

Original Research Article

Comparative evaluation of management of intertrochanteric fracture femur with proximal femoral nailing versus dynamic hip screw

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ABSTRACT

Background: Fractures involving trochanteric region of femur are one of the common fractures affecting elderly population. Presently surgical treatment is the treatment of choice with early mobilisation as primary goal. The two most common implants that are used are Dynamic hip screw (DHS) and Proximal femoral nail (PFN).

Methods: This was a prospective study with 50 patients divided randomly into two groups of 25 each. One group operated by PFN and other with DHS. Patients were evaluated periodically and final comparison between two group was done at six months for analysing results on the basis of Harris hip score.

Results: At final follow up in patients in PFN group 9 (36%), 7 (28%), 5 (20%), 4 (16%) patients had functional grade in excellent, good, fair and poor category respectively. In DHS group patients, 7 (28%), 10 (40%), 6 (24%), 2 (8%) patients had functional grade in excellent, good, fair and poor functional grade. Harris hip score was insignificantly ($p>0.05$) lower in patients of PFN (82.68 ± 12.28) than DHS (84.60 ± 10.39).

Conclusion: At final follow up we found that pain, limp, use of support while walking and hospital stay was less in PFN group. However, range of motion and hip functions were better in patients treated with DHS. Complications like Varus malunion and infection were common in DHS group while hip joint stiffness was seen more commonly in PFN group. So, both PFN and DHS in are comparable in respect to most of functional criteria for treatment of intertrochanteric fracture femur.

Keywords: DHS, PFN, Intertrochanteric fracture, Harris hip score

INTRODUCTION

Fractures involving trochanteric region of femur are one of the common fractures affecting elderly population. Sir Astley Cooper was the first to give the accurate description of fracture occurring at proximal femur and distinguished extra capsular from intra capsular fractures many decades before the discovery of X-rays.¹

Injury creates a spectrum of fractures in this proximal metaphyseal region of bone with damage to the intersecting cancellous compressive and tensile lamellar network and the weak cortical bone. Hagino et al reported

a lifetime risk of hip fractures for individuals at 50 years of age to be 5.6% for men and 20% for women.² Per trochanteric fractures make up 34% of all hip fractures. Incidence of the intertrochanteric fracture has increased in recent past primarily due to increased life span and also due to sedentary lifestyle. Though predominantly associated with low energy trauma in older age patients, high energy trauma in young patients also accounts for a small number of intertrochanteric fractures. Incidence is more in females as compared to males mainly because of higher incidence of osteoporosis in females. Gullberg et al estimated the future incidence of hip fractures worldwide would double to 2.6 million by the year 2025 and 4.5

million in the year 2050. The percentage increase would be greater in men (310%) than in women (240%). In 1990, 20% of hip fractures occurred in Asia, whereas this figure could rise up to 37% in 2025 and to 45% in 2050.³ In spite of advances in anesthesia, nursing care and surgical techniques, intertrochanteric fractures have mortality and morbidity and have become a serious health resource issue due to high cost of care required after surgery. The reason for high cost of care is primarily related to the poor recovery of functional independence. So, early and adequate fixation is very important in these patients to help them ambulate at the earliest and also to avoid complications of recumbency.

At present open reduction and internal fixation is the treatment of choice for intertrochanteric fracture unless contraindicated by medical illness of patient. In due course of time various types of internal fixation devices have been tried and tested for use in intertrochanteric fractures because of complications related to each type of implant. Dynamic hip screw (DHS) with side plate assembly is presently the most commonly used device for fixation of intertrochanteric fractures. Stable fractures can be very well treated with dynamic hip screw alone with good results proven by various studies. It is the unstable fractures which are difficult to manage with dynamic hip screw alone. Rates of complications like screw cut out, shortening of limb, varus deformity of proximal femur, and even non-union are higher in unstable fractures as compared with stable fractures. Hence the need for any other better fixation device or any modifications in design of dynamic hip screw or any add-on fixation device with DHS is felt.

Proximal femoral nail (PFN) is a relatively new implant for treatment of intertrochanteric fractures. This implant is a cephalomedullary device and has many potential advantages like, being intramedullary, load transfer is more efficient, shorter lever arm results in less transfer of the stress & less implant failures, advantage of controlled impaction is maintained, sliding is limited by intramedullary location, so less shortening & deformity, shorter operative time, less soft tissue dissection and less blood loss, In view of these conditions, this study is taken up to compare the results of DHS and PFN in the treatment of intertrochanteric fractures.

METHODS

After taking approval from institutional ethical committee this study was carried out in the department of orthopedics Batra hospital and medical research Centre New Delhi for a period of 1 year (from April 2015 to March 2016). 50 patients who met the inclusion criteria were selected and divided randomly into two groups. Inclusion criteria are patients with >18 years of age, Type I, II of Fracture pattern –Boyd and Griffin's Classification, patients who were able to walk before injury.⁴ Radiologically fractures with intact lateral cortex and intact entry point i.e. greater trochanter of femur. Exclusion criteria were patients with

subtrochanteric fracture, Type III, IV of fracture pattern – Boyd and Griffin's classification, patients who were unable to walk before surgery, patients with fracture non-union and delayed union intertrochanteric region, patients not willing and medically unfit for surgery. 25 patients were operated by PFN and other group of 25 patients were operated with DHS. Patients were evaluated at second week, 1 month, 3 months and 6 months after surgery and final comparison between two group was done at six months for analyzing results using preset and predetermined Harris hip score.⁵

