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Original Research Article

Functional outcomes of proximal femoral locking plate versus proximal femoral nail in subtrochanteric femur fractures

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ABSTRACT

Background: Subtrochanteric femur fractures are difficult to manage because of strong deforming muscular forces and high rates of implant failure. Although several fixation devices are available, the optimal choice remains debated. This study compared the functional outcomes of proximal femoral locking plate (PFLP) and proximal femoral nail (PFN) in subtrochanteric femur fractures.

Methods: A prospective observational study was carried out at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, from September 2019 to March 2022. Forty-four patients were included, where 22 treated using PFLP and 22 with PFN. Demographic and clinical data were recorded. Outcomes were assessed by radiological union, limb length discrepancy (LLD), hip pain, range of motion (ROM), Harris hip score (HHS), and complication rates.

Results: Union occurred significantly earlier with PFN (13.5±3.2 weeks) than with PFLP (15.6±3.1 weeks; p=0.007). Mean LLD was lower in PFN (0.2±0.33 cm) than in PFLP (0.43±0.47 cm; p=0.0003). Pain-free status was more common in PFN patients (63.6%) compared with PFLP (31.8%). Hip ROM was similar in both groups. However, mean HHS was significantly higher in PFN at final follow-up (89.2±10.1 versus 83.6±12.9; p=0.04). Excellent outcomes were more frequent with PFN (51.9%) than with PFLP (36.4%). Complications were fewer in the PFN group.

Conclusion: PFN offers superior functional outcomes and fewer complications compared with PFLP, supporting PFN as the preferred implant for subtrochanteric femur fractures.

Keywords: Subtrochanteric femur fracture, Proximal femoral nail, Proximal femoral locking plate

INTRODUCTION

Subtrochanteric femur fractures, defined as fractures occurring within 5 cm distal to the lesser trochanter, account for approximately 5–10% of all proximal femoral fractures.[1] These injuries remain a complex entity due to their anatomical location, high deforming muscular forces and biomechanical stress concentration often resulting in challenging reductions, delayed union malunion, or implant failure.[2,3]

The epidemiology of subtrochanteric fractures reveals a bimodal age distribution. In elderly osteoporotic individuals, low-energy trauma such as a fall from standing height is the predominant mechanism, whereas in younger patients, high-energy mechanism including road traffic accidents and fall from height predominate.[4,5]

With global population aging and rising rates of motor vehicle collisions, the incidence of these injuries has increased, particularly in low- and middle-income countries.[6]

Non-operative treatment is largely obsolete in modern practice due to prolonged immobilization and its associated complications, such as pneumonia, venous thromboembolism, and pressure sores.[7] Surgical fixation has thus become the standard of care with goals of restoring stability, allowing early mobilization, and reducing morbidity and mortality. Two major categories of fixation exist: extramedullary devices (plates and screws) and intramedullary nails.

Extramedullary fixation, historically using angled blade plates or dynamic condylar screws offers stable fixation but is associated with extensive soft tissue dissection, higher infection rates, delayed rehabilitation, and increased risk of implant failure.[8] The introduction of locking compression plates provided angular stability and improved fixation in osteoporotic bone, leading to the development of the proximal femoral locking plate (PFLP). PFLP allows multiple angular-stable screws into the proximal femur with less bone sacrifice, making it valuable in highly comminuted or anatomically challenging cases.[9]

Intramedullary devices, conversely, offer a biomechanical advantage due to their load-sharing, shorter lever arm and closer alignment with the mechanical axis. The proximal femoral nail (PFN) introduced in 1997, incorporates a cephalomedullary design with both a load-bearing screw and an anti-rotation screw for improved stability.[10] PFN is associated with reduced blood loss, shorter operative time and earlier rehabilitation although technical errors may predispose to complications.[11]

Despite widespread use of both implants, there remains no universal consensus on the optimal device for subtrochanteric fracture fixation. Several comparative studies report favorable outcomes with PFN, highlighting earlier union and superior functional scores, whereas others have demonstrated comparable outcomes between PFN and PFLP.[12] In Bangladesh, where these injuries are becoming increasingly common due to road traffic accidents, comparative data are scarce.

This study aimed to evaluate the functional outcomes of PFLP versus PFN in the treatment of subtrochanteric femur fractures, focusing on radiological union, Harris hip score (HHS), limb length discrepancy, hip motion, pain, and complications.

