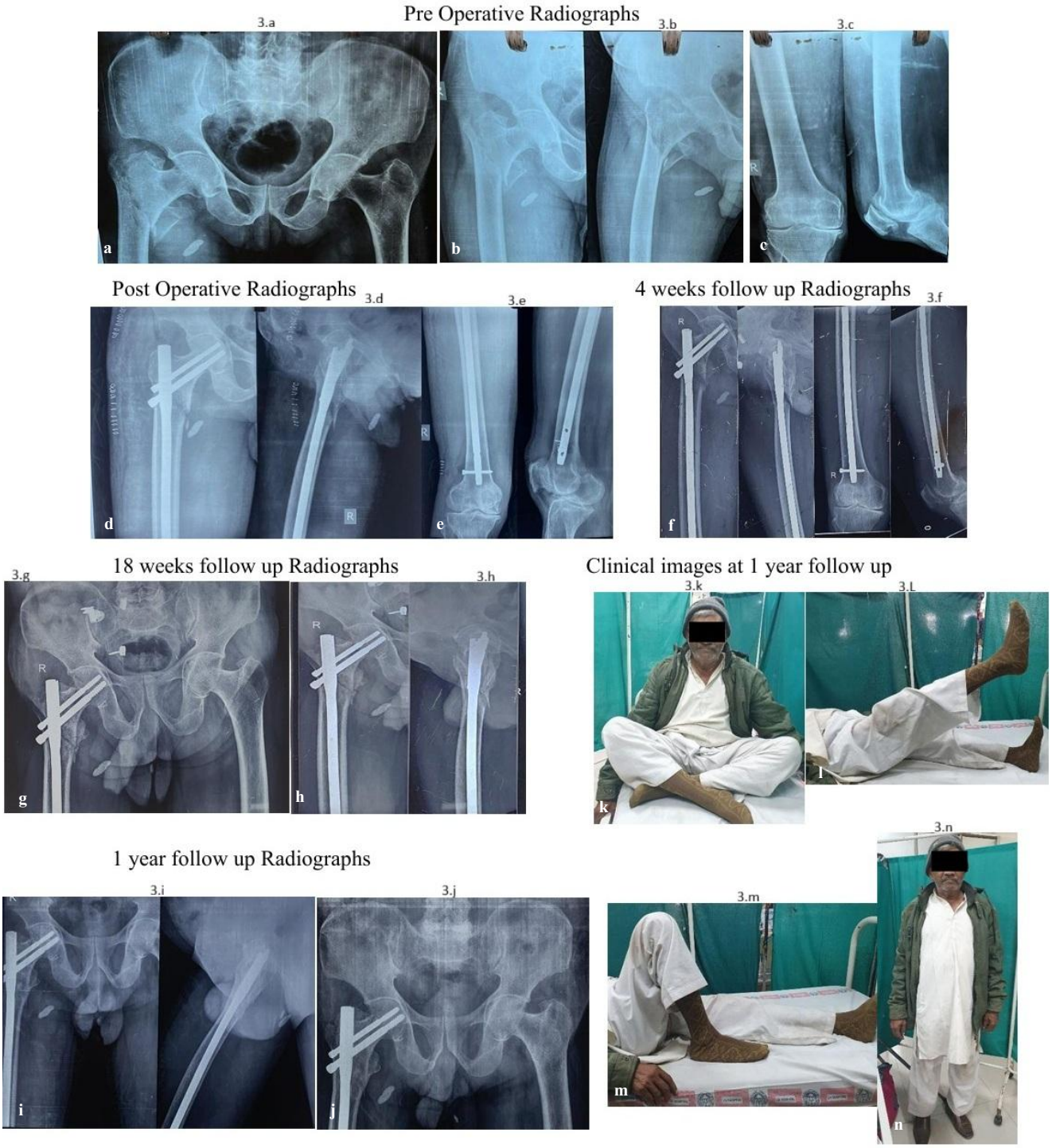


Figure 4 (a-n): Case 3, (a-c): Pre-operative X-ray, (d and e): immediate post-operative X-ray, (f-j): follow-up X-ray showing union, (k-n): clinical images at 1 year.

