How to Cite:
Gupta, A. G., Raghuwanshi, G. R., Adhikari, A. A., & Jadhao, A. B. (2022). Comparison of the dynamic HIP screw to PFN (proximal femoral nail) for unstable peri trochanteric femur fracture. *International Journal of Health Sciences*, *6*(S9), 2518–2526.
https://doi.org/10.53730/ijhs.v6nS9.12970

Comparison of the dynamic HIP screw to PFN (proximal femoral nail) for unstable peri trochanteric femur fracture

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***Abstract*---**Introduction: One of the most common fractures in the elderly is inter-trochanteric fractures where surgical management allows better functional and rehabilitation outcomes making it a treatment of choice. Aim: To compare radiological, functional, and clinical outcomes following treatment of unstable intertrochanteric femur fractures using dynamic hip screw (DHS) or proximal femur nail (PFN). Methods: The study assessed 120 subjects with unstable intertrochanteric femur fractures where 60 were treated with DHS and the other 60 with PFN. For assessment of the outcomes, Harris hip scores were used. Results: Most surgeries were done in 56-70 minutes in 30% (n=18) subjects and 37% (n=22) subjects in DHS and PFN group respectively which was statistically non-significant with p=0.86. Most common complication was lateral cortex shattering in 16.6% (n=10) study subjects followed by ill-fitting jig in 13.3% (n=8) study

subjects and distal locking difficulty in 10% (n=6) study subjects respectively. Mean Harris hip score was higher in PFN group (83.5±2.38) compared to DHS group (82.1±2.32). Excellent results were seen in 11.6% (n=7) and 16.6% (n=10) subjects from DHS and PFN groups respectively, good results in 53.3% (n=32) and 56.6% (n=34), and poor results in 8.33% (n=5) and 5% (n=3) subjects from DHS and PFN groups respectively. Conclusion: The complications related to the implants were significantly lesser in subjects treated with DHS (dynamic hip screw) compared to PFN (proximal femur nail). No secondary femoral fracture was reported in subjects managed with PFN.

***Keywords*---**Dynamic Hip Screw (DHS), femoral fracture, Proximal Femoral Nail, Modified Harris Hip Score, Peri-trochanteric Fractures

Introduction

One of the most common fractures reported in the elderly subjects is proximal femur fractures with rising incidence globally including in India with nearly nine out of ten fractures in subjects of age more than 65 years are femur fractures with higher female predilection and half of these fractures being intertrochanteric. Most of these fractures are reported after a simple fall.[1]

With the increased life expectancy, there is an increase in intertrochanteric fractures. Early rehabilitation and internal fixation have been the gold standard for treating these fractures in the recent era. The short-term desirable goals are fracture stability with early mobilization and minimum complications. In the long-term management should provide a similar functional outcome as was preoperatively.[2]

Commonly encountered challenges are fixation complications and fracture instability. For trochanteric fractures, stability is defined by the ability to resist gravitation and muscle forces around the hip to prevent fracture-displacement. Failure of the fixation is largely governed by implant, insertion technique, reduction choice, fracture comminution, and osteoporosis. Implant type largely influences the fixation complications. Fracture fragment to implant stability depends on implant placement, implant design, reduction, fracture geometry, and bone quality whereas stable fixation, reduction quality, implant choice, and implant placement are controlled by the operating surgeon.[3]

Generally, the two primary management options for these fractures are extramedullary and intramedullary fixation. Among extramedullary fixation, DHS (dynamic hip screw) is commonly used and is a standard implant procedure. In intramedullary fixation, Gamma nail and PFN (proximal femoral nail) are the commonly used methods.[4]

Previous literature data depicts that Gamma nail is not desirable for these fractures as it shows a higher incidence of femoral shaft fracture postoperatively. PFN was first introduced in 1997 by AO/ASIF group. However, its use has become

prevalent in recent years owing to its improvement with the addition of an anti-rotation hip screw proximal to the main lag screw. However, previous literature data suggest both technical failure and advantages of PFN (proximal femoral nail).[5]

Despite the effectiveness of both DHS and PFN has been reported for managing intertrochanteric fractures, the conclusive results are inconsistent and scarce. Hence, the present study was done to compare radiological, functional, and clinical outcomes following treatment of unstable intertrochanteric femur fractures using dynamic hip screw (DHS) or proximal femur nail (PFN).

