

A Comparative Study of Proximal Femoral Nail and Dynamic Hip Screw in the Treatment of Intertrochanteric Fractures of Femur

MUHAMMAD SARFRAZ¹, SAEED AHMAD², MUHAMMAD SHAHBAZ RAZA³, SYED ALAM ZEB⁴, SARTAJ LAKHANI⁵, RAHIM KHAN⁶

¹Surgeon/ Assistant Professor Department of Orthopedic Surgery, F-11 G Polyclinic, Islamabad

²Consultant Orthopedic Surgeon, Department of Orthopaedic Surgery, Capital Hospital (CDA), Islamabad

³Assistant Professor of Orthopaedics, SKBZ/CMH, Muzaffarabad AJK

⁴Clinical Fellow Orthopaedic, Royal Oldham Hospital, Oldham Greater Manchester

⁵Consultant Orthopaedic Surgeon, Civil Hospital Mithi District, Tharparkar

⁶Associate Professor, Orthopaedic Department, MMC/BKMC /MTI, Mardan

Corresponding author: Saeed Ahmad, Email: saeeddhs@gmail.com

ABSTRACT

Aim: The aim of this analysis is the comparison of the functional and radiological results of stable intertrochanteric femoral fractures managed with the dynamic hip screw (DHS) and proximal femoral nail (PFN).

Study Design: A Randomized, controlled study.

Place and Duration: In the Orthopaedics department of Capital Hospital (CDA), Islamabad for two years duration from January 2020 to December 2021.

Methods: All patients with stable intertrochanteric fractures who met the criteria of selection were randomly allocated to group A (DHS) and B (PFN). There were 80 total patients alienated into group A and B. Patients were x-rayed for union evaluation and functional evaluation was done with Harris Hip Score (HHS) was performed, rated as poor (score <70), good (80 to 90), fair (70 to 80) and excellent (90 to 100). The comparison of the results in the two groups was made at the third, sixth and twelfth months, and the P value was calculated using the chi-square test and the independent sample t-test. P <0.05 was measured significant.

Results: There were 80 total patients. They were divided equally and randomly into groups A and B of 40 patients each. The PFN group had a shorter operative time, smaller incision and minimum blood loss intraoperatively than the DHS group (p <0.05). The group A mean age was 60.10±4.48 years, and of group B was 59.20±5.71 years. There were 25 men (62.5%) in A group and 23 (57.5%) in B group. Women were 15 (37.5%) in A group and 17 (42.5%) in B group. Mean time of radiological union was 14.2±4 weeks in group A and 12.8±6 weeks in group B (P > 0.05). During the 3-month follow-up period, the Harris Hip Score (HHS) was 54.20 ± 4.20 (poor) and 35.03 ± 4.11 (poor) in Groups A and B, correspondingly (P <0.05). HHS in group A was 90.27 ± 3.80 (good) and in B group, it was 82.27 ± 3.65 (good) (P <0.05) at 6 months and HHS 94.61 ± 2.08 (excellent) and 93.27 ± 2.18 (excellent) 1 year in the group A and B (P > 0.05).

Conclusions: Both DHS and PFN gave similar results in terms of radiological union in stable intertrochanteric fractures. The short-term functional score was poor and good for both DHS and PFN at 3 and 6 months, although DHS scored statistically better than PFN. After one year of follow-up, both DHS and PFN had similar excellent functional scores, but had no statistically significant difference in score.

Keywords: Harris hip Score, Proximal femoral nail, Dynamic hip screw and Intertrochanteric fracture.

INTRODUCTION

Hip fractures are a serious problem and a major health problem worldwide. It is estimated that by 2055, more than 50% of all fractures of hip will be due to an increase in life expectancy in the Asian population^{1,2}. Intertrochanteric fractures approximated for about 50% of the fractures of hip in the elderly³. The foremost goal of intertrochanteric fractures treatment is fracture union with minimal complications and early mobilization⁴⁻⁵. Although the dynamic hip screw (DHS) is the extensively used implant for stable intertrochanteric fractures treatment, the proximal femur nail (PFN) has recently been increasingly favoured due to its more biomechanically stable design⁶. However, there have been reports of PFN failures in the literature, mainly due to technical errors. Many studies have compared the outcomes of PFN and DHS in intertrochanteric unstable fractures, but there are no comparisons done for stable intertrochanteric fractures⁷⁻⁸. The aim of this analysis is the comparison of the functional and radiological results of stable intertrochanteric femoral fractures managed with the dynamic hip screw (DHS) and proximal femoral nail (PFN).