DISCUSSION

The goal of fracture management is restoration of physiological function at the earliest. Operative reduction and internal fixation permit early mobilization and minimize complications, making surgical management the treatment of choice for intertrochanteric fractures. Intramedullary nails such as PFN provide axial telescoping and rotational stability with a minimally invasive approach, which is particularly well tolerated in elderly patients.[4]

In our study, the average time to radiological union was 12 weeks, with most patients mobilized fully by 10 weeks. These findings are in line with Gadegone et al who reported an average union time of 4.5 months, and Boldin et al who observed union within 3-5 months.[7,8] Our slightly earlier union rates may be attributed to early mobilization

protocols and preservation of fracture hematoma by minimally invasive technique.

Functional outcomes were favorable, with 85% of patients achieving excellent to good results on HHS. This is comparable to Hutchings et al and Hsu et al who documented significant improvement in function with intramedullary fixation.[10,11] A recent study by Rathore et al also reported mean HHS of 86 at one year in a similar patient cohort, supporting our findings.[12]

Complication rates in our series were 15%, primarily screw back-out (7%), infection (5%), and varus collapse (4%). These rates are consistent with previous literature.[13] Boldin et al reported screw migration in 8% of cases, while Gadegone et al observed infection in 4% and varus collapse in 5%.[7,8] In contrast, Rathore et al noted a lower infection rate (2%) but similar rates of implant-related complications.[12] Our absence of non-union cases highlights the biomechanical advantage of PFN over extramedullary devices such as DHS, which have reported non-union rates up to 3-5%.[14,15]

When compared with dynamic hip screw (DHS), PFN offers distinct advantages including shorter lever arm, less blood loss, and earlier mobilization.[16] Recent meta-analyses (Yang J et al and Chen et al) have shown that PFN is associated with reduced operative time, less intraoperative bleeding, and fewer complications compared to DHS in unstable intertrochanteric fractures.[16,17] These findings further validate our results.

Overall, our study reinforces that PFN is a reliable fixation method for both stable and unstable intertrochanteric fractures, with high union rates, excellent functional outcomes, and acceptable complication profile.

Limitations include the single-center nature, relatively short follow-up, and lack of a control group. Larger randomized studies are required for further validation. Indian studies by Tronzo et al and others further highlight DHS limitations in unstable fractures.[4] Comparable findings were noted in Kyle et al.[18]

In our study, average radiological sign of union was found at 12 weeks with minimum time being 8 weeks and maximum time being 18 weeks. In Gadegone et al study found average union time to be 4.5 months.[8]

Early mobilization with partial or full weight bearing depends on type of fracture, reduction and stability obtained by fixation, bone quality and postoperative radiographs. After signs of union seen patient were advise for partial weight bearing, walk with walker at around 6 weeks postoperatively. Later on, 3-6 weeks full weight bearing was advised. Average time for full weight bearing in our study is 10 weeks.

This study confirms that PFN provides excellent biomechanical stability for intertrochanteric fractures, particularly unstable patterns. Our results (85% excellent/good outcomes, mean HHS 88.8) are comparable to previous studies such as Gadegone et al and Boldin et al no non-unions occurred.[7,8] These findings are consistent with Hutchings et al and Hsu et al who reported favorable outcomes with intramedullary fixation.[10,11] Early mobilization minimized complications associated with conservative management.

Limitations include single-center design, relatively short follow-up, and lack of comparison with other fixation methods (e.g., DHS).

CONCLUSION

PFN as it is intramedullary device has excellent biological and mechanical advantage as it is close procedure which preserves fracture hematoma and helps in early bone union and early mobilization with lesser soft tissue damage.

Proximal femoral nailing is an effective and reliable method for treating intertrochanteric femur fractures, allowing early mobilization, achieving high union rates, and yielding excellent functional outcomes with minimal complications.

Proximal femoral nail being load sharing implant with fewer complication and minimally invasive technique which favors early full weight bearing and start routine day to day activity in elderly patients without any serious complication.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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