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Comparison of Unstable Per-Trochanteric Fractures Fixed with Proximal Femoral Nail Versus Dynamic Hip Screw Using Harris Hip Score

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ABSTRACT

Objective: To compare the frequency of a good functional outcome in unstable per-trochanteric fractures fixed with a dynamic hip screw and proximal femoral nail using the Harris Hip Score.

Methodology: A comparative study was conducted at the Department of Orthopaedic Surgery, Pakistan Institute of Medical Sciences, Islamabad, from June to December 2021. A total of 80 patients with per-trochanteric femur fractures were selected and divided into two groups based on the surgical procedure performed: dynamic hip screw or proximal femoral nail. A comprehensive history and thorough examination were performed for all patients during scheduled follow-up visits. Patients were called in for follow-up assessments at 1 month and 3 months to evaluate the functional outcomes using the Harris Hip Score.

Results: The mean age of all patients was 58.73±6.78 years. At the 3-month follow-up, the mean Harris Hip Score was significantly higher in the proximal femoral nail group compared to the dynamic hip screw group (84.64±7.05 vs. 73.9±12.53; p = 0.005). The proportion of patients with good functional outcomes (Harris Hip Score ≥ 70 points) was significantly higher in the proximal femoral nail group compared to the dynamic hip screw group (97.5% vs. 72.5%, p = 0.002).

Conclusion: In this study, the proximal femoral nail group demonstrated superior functional outcomes compared to the dynamic hip screw group. The use of proximal femoral nail fixation can provide better outcomes and facilitate an earlier return to pre-injury status for patients.

Keywords: Bone nails,Bone screws, Harris hip score, Trochanteric fractures.

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Introduction

The dynamic hip screw (DHS) has traditionally been a widely used implant for intertrochanteric hip fractures. However, the introduction of intramedullary nails and proximal femoral locking compression plates has significantly transformed their management. As both devices have undergone design advancements, there has been ongoing debate regarding their comparative superiority.

The hip fractures in ≥ 50 years of people are more than 90% of per-trochanteric fractures. The complications and mortality rate in these cases are about 20-30% and 17%, respectively.[1] Generally, instability is determined by the presence of a zone of the medial cortex.

The standard implant, the dynamic hip screw (DHS) has long been a common replacement for intertrochanteric hip fractures. The onset of intramedullary nails and proximal femoral locking compression plate has dramatically changed their management. With the evolution in the designs of both devices, there has always been some controversy over the superiority of one another.[2] DHS with fixed angle locking screws reduces the risk of implant failure and is especially important for osteoporotic bones and repairing unstable fractures.[3] The Proximal Femoral Locking Compression Plate (PF-LCP) serves as a consistent angle internal fixation device, offering enhanced stability in comparison to the Dynamic Hip Screw (DHS) and side plate, while minimizing excessive bone removal. Additionally, it is particularly suitable for treating fractures in osteoporotic bones.[4] The PF-LCP effectively mitigates rotational instability and enables angular stability through the establishment of a fixed-angle construct for complex, intertrochanteric femoral fractures.[5] Proximal locking screws (5mm, unstructured) provide independent angular construction without bone quality.[6]

Proximal femoral nail (PFN) is one of the latest modalities for unstable intertrochanteric femoral fractures. It is a cephalon-medullary device and has potential benefits such as intramedullary load transfer is very efficient, short lever arm resulting in low pressure transmission and fewer implant failures, being closer to the Q axis, and the advantage of controlled rotation is maintained.[7] The Harris Hip Score (HHS) is a multidimensional evaluation consisting of eight items representing pain, walking distance, ADLs, and range of motion of the hip joint. The HHS score ranges from 100 (no disability) to 0 (maximum disability).[8]

The rationale behind doing this study was that per-trochanteric fractures are being treated on regular basis with aforementioned implants/techniques. However, local data comparing the outcomes of proximal femoral nail and dynamic hip screw procedures was lacking. This study aimed to address this gap and provide local evidence regarding the functional outcomes associated with the use of a proximal femoral nail and a dynamic hip screw in unstable per-trochanteric fractures. The intention was to share the results with orthopaedic surgeons and recommend the optimal fixation method for overall patient benefit, promoting a better and quicker return to pre-injury status.

Methodology

Following approval from the Ethical Committee of SZABMU, Islamabad, a comparative study was conducted at the Department of Orthopaedic Surgery, Pakistan Institute of Medical Sciences, Islamabad, between June to December 2021. With a written informed consent, a sample of 80 cases of unstable per-trochanteric fractures (calculated by the WHO sample size calculator, and the following parameters were used; population proportion of good outcome in PFN group and DHS group was 75% and 35%, respectively. (Level of significance 5% and power of test was 80%).[2] Patient's age between 45 to 90 years, both males and females, fresh fractures (one week) and closed fractures were enrolled in this study on volunteer basis by consecutively non-probability sampling technique. Patients with polytrauma and associated injuries, pregnant females, infected cases and pathological fractures were excluded from the study. A random assignment of 40 patients to the PFN (Proximal Femoral Nail) group and 40 patients to the DHS (Dynamic Hip Screw) group was performed based on the surgical procedure to be performed. Computer-generated random numbers were enclosed in consecutively numbered, sealed envelopes.