We hypothesized that better radiological and functional outcomes could be obtained by using DHS instead of PFN in stable intertrochanteric fractures.

MATERIAL AND METHODS

We conducted this randomized, controlled study in Orthopaedics department of Capital Hospital (CDA), Islamabad for two years duration from January 2020 to December 2021. The patients with Stable intertrochanteric femoral fracture (AO / OTA type 31 -A1) of any age and gender were encompassed in this research and appropriate studies were accomplished on all patients. The

hospital Ethical committee obtained written informed consent from all patients. The volunteers were alienated randomly into groups A (DHS) and B (PFN) by randomization.

Surgical Techniques: All operations were performed under spinal or general anesthesia on radiolucent table and under the control of an image intensifier. The same surgical team performed all operations according to the same standard surgical techniques for DHS and PFN. Fractures have been closely reduced. A 5 cm linear lateral incision was made distal from the greater trochanter in an appropriate position to expose the DHS (@Esmeco) entry point. For DHS application, we used the appropriate size lag screw and a 4-hole side plate at a 135 ° angle with a 4.5mm cortical screw. The lag screw position was held posterior-inferior in the femoral neck and tip apex distance (TAD) of <25 mm was maintained.

A 5 cm long incision was used as the PFN entry point just proximal to the greater trochanter tip. In all cases, 135 ° neck shaft angle and 240 mm long PFN (@Rech) locking were used. At the end of surgery, all swabs were weighed and blood loss was determined according to Lee's method.

On the first postoperative day, a uniform postoperative rehabilitation protocol was implemented under the supervision of a qualified physiotherapist. All subjects were advised to perform frequent isometric exercises for the abductors and quadriceps. Patients in both groups were permitted non weight bearing with crutches or walker on the 2nd day postoperatively. The follow-up appointments are planned at two weeks, three months, six months and a year after surgery. Radiological evaluation of the fracture union was performed observing the callus on the anterior-posterior and lateral radiographs. Functional score was assessed using the Harris Hip Score (HHS) was performed, rated as poor (score <70), good (80 to 90), fair (70 to 80) and excellent (90 to 100). We

analyzed our data using SPSS 24.0. The percentages and frequencies were determined for qualitative variables and for quantitative variables; standard deviation and mean were calculated. Significant demographic characteristics and outcomes for both groups were compared at 3, 6, and 12 months, and the P-value was evaluated using the chi-square test and the t-test for independent samples. P <0.05 was regarded as significant. Data are accessible in tables where applicable.

RESULTS

There were 80 total patients. They were divided equally and randomly into groups A(DHS) and B(PFN) of 40 patients each. The demographic features like side of surgery, gender and age were the same in both groups (Table I).

Table 1: Comparison of baseline demographics and outcome variables of both groups

Demographic/outcome variable	Group A (DHS) (n=40)	Group B (PFN) (n=40)	P value
Age(years)±SD	60.10±4.48	59.20±5.71	
Gender			
Male	25(62.5%)	23(57.5%)	0.39
Female	15(37.5%)	17(42.5%)	0.50
Surgery side			
Right	24(60%)	22(55)	0.29
Left	16(40%)	18(45)	0.72
Incision length(cm)	7.45±0.89	4.62±0.71	0.001
Duration of surgery(min)	69.40±7.02	53.22±5.85	0.03
Intraoperative blood loss(ml)	219.25±42.12	121.65±32.20	0.01
Radiological union(weeks)	14.2±4	12.8±6	0.05

The PFN group had a shorter operative time, smaller incision and minimum blood loss intraoperatively than the DHS group (p <0.05). The group A mean age was 60.10±4.48 years, and of group B was 59.20±5.71 years. There were 25 men (62.5%) in A group and 23 (57.5%) in B group. Women were 15 (37.5%) in A group and 17 (42.5%) in B group. Mean time of radiological union was 14.2±4 weeks in group A and 12.8±6 weeks in group B (P> 0.05). During the 3-month follow-up period, the Harris Hip Score (HHS) was 54.20 ± 4.20 (poor) and 35.03 ± 4.11 (poor) in Groups A and B, correspondingly (P <0.05). HHS in group A was 90.27 ± 3.80 (good) and in B group, it was 82.27 ± 3.65 (good) (P <0.05) at 6 months and HHS 94.61 ± 2.08 (excellent) and 93.27 ± 2.18 (excellent) 1 year in the group A and B (P> 0.05).