Materials and Methods

The present prospective randomized clinical study was conducted to compare radiological, functional, and clinical outcomes following treatment of unstable intertrochanteric femur fractures using dynamic hip screw (DHS) or proximal femur nail (PFN). The study was done at Department of Orthopaedics, Government Medical college and Hospital, Akola, Maharashtra, after the clearance was given by the Institution Ethical committee. The study population was contributed by the subjects visiting the Department of Orthopedics of the institute.

The study included a total of 120 subjects from both genders having unstable intertrochanteric fractures. The inclusion criteria for the study were subjects within the age range of 20-80 years, having fractures with subtrochanteric extension, reverse oblique pattern, and unstable posterior medial large separate fragment. The exclusion criteria were subjects with a compound fracture, knee arthritis, hip arthritis, pathological fractures, stable fractures with intact posterior medial cortex, and subjects not willing to participate. After explaining the detailed study design, informed consent was taken from all the subjects in both written and verbal form.

After final inclusion, detailed history, injury cause, and demographics were recorded for all the study subjects followed by an examination. Consideration for ambulatory status before surgery was also done. Patients having present or past medical conditions were noted that could affect the treatment outcomes. To give comfort and prevent further damage to the soft tissues, limb immobilization was done with Buck's skin traction.

Following limb immobilization, to confirm the diagnosis, assessment of quality of bone, and delineate the fracture pattern, radiographs were taken. Fracture classification was then done using the AO classification system, Boyd and Griffin, and Evan's classification based on the radiographs. Before the surgery, pre-anesthetic evaluation was done for each subject and preoperative preparation was done. Among 120 subjects, 60 were treated with DHS and the other 60 with PFN. Fracture-implant assembly was assessed for each subject considering implant placement, implant design, reduction, fragment geometry, and bone quality. Collected data was analyzed for results formulation. The collected data were subjected to statistical evaluation using SPSS version 20, Chicago Inc., USA. The data were expressed in percentage and number, and mean and standard

deviation. The level of significance was kept at $p<0.05$.

Results

The present prospective randomized clinical study was conducted to compare radiological, functional, and clinical outcomes following treatment of unstable intertrochanteric femur fractures using dynamic hip screw (DHS) or proximal femur nail (PFN). The study included a total of 120 subjects from both genders having unstable intertrochanteric fractures within the age range of 20-80 years. Among 120 subjects, 60 were treated with DHS and the other 60 with PFN. The mean age of the study subjects was 53.6±6.42 and 54.2±4.88 years respectively for DHS and PFN groups. For age-wise distribution, the difference between the two groups was statistically non-significant with p=0.79. There were 26 females and 34 males in the DHS group and 30 males and 30 females in the PFN group which was statistically non-significant with p=0.06. For sides in the DHS group, the right and left sides were involved in 32 and 28 subjects, whereas, for PFN, it was 38 and 22 respectively (p=0.45). The most common cause was domestic falls in both groups followed by RTA (road traffic accident) with p=0.18. The surgery was commonly done within 6-10 days followed by <5 days, 11-15 days, 16-20 days, and >20 days in both the groups with p=0.37 (Table 1). All demographic and disease characteristics were statistically non-significant between the two groups.
For fracture classification, AO type was most common 31A 2.3 in 24 and 26 subjects of DHS and PFN group followed by 31A 2.2 in 18 and 16 subjects of DHS and PFN group respectively. The difference in AO classification was statistically non-significant between the two groups (p=0.57). For Evan's classification, Type 1c was the most common fracture in 22 and 24 subjects of the DHS and PFN group followed by type 1d in 24 and 18 subjects of the DHS and PFN group respectively which was also statistically non-significant with p=0.63. Concerning Boyd and Griffin classification, the most common was type 2 in 50 and 40 subjects of DHS and PFN groups respectively followed by type 3 and type 4. This difference was also statistically non-significant with p=0.34 as shown in Table 2.