The following procedure was performed to evaluate patients: Per-trochanteric fractures; a fracture through the per-trochanteric region of the femur; a form of extra capsular hip fracture diagnosed by using two dimensional X-rays as diagnostic tool.[9] Unstable fractures were included in Boyd & Griffin classification 1 to 4 types.[10] Comprehensive history and thorough examination were performed of all patients on scheduled follow up. Patients were called for follow up after 1 month and 3 months for assessment of functional outcome using the Harris hip score. Harris hip score (0-100) was calculated, HHS above 70 was labelled as good, less than 70 was labelled as poor. All the study procedures and data collection were performed by the researcher himself to limit selection bias. The data was collected on a pre-structured proforma.

Data entry and analysis were performed using SPSS v23 software. Frequencies and percentages were calculated for categorical variables such as gender and fracture side with good functional outcomes. Means and standard deviations were calculated for continuous variables such as age. To compare the Harris Hip Scores between the two groups, an independent sample t-test was used.

Stratification was employed to control for effect modifiers such as age, gender, fracture side, and functional outcome. Post stratification was carried out using the chi-square test, considering a p-value of ≤ 0.05 as statistically significant.

Results

Eighty patients with per-trochanteric femur fractures were selected in this study. The mean age of all patients was 58.73±6.78 years. The mean age of the PFN group and DHS group was 58.38±7.30 and 59.08±6.29 years, respectively. There were 56 (70%) males and 24 (30%) females. Gender distribution with respect to groups, in PFN 29 (72.5%) male and 11 (27.5%) female and in DHS group 27 (67.5%) male and 13 (32.5%) were female. Side of fracture was also recorded, and there were 30 (75%) right sided and 10 (25%) left sided fractures in the PFN group. In the DHS group, there were 24 (60%) right sided and 16 (40%) left sided fractures reported. The mean Harris hips score was measured between both study groups at 1st month and at 3rd month (Table I).

Functional outcome (Harris hips score ≥ 70) was measured between both study groups at the 1st month and at 3rd month (Table II). Stratification analysis of functional outcome in unstable per-trochanteric fracture between age group was insignificant (p ≥ 0.05). Stratification analysis was performed with respect to gender and found that "good" (Harris hips score ≥ 70) functional outcome was high in group PFN than DHS group (Table III). The stratification analysis of functional outcome in unstable per-trochanteric fractures between side of fracture (right/left) group was insignificant (p ≥ 0.05).

Table I: Comparison of Harris hips score between groups at 1st month and 3rd month (n=80)

Harris Hips Score	PFN group	DHS group	t*	p value
	Mean±SD	Mean±SD		
HHS at 1st month	76.35±11.01	69.13±15.81	88.00	.02
HHS at 3rd month	84.64±7.05	73.9±12.53	28.00	.005

* Independent sample t-test

Discussion

The results showed that in the PFN group, the Harris Hip Score was significantly higher at 1st and 3rd months (p ≤ 0.05) as compared to the DHS group. When analyzing functional outcomes (Harris Hip Score ≥ 70) at the 1st and 3rd months, a greater proportion of patients in the PFN group demonstrated good functional outcomes (82.5% and 97.5%, respectively) compared to the DHS group (57.5% and 72.5%, respectively), with a p-value ≤ 0.05. Stratification analysis based on gender also revealed a higher rate of good functional outcomes (Harris Hip Score ≥ 70) in the PFN group compared to the DHS group (p ≤ 0.05).

The proper treatment of intertrochanteric fractures has long been debated. Failure rates for this fracture were reported as 9–16% and shortening of the femoral neck usually results.[11] Implants designed in the past that were intended to restore hip anatomy have a high rate of failure. Gamma nail was introduced in the early 80s to overcome obvious barriers to fixation with a slippery screw.[12]

Table II: Compare functional outcome in unstable per-trochanteric fracture between groups at 1st month and 3rd month (n=80)

Functional outcome		DHS group	PFN group	Total	χ^2 value	p value
1st month	Good	23 (57.5%)	33 (82.5%)	56 (70%)	5.95	0.015
	Poor	17 (42.5%)	7 (17.5%)	24 (30%)		
3rd month	Good	29 (72.5%)	39 (97.5%)	68 (85%)	9.80	0.002
	Poor	11 (27.5%)	1 (2.5%)	12 (15%)		