Table-2: Mean HHS score at 3, 6 and 12 months

At 3-months	Group A(DHS)	Group B(PFN)	P-Value
Harris Hip Score	54.20 ± 4.20 (poor)	35.03 ± 4.11 (poor)	<0.05
At 6-months			
Harris Hip Score	90.27 ± 3.80 (good)	82.27 ± 3.65 (good)	<0.05
At 12-months	94.61 ± 2.08 (excellent)	93.27 ± 2.18 (excellent)	> 0.05

Superficial skin infection was observed in 3 (7.5%) DHS patients and 2 (5%) PFN patient, but all resolved with dressing and antibiotics. A DHS cut-out was documented in 1 (2.5%) patient and a breakage of PFN in 1 (2.5%) patient. Both were treated with revision surgery. No mortality was observed in our series.

Table 4: Results of meta-analysis of Zhang et al comparing PFN and DHS

S No	Author Name	Year of publication of study	Operation Time(min)		Blood Loss(ml)		Wound Complications				Re operation		Mortality	
			DHS	PFN	DHS	PFN	DHS		PFN		DHS	PFN	DHS	PFN
							Events	Total	Events	Total				
1	Huang ZY ²⁵	2010	52.4±18.3	50.5±20.2	225	202	03	48	04	48	00	00	00	00
2	Parker M ²⁴	2012	46±12.3	49±12.7	NA	NA	09	300	06	300	13	05	85	85
3	Pajarinen JJ ²⁷	2005	45 (20–	55 (35–	357±495	320±3109	05	40	04	40	11	08	11	10

Table-3: Complication rate among the two groups

Complications	Group A(DHS)	Group B(PFN)
Superficial skin infection	3 (7.5%)	2 (5%)
DHS cut-out	1 (2.5%)	0
breakage of PFN	0	1 (2.5%)

DISCUSSION

We treated 40 DHS patients and 40 PFN patients. Our results showed that the mean time of radiological union was 14.2±4 weeks in group A and 12.8±6 weeks in group B (P> 0.05). During the 3-month follow-up period, the Harris Hip Score (HHS) was 54.20 ± 4.20 (poor) and 35.03 ± 4.11 (poor) in Groups A and B, correspondingly (P <0.05). HHS in group A was 90.27 ± 3.80 (good) and in B group, it was 82.27 ± 3.65 (good) (P <0.05) at 6 months and HHS 94.61 ± 2.08 (excellent) and 93.27 ± 2.18 (excellent) 1 year in the group A and B (P> 0.05). Kamboj treated 42 patients with DHS and PFN and observed radiological union after 15.84 ± 1.4 weeks in the DHS group, while the mean time to radiological union in the PFN group was 14.30 ± 1.38 weeks (p> 0.05). HHS functional score at 6 months was 77.2 in the DHS group and 86.9 in the PFN group (p 0.03)⁸⁻¹⁰. These authors concluded that PFN was associated with less perioperative loss of blood and fewer complications postoperatively. PFN patients were mobilized earlier and had better HHS than DHS. However, this study had an inadequate number of patients and a brief follow-up duration of only six months¹¹⁻¹². Sharma treated 60 patients with stable DHS and PFN intertrochanteric fractures. HHS was 53.4 in DHS and 47.6 in PFN (p <0.01). After 2 years, HHS was 94.2 in DHS and 94.0 in the PFN group (p 0.79). Sharma found that while PFN has fewer complications from a surgical wound, it has a greater likelihood of technical error, which could lead to a higher frequency of reoperations in the group of PFN than in the DHS group¹³. Similarly, Harish treated 30 patients with DHS and PFN and concluded that PFN was better than DHS, but technically demanding¹⁴. Karanam et al compared the results of 20 DHS-treated patients and 20 PFN-treated patients. There were 24 stable intertrochanteric fractures (57.5%), and 18 fractures which are unstable (42.5%)¹⁵. They concluded that patients with unstable intertrochanteric fractures had significantly improved outcomes functionally when managed with PFN, while for stable intertrochanteric fractures there was no substantial alteration in results when these fractures were fixed with DHS or PFN¹⁶⁻¹⁷. The devotee treated 31% of stable intertrochanteric fractures, 58% of unstable fractures and 11% of DHS and PFN inverted oblique fractures. The mean monthly HHS was 24.5 in the DHS group and 35.2 in the PFN group. (P 0.0001). After 6 months, the HHS was 78.8 in the DHS group and 82.8 (p 0.02) in the PFN group. After one year, DHS had HSS 92.1 and PFN 92.5 (P 0.4). These authors concluded that PFN works well in old osteoporotic and unstable intertrochanteric fractures, while DHS works well in younger patients¹⁸⁻¹⁹. As with Bhakat, Kumar and Singh treated 50 subjects with 62.3 years mean age with PFN and DHS²⁰⁻²¹. At months 3 and months, PFN had better functional results for HHS than DHS, but the long-term results for both implants were the same. These authors concluded that older patients with osteoporosis and unstable fractures are effective in PFN, while younger patients with stable intertrochanteric fractures are candidates for DHS²².

