

Comparative Evaluation of Outcomes of Intertrochanteric Femur Fractures Treated with Proximal Femur Nail versus Proximal Femur Nail with Trochanteric Support Plate: A Prospective Comparative Study

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ABSTRACT

Background: Intertrochanteric femur fractures are common injuries, particularly in older adults, and are associated with substantial morbidity and functional impairment. Proximal femur nail (PFN) is widely used because of its intramedullary load-sharing characteristics. Unstable fractures with compromised lateral wall integrity may require additional lateral buttressing. Trochanteric support plate (TSP) augmentation has been proposed for this purpose.

Methods: This prospective comparative study was conducted in the Department of Orthopaedics, National Institute of Medical Sciences & Research, Jaipur, over 18 months. Seventy patients with intertrochanteric femur fractures were included, with 35 patients treated with PFN alone and 35 with PFN plus TSP. Functional outcome was assessed using the Harris Hip Score (HHS), and radiological healing using the Radiographic Union Score for Hip (RUSH). Operative time, blood loss, hospital stay, weight-bearing, limb shortening and complications were also recorded.

Results: Mean age was 60.4 ± 14.2 years in the PFN group and 66.8 ± 12.5 years in the PFN + TSP group. Stable fractures constituted 80% of the PFN group, whereas 85.7% of the PFN + TSP group had unstable fractures. Mean operative time was 82 ± 12 versus 112 ± 15 minutes, and mean blood loss was 170 ± 40 versus 290 ± 90 mL. Mean time to partial weight bearing was 8 ± 5 versus 42 ± 2 days. Mean HHS at 6 weeks, 12 weeks and 6 months was 78 ± 8 , 92 ± 6 and 98 ± 4 with PFN, compared with 60 ± 10 , 75 ± 9 and 88 ± 10 with PFN + TSP. RUSH scores at 6 months were 29 ± 1 and 27 ± 2 , respectively. Early and late complications were reported only in the PFN + TSP group in the dissertation dataset.

Conclusion: In this cohort, PFN alone was associated with shorter operative time, lower blood loss, earlier weight bearing, better HHS and higher RUSH scores. PFN + TSP was predominantly used for unstable 31A2 and 31A3 fractures and should be considered selectively when additional lateral wall support is required.

Keywords: Intertrochanteric femur fracture; proximal femur nail; trochanteric support plate; Harris Hip Score; RUSH score; radiological union; functional outcome.

INTRODUCTION

Intertrochanteric femur fractures are among the commonest fractures encountered in orthopaedic practice, particularly in elderly patients. They are extra-capsular fractures occurring between the greater and lesser trochanters. Their clinical importance relates to morbidity, mortality, loss of mobility and the burden of associated medical comorbidities.

Surgical fixation is the standard treatment for most patients. The goals are stable reduction, restoration of medial and lateral cortical support, fracture union and early mobilization. PFN provides intramedullary load sharing, a shorter lever arm and reduced bending moment compared with extramedullary constructs.

However, unstable fracture patterns, posteromedial comminution, reverse-oblique configurations and lateral wall deficiency can compromise fixation. Loss of lateral wall support may contribute to varus collapse, excessive shortening, implant migration and failure.

The TSP is intended to act as a lateral buttress when the lateral wall is deficient or at high risk of failure. Combining a PFN with a TSP therefore provides both intramedullary and lateral support. The present study compared the clinical and radiological outcomes of PFN alone versus PFN with TSP.

Aim and Objectives

Aim: To compare the outcome of intertrochanteric femur fractures treated with proximal femur nail versus proximal femur nail with trochanteric support plate using the Harris Hip Score.

- To compare functional outcomes using HHS.
- To compare radiological healing using RUSH score.
- To compare operative duration and blood loss.
- To compare postoperative recovery including hospital stay and weight bearing.
- To document complications and implant-related outcomes.

