

## Proximal Femoral Nail versus Proximal Femoral Plate Fixation for Unstable Trochanteric Fractures in Elderly Patients

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### ABSTRACT

**Background:** Unstable trochanteric fractures in elderly patients present significant challenges, necessitating robust fixation methods to ensure optimal clinical outcomes. Comparing Proximal Femoral Nail (PFN) and Proximal Femoral Plate (PFP) fixation is crucial for determining the most effective treatment.

**Objective:** To evaluate the clinical and radiological outcomes of PFN versus PFP fixation for unstable trochanteric fractures in elderly patients.

**Patients and Methods:** A prospective study was conducted on 20 elderly patients with unstable, closed trochanteric fractures at the Orthopedic Surgery Department, Faculty of Medicine, Benha University. Patients were divided into two groups: Group I (n=10) underwent PFN fixation, and Group II (n=10) underwent PFP fixation. Assessments included patient history, clinical examination, radiological evaluations, and follow-ups at 4 weeks, 12 weeks, 6 months, and 12 months.

**Results:** No significant differences were found in baseline characteristics. Group I had significantly lower blood loss ( $53.4 \pm 10.6$  ml vs.  $137.4 \pm 14.6$  ml;  $p=0.02$ ) and shorter hospital stays ( $8.2 \pm 1.72$  days vs.  $10.33 \pm 2.11$  days;  $p=0.002$ ). Complications were higher in Group II, including pressure sores (0% vs. 40%) and dislocated prosthesis (10% vs. 50%). Group I showed earlier full weight bearing ( $4.52 \pm 1.22$  weeks vs.  $8.48 \pm 1.64$  weeks;  $p<0.001$ ) and higher Harris hip scores at 12 months ( $89.1 \pm 1.12$  vs.  $81.5 \pm 2.32$ ;  $p<0.001$ ).

**Conclusions:** PFN fixation for unstable trochanteric fractures in elderly patients is associated with less blood loss, shorter hospital stays, fewer complications, and better functional recovery compared to PFP fixation, supporting its preferential use.

**Keywords:** Proximal Femoral Nail; Proximal Femoral Plate; Unstable Trochanteric Fractures; Elderly Patients.

### INTRODUCTION

Unstable trochanteric fractures are a prevalent and challenging injury in the elderly population, primarily due to the high incidence of osteoporosis and low-energy falls. These fractures significantly impact patient mobility and quality of life, necessitating effective surgical interventions to restore function and reduce morbidity [1]. The choice of fixation method is crucial, as it influences the clinical outcomes and the recovery trajectory of these patients [2].

Proximal Femoral Nail (PFN) and Proximal Femoral Plate (PFP) fixation are two widely used surgical techniques for managing unstable trochanteric fractures. PFN is designed to provide strong intramedullary support and is often preferred for its minimally invasive nature and biomechanical advantages. In contrast, PFP fixation, which involves extramedullary plating, offers a different approach with potentially broader applications depending on the fracture pattern and patient-specific factors [3].

Despite the widespread use of both PFN and PFP, the debate continues regarding their relative efficacy in terms of operative metrics, postoperative complications, and functional outcomes. While PFN is often associated with reduced operative time and blood loss, PFP may offer benefits in certain complex fractures. Comprehensive comparative studies are essential to guide clinical decision-making and optimize patient outcomes [4,5].

The aim of this study was to assess the clinical and radiological outcomes of PFN versus PFP fixation for unstable trochanteric fractures in elderly patients, providing evidence to support the most effective treatment modality for this vulnerable population.

### PATIENTS AND METHODS

This study was conducted on 20 patients of old age, with unstable, closed trochanteric fractures, at Orthopedic Surgery Department, Faculty of Medicine, Benha University, throughout the period from January 2022 to August 2023.

Exclusion criteria were young patients, stable trochanteric fractures and those with open fractures.

### Grouping:

Twenty patients were divided into 2 groups; group 1 (n=10) included patients subjected to PFN and group 2 (n=10) included patients subjected to PFP.

Each patient underwent thorough assessment and preoperative preparation, which included detailed history-taking that covered personal data (age, gender, occupation), significant medical habits (such as smoking), existing comorbidities (e.g., diabetes, hypertension), the injury mechanism, and any associated injuries. Clinical examinations were performed to identify associated injuries, evaluate skin condition, and check for ecchymosis on the affected side. Radiological evaluations included plain X-rays

(AP and lateral views of the hip joints and ipsilateral knee joint) and, when necessary, CT scans to assess fracture extension into the piriformis fossa.