			105)	200)										
4	Liu XW ²⁶	2009	53.4±8.3	46.5±20.5	152	136	02	65	06	69	00	00	00	00
5	Papasimos S29	2005	59.2 (40–100)	71.2 (60–240)	282.4	265	0o	54	00	54	03	05	01	01
6	Giraud B ²⁸	2005	42	35	325	410	NA	NA	NA	NA	00	03	01	02
7	Saudan M ³¹	2002	65± 26	64 ±33	NA	NA	10	106	11	100	06	11	17	21
8	Pan X ³⁰	2004	87.35± 21.29	59.16± 16.92	489.88± 177.90	273.33±12 0.8	04	34	02	30	00	00	00	00

Zhang et al. Conducted a meta-analysis of 8 studies comparing DHS and PFN in stable and unstable intertrochanteric fractures with a mean follow-up of 9.6 months. (Table II) This meta-analysis showed significantly shorter operative times, smaller incisions, and less intraoperative blood loss in PFN than in DHS. These were exactly our findings²³⁻²⁴. According to Zhang et al. A higher (but not significant) infection rate was observed in the group of DHS. PFN has documented a higher (but not significant) percentage of postoperative operations than DHS. There was no substantial variance in mortality in the 2 groups. We have not documented mortality in our series. Our study had several limitations. Our sample was small and the observation lasted only one year. We recommend further research to address these limitations and further validate our results.

CONCLUSION

Both DHS and PFN gave similar results in terms of radiological union in stable intertrochanteric fractures. The short-term functional score was poor and good for both DHS and PFN at 3 and 6 months, although DHS scored statistically better than PFN. After one year of follow-up, both DHS and PFN had similar excellent functional scores, but had no statistically significant difference in score.