MATERIALS AND METHODS

Study design and setting

This was a prospective comparative study conducted in the Department of Orthopaedics, National Institute of Medical Sciences & Research, Jaipur, Rajasthan, over an 18-month period. Institutional Scientific and Ethics Committee approval was obtained and written informed consent was taken from each patient or legally authorized representative.

Study population and eligibility

Patients aged >18 years with intertrochanteric femur fracture admitted to the Department of Orthopaedics were considered. Inclusion criteria were age above 18 years, intertrochanteric femur fracture and willingness to participate. Exclusion criteria were pathological intertrochanteric fracture and open intertrochanteric fracture.

Sample size and groups

The calculated sample size was 70 patients, with 35 patients in each group. Group A received PFN alone and Group B received PFN + TSP. Allocation was according to the institutional surgical plan and surgeon decision based on fracture pattern and lateral wall status.

Clinical and radiological assessment

Diagnosis was established using clinical examination and AP/lateral hip and pelvis radiographs; CT was obtained when fracture geometry required further delineation. Fractures were classified according to AO/OTA. Recorded variables included demographic characteristics, fracture stability, AO/OTA type, limb shortening, anaesthesia, operative time, intraoperative complications, blood loss, hospital stay, weight-bearing, HHS, radiological union, RUSH score and postoperative complications.

Outcome measures

Primary outcome: Harris Hip Score at follow-up. Radiological outcome: RUSH score and time to union. Additional outcomes included operative duration, blood loss, hospital stay, time to weight bearing, limb shortening and complications.

Statistical analysis

Data were analysed using SPSS version 25 and Microsoft Excel with appropriate descriptive statistical methods. Exact test statistics and p-values were not consistently available in the source dataset; therefore, no p-values have been generated or inferred in this manuscript.

RESULTS

Seventy patients were included, with 35 patients in each treatment group. The PFN + TSP group was older on average and contained a substantially greater proportion of unstable fractures.

Table 1. Baseline demographic and injury characteristics.

Variable	PFN (n=35)	PFN + TSP (n=35)
Age, mean $\pm$ SD (years)	60.4 $\pm$ 14.2	66.8 $\pm$ 12.5
Male	14 (40%)	9 (25.7%)
Female	21 (60%)	26 (74.3%)
Right side	18 (51.4%)	14 (40%)
Left side	17 (48.6%)	21 (60%)
Slip & fall	30 (85.7%)	32 (91.4%)
RTA	4 (11.4%)	2 (5.7%)
Fall from height	1 (2.9%)	1 (2.9%)

Table 2. Fracture stability and AO/OTA classification.

Fracture characteristic	PFN	PFN + TSP
Stable	28 (80%)	5 (14.3%)
Unstable	7 (20%)	30 (85.7%)
AO/OTA 31A1	28 (80%)	0
AO/OTA 31A2	7 (20%)	20 (57.1%)
AO/OTA 31A3	0	15 (42.9%)

The marked difference in fracture morphology is important for interpretation: PFN was predominantly used for stable 31A1 fractures, while PFN + TSP was predominantly used for unstable 31A2 and 31A3 fractures.