Preoperative care involved skin traction in bed, adequate padding of all bony prominences, and deep vein thrombosis (DVT) prophylaxis with low molecular weight heparin, which was discontinued 12-24 hours before surgery. Additionally, antibiotics were administered two hours prior to the procedure. Data recorded for each patient included operative time, blood loss, fluoroscopy time, duration of hospital stay, and clinical and radiographic outcomes.

**Surgical technique:**

For the PFN procedure, a fracture table was utilized to attempt closed reduction of the fracture under fluoroscopic guidance. If closed reduction was unsuccessful, open reduction was performed, necessitating a longer incision and additional exposure. A 3-5 cm skin incision was made, located 10 cm proximal to the tip of the greater trochanter along the proximal extension of the anatomical femoral bow. The subcutaneous tissue and deep fascia were incised, and the gluteal muscle was split along its fibers to insert the PFN in a standard manner.

A bone awl was used to create the entry point at the tip of the greater trochanter in the anteroposterior view, positioned between the anterior one-third and posterior two-thirds in the lateral view. A guide was inserted, followed by adequate reaming to facilitate smooth nail insertion. The nail was manually inserted as far as possible into the femoral opening, using slight twisting movements without hammering. The nail was then fixed into the femoral head with one or two screws. The final position was confirmed with an image intensifier. The rotation of the distal fragment was confirmed, followed by distal locking with a guide arm, and the wound was closed in layers.

For the PFP procedure, all cases involved using a lateral subvastus approach to the proximal femur for open reduction and internal fixation. The plate employed had three proximal holes angled at 115° to accommodate 6.0 mm locking screws for securing the femoral neck and head. The distal holes were filled with either 4.5 mm non-locking cortex screws or 5.0 mm locking screws to ensure secure fixation of the femoral shaft. Following the fixation, the wound was closed in layers.

**Postoperative follow up:**

Patients received low molecular weight heparin 12-24 hours post-surgery and oral anticoagulants for 28 days. Antibiotics were administered for 2 weeks. Active and active-assisted range of motion (ROM) exercises for the hip and knee began on the second postoperative day. Partial weight-bearing was initiated after 6-8

weeks, upon the appearance of radiographic crossing trabeculae, and full weight-bearing was permitted once a sound union was achieved.

All patients were monitored through serial clinical and radiographic evaluations. Radiographs were taken immediately postoperatively, and subsequently at 4 weeks, 12 weeks, 6 months, and the final follow-up. Any intraoperative or postoperative complications were recorded.

**Ethical considerations:**

The study was done after being accepted by the Research Ethics Committee, Benha University. All patients provided written informed consents prior to their enrolment. The consent form explicitly outlined their agreement to participate in the study and for the publication of data, ensuring protection of their confidentiality and privacy. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

**Statistical analysis**

Statistical analysis was performed using SPSS v26 (IBM Inc., Chicago, IL, USA). Quantitative variables were expressed as mean and standard deviation and compared between the two groups using the unpaired Student's t-test. Qualitative variables were presented as frequencies and percentages and analyzed using the Chi-square test. A two-tailed P value ≤ 0.05 was considered statistically significant.

**RESULTS**

There was no statistically significant difference among both studied groups as regard age, gender, BMI or stage of arthritis of studied cases (Table 1).

**Table 1: Basic characteristics of the studied group**

	Group I (n=10)	Group II (n=10)	P
Age (years)	68.6 ± 5.14	69.1 ± 5.18	0.831 NS
BMI (Kg/m <sup>2</sup> )	26.5 ± 3.22	26.4 ± 4.33	0.954 NS
Gender	Male	4 (40%)	0.639 NS
	Female	6 (60%)	

Data presented as mean ± SD or frequency (%), BMI: body mass index, NS: Not significant.

Table 2 shows a longer surgical duration among studied group II with no significant difference, while total perioperative blood loss and hospital stay were significantly higher among group II than the PFN group.

