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Original Article

Treatment of Intertrochanteric Fracture With Dynamic Hip Screw Versus Proximal Femoral Nail

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ABSTRACT

Background: Intertrochanteric hip fractures are of the most common fractures in orthopedics. Several devices have been developed to obtain accurate reduction and stable surgical fixation. Dynamic hip screw (DHS) and proximal femoral nail (PFN) are the most used**.**

Methods Our randomized control clinical trial was conducted upon patients with intertrochanteric fracture femur presented to the emergency department (ED) of Zagazig university hospitals and Zagazig ministry of health hospitals. This study started from February 2020 till August 2023. This study included 36 cases of intertrochanteric femur fracture. The patients were divided into two groups of the first included 18 patients treated by DHS and the second group included 18 patients fixed by PFN. All patients underwent a thorough preoperative evaluation. Intraoperative and postoperative complications were recorded. After discharge, regular follow-up was done. Finally functional outcome is calculated.

Results: PFN was better than DHS, Intra-operatively amount of blood loss, incision and duration of surgery is fewer inpatients with PFN Compared to DHS. Postoperatively PFN had fewer complications and better functional outcomes in patients with unstable intertrochanteric fracture as per the Harris hip scores.

Conclusion: Both the PFN and DHS almost always produce functional results that are equivalent in stable trochanteric fractures. However, in unstable trochanteric fractures the PFN has better results than DHS.

Keywords: Intertrochanteric; Fracture; DHS; PFN.

INTRODUCTION

Extra-capsular proximal femur fractures called "intertrochanteric hip fractures" happen between the greater and lesser trochanters. One of the most frequent fractures seen in orthopedic practice is those **[1].** For the majority of trochanteric fracture situations, surgery is the best course of action. For the majority of patients, immediate internal fixation of trochanteric fractures has been established as the standard treatment. Getting a correct reduction and stable fixation that allows for early mobilization is the aim of treating intertrochanteric fractures to lower the risk of complications and achieve satisfactory functional recovery **[2].**

One of the greatest alternatives for treatment of trochanteric fractures is the Dynamic Hip Screw (DHS). The DHS has shown over a number of years that trochanteric fractures can be effectively stabilized with great functional results. A plate and screws are used to attach the DHS to the lateral side of the femur **[3].** Dynamic hip screw (DHS) is a

screw device from mechanical standpoint. It has various benefits, including improving fracture healing because it permits controlled telescoping and impaction of the fracture while a patient is bearing weight **[4].** Yet there have also been reports linking the use of DHS in unstable intertrochanteric fractures to higher rate of screw cut out substantial shaft medial displacement due to excessive screw sliding inside the barrel **[5].**

For unstable intertrochanteric fractures, the intramedullary device, which consists of the proximal femoral nail with various variations, is frequently utilized. Since then, nearly all types of trochanteric fractures have been treated with it. It is made up of an intramedullary nail with a proximal angulation of 6° that comes in both short and long forms and can be distally locked with either static or dynamic screws. The cancellous bone can be compacted, and the rotational stability is increased by a helical blade applied into the head of femoral **[6].**

The intramedullary fixation device possesses theoretical merits over the dynamic hip screw because it has shorter lever arm and provide better load transfer than a dynamic hip screw so that decrease tensile forces on the fixation device, hence decreasing the risk of implant cut out **[4].**

AIM AND OBJECTIVES

To compare the clinical, radiological healing and functional outcome between Dynamic hip screw (DHS) and Proximal femoral nail (PFN) in the treatment of patients with trochanteric hip fractures.

PATIENTS AND METHODS

Technical design: Our randomized control clinical trial was conducted upon patients suffering from intertrochanteric fracture femur presented to the emergency department (ED) of Zagazig university hospitals and Zagazig ministry of health hospitals. This study started from February 2020 till August 2023. This study included 36 case of intertrochanteric femur fracture, of which 18 treated by Dynamic Hip Screw and 18 treated by Proximal Femoral Nail. We included patients aged >18 years, less than 1 month since injury and with fractures with subtrochanteric extensions. On the other hand, we excluded patients with concomitant ipsilateral lower extremity trauma, preoperative significant functional loss in same affected lower limp, patient who reufuse participate in this study, patients with subtrochanteric fractures and pathological trochanteric fractures.