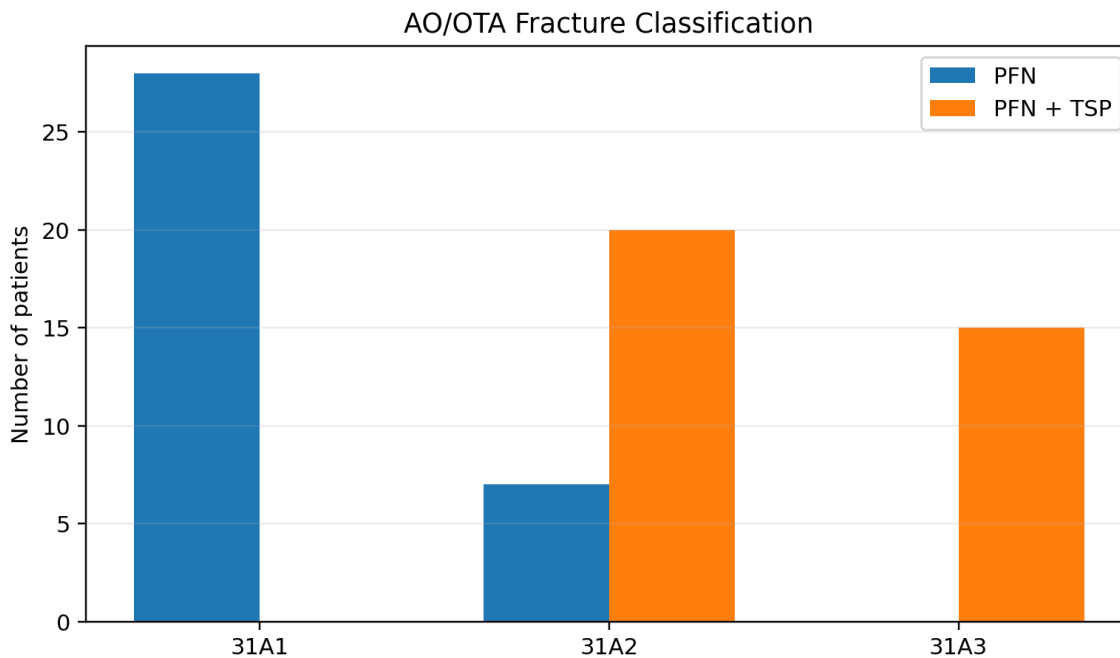


Figure 1. Distribution of patients according to AO/OTA fracture classification.

Table 3. Operative and postoperative parameters.

Operative/postoperative variable	PFN	PFN + TSP
Limb shortening, mean $\pm$ SD (cm)	1.1 $\pm$ 0.6	1.7 $\pm$ 0.5
Spinal anaesthesia	31 (88.6%)	28 (80%)
General anaesthesia	4 (11.4%)	7 (20%)
Operative time, mean $\pm$ SD (min)	82 $\pm$ 12	112 $\pm$ 15
Blood loss, mean $\pm$ SD (mL)	170 $\pm$ 40	290 $\pm$ 90
Hospital stay, mean $\pm$ SD (days)	4.5 $\pm$ 1	6.8 $\pm$ 2
Partial weight bearing, mean $\pm$ SD (days)	8 $\pm$ 5	42 $\pm$ 2

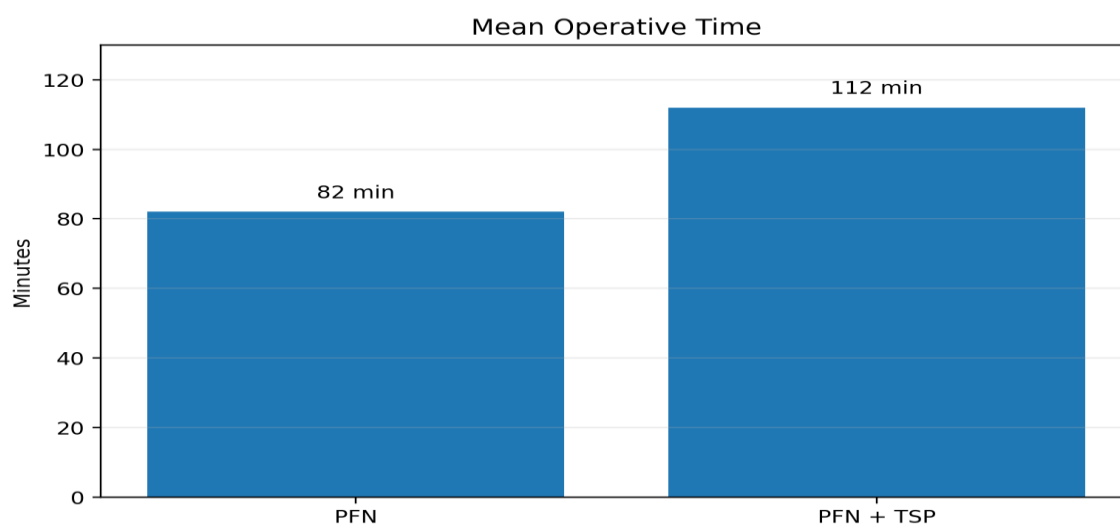


Figure 2. Comparison of mean operative time between treatment groups.