**Table 2: Operative data among the studied groups**

	Group I (n=10)	Group II (n=10)	P
Surgical duration (min.)	74.5 ± 5.11	76.5 ± 5.17	0.396 NS
Blood loss (ml) 24 h. drain production	53.4 ± 10.6	137.4 ± 14.6	<0.001 HS
Hospitalization length	8.2 ± 1.72	10.33 ± 2.11	0.024 S

Data presented as mean ± SD, NS: Not significant, S: Significant, HS: Highly significant.

The postoperative complications were insignificantly higher in group-II than in group I. Superficial wound infection resolved completely after a course of antibiotics. (Table 3).

**Table 3: Postoperative complications among both studied groups**

	Group I (n=10)	Group II (n=10)	P value
Wound infection	2 (20%)	3 (30%)	0.606 NS
Pressure sores	0 (0%)	4 (40%)	0.025 NS
Deep vein thrombosis	1 (10%)	0 (0%)	0.305 NS
Dislocated prosthesis	1 (10%)	5 (50%)	0.051 NS
Revision due to loosening & subsidence	2 (20%)	6 (60%)	0.068 NS
Cardiovascular complications	0 (0%)	2 (20%)	0.136 NS
Pulmonary complications	1 (10%)	0 (0%)	0.305 NS
Mortality rate	1 (10%)	2 (20%)	0.531 NS

Data presented as frequency (%), NS: Not significant.

Mobilization was started in group I on 7<sup>th</sup> day postoperatively whereas in group II mobilization was started at mean of 10.7 days, the delay was attributed to pain. The mean time to independent full weight bearing was significantly shorter in group I than in group II (Table 4).

**Table 4: Functional outcome on follow up among both studied groups**

	Group I (n=10)	Group II (n=10)	P value
Time to full weight bearing (weeks)	4.52 ± 1.22	8.48 ± 1.64	<0.001 HS
Return to normal daily activities	7.14 ± 1.45	10.7 ± 2.23	<0.001 HS

Data presented as mean ± SD, HS: Highly significant

Harris hip score at 3<sup>rd</sup> month was significantly higher in patients who underwent PFP compared to

those who were operated upon with PFP. At 6<sup>th</sup> month the score increased in both groups but was still significantly higher among group I (Table 5).

**Table 4: Harris hip score over follow up time among both studied groups**

Harris score	Group I (n=10)	Group II (n=10)	P value
3 months	79.1 ± 6.31	70.2 ± 5.57	0.004 S
6 months	83.6 ± 4.31	78.2 ± 4.22	0.01 S
12 months	89.1 ± 1.12	81.5 ± 2.32	<0.001 HS

Data presented as mean ± SD, S: Significant, HS: Highly significant

## DISCUSSION

Intertrochanteric fractures of the femur are a prevalent condition in elderly patients. It has been established for several decades that surgical intervention can reduce morbidity and mortality by enabling early mobilization and minimizing the risks associated with prolonged bed rest in elderly patients [6]. The Proximal Femoral Nail Anti-rotation (PFNA) was developed to address rotational instability issues by using a single femoral neck element, specifically the helical blade [7].

Our study indicated that although surgical duration was longer in group II, the difference was not statistically significant. However, group II had significantly greater perioperative blood loss and longer hospital stays. Postoperative complications were more frequent in group II, with 4 cases of pressure sores (none in group I), 5 dislocated prostheses (compared to 1 in group I), and 6 revisions due to loosening and subsidence (compared to 2 in group I). Additionally, group II had 2 cardiac complications and 3 superficial wound infections (compared to 2 in group I). Despite these findings, the overall incidence of complications was not significantly different between the groups.

This finding aligns with Gavaskar *et al.* [8], who reported that PFNA achieved good outcomes with relatively low complication rates in elderly patients with trochanteric fractures. The primary complication observed was varus collapse, with one case of helical blade cut out.

In our study, mobilization in group I began on the 7<sup>th</sup> postoperative day, whereas group II patients started mobilizing at an average of 10.7 days, primarily due to pain. The average time to independent full weight bearing was 4.52 weeks in group I and 8.4 weeks in group II (p<0.001). At 3 months, the Harris Hip Score was significantly higher in group I patients (79.1) compared to those in group II (70.2 ± 5.57). Although scores improved in both groups by the 6<sup>th</sup> month, Group I continued to have significantly higher scores.