METHODS

This prospective observational study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, over the period of September 2019 to March 2022. A total of 44 patients with subtrochanteric femur fractures were included, where 22 treated using PFLP and 22 treated using PFN, according to eligibility criteria.

Sample selection

Inclusion criteria

Inclusion criteria included individuals of age ≥18 years, both sexes, closed subtrochanteric fractures of the femur, and patients that were suitable for surgical intervention and postoperative follow-up of ≥6 months.

Exclusion criteria

Individuals with open fractures, polytrauma or multiple fractures, pathological fractures (except senile osteoporosis) and patients that were unable to attend follow-up were excluded.

Data collection procedure

Data were prospectively collected using a pre-tested structured questionnaire. Demographics, clinical variables, operative details, and outcomes were recorded. Radiological assessments were performed at baseline and follow-up visits. Functional outcomes were measured using HHS, limb length discrepancy, hip ROM, and pain status. Follow-up visits were scheduled at 2 weeks, 6 weeks, 12 weeks, and 24 weeks postoperatively, with radiological union and complications documented.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of NITOR. Written informed consent was taken from all participants. Confidentiality was ensured, and participation was voluntary with the right to withdraw at any stage.

Statistical analysis

Data were analyzed using statistical package for the social sciences (SPSS) version 23.0. Descriptive statistics (mean, standard deviation, frequency, percentage) were used to summarize data. Inferential analyses included the Chi-square test for categorical variables and the unpaired t-test for continuous variables. A $p<0.05$ was considered statistically significant.

RESULTS

Table 1 shows the distribution of the study subjects according to different age groups. The mean age of the study subjects in the PFLP group was 46.7±16.8, and in the PFN group was 45.2±16.3. There was no significant difference in age between the groups (p=0.7). In this study, males were predominant (81.8%) over females (18.2%) in both the PFLP and PFN groups. Most of the patients were either businessman (25%) or service holders (22.7%). There was no intergroup difference (p=0.35).

Table 2 shows the fracture characteristics. Motor vehicle accidents were the predominant cause in both groups, accounting for 15 cases (68.2%) each, followed by falls (27.3% in PFLP and 22.7% in PFN). Right-sided injuries were slightly more frequent (54.5% in PFLP, 59.1% in PFN) than left-sided. The most common fracture type was Seinsheimer IIa (25%, n=11), followed by IIb (11.4%), IIc (6.8%), IIIa (15.9%), IIIb (15.9%), IV (15.9%), and V (9.1%). No significant differences were observed between the groups (p=0.35).

The mean radiological union time was 15.6±3.1 weeks in the PFLP group and 13.5±3.2 weeks in the PFN group. Most of the cases required a time between 12 to 16 weeks for radiological union in both groups. In the PFN group, the time for radiological union is significantly less (p=0.007) (Table 3). Regarding Limb length discrepancy, in the PFLP group 9 (40.9%) cases had no LLD, in 9 (40.9%) cases LLD was 0.5 cm, in 2 (9.1%) cases LLD was 1 cm, and in 1 (9.1%) case LLD was 1.5 cm. Whereas in the PFN group, there were no LLD in 14 (63.6) cases, in 7 (31.8%) cases, LLD was 0.5 cm, and in 1 (4.5%) case, LLD was 1 cm. The PFN group has significantly less LLD (p value<0.05) (Table 4).

Table 1: Demographic profile of study population (n=44).

Variable	PFLP (n=22)	PFN (n=22)	Total (n=44)	P value
Age, mean±SD (years)	46.7±16.8	43.8±16.1	45.2±16.3	0.7
Gender, N (%)				
Male	18 (81.8)	18 (81.8)	36 (81.8)	1
Female	4 (18.2)	4 (18.2)	8 (18.2)	
Occupation N (%)				
Business	8 (36.4)	3 (13.6)	11 (25.0)	0.35
Service holder	5 (22.7)	5 (22.7)	10 (22.7)	
Housewife	4 (18.2)	4 (18.2)	8 (18.2)	
Farmer	1 (4.5)	4 (18.2)	5 (11.4)	
Student	1 (4.5)	4 (18.2)	5 (11.4)	
Day laborer	1 (4.5)	1 (4.5)	2 (4.5)	
Ex-service holder	2 (9.1)	1 (4.5)	3 (6.8)	

Table 2: Fracture characteristics (n=44).