Table III: Compare functional outcome in unstable per-trochanteric fracture between groups for gender at 1st month and 3rd month (n=80)

Functional outcome (Male)		DHS group	PFN group	Total	χ^2 value	p value
1st month	Good	18 (66.7%)	24 (82.8%)	42 (75%)	1.931	0.165
	Poor	9 (33.3%)	5 (17.2%)	14 (25%)		
3rd month	Good	19 (70.4%)	28 (96.6%)	47 (83.9%)	7.11	0.008
	Poor	8 (29.6%)	1 (3.4%)	9 (16.1%)		
Functional outcome (Female)						
1st month	Good	5 (38.5%)	9 (81.8%)	14 (58.3%)	4.61	0.032
	Poor	8 (61.5%)	2 (18.2%)	10 (41.7%)		
3rd month	Good	10 (76.9%)	11 (100%)	21 (87.5%)	2.90	0.089
	Poor	3 (23.1%)	0	3 (12.5%)		

The nails have emerged over time, and modern designs have a small distal shaft width that reduces the pressure at its ends thus preventing the fracture of the femoral shaft. Also, rotational control is focused on nail formation and does not depend on the many parts of the implant that increase the risk of failure. The diameter of the small screw lag no longer requires flare-up of the closest aspect of the nail thus preventing mechanical failure of the nail and involves a slight repetition of the proximal femur, thus reducing the chances of iatrogenic femoral shaft fractures. Changes in the entrance area from the piriform fossa to the greater trochanter also reduce surgical dislocation in the tendinous hip muscles.[13] A met analysis that considered all studies after 2000, confirmed this when it was said that equal levels of peri-prosthetic fractures were both intra or extra medullary implants.[14]

In practice, using the Harris hip scoring system, in the final follow-up, our study confirms that PFN is higher than DHS in unstable intertrochanteric fractures while in stable fractures, performance results are the same. Similar observations were also reported in the Gill et al study, in this study out of total 20% of the patients showed poor score on Harris Hip Score in DHS group as compared to none in PFN group.[2]

This result was confirmed by Bhakat et al who announced the corresponding results using the same points.[15] Gadegone et al presented positive results with stable and unstable fractures in their analysis with PFN.[16] In unstable fractures, axial telescoping control and rotation stability are very important and the intramedullary device placed in a less aggressive manner is better tolerated in the elderly. It can also deal with higher static and multi-fold rotation loading than a local installation and temporarily compensates for the function of the middle column.[17]

After surgery also, patients from the PFN group were more successful than the DHS group, with less postoperative pain, fewer episodes of deep infection and a better range of motion.

Moreover, a significantly higher number of patients in the trauma organization achieved pre-injury mobility compared to the PFN group. The incidence of limb length reduction was notably lower in the PFN group when compared to the DHS group. This could be attributed to the possibility of improper lag screw positioning within the barrel in DHS patients. The shorter incision with minimal soft tissue damage and the utilization of load-sharing implants may have contributed to this outcome. Reindl et al. suggested an average 1cm shorter DHS than PFN, although it did not lead to any functional impairment.[18] Similarly, Zehir et al. reported similar results in terms of postoperative range of motion, while postoperative pain outcomes were comparable. [19] There were no significant differences observed between the groups regarding the time of union in our series.

Conclusion

This study demonstrated that the group treated with Proximal Femoral Nail (PFN) had a significantly higher rate of good functional outcomes compared to the group treated with Dynamic Hip Screw (DHS). Functionally, PFN showed superiority over DHS in the management of femoral per-trochanteric fractures. PFN is better mode of fixation, and this treatment could be a better and early return to patient pre-injury status.

References

1. Azar FM, Canale ST, Beaty JH. Campbell's Operative Orthopaedics, E-Book. Elsevier Health Sciences; 2020.
2. Gill SP, Mittal A, Raj M, Singh P, Kumar S, Kumar D. Dynamic hip screw with locked plate VRS Proximal Femoral Nail for the management of intertrochanteric fracture: A comparative study. Int J Orthop Sci. 2017;3(2):173-180. https://doi.org/10.22271/ortho.2017.v3.i2c.27
3. Zang W, Liu PF, Han XF. A comparative study of proximal femoral locking compress plate, proximal femoral nail antirotation and dynamic hip screw in intertrochanteric fractures. Eur Rev Med Pharmacol Sci. 2018;22(1 Suppl):119-123. https://doi.org/10.26355/eurrev_201807_15373
4. Kumar N, Kataria H, Yadav C, Gadagoli BS, Raj R. Evaluation of proximal femoral locking plate in unstable extracapsular proximal femoral fractures: Surgical technique & mid-term follow up results. J Clin Orthop Trauma. 2014;5(3):137-145. https://doi.org/10.1016/j.jcot.2014.07.009
5. Lee WT, Murphy D, Kagda FH, Thambiah J. Proximal femoral locking compression plate for proximal femoral fractures. J Orthop Surg. 2014;22(3):287-293. https://doi.org/10.1177/230949901402200304
6. Yaradilmis YU, Okkaoglu MC, Ozdemir E, Ahmet AT, Demirkale I, Altay M. The quality of life of the elderly is negatively affected by pertrochanteric femoral fractures: a comparative study. European Res J. 2022;8(1):24-30. https://doi.org/10.18621/eurj.819867

