

Proximal Femoral Nail Versus Dynamic Hip Screw in Unstable Proximal Femoral Fracture

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ABSTRACT

Background: Unstable proximal femoral fracture occurs at the top of femur bone, typically in elderly people or those involved in high-impact accidents. The fracture can occur in different ways, including intertrochanteric, subtrochanteric, or femoral neck fractures. The two most common techniques implied for its repair are Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS).

Objectives: The research was conducted to evaluate these both techniques and compare their clinical outcome in terms of Harris Hip Score, clinical assessment and clinical complications.

Methods: Cross-sectional study was completed in 2020-2022 and comprised 104 patients equally divided into Group A (DHS) and Group B (PFN). Both techniques were comparatively analyzed and the outcomes were evaluated using Harris Hip Score and clinical assessment.

Results: Group A and B had mean surgery duration of 76.78+13.40 and 57.09+11.67 minutes, mean intra-operative blood loss of 239+32.98 and 149+17.29 ml, mean weight bearing time was 3.13+0.56 and 2.98+0.39 months, average incision length was 8.78+2.81 and 5.12+1.94 cm, radiological union of the fractured bones took 3.27+0.78 and 3.11+0.82 months, respectively. Harris Hip Scores were recorded on monthly basis and revealed that 1st monthly scores of Group A and B were 71 and 74, 2nd month had 77 and 81, 3rd month had 80 and 84, 4th month had 83 and 88, 5th month had 84 and 89 and 6th month revealed 86 and 90 scores, respectively.

Practical implication: The surgeons would prefer PFN technique while surgery of unstable femoral fracture to avoid complications and achieve better results.

Conclusion: PFN technique was associated with less blood loss, lower complications and a higher Harris Hip Score. It has marginally superior results to DHS. Thus PFN is a minimally invasive technique that necessitates less tissue dissection, resulting in negligible blood loss. In treating unstable femoral fractures, an analysis of clinical indicators revealed that PFN has superior clinical manifestation than DHS.

Keywords: Femoral fractures; Harris Hip Scores; Intramedullary device; Osteoporosis.

INTRODUCTION

The incidence of unstable intertrochanteric femoral fractures, such as comminuted fracture and wedge fracture, lies between 12.4 and 23.1% in older individuals with osteoporosis. It can also develop in younger persons, typically as a result of road accidents, trauma or falls, with 5.6% incidence rate. The clinical treatment is intimately tied to the anatomy of hip joint, and a healthy blood supply promotes clinical recovery¹. These account for over 50% of total hip fractures, are associated with substantial morbidity and death. Compared to stable patterns, 40% of per-trochanteric femoral fractures are unstable and have greater failure risk whilst addressed with traditional treatment. This instability is multifactorial, including loss of postero-medial calcar, postero-lateral support and inadequacy of the lateral femoral wall².

Numerous classification schemes exist for these fractures. On the basis of fracture patterns, Evans classification divided it into stable and unstable categories. Accordingly, two-part fractures are considered stable, while three- or four-part fractures are considered unstable²⁻⁴.

The primary objective in the rehabilitation of hip fractures is the earliest feasible mobilization and therapy. DHS had been widely employed, but fresh research continues to support use of the PFN approach⁵⁻⁶.

DHS was introduced in 1970s, and could provide both dynamic and static support for fracture stabilization. However, complications related to screw displacements, such as distal screw extrusion and secondary fracture displacement, are not uncommon⁷. PFN was established by AO/ ASIF in 1996 as least invasive approach to treat unstable femoral fractures by intra-medullary device⁸. In 2003, PFN anti-rotation system with a helically shaped sliding column-blade plan was introduced and provided improved contact area between bone and implant, and prevented rotation-induced cut-outs⁹.

The DHS is extra-medullary fixation with pressure-locking device. It has been the treatment of choice for inter-trochanteric fractures bearing excellent clinical outcomes, lowered non-union frequency, and infrequent fixation failures, while, PFN is a specialized intramedullary device with a helical blade that compacts cancellous bone through sliding compression, thereby enhancing axial compressive forces and rotational stability¹⁰⁻¹².