Concerning the operative parameters, blood loss was most common in range of 301-350 ml in 30% (n=18) and 13.3% (n=8) study subjects followed by 251-300ml in 6.7% (n=16) and 33.3% (n=20) subjects respectively in DHS and PFN group respectively which was significantly higher for DHS with more than >500ml blood loss in 6.7% (n=4) subject than no subject in PFN group (p=0.02). For an operative time in minutes, most surgeries were done in 56-70 minutes in 30% (n=18) subjects and 37% (n=22) subjects in DHS and PFN groups respectively which were statistically non-significant with p=0.86 as depicted in Table 3.

On assessing the complications intraoperatively, the most common complication was lateral cortex shattering in 16.6% (n=10) study subjects followed by ill-fitting jig in 13.3% (n=8) study subjects and distal locking difficulty in 10% (n=6) study subjects respectively (Table 4). Mean Harris hip score was higher in PFN group (83.5±2.38) compared to DHS group (82.1±2.32). Excellent results were seen in 11.6% (n=7) and 16.6% (n=10) subjects from DHS and PFN groups respectively, good results in 53.3% (n=32) and 56.6% (n=34), fair in 26.6% (n=16) and 21.6% (n=13) subjects, and poor results in 8.33% (n=5) and 5% (n=3) subjects from DHS and PFN groups respectively as shown in Table 4.

Discussion

The mean age of the study subjects was 53.6±6.42 and 54.2±4.88 years respectively for DHS and PFN groups. For age-wise distribution, the difference between the two groups was statistically non-significant with p=0.79. There were 26 females and 34 males in the DHS group and 30 males and 30 females in the PFN group which was statistically non-significant with p=0.06. For sides in the DHS group, the right and left sides were involved in 32 and 28 subjects, whereas, for PFN, it was 38 and 22 respectively (p=0.45). The most common cause was domestic falls in both groups followed by RTA (road traffic accident) with p=0.18. The surgery was commonly done within 6-10 days followed by <5 days, 11-15 days, 16-20 days, and >20 days in both the groups with p=0.37. All demographic and disease characteristics were statistically non-significant between the two groups. These demographic and disease characteristics were comparable to the results of Domingo LJ et al[6] in 2001 and Pajarinen J et al[7] in 2005 where authors assessed subjects with demographics comparable to the present study.

Concerning fracture classification, AO type was most common 31A 2.3 in 24 and 26 subjects of DHS and PFN group followed by 31A 2.2 in 18 and 16 subjects of DHS and PFN group respectively. The difference in AO classification was statistically non-significant between the two groups (p=0.57). For Evan's classification, Type 1c was the most common fracture in 22 and 24 subjects of the DHS and PFN group followed by type 1d in 24 and 18 subjects of the DHS and PFN group respectively which was also statistically non-significant with p=0.63. Concerning Boyd and Griffin classification, the most common was type 2 in 50 and 40 subjects of DHS and PFN groups respectively followed by type 3 and type 4. This difference was also statistically non-significant with p=0.34. These results were consistent with the results of Saudan M et al[8] in 2002 and Pan X et al[9] in 2004 where authors reported a similar proportion of these classifications in their studies as in the present study.

On assessing the operative parameters, blood loss was most common in range of 301-350 ml in 30% (n=18) and 13.3% (n=8) study subjects followed by 251-300ml in 6.7% (n=16) and 33.3% (n=20) subjects in DHS and PFN group respectively which was significantly higher for DHS with more than >500ml blood loss in 6.7% (n=4) subject than no subject in PFN group (p=0.02). For an operative time in minutes, most surgeries were done in 56-70 minutes in 30% (n=18) subjects and 37% (n=22) subjects in DHS and PFN groups respectively which were statistically non-significant with p=0.86. These results were in agreement with the findings of Windroff J et al[10] in 2005 and Koval KJ et al[11] in 2005 where blood loss was higher in the DHS technique and operative time was within 1 hour.