7. Ramnarayan V, Vanchi PK, Kumar MM. Intra-medullary or Extra-medullary fixation for Inter-trochanteric fractures-A comparison study. IOSR J Dent Med Sci. 2015;14(9):15-21. https://doi.org/10.9790/0853-14911521
8. Shetty A, Ballal A, Sadasivan AK, Hegde A. Dynamic hip screw with trochanteric stablization plate fixation of unstable inter-trochanteric fractures: a prospective study of functional and radiological outcomes. J Clin Diagnostic Res: JCDR. 2016;10(9):06-08. https://doi.org/10.7860/JCDR/2016/20275.8415
9. Catania P, Passaretti D, Montemurro G, Ripanti S, Carbone S, Candela V, et al. Intramedullary nailing for pertrochanteric fractures of proximal femur: a consecutive series of 323 patients treated with two devices. J Orthop Surg Res. 2019;14(1):1-7. https://doi.org/10.1186/s13018-019-1506-1
10. Taqi M, Tasneem M, Akhtar M, Naqshband MS, Faraz S, Gillani S, et al. Treatment and Outcomes of Proximal Femoral Locking Plate Versus Proximal Femoral Nail in Unstable Pert-Trochanteric Fractures (Boyd and Griffin Type III & IV). Pakistan J Medical Health Sci. 2021;15(1):133-136.
11. Aktselis I, Kokoroghiannis C, Fragkomichalos E, Koundis G, Deligeorgis A, Daskalakis E, et al. Prospective randomised controlled trial of an intramedullary nail versus a sliding hip screw for intertrochanteric fractures of the femur. Int Orthop. 2014;38(1):155-161. https://doi.org/10.1007/s00264-013-2196-7
12. Arirachakaran A, Amphansap T, Thanindratarn P, Piyapittayanun P, Srisawat P, Kongtharvonskul J. Comparative outcome of PFNA, Gamma nails, PCCP, Medoff plate, LISS and dynamic hip screws for fixation in elderly trochanteric fractures: a systematic review and network meta-analysis of randomized controlled trials. Eur J Orthop Surg Traumatol. 2017;27(7):937-952. https://doi.org/10.1007/s00590-017-1964-2
13. Baldwin III PC, Lavender RC, Sanders R, Koval KJ. Controversies in intramedullary fixation for intertrochanteric hip fractures. J Orthop Trauma. 2016;30(12):635-641. https://doi.org/10.1097/BOT.0000000000000652
14. Yu J, Zhang C, Li L, Kwong JS, Xue L, Zeng X, et al. Internal fixation treatments for intertrochanteric fracture: a systematic review and meta-analysis of randomized evidence. Sci Rep. 2015;5(1):1-11. https://doi.org/10.1038/srep18195
15. Bhakat U, Bandyopadhayay R. Comparitive study between proximal femoral nailing and dynamic hip screw in intertrochanteric fracture of femur. Open J Orthop. 2013;3(07):291-295. https://doi.org/10.4236/ojo.2013.37053
16. Gadegone WM, Shivashankar B, Lokhande V, Salphale Y. Augmentation of proximal femoral nail in unstable trochanteric fractures. Sicot J. 2017;3(2):12-18. https://doi.org/10.1051/sicotj/2016052
17. Jolly A, Bansal R, More AR, Pagadala MB. Comparison of complications and functional results of unstable intertrochanteric fractures of femur treated with proximal femur nails and cemented hemiarthroplasty. J Clin Orthop Trauma. 2019;10(2):296-301. https://doi.org/10.1016/j.jcot.2017.09.015
18. Reindl R, Harvey EJ, Berry GK, Rahme E. Intramedullary versus extramedullary fixation for unstable intertrochanteric fractures: a prospective randomized controlled trial. JBJS. 2015;97(23):1905-1912. https://doi.org/10.2106/JBJS.N.01007
19. Zehir S, Zehir R, Zehir S, Azboy İ, Haykir N. Proximal femoral nail antirotation against dynamic hip screw for unstable trochanteric fractures; a prospective randomized comparison. Eur J Trauma Emerg Surg. 2015;41(4):393-400. https://doi.org/10.1007/s00068-014-0463-y