REFERENCES

- Zeng X, Zhan K, Zhang L, Zeng D, Yu W, Zhang X, Zhao M. Conversion to total hip arthroplasty after failed proximal femoral nail antirotations or dynamic hip screw fixations for stable intertrochanteric femur fractures: a retrospective study with a minimum follow-up of 3 years. *BMC Musculoskeletal Disorders*. 2017 Dec;18(1):1-7.
- Mansukhani SA, Tuteja SV, Kasodekar VB, Mukhi SR. A comparative study of the dynamic hip screw, the cemented bipolar hemiarthroplasty and the proximal femoral nail for the treatment of unstable intertrochanteric fractures. *Journal of clinical and diagnostic research: JCDR*. 2017 Apr;11(4):RC14.
- Adeel K, Nadeem RD, Akhtar M, Sah RK, Mohy-Ud-Din I. Comparison of proximal femoral nail (PFN) and dynamic hip screw (DHS) for the treatment of AO type A2 and A3 pertrochanteric fractures of femur. *JPMA*. 2020 Mar 16;70(5):815-9.
- Wang B, Liu Q, Liu Y, Jiang R. Comparison of proximal femoral nail antirotation and dynamic hip screw internal fixation on serum markers in elderly patients with intertrochanteric fractures. *J Coll Physicians Surg Pak*. 2019 Jul 1;29(7):644-8.
- Ahmed HH, Bassiooni HA, Mohamady EM, Mostafa MA. A comparison study of proximal femoral nail and dynamic hip screw devices in unstable trochanteric fractures. *Benha Medical Journal*. 2018 Sep 1;35(3):413.
- Mittal M, Bhuyan SK, Ailani R, Tontanahal S, Mittal CS. Comparison of the functional and radiological outcomes of unstable intertrochanteric fractures treated with dynamic hip screw and proximal femoral nail-A prospective randomized controlled study. *International Journal of Orthopaedics Sciences*. 2017;3(3):81-5.
- Wang W, Zhai S, Han XP, Cui Y. Comparative study of proximal femoral nail anti-rotation and dynamic hip screw in the unstable intertrochanteric fractures in the elderly. *Zhonghua yi xue za zhi*. 2018 Jan 1;98(5):357-61.
- Hussain N, Patel HB, Patil ND. Management of complex intertrochanteric fractures of the femur in elderly patients—dynamic hip screws or proximal femoral nails or arthroplasty. *Int J Res Orthopaedics*. 2017 Jul;3(4):656-0.
- Agrawal P, Gaba S, Das S, Singh R, Kumar A, Yadav G. Dynamic hip screw versus proximal femur locking compression plate in intertrochanteric femur fractures (AO 31A1 and 31A2): A prospective randomized study. *Journal of Natural Science, Biology, and Medicine*. 2017 Jan;8(1):87.
- Jakkala S, Kurukunda V, Madiga N, Tirumuru S, Athinarapu MS, Raj N. A comparative study of proximal femoral nail and dynamic hip screw in the management of intertrochanteric fractures of femur. *Orig Res Artic J Evid Based Med Heal*. 2019:P6.
- Goel K, Taneja DK. Proximal femoral nail v/s Dynamic hip screw in treatment of intertrochanteric fracture femur. *Indian Journal of Orthopaedics*. 2018 Jul;4(3):249-55.
- Swamy A, Swamy A, Kshirsagar A, Sharma K. Comparative study between dynamic hip screw & proximal femoral nail in treatment of intertrochanteric fracture. *International Journal of Orthopaedics*. 2017;3(3):628-37.
- Kamboj P, Sharma PK, Jesadia B, Arora S, Siwach RC. A comparative prospective study of osteosynthesis in intertrochanteric fractures, using dynamic hip screw (DHS) and proximal femoral nailing (PFN). *Int J Orthop Sci*. 2019;5(2):954-60.
- Redd PJ, Reddy RM, Rao KJ, Reddy KJ. A comparative study of surgical management of intertrochanteric fractures using dynamic hip screw (DHS) and proximal femoral nail (PFN). *Int J Orthopaedics Sci*. 2020;6:480-4.
- Naushad Hussain AR, Kamat SG. A comparative study of proximal femoral nail versus dynamic hip screw fixation for unstable and complex intertrochanteric fractures of the femur. *Infection*. 2017;4:5-7.
- Yam M, Chawla A, Kwek E. Rewriting the tip apex distance for the proximal femoral nail anti-rotation. *Injury*. 2017 Aug 1;48(8):1843-7.
- Mishra SK, Deepak CE, Goari K, Shukla S. Study internal fixation of subtrochanteric fracture of femur with dynamic hip screw, dynamic condylar screw and proximal femoral nail-a retro-prospective study. *International Journal of Research in Medical Sciences*. 2018 Feb 22;6(3):1011-6.
- Airachakaran A, Amphansap T, Thanindrataran P, Piyapittayanun P, Srisawat P, Kongtharvonksul 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. *European Journal of Orthopaedic Surgery & Traumatology*. 2017 Oct;27(7):937-52.
- Kumar A, Rao BS, Bhaskar SK. Long term functional outcome of intertrochanteric femur fractures treated with dynamic hip screw v/s proximal femoral nail: Retrospective study. *International Journal of Orthopaedics*. 2018;4(2):672-6.
- Patil SN, Srinivas P. Comparative study between proximal femoral nail and dynamic hip screw with trochanteric stabilizing plate in unstable intertrochanteric femur fractures. *Int J Res Orthop*. 2017 Sep;10.
- Antony Vimalraj M, Vinodh Rajkumar P, Dalton J, Azhagan K. Functional and radiological outcome of intertrochanteric fracture in patients treated with dynamic hip screw and proximal femoral nail. *International Journal of Orthopaedics*. 2017;3(4):412-7.
- 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. *International journal of orthopedic sciences*. 2017;3(2):173-80.
- Xie H, Wang Z, Zhang J, Xu L, Chen B. Clinical outcome of dynamic hip locking plates and proximal femoral nails anti-rotation-Asia for treating intertrochanteric femur fracture with lateral wall fractures in the elder patients. *Oncotarget*. 2017 Oct 10;8(47):82700.
- Mohan H, Kumar P. Surgical treatment of type 31-A1 two-part intertrochanteric femur fractures: Is proximal femoral nail superior to dynamic hip screw fixation?. *Cureus*. 2019 Feb 20;11(2).
- Shishodia AS, Dakour VK, Bhatia R. A prospective study comparing the outcome of dynamic hip screw and proximal femoral nail in the treatment of intertrochanteric fractures of femur. *EXECUTIVE EDITOR*. 2017 Apr;8(2):100.