Variables	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total (n=44), N (%)	P value
Mechanism of injury				
Motor vehicle accident	15 (68.2)	15 (68.2)	30 (68.2)	0.72
Fall on ground	6 (27.3)	5 (22.7)	11 (25.0)	
Others	1 (4.5)	2 (9.1)	3 (6.8)	
Side of injury				
Right	12 (54.5)	13 (59.1)	25 (56.8)	0.77
Left	10 (45.5)	9 (40.9)	19 (43.2)	
Fracture type (Seinsheimer)				
IIa	4 (18.2)	7 (31.8)	11 (25.0)	0.35
IIb	1 (4.5)	4 (18.2)	5 (11.4)	
IIc	2 (9.1)	1 (4.5)	3 (6.8)	
IIIa	5 (22.7)	2 (9.1)	7 (15.9)	
IIIb	5 (22.7)	2 (9.1)	7 (15.9)	
IV	4 (18.2)	3 (13.6)	7 (15.9)	
V	1 (4.5)	3 (13.6)	4 (9.1)	

Table 3: Time required for radiological union (n=44).

Radiological union (weeks)	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total, N (%)	P value
12–16	17 (77.3)	20 (90.9)	37 (84.1)	0.007
17–21	4 (18.2)	1 (4.5)	5 (11.4)	
22–26	1 (4.5)	1 (4.5)	2 (4.5)	
Mean±SD	15.6±3.1	13.5±3.2	14.5±3.3	

Table 4: Comparison of limb length discrepancy (LLD) between groups.

LLD (cm)	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total, N (%)	P value
0	9 (40.9)	14 (63.6)	23 (52.3)	0.0003
0.5	9 (40.9)	7 (31.8)	16 (36.4)	
1	2 (9.1)	1 (4.5)	3 (6.8)	
1.5	2 (9.1)	0 (0.0)	2 (4.5)	
Mean±SD	0.43±0.47	0.20±0.33	0.32±0.42	

At the last follow-up after the operation, 7 (31.8%) cases had no pain, and 15 (68.2%) had slight pain in the PFLP group. Whereas in the PFN group, 14 (63.6%) cases had no pain, 7 (31.8%) cases had slight pain, and 1 (4.5%) case had mild pain (Table 5).

Table 5: Comparison of pain status at final follow-up.

Pain status	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total, N (%)
No pain	7 (31.8)	14 (63.6)	21 (47.7)
Slight pain	15 (68.2)	7 (31.8)	22 (50.0)
Mild pain	0 (0.0)	1 (4.5)	1 (2.3)

At last, follow up, the mean flexion of hip was 120.3±11.5-degree, Abduction 31.8±4.8-degree, adduction 31.8±4.6 degrees, internal rotation 28.2±4.3 degree and external rotation was 28.2±4.6 degree. There was no significant intergroup difference (p value>0.05 in all movements) (Table 6).

Table 6: Comparison of hip range of motion (ROM).

Movement (degrees)	PFLP (mean±SD)	PFN (mean±SD)	P value
Flexion	120.7±11.7	120.0±11.6	0.42
Abduction	31.8±5.5	31.8±4.2	0.5
Adduction	31.8±5.0	31.8±4.2	0.5
Internal rotation	27.5±3.4	28.9±5.1	0.13
External rotation	27.3±4.0	29.1±5.0	0.09

Both groups improved over time; however, PFN patients achieved significantly higher HHS at final follow-up (Table 7).

Table 7: Harris hip score at different follow up (n=44).

Follow-up (weeks)	PFLP (mean±SD)	PFN (mean±SD)	P value
6	43.6±9.0	47.0±7.8	0.09
12	68.0±11.6	72.1±10.5	0.11
Final follow-up	83.6±12.9	89.2±10.1	0.04

Outcome was evaluated according to the HHS. In the PFLP group, the outcome was excellent in 36.4% cases, good in 31.8% cases, fair in 18.2% cases, and poor in 13.6% cases. In the PFN group, the outcome was excellent in 59.1% cases, good in 22.7% cases, fair in 13.6% cases, and poor in 4.5% cases. There was no significant intergroup difference (Table 8).

Table 8: Final functional outcome (n=44).