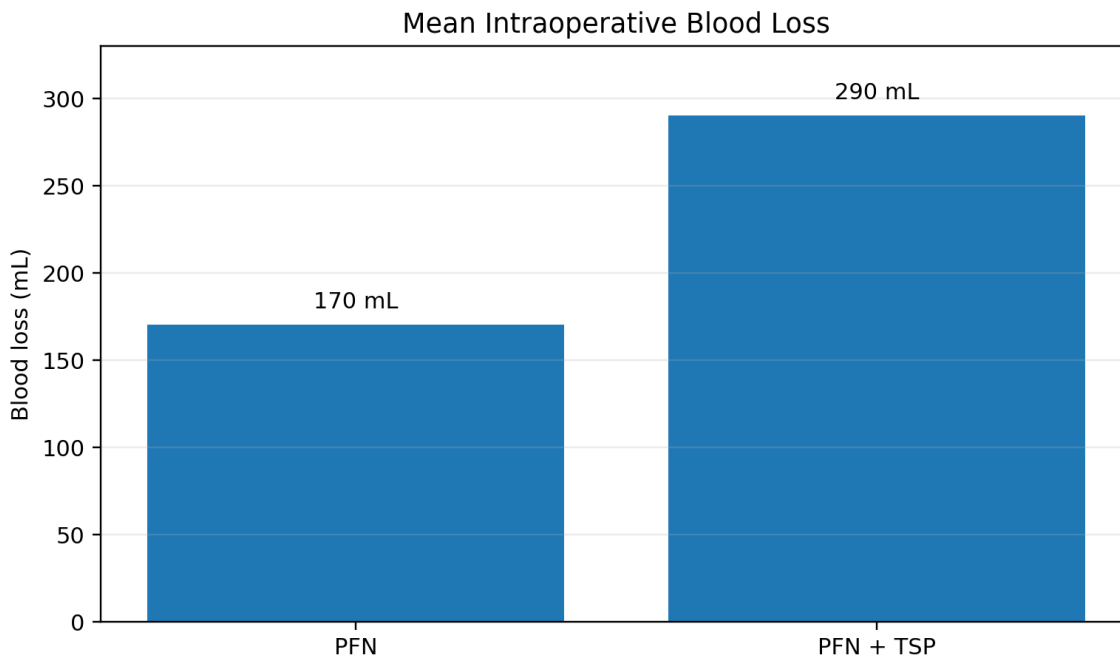


Figure 3. Comparison of mean intraoperative blood loss between treatment groups.

Table 4. Complications reported in the dataset.

Outcome	PFN	PFN + TSP
No intraoperative complication	35 (100%)	30 (85.7%)
Iatrogenic fracture	0	2 (5.7%)
Hypovolemia	0	3 (8.6%)
No early complication	35 (100%)	30 (85.7%)
DVT/PE/infection	0	5 (14.3%)
No late complication	35 (100%)	27 (77.1%)
Late complications	0	8 (22.9%)

Functional Outcome

Table 5. Mean Harris Hip Score at follow-up.