The study was purposed to evaluate this spat and compare the clinical outcome, success rate, and minimal surgical complications of PFN and DHS in patients with unstable proximal femoral fractures, because the data comparing the significance and efficacy of these two surgical techniques is insufficient in literature. .

MATERIAL AND METHODS

Study design: This cross-sectional research was conducted between July 2020 and November 2022 at the Orthopedics Department of Mufti Mehmood Memorial Teaching (MMMT) Hospital in Dera Ismail Khan, Pakistan.

Sample size: The study comprised 104 patients and was divided into two groups; Group A and B.

Study procedure and data collection: Group A patients were operated on using DHS technique, and Group B patients were operated on using PFN technique. Both techniques were contrasted and analyzed, and patient's demographic and clinical data were recorded. Cause of injury, operational time, incision length, blood loss during surgery, post-surgical complications, and all related parameters were duly recorded. To reduce the fracture, general and spinal anesthesia was administered.

Development of instrument: The outcomes were evaluated using Harris Hip Score. It is a clinical assessment tool used to assess the function and pain of hip joint based on subjective and objective criteria. The score is calculated based on nine items, including

pain, function, range of motion, and deformity. Each item is scored as below:

Nine items and their respective maximum scores are:

1. Pain (44 points)
2. Function (47 points)
3. Deformity (4 points)
4. Range of motion (5 points)
5. Muscle strength (4 points)
6. Walking aids (4 points)
7. Activities of daily living (4 points)
8. Limp (3 points)
9. Sitting (2 points)

Reliability and validity: It is universally used to appraise the effectiveness of hip surgeries, such as hip replacement or fixation procedures like DHS or PFN, as it allows for tracking of patients' progress over time.

A score below 70 was poor, a fair score was 70-80, 80-90 was good and an above 90 score ranked excellent. In outpatient clinic, radiographs were taken on the first postoperative day, 4 weeks after surgery, and every month thereafter. The maximum follow-up duration was six months.

Inclusion and exclusion criteria: Inclusion criteria comprised the patients diagnosed with proximal femoral fractures through X-ray, no cardiac or respiratory complications within six months of admission, normal blood parameters, and not diabetic and hypertensive. Exclusion criteria included severe cardiovascular, respiratory, cerebrovascular disorders, diabetes mellitus, multiple fractures, pathological hip fractures and surgical contraindications.

Ethical approval: The study was approved by the hospital's institutional Ethics Committee, all patients provided written informed consent, and were volunteered to participate.

Statistical analysis: SPSS 23.0 was utilized to analyze the outcomes. For qualitative variables, frequencies and percentages were calculated, while for quantitative variables, the mean and standard deviation were determined. Chi-square test was utilized for nonparametric variables, whereas one-way ANOVA with Tukey's HSD was utilized to compare the mean values of variables between the DHS and PFN groups.

RESULTS

The study was conducted at MMMT Hospital, comprising 104 patients, equally divided into Group A (operated through DHS technique) and Group B (operated through PFN technique), having 52 patients in each. The demographic values of the patients revealed that the patients in Group A (DHS operated) had mean age of 63.13+12.98 years and Group B patients had 61.94+12.06 years. Females were significantly affected more by proximal femoral fractures in both the groups i.e. 31 and 28 (p<0.05), while there were 21 and 24 males in Group A and B, respectively. The main mode of injury was fall on the ground, followed by road accidents, overstretching and other causes were also prominent in study patients (Table 1). Most of the patients had right-sided fractures 32 and 37, in Group A and B, while 20 patients in Group A and 15 in Group B were affected with left-sided femoral fractures (Table 1).

Comparative analysis of study observations was done in both DHS and PFN groups and it was found that all of these were better in Group B treated using PFN technique as compared to DHS surgery. Group A and B had mean surgery duration of 76.78+13.40 and 57.09+11.67 minutes, mean intra-operative blood loss of 239+32.98 and 149+17.29 ml, mean weight bearing time was 3.13+0.56 and 2.98+0.39 months, average incision length was 8.78+2.81 and 5.12+1.94 cm, radiological union of the fractured bones took 3.27+0.78 and 3.11+0.82 months, respectively (Table 2).