Our findings align with the meta-analysis by **El Madboh *et al.*** <sup>[9]</sup>, which demonstrated that intramedullary fixation leads to significantly shorter operative times, less intraoperative blood loss, and higher postoperative functional hip scores. These benefits contribute to long-term goals such as restoring limb function, enabling early mobilization, and reducing re-operation rates compared to proximal femoral plate and hip arthroplasty for managing unstable intertrochanteric femoral fractures in the elderly.

Conversely, our results differed from those of **Han *et al.*** <sup>[10]</sup>, who found that both gamma nails and PFLPs were effective for unstable intertrochanteric femoral fractures with broken lateral walls in terms of hip functional recovery. They noted that PFLP was more effective for severe comminuted fractures and better at protecting the broken lateral wall compared to the gamma nail, although early weight bearing was not recommended for patients treated with PFLPs. **Bonnaire *et al.*** <sup>[11]</sup> conducted a prospective observational study comparing the gamma 3 nail and the PFNA in 106 unstable trochanteric fractures. They reported that both the gamma 3 nail and the PFNA produced comparable clinical results and significantly improved outcomes for unstable trochanteric fractures compared to older nail generations.

This study has the limitations of being a small and heterogeneous group. The inclusion of a larger number of patients might have yielded significant differences. The study participants were difficult to follow up due to numerous factors including multiple co-morbidities and transport issues to clinic. Improvement of these conditions in future studies may provide more information for validating the results presented here.

## CONCLUSIONS

PFN fixation for unstable trochanteric fractures in elderly patients is associated with significantly less blood loss, shorter hospital stays, fewer complications, and superior functional recovery compared to PFP fixation. These findings support the preferential use of PFN in managing such fractures in elderly patients.

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## REFERENCES

1. **Karthik K, Natarajan M (2012):** Unstable trochanteric fractures in elderly osteoporotic patients: role of primary hemiarthroplasty. *Orthop Surg.*, 4:89-93.
2. **Trilok V, Kurupati R, Sherikar N *et al.* (2023):** Surgical management of unstable trochanteric fractures of the femur using cemented hemi-prosthesis in elderly patients: A Prospective Study. *Cureus*, 15:e45351.
3. **Rajput A, Gupta P, Gill S *et al.* (2022):** Prospective comparative study between proximal femoral nail vs. screw augmented proximal femoral nail in unstable intertrochanteric fractures of femur. *Cureus*, 14:e32791.
4. **Xu H, Liu Y, Sezgin E *et al.* (2022):** Comparative effectiveness research on proximal femoral nail versus dynamic hip screw in patients with trochanteric fractures: a systematic review and meta-analysis of randomized trials. *J Orthop Surg Res.*, 17:292.
5. **Jonnes C, Sm S, Najimudeen S (2016):** Type II intertrochanteric fractures: Proximal femoral nailing (PFN) versus dynamic hip screw (DHS). *Arch Bone Jt Surg.*, 4:23-8.
6. **Zuckerman J, Skovron M, Koval K *et al.* (1995):** Postoperative complications and mortality associated with operative delay in older patients who have a fracture of the hip. *J Bone Joint Surg Am.*, 77:1551-6.
7. **Hockertz T (2005):** PFNA—Does this new implant for per/subtrochanteric femoral fractures offer any advantages. *Synthes Trauma Facts*, 5:34-9.
8. **Gavaskar A, Subramanian M, Tummala N (2012):** Results of proximal femur nail antirotation for low velocity trochanteric fractures in elderly. *Indian J Orthop.*, 46:556-60.
9. **El Madboh M, Yonis L, Kabbash I *et al.* (2022):** Proximal femoral plate, intramedullary nail fixation versus hip arthroplasty for unstable intertrochanteric femoral fracture in the elderly: A meta-analysis. *Indian J Orthop.*, 56:155-61.
10. **Han L, Liu J, Hu Y *et al.* (2018):** Controlled study on Gamma nail and proximal femoral locking plate for unstable intertrochanteric femoral fractures with broken lateral wall. *Sci Rep.*, 8:11114.
11. **Bonnaire F, Lein T, Fülling T *et al.* (2020):** Reduced complication rates for unstable trochanteric fractures managed with third-generation nails: Gamma 3 nail versus PFNA. *Eur J Trauma Emerg Surg.*, 46:955-62.