Follow-up	PFN HHS	PFN + TSP HHS
6 weeks	78 ± 8	60 ± 10
12 weeks	92 ± 6	75 ± 9
6 months	98 ± 4	88 ± 10

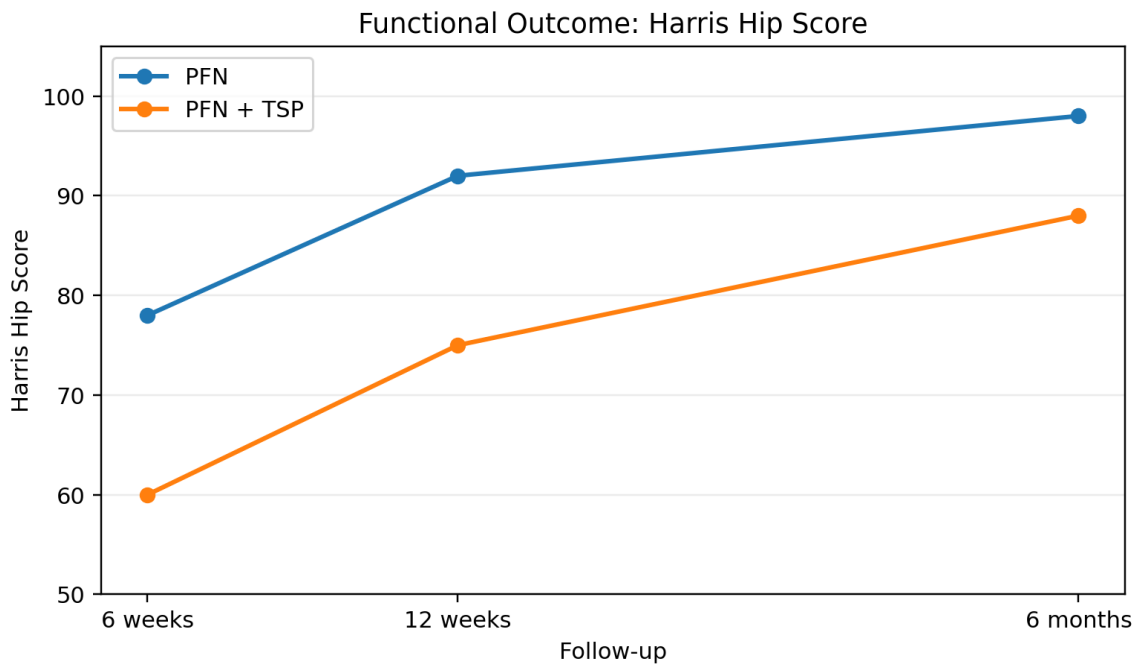


Figure 4. Harris Hip Score at 6 weeks, 12 weeks and 6 months.

Harris Hip Score progressively improved in both groups, with higher mean scores in the PFN group at all reported follow-up points.

Table 6. Final functional outcome based on HHS.

HHS category	PFN	PFN + TSP
Excellent	30 (85.7%)	18 (51.4%)
Good	5 (14.3%)	10 (28.6%)
Fair	0	4 (11.4%)
Poor	0	3 (8.6%)