The comparative analysis of complications that occurred during surgical procedure of proximal femoral fracture in both techniques was also done and it was found that patients of Group A (DHS) revealed higher intra-operative complications (12 patients) and orthopedic complications (n=6) than Group B (PFN)

having 9 and 4 patients showing such complications, respectively. While, Group B patients had higher wound complications (n=5) and failure of weight bearing (n=8) than Group A having 3 and 7 patients affected by each complication, respectively (Figure 1).

Patients of both groups were evaluated through Harris Hip Score of patients, on monthly basis, through keen clinical assessment and it was evident that the patients of Group B treated with PFN technique had significantly higher Harris hip score values than Group A patients treated with DHS (Figure 2). Their Harris hip scores were recorded on monthly basis and revealed that 1st monthly scores of Group A and B were 71 and 74, 2nd month had 77 and 81, 3rd month had 80 and 84, 4th month had 83, 88, 5th month had 84 and 89 and 6th month revealed 86 and 90 scores, respectively.

Table 1: Demographic values of study population

S. No	Study variable	Group A (DHS)	Group B (PFN)	p-value
1	Age (Mean+SD) years	63.13+12.98	61.94+12.06	-
2	No. of patients (n)	52	52	1.0
3	Gender (n)			
	Male	21	24	0.0001*
	Female	31	28	
4	Mode of Injury (n)			
	Fall	38	36	0.1449
	Road accident	4	5	0.3665
	Over-stretch	2	1	0.5473
	Other causes	8	10	0.1411
5	Side (n)			
	Right	32	37	0.1150
	Left	20	15	0.8571

*indicated that the p-value was significant

Table 2: Comparative analysis of study observations in both DHS and PFN surgeries

S. No	Study Observations	Group A (DHS)	Group B (PFN)
1	Surgery duration (Mean+SD) minutes	76.78+13.40	57.09+11.67
2	Intra-operative blood loss (Mean+SD) ml	239+32.98	149+17.29
3	Weight-bearing time (Mean+SD) months	3.13+0.56	2.98+0.39
4	Incision length (Mean+SD) cm	8.78+2.81	5.12+1.94
5	Radiological union (Mean+SD) months	3.27+0.78	3.11+0.82

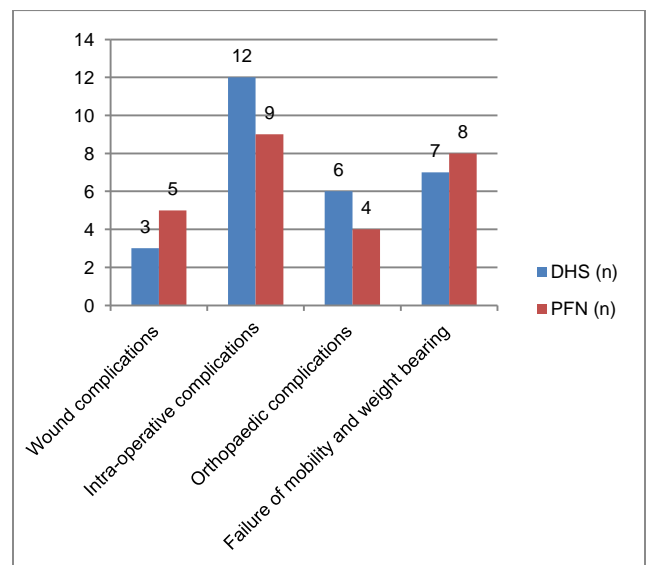


Figure 1: Comparative analysis of complications that occurred during surgical management of proximal femoral fracture