For the complications intraoperatively, the most common complication was lateral cortex shattering in 16.6% (n=10) study subjects followed by ill-fitting jig in 13.3% (n=8) study subjects and distal locking difficulty in 10% (n=6) study subjects respectively (Table 4). The mean Harris hip score was higher in the PFN group (83.5±2.38) compared to the DHS group (82.1±2.32). Excellent results were seen in 11.6% (n=7) and 16.6% (n=10) subjects from DHS and PFN groups respectively, good results in 53.3% (n=32) and 56.6% (n=34), fair in 26.6% (n=16) and 21.6% (n=13) subjects, and poor results in 8.33% (n=5) and 5% (n=3) subjects from DHS

and PFN groups respectively. These findings were similar to the results of Sengodan VC et al[12] in 2017 and Adeel K et al[13] in 2020 where authors reported better functional outcomes with PFN compared to the DHS technique.

Conclusion

Considering its limitations, the present study concludes that better clinical outcomes are seen with PFN compared to DHS in the present study. Complications related to the implants were significantly lesser in subjects treated with DHS (dynamic hip scores) compared to PFN (proximal femur nail). No secondary femoral fracture was reported in subjects managed with PFN. However, the present study had a few limitations including a small sample size, short monitoring time, and geographical area biases. Hence, more longitudinal studies with larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

Table 1: Demographic and disease characteristics of the study subjects

Characteristics	DHS (n)	PFN (n)	p-value
Mean age (years)	53.6±6.42	54.2±4.88	
Age range (years)			
21-30	2	3	0.79
31-40	4	3	
41-50	6	5	
51-60	14	15	
61-70	26	28	
71-80	8	6	
Gender			
Females	26	30	0.06
Males	34	30	
Side			
Right	32	38	0.45
Left	28	22	
Cause			
Assault	0	0	0.18
Domestic fall	46	36	
RTA	14	24	
Surgery duration (days)			
<5	18	30	0.37
6-10	32	24	
11-15	6	6	
16-20	2	0	
>20	2	0	

Table 2: Fracture classification and types in the study subjects

Fracture type	DHS (n)	PFN (n)	p-value
AO classification			
31A 2.1	10	4	0.57
31A 2.2	18	16	
31A 2.3	24	26	
31A 3.1	6	14	
31A 3.2	2	0	
31A 3.3	0	0	
Evan's			
Type 1c	22	24	0.63
Type 1d	24	18	
Type 1e	8	6	
Type 2	6	12	
Boyd & Griffin			
Type 2	50	40	0.34
Type 3	6	12	

Type 4	4	8	

Table 3: Operative parameters in the study subjects

Operative parameters	DHS n (%)	PFN n (%)	p-value
Blood loss (ml)			
<150	0	2 (3.3)	0.02
151-200	0	10 (16.7)	
201-250	6 (10)	16 (26.7)	
251-300	16 (6.7)	20 (33.3)	
301-350	18 (30)	8 (13.3)	
351-400	8 (13.3)	2 (3.3)	
401-450	4 (6.7)	2 (3.3)	
451-500	4 (6.7)	0	
>500	4 (6.7)	0	
Operative Time (min)			
40-55	10 (16.7)	10 (16.7)	0.86
56-70	18 (30)	22 (37)	
71-85	20 (33.3)	18 (30)	
86-100	8 (13.3)	6 (10)	
101-115	2 (3.3)	4 (6.3)	
>115	2 (3.3)	0	

Table 4: Intraoperative complications in the study subjects

Complications and outcomes	Number (n)	Percentage (%)
Complications		
Screw breakage	0	0
Plate breakage	0	0
Fracture below plate	0	0
Lateral cortex shattering	10	16.6
Intraoperative DHS complications	0	0
Revision surgery	0	0
Fracture below nail tip	0	0
Greater Trochanter fracture	0	0
Distal locking difficulty	6	10
Inappropriate proximal screw length	0	0
Ill-fitting jig	8	13.3
Harris hip scores	**DHS n (%)**	**PFN n (%)**
Mean	82.1±2.32	83.5±2.38
Excellent	7 (11.6)	10 (16.6)
Good	32 (53.3)	34 (56.6)
Fair	16 (26.6)	13 (21.6)
Poor	5 (8.33)	3 (5)