Methods: All patients underwent a thorough medical history and preoperative evaluation, physical examination, as well as laboratory tests such as complete blood count, bleeding profile, liver and kidney function tests, and monitoring blood glucose level. Radiographs recommended views of the hip (Anteroposterior (AP) and lateral views of the hip joint) were done. CT scan was useful if radiographs were negative but physical exam consistent with fracture. In his study Evan's classification was used to grade each fracture. The patients were grouped into two equal groups according to the implant used, Group (A) were treated by DHS while group (B) were treated by PFN. The surgery was performed within 48 hours of admission after doing routine pre-operative labs. After discharge from the hospital, all patients were asked to present to the outpatient clinic after 2 weeks to check wound healing, then after 4 weeks, then monthly till 4 months to follow up fractures union. Clinical and radiological examinations were accomplished at each follow-up. After fracture union we continued patients follow every six months till two years. Finally Harris hip score was calculated.

Administrative considerations: Written informed consent was obtained from all participants after clear explanation of the study and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University (Institutional Research Board IRB). The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

STATISTICAL ANALYSIS

Data were fed to the computer and analyzed using IBM SPSS software package version

20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. The significance of the obtained results was judged at the 5% level.

RESULTS

The patients were grouped into two equal groups according to the implant used. The patients of group (A) were managed by DHS while patients of group (B) were managed by PFN. **Table (1)** reveals a comparison between DHS and PFN according to intraoperative evaluation. For group (A) the mean Incision length was 9.56 ±1.34 with range (7-12), the mean surgery time was 82.0 ±11.92 with range (65-103) minutes, the mean Amount of blood loss during surgery was 204.7 ± 55.72 with range (125-350) cm and the mean fluoroscopy time was 57.22 ± 7.55 with range (46-70) seconds. For group (B) the mean Incision length was 8.50 ± 1.54 with range (7-13), the mean surgery time was 71.94 ± 12.18 with range (55-110) minutes, the mean Amount of blood loss was 121.1 ± 41.04 with range (75-250) cm and the mean fluoroscopy time was 76.11 ± 7.31 with range (62-90) seconds. This study showed significant difference between the studied groups Incision length and the surgery time for PFN and a high significant difference as regard Amount of blood loss and fluoroscopy time. Postoperative parameters in both groups were shown in **Table (2)**. For group (A) there are 5 patients of complained severe postoperative pain that did not respond to NSAIDs injection. Superficial wound Infection was seen in two patients and one patient with deep infection of them accompanied by Screw cut out and need revision. Varus deformity appeared at single patient in group (A).Finally Medialization was seen in 1 patient in group (A). In other side group (B) there are 3 patients complained sever pain postoperative that did not respond to NSAIDs injection and medialization also was seen in 1 patient in group (B). Patients with PFN show less postoperative complication than DHS patients. Mean time to bony union was also insignificantly more in PFN group (11.87 ± 2.29) with range (8-18) as compared to DHS group (11.82 ± 2.94) with range (9-16). Fractures nonunion was absent in this study. There is no statistically significant difference as regards Union time as demonstrated in **Table (3)**. **Table (4)** clears that functional outcome calculated by mean Harris hip score in group (A) there were 4 fair (26.7%), 2 poor (13.3%), 6 good (40%) and 3 excellent (20%). calculated by using mean Harris hip was 81.40±9.93 with range (63-96). For group (B) there were 2 fair (11.8%), 1 poor (5.9%), 7 good (41.2%) and 7 excellent (41.2%). The mean Harris hip was 86.41 ± 8.78 with range (67-96). This study declared significant difference between the studied groups in number of patients with fair and excellent score between the two groups but no significant difference seen between the studied groups in functional outcomes calculated by mean Harris hip score in stable fractures in both groups as demonstrated in **Table (5)**. **Table (6)** showed significant difference between the studied groups in functional outcomes measured by Harris hip scores in unstable fractures in both groups in number of patients with poor, fair and excellent score between the two groups.

Table 1: Comparison between DHS and PFN according to intraoperative evaluation.

	DHS (n = 18)	PFN (n = 18)	Test of Sig.	P
Incision length(cm)				
Min. – Max.	7.0 – 12.0	7.0 – 13.0	U= 85.50*	0.014*
Mean ± SD.	9.56 ± 1.34	8.50 ± 1.54		
Median (IQR)	9.50 (9.0 – 11.0)	8.0 (8.0 – 9.0)		
Duration the surgery (min.)				
Min. – Max.	65.0 – 103.0	55.0 – 110.0	t= 2.503*	0.017*
Mean ± SD.	82.0 ± 11.92	71.94 ± 12.18		
Median (IQR)	83.0 (72.0 – 91.0)	69.0 (64.0 – 78.0)		
Amount of blood loss (cm^3)				
Min. – Max.	125.0 – 350.0	75.0 – 250.0	U= 26.50*	<0.001*
Mean ± SD.	204.7 ± 55.72	121.1 ± 41.04		
Median (IQR)	200.0 (170.0 – 230.0)	112.5 (100.0 – 150.0)		
Fluoroscopy time(second)				
Min. – Max.	46.0 – 70.0	62.0 – 90.0	t= 7.627*	<0.001*
Mean ± SD.	57.22 ± 7.55	76.11 ± 7.31		
Median (IQR)	58.0 (50.0 – 64.0)	76.0 (70.0 – 82.0)		

U: Mann Whitney test, t: Student t-test ,p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

Table 2: Postoperative parameters in both groups.