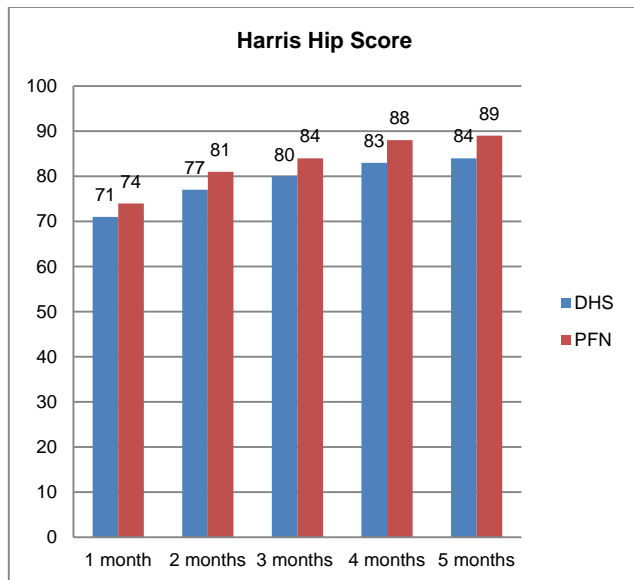


Figure 2: Evaluation of Harris hip score of patients through clinical assessment who underwent DHS and PFN surgeries

DISCUSSION

Comparative analysis of study observations as well as month-wise clinical assessment through Harris hip score, of both DHS and PFN groups and the clinical complications associated with both techniques, revealed that PFN technique was more successful and satisfactory than DHS technique. The mean Harris Hip Score showed by patients of PFN group was 84.33 while patients of DHS group had mean score of 80.16.

Another study drew a similar conclusion that PFN had fewer complications related to surgical wounds, but the risk of technical errors was higher, which could contribute to a higher reoperation rate in PFN compared to DHS group¹³⁻¹⁴. Similarly, our findings were also comparable to the results whereby patients with unstable intertrochanteric fractures had a significantly enhanced functional outcome when treated with PFN, whereas, for stable intertrochanteric fractures, there was no significant difference in functional outcome between DHS and PFN. DHS and PFN were used to treat 31% of stable intertrochanteric fractures, 58% of unstable fractures, and 11% of reverse oblique fractures. At one month, mean HHS in DHS group was 24.5 while in PFN group, it was 35.2. ($P=0.0001$). At 6 months, DHS group HHS was 78.8 and PFN group HHS was 82.8. ($P=0.02$). At one year, the DHS HHS was 92.1 and the PFN was 92.5. ($P=0.4$)¹⁵⁻¹⁷.

In another study, the HHS of PFN patients was found to be superior to that of DHS patients. In sixty patients treated for IFF, HHS was 53.4 in DHS and 47.6 in PFN three months after surgery¹⁸. As time progressed, the Harris hip assessment of both DHS and PFN became nearly identical, 94.2 for DHS and 94 for PFN, indicating that there was no significant difference between two techniques in terms of long-term outcome^{5, 19-21}.

A researcher who treated 31% stable intertrochanteric fractures, 58% unstable fractures, and 11% reverse oblique fractures with DHS and PFN supported our findings. At one month, the mean HHS in the DHS group was 24.5 while in the PFN group it was 35.2. ($P 0.0001$). At 6 months, DHS group HHS was 78.8 and PFN group HHS was 82.8. ($P 0.02$). At one year, the DHS HHS was 92.1 and the PFN was 92.5. ($P 0.4$). The authors concluded that PFN performed well in elderly patients with osteoporosis and unstable intertrochanteric fractures, whereas DHS performed well in younger patients^{14, 22}.

Our findings were supported by a study comparing DHS and PFN antirotation for the fixation of stable type A1 intertrochanteric fractures, which revealed that the PFNA group had less operative

time, blood loss, and postoperative discomfort²³. Similarly, fewer orthopaedic and non-orthopaedic complications were observed in the PFNA group, according to the findings²⁴.

CONCLUSION

In our study, unstable femoral fracture patterns were more prevalent in elderly patients, particularly women, and PFN technique was associated with less blood loss, a lower rate of complications, a higher Harris Hip Score, and smaller incision size. It has marginally superior results to the dynamic screw hip implant procedure. This minimally invasive technique necessitates less tissue dissection, resulting in negligible blood loss. In treating unstable femoral fractures, an analysis of clinical indicators revealed that PFN has superior clinical manifestation than DHS.

Conflict of Interest: None

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