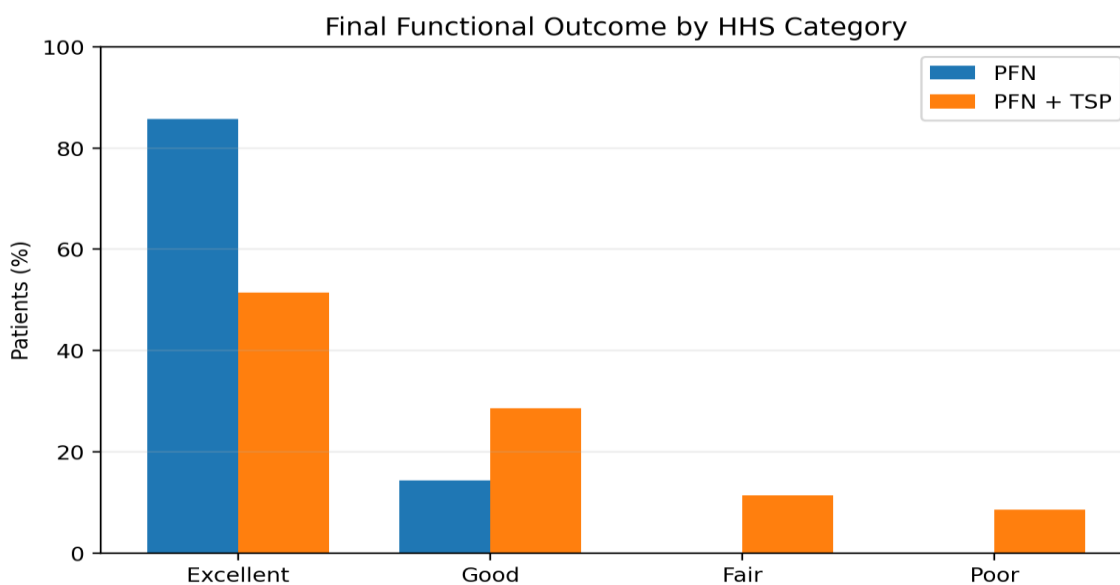


Figure 5. Final functional outcome according to HHS category.

Radiological Outcome

Table 7. RUSH score at follow-up.

Follow-up	PFN RUSH	PFN + TSP RUSH
6 weeks	17.5 ± 1.2	15.2 ± 2
12 weeks	23.5 ± 1	21 ± 2
6 months	29 ± 1	27 ± 2

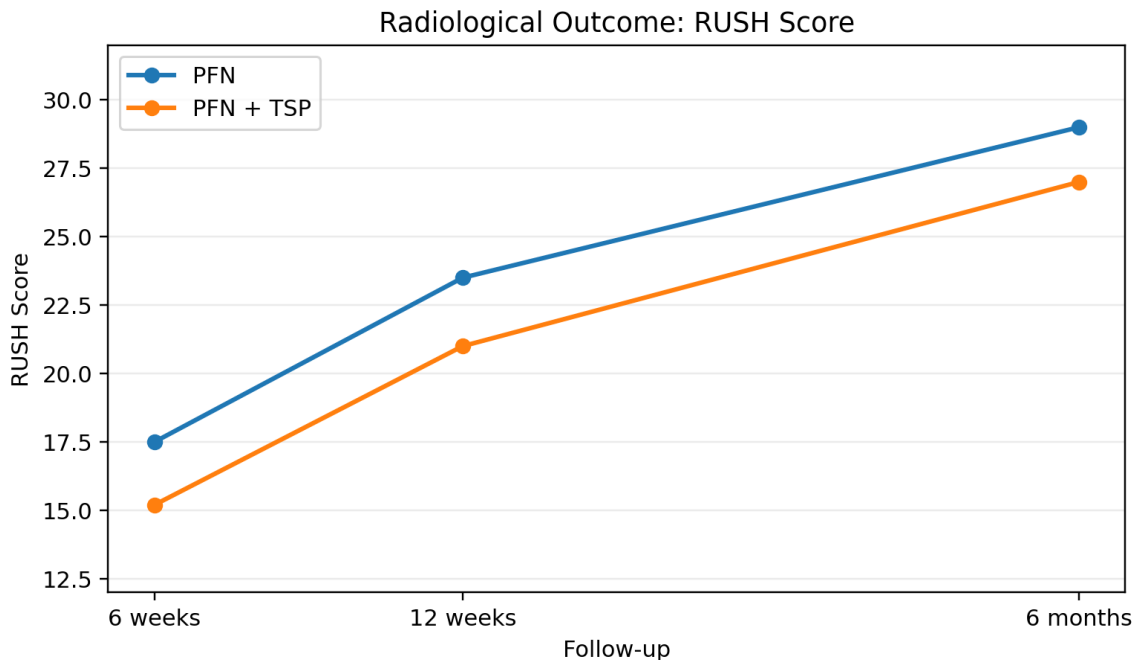


Figure 6. RUSH score at 6 weeks, 12 weeks and 6 months.