Parameter	DHS Group	PFN Group	P Value
Pain	5	3	0.01
Superficial wound Infection (no. of pt.)	2	1	0.741
Deep Infection (no. of pt.)	1	0	0.493
Screw cut out/ back out (no. of pt.)	1	0	0.493
Medicalization (no. of pt.)	1	1	1
Varus deformity (no. of pt.)	1	0	0.493
Time to union	11.87 ± 2.29	11.82 ± 2.94	0.961

Table 3: Comparison between DHS and PFN according to union time.

	DHS (n = 15)	PFN (n = 17)	T	P
Union time				
Min. – Max.	9.0 – 16.0	8.0 – 18.0	t= 0.046	0.964
Mean ± SD.	11.87 ± 2.29	11.82 ± 2.94		
Median (IQR)	11.0 (10.50 – 14.0)	11.0 (10.0 – 13.0)		

t: Student t-test.

Table 4: Comparison between DHS and PFN according to Harris hip Score.

Harris hip	DHS (n = 18)		PFN (n = 18)		Test of Sig.	P
	No.	%	No.	%		
Poor	3	13.3	1	5.9	χ^2= 2.588	^{MC}p= 0.549
Fair	5	26.7	2	11.8		
Good	7	40.0	8	41.2		
Excellent	3	20.0	7	41.2		
Min. – Max.	63.0 – 96.0		67.0 – 96.0		t= 1.516	0.140
Mean ± SD.	81.40 ± 9.93		86.41 ± 8.78			
Median (IQR)	84.0 (76.0 – 86.0)		89.0 (84.0 – 93.0)			

χ^2: **Chi square test** **MC: Monte Carlo** **t: Student t-test**

Table 5: Functional Outcomes in stable fractures in both groups as per the Harris hip scores.

Harris hip	DHS (n = 8)		PFN (n = 7)		Test of Sig.	P
	No.	%	No.	%		
Poor	0	0	0	0	χ^2= 13.4	^{MC}p= 0.001
Fair	1	12.5	0	0		
Good	4	50.0	4	57.2		
Excellent	3	37.5	3	42.8		
Total	8(100%)		7(100%)			

χ^2: **Chi square test** **MC: Monte Carlo**

Table 6: Functional Outcomes in unstable fractures in both groups as per the Harris hip scores.

Harris hip	DHS (n = 10)		PFN (n = 11)		Test of Sig.	P
	No.	%	No.	%		
Poor	2	20	1	9.1	χ^2= 109.2	^{MC}p= 0.01
Fair	3	30	2	18.18		
Good	5	50	4	36.36		
Excellent	0	0	4	36.36		
Total	7(100%)		10(100%)			

χ^2: **Chi square test** **MC: Monte Carlo**

DISCUSSION

In this study, the intra-operative parameters such as incision length, blood loss, time of surgery, and fluoroscopy time were recorded in the two groups. Incision length, surgery time and blood loss were in favor of proximal femoral nail as the closed reduction smaller incision and less soft tissue damage are less with intramedullary fixation by PFN. The fluoroscopy time whish was less in DHS group as PFN needs closed reduction and more radiological control. This study revealed significant difference ($p \leq 0.05$) between the two implants in incision length and time of the surgery for the favor of PFN. For DHS group (A) the mean incision length was 9.56 cm and for group (B) patients treated with PFN the mean Incision length was 8.50 cm. The mean surgery time for DHS patients was 82.0 minutes, For PFN group the mean surgery time was 71.94 minutes. There was a high significant difference as regard Amount of blood loss and fluoroscopy time. According to amount of blood loss, DHS group which was highly significant (P value <0.001) and amount of blood loss during surgery was higher. This could be due to longer incision that causes more soft tissue handling and more intra-operative blood loss in patients fixed by DHS. The mean amount of blood loss recorded in DHS patients was 204.7 with range (125-350) cm .Yet, PFN patients the mean amount of blood loss was 121.1 with range (75-250) cm. on the other side fluoroscopy time was higher at PFN group as nailing need close reduction in most cases and strict radiological control intra-operative. In their study Anshul and colleagues found that the average surgery time in DHS patients was 110.3 and longer than in PFN patient which was 96.6.they also recorded a higher mean blood loss in DHS group in comparison to PFN group and this is with the present study **[7]**. Bakshi and colleagues showed the mean surgery time in PFN was 54.70 minutes which is shorter than mean time required for DHS which is 63.35 minutes. Mean blood loss in the patients treated by DHS was 292.50 and insubjects of PFN was 108.50 ml **[8]**. Mean surgery time and mean blood loss recorded by Adeel, and colleagues were significantly lower in Group B, which was fixed by PFN, and this is with this study **[9]**. In study by Gill and colleagues, similar intraoperative parameters to that in this study have been proclaimed in their study including the surgery duration, incision length, amount of blood loss and fluoroscopy time and were in favor of PFN with significantly less surgery duration, length of incision and bleed amount except fluoroscopy exposure duration was less in DHS patients and that corroborated with this study **[10]**. Khan and colleagues on comparison the intraoperative parameter in patients with DHS to patents with PFN, the incision length of DHS cases was 7.61 in comparison to 4.72 in PFN cases with a longer duration of surgery in case of DHS than PFN patients and this was with the present study **[11]**.