Outcome	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total, N (%)	P value
Excellent	8 (36.4)	13 (51.9)	21 (47.7)	0.45
Good	7 (31.8)	5 (22.7)	12 (27.3)	
Fair	4 (18.2)	3 (13.6)	7 (15.9)	
Poor	3 (13.6)	1 (4.5)	4 (9.1)	

In the PFLP group, 9 (40.9%) cases had complications, while in the PFN group, only 3 (22.7%) cases had complications. Complication was found significantly higher in the PFLP group than the PFN group (p value=0.04). Among the complications, 4 (9.1%) had wound infection, 2 (4.6%) had delayed union, 4 (9.1%) had varus malunion, 1 (2.3%) had Z effect, and 1 (2.3%) had pulmonary infection (Table 9).

Table 9: Postoperative complications (n=44).

Complications	PFLP (n=22), N (%)	PFN (n=22), N (%)	Total (n=44), N (%)	P value
Wound infection	3 (13.6)	1 (4.5)	4 (9.1)	0.04
Delayed union	1 (4.5)	1 (4.5)	2 (4.5)	
Varus malunion	4 (18.2)	0 (0.0)	4 (9.1)	
Z-effect	0 (0.0)	1 (4.5)	1 (2.3)	
Pulmonary infection	1 (4.5)	0 (0.0)	1 (2.3)	
Total	9 (40.9)	3 (22.7)	12 (27.3)	

DISCUSSION

This study compared PFLP and PFN in subtrochanteric femur fractures where PFN had better functional outcomes. Patients treated with PFN achieved earlier radiological union, higher HHS, lower limb length discrepancy, and fewer complications, while hip range of motion was similar in both groups.

The mean time to radiological union was significantly shorter in the PFN group. This observation corresponds with findings reported by Pradhan et al, who demonstrated earlier union with PFN than with plating and Roy and Banik, who also reported delayed union with PFLP compared with intramedullary nails.[13,14] The biomechanical rationale supports these results, as Curtis et al showed that intramedullary fixation shares load more effectively and reduces bending stress, which accelerates consolidation compared to extramedullary plating.[15]

In terms of functional outcomes, our study found that PFN patients attained significantly higher HHS at final follow-up. Mirbolook et al reported no difference in range of motion between PFN and PFLP, which agrees with the present study.[16] However, Pradhan et al and Kumar and Harshwardhan both demonstrated higher functional scores in PFN patients, similar to our results.[1,12] The greater proportion of pain-free patients in the PFN group also supports the evidence that intramedullary fixation provides more stable fixation and less micromotion, resulting in better pain relief during recovery.[15]

LLD was significantly lower in PFN patients. This aligns with findings by Nirup and Reddy, who noted higher rates of shortening and malalignment in patients treated with plating.[17] The superior ability of intramedullary nails to maintain mechanical alignment likely accounts for this outcome.[15] Proper restoration of limb length is critical for gait and function, and reduced LLD may partially explain the higher HHS achieved in the PFN group.

Final outcomes in this study showed excellent results in nearly twice in PFN cases compared to PFLP. Furthermore, complications were markedly higher in the plating group. Vinay and Sain similarly reported that complications such as varus collapse, screw back-out, and delayed union were more frequent in PFLP patients.[18] Roy and Banik also described a higher incidence of complications in plating compared with nailing.[14] Although PFN is not complication-free, Simmermacher et al emphasized that most PFN-related issues are technical and can be avoided with proper insertion technique.[19]

Nevertheless, not all studies have found PFN to be superior. Pisoude et al observed comparable functional and radiological outcomes between PFN and PFLP when performed under strict surgical technique.[20] These variations suggest that surgeon experience, fracture type, and patient factors may influence outcomes more than implant selection in certain cases. While PFN appears advantageous in most situations, PFLP still has a role in complex fractures with severe comminution, narrow medullary canals, or where intramedullary nailing is not feasible.

Overall, the current findings reinforce PFN as the implant of choice for subtrochanteric femur fractures, providing better stability, earlier union, and superior functional recovery. However, the choice of fixation should be individualized, and PFLP remains a valuable alternative in selected clinical scenarios.

Limitations of the study

This study has several limitations like sample size was small, limiting generalizability, the sampling method was purposive rather than randomized, introducing potential bias and follow-up duration was limited to six months, restricting assessment of long-term outcomes.

CONCLUSION

This comparative study demonstrated that the PFN provides superior functional outcomes over the PFLP in managing subtrochanteric femur fractures. PFN achieved earlier union, reduced limb length discrepancy, higher Harris Hip Scores, and fewer complications, while hip range of motion was comparable between groups. These findings support PFN as the preferred fixation method, although PFLP remains a reasonable alternative in selected complex cases where intramedullary nailing is not feasible.