Higher RUSH scores were observed in the PFN group at each reported follow-up point. At 6 months, the mean RUSH score was 29 ± 1 with PFN compared with 27 ± 2 with PFN + TSP.

DISCUSSION

The principal finding of this study was that PFN alone was associated with better measured functional and perioperative outcomes in the study cohort. However, the two treatment groups were not comparable in fracture severity: 80% of PFN patients had stable fractures, while 85.7% of PFN + TSP patients had unstable fractures. Most PFN + TSP patients had AO/OTA 31A2 or 31A3 fractures. This substantial baseline difference is a major consideration when interpreting between-group outcomes.

The PFN group had a shorter mean operative duration (82 ± 12 minutes versus 112 ± 15 minutes) and lower blood loss (170 ± 40 mL versus 290 ± 90 mL). The additional steps required for lateral support may contribute to the increased operative exposure in the augmented group. More intraoperative complications were recorded in the PFN + TSP group.

Postoperative recovery was faster in the PFN group. Mean hospital stay was 4.5 ± 1 days compared with 6.8 ± 2 days, while partial weight bearing was initiated at a mean of 8 ± 5 days versus 42 ± 2 days.

Functional outcome showed a consistent difference. Mean HHS was higher in the PFN group at 6 weeks, 12 weeks and 6 months, and 85.7% of PFN patients had an excellent final outcome compared with 51.4% in the PFN + TSP group.

Radiological healing, assessed by RUSH score, was also higher in the PFN group at all reported time points. At 6 months, the mean score was 29 ± 1 with PFN and 27 ± 2 with PFN + TSP.

Importantly, these findings should not be interpreted as demonstrating that TSP itself causes inferior outcomes. The PFN + TSP group contained substantially more unstable fractures and was therefore a more complex clinical population. The higher complication burden may partly reflect fracture severity, older age and associated comorbidity rather than the augmentation device alone.

The role of TSP in this context is therefore best understood as selective augmentation for fractures in which lateral wall support is deficient or threatened.

Strengths

- Prospective comparative design with two defined treatment groups.
- Sample size of 70 patients with equal group allocation.
- Assessment of both functional and radiological outcomes.
- Use of Harris Hip Score and RUSH score.
- Recording of operative, postoperative and complication outcomes.
- Specific attention to fracture stability and AO/OTA classification.

Limitations

- Single-centre study with relatively small sample size.
- Treatment allocation was influenced by fracture pattern and surgeon decision, creating potential selection bias.
- The PFN and PFN + TSP groups differed substantially in fracture stability and AO/OTA distribution.
- Bone quality and osteoporosis were not uniformly controlled.
- Long-term follow-up was limited.
- Exact statistical test results and p-values were not consistently available and are therefore not reported here.
- No comparison with other fixation strategies such as DHS or other cephalomedullary devices was performed.

CONCLUSION

In this prospective comparative cohort, PFN alone was associated with shorter operative duration, lower blood loss, shorter hospital stay, earlier partial weight bearing, higher Harris Hip Scores and higher RUSH scores. PFN + TSP was predominantly used for unstable AO/OTA 31A2 and 31A3 fractures and had greater perioperative and postoperative complication burden in the recorded cohort.

The results support PFN as an effective treatment for appropriate intertrochanteric fractures while suggesting that TSP should be used selectively in complex unstable fractures requiring additional lateral wall support. Because the PFN + TSP group had more unstable fractures, further prospective studies with balanced fracture

morphology, standardized allocation and longer follow-up are required to determine the independent effect of TSP augmentation.

Ethics, Funding and Declarations

Ethical approval: Institutional Scientific and Ethics Committee approval was obtained as per institutional protocol.

Informed consent: Written informed consent was obtained from patients or legally authorized representatives.

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Conflict of interest: The authors declare no conflict of interest.

Data availability: Patient-level data are not reproduced in this manuscript and are available from the corresponding author on reasonable request, subject to institutional policy.

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