According to post operative complication recorded during this study we showed that

complication as superficial wound Infection, deep wound infection, screw cut out, medicalization and varus deformity were all recorded patients of DHS group. On contrast superficial wound infection and medialization recorded in patients of PFN group. The mean fracture union duration was also insignificantly more in PFN group as compared to DHS group. In their study Anshul and colleagues decleared that 10% of patients of DHS group developed complications, including DVT, cut out of screw and infection and 7.5% of patients in PFN group had complications which included deep infection, Z effect, and nail fracture. There were insignificant more complications at DHS patients and this similar to our results. The DHS patient needed longer time for fracture union (3.26 months) than time PFN patients needed (2.20 months) which uncorroborated with this study **[7].** In comparison to the present study, Bakshi and colleagues found that there was no difference between the two implants in post-operative Complications rate, and fracture union **[8].** Gill and colleagues showed that there was no difference between the patients of both implants in terms of Number of post-operative Complications and this isn't with this study, and there is no difference between both in Fracture union as the present study showed **[10].** In their study, Khan and colleagues recorded that the number of complications either medical or orthopaedic were significantly higher in DHS cases than PFN patients and this is with this study. Mean time to bone healing was 14.52in DHS group and 15.07 in PFN which was insignificant difference for DHS patients **[11].**

This study declared that mean Harris hip score was calculated for both modules which was 81.40 in DHS patients and 86.41 in PFN patient. Harris hip scores were compared in patients with stable trochanteric fracture and in patients with unstable trochanteric fracture. For stable fractures The results showed significant functional outcome difference between the PFN and DHS. In the other side for unstable trochanteric fractures, this study showed significant functional outcome difference between both implants for favor of PFN. Similar results to this study by Gill and colleagues they affirm that PFN elicit better results than DHS in unstable intertrochanteric fractures while in stable fractures, both produce similar results **[10].** Bakshi and colleagues who calculated Harris hip score after 6 months in patients with intertrochanteric fracture treated by PFN and DHS and they found that in PFN patients most of cases belonged to excellent and good Harris score but in patients treated by DHS most of cases belonged to good score. And this is parallel to this study, but they not compared results in stable and unstable fractures **[8].**

Study limitations

Small number of patients in this study in all types of trochanteric fracture especially those with reversed oblique trochanteric fracture that considered chalanging fracture and Some observations like incidence of technical errors which were not found to be statistically significant in the present study but are noted in many other studies is probably due to the smaller size of this study. Also some patients neclected regular follow up and postoperative physiotherapy, hence that prolonged non weight-bearing period and fracture healing time and led worse functional outcome. We recommend a larger study size and other trials to compare varity of trochanteric fractures inculding larger number of revesed oplique type .

CONCLUSION

We concluded that PFN elicits better results than DHS intra-operatively in terms of reduced bleeding, smaller incision and shorter surgical duration. Compared to DHS patients, PFN postoperative patients had fewer complications. Both the PFN and DHS almost always produce functional results that are nearly equivalent in stable trochanteric fractures. However, the PFN is more efficient than DHS in unstable trochanteric fractures. Thus this study recommends using Proximal Femoral Nail for fixation unstable intertrochanteric fractures as it has less blood loss, fewer complication during surgery, lesser operative time and has fewer

postoperative complications and this will help to decrease morbidity and mortality for patients with unstable intertrochanteric fractures.

Conflict of interest: None

Financial disclosure: None

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