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REFERENCES

1. Panteli M, Giannoudi MP, Lodge CJ, West RM, Pountos I, Giannoudis PV. Mortality and medical complications of subtrochanteric fracture fixation. J Clin Med. 2021;10(3):540.
2. El-Sayed AS, El-Mowafi HM, Zalalo SH, Eid TA. Fixation of subtrochanteric fracture femur using a proximal femoral nail. Menoufia Med J. 2014;27(1):208-14.
3. Jiang L, Shen L, Dai L. Intramedullary fixation of subtrochanteric fractures with long proximal femoral nail or long gamma nail: technical notes and preliminary results. Ann Acad Med Singapore. 2007;36(10):821.
4. Jackson C, Tanios M, Ebraheim N. Management of subtrochanteric proximal femur fractures: a review of

recent literature. Adv Orthop. 2018;2018(1):1326701.
5. Ng AC, Drake MT, Clarke BL, Sems SA, Atkinson EJ, Achenbach SJ, Melton III LJ. Trends in subtrochanteric, diaphyseal, and distal femur fractures, 1984–2007. Osteoporos Int. 2012;23(6):1721-6.
6. Nieves JW, Bilezikian JP, Lane JM, Einhorn TA, Wang Y, Steinbuch M, et al. Fragility fractures of the hip and femur: incidence and patient characteristics. Osteoporos Int. 2010;21(3):399-408.
7. Dobbs RE, Parvizi J, Lewallen DG. Perioperative morbidity and 30-day mortality after intertrochanteric hip fractures treated by internal fixation or arthroplasty. J Arthroplasty. 2005;20(8):963-6.
8. Burnei C, Popescu GH, Barbu D, Capraru F. Intramedullary osteosynthesis versus plate osteosynthesis in subtrochanteric fractures. J Med Life. 2011;4(4):324.
9. Streubel PN, Moustoukas MJ, Obremskey WT. Mechanical failure after locking plate fixation of unstable intertrochanteric femur fractures. J Orthop Trauma. 2013;27(1):22-8.
10. Simmermacher RK, Bosch AM, Van der Werken CH. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. Injury. 1999;30(5):327-32.
11. Kanthimathi B, Narayanan VL. Early complications in proximal femoral nailing done for treatment of subtrochanteric fractures. Malays Orthop J. 2012;6(1):25.
12. Kumar DY, Harshwardhan DH. Comparison of proximal femur locking compression plate and proximal femur nail in treatment of complex proximal femoral fractures. Int J Orthop Sci. 2018;4(2c):164-8.
13. Pradhan V, Jain S, Agrawal S, Sharma SL. Comparative prospective study of proximal femoral nail and locking compression plate in subtrochanteric fractures of femur. Natl J Clin Orthop. 2018;2(4):188-94.
14. Roy S, Banik R. A comparative study between proximal femoral nail and proximal femoral locking plate in subtrochanteric femoral fractures: A prospective analysis of 36 cases. Int J Orthop. 2019;5(3):815-21.
15. Curtis MJ, Jinnah RH, Wilson V, Cunningham BW. Proximal femoral fractures: a biomechanical study to compare intramedullary and extramedullary fixation. Injury. 1994;25(2):99-104.
16. Mirbolook A, Siavashi B, Jafarinezhad AE, Khajeh Jahromi S, Farahmand M, Roohi Rad M, et al. Subtrochanteric fractures: comparison of proximal femur locking plate and intramedullary locking nail fixation outcome. Indian J Surg. 2015;77:795-8.
17. Nirup NC, Reddy VN. A prospective comparative study of subtrochanteric fractures treated with long proximal femur nail and proximal femur locking plate. Int J Sci Res. 2019;8(9):62-5.
18. Vinay N, Sain A. Comparative evaluation of clinico-radiological and functional outcome of proximal femoral locking compression plate and proximal femoral nail in unstable proximal femoral fractures. Int J Orthop Sci. 2016;2:103-7.
19. Simmermacher RK, Bosch AM, Van der Werken CH. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. Injury. 1999;30(5):327-32.
20. Pisoude K, Elahifar O, Sohrabi MB, Khajemozafari J. Comparison of proximal femur locking compression plate and intramedullary nailing in the treatment of sub-trochanteric fractures. J Res Orthop Sci. 2019;6(2):1.

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