Statistical methods

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as mean \pm SD or median if the data is unevenly distributed. Categorical variables were expressed as frequencies and percentages. The comparison of normally distributed continuous variables between the groups was performed using Student's t-test. Nominal categorical data between the groups were compared using Chi-squared test or Fisher's exact test as appropriate. Non-normal distribution continuous variables were compared using Mann Whitney U- test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

RESULTS

50 patients took part in our study out of which more than half of patients in both PFN (60%) and DHS (68%) were between 60-70 years of age and most of them were females in both PFN (72%) and DHS (64%) groups. There was no significant ($p>0.05$) difference in the age and gender between the groups showing comparability of the two groups as shown in table 1. Most common mode of injury in both groups remained trivial trauma due to fall at home accounting for 76% patients in PFN group and 80% patients in DHS group. Other modes of injury were road traffic accidents and fall from height. Duration of hospital stay was lower in patients of PFN (7.12 ± 1.13) days than DHS (7.52 ± 1.01) days.

At the end of 6 months follow up, pain score was insignificantly ($p>0.05$) lower in patients of PFN (38.96 ± 4.86) than DHS (39.76 ± 4.05) as per Harris hip score. Limp and use of support were insignificantly ($p>0.05$) higher in PFN than DHS and distance walked was found to be insignificantly ($p>0.05$) lower in PFN compared to DHS (Table 2). Patient's ability to use stairs and put on shoes & shocks were insignificantly ($p>0.05$) lower in patients of PFN than DHS. However, sitting ability and ability to enter public transportation were insignificantly ($p>0.05$) higher in patients of PFN than DHS (Table 3). Absence of deformity was insignificantly ($p>0.05$) lower in patients of PFN (3.36 ± 1.49) than DHS (3.68 ± 1.10) as per Harris hip score. Range of motion was insignificantly ($p>0.05$) lower in patients of PFN (3.92 ± 0.70) than DHS (4.24 ± 0.66). Overall, Harris Hip

score was insignificantly ($p>0.05$) lower in patients of PFN (82.64 ± 12.39) than DHS (84.60 ± 10.39), complete distribution of Harris hip score is shown in (Table 4). Table 5 shows the comparison of complications between the groups. Hip joint stiffness was the most common clinical complication in both PFN (16%) and DHS (12%). Varus collapse was the most common radiological complication in both PFN (8%) and DHS (12%). There was no statistically significant difference (p value >0.05) between the two groups in terms of clinical or radiological

complications. Radiologically Callus formation was seen in all 25 patients of both groups with moderate callus seen in 10 (40%) patients of PFN group and 17 (68%) patients of DHS whereas exuberant callus was seen in 15 (60%) patients of PFN group and 8 (32%) patients of DHS group. Neck shaft angle was less than 120° in 2 (8%) patients and 3 (12%) patients of PFN and DHS group respectively whereas 23 (92%) patients and (88%) patients had neck shaft angle between 120° and 130° in PFN and DHS group respectively at the end of 6 months as shown in Table 6.

Table 1: Distribution of age and gender between groups.

Characteristics	PFN (n=25)		DHS (n=25)		P value*
	No.	%	No.	%	
Age in years					
<60	6	24.0	4	16.0	0.76
60-70	15	60.0	17	68.0	
>70	4	16.0	4	16.0	
Mean±SD	63.96±5.91		62.20±11.63		
Gender					
Male	7	28	9	36	0.54
Female	18	72	16	64	

*Chi square test

Table 2: Comparison of Gait between the groups at 6 months.

Gait	PFN	DHS	P value*
Limp	9.68±1.95	9.56±1.53	0.56
Support	9.00±2.38	8.92±2.04	0.90
Distance walked	7.76±2.10	7.88±1.83	0.83

*Mann-Whitney U test

Table 3: Comparison of function/activities between the groups at 6 months.

Function/Activities	PFN	DHS	P value*
Stairs	2.08±1.03	2.28±0.93	0.57
Shoes and shocks	2.32±1.10	2.88±1.16	0.08
Sitting	4.68±0.74	4.60±0.81	0.71
Enter public transportation	0.88±0.33	0.80±0.40	0.44

¹Mann-Whitney U test

Table 4: Distribution of level of Harris hip score between the groups at 6 months.

T Level of Harris Hip score	PFN (n=25)		DHS (n=25)		P value*	
	N	%	N	%		
Excellent	90-100	9	36.0	7	28.0	0.67
Good	80-89	7	28.0	10	40.0	
Fair	70-79	5	20.0	6	24.0	
Poor	<70	4	16.0	2	8.0	

*Chi square test

Table 5: Comparison of complication between the groups.

Complications	PFN (n=25)		DHS (n=25)		P value*
	N	%	N	%	
Clinical					
Deep infection	0	0.0	1	4.0	0.71
Hip joint stiffness	4	16.0	3	12.0	
Superficial infection	2	8.0	3	12.0	
None	19	76.0	18	72.0	
Radiological					
Screw cut out	0	0.0	1	4.0	0.52
Varus collapse	2	8.0	3	12.0	
None	23	92.0	21	84.0	

*Chi square test

Table 6: Comparison of radiological features between groups at months.

Radiological assessment at 6 months	PFN	DHS
Callus formation		
None	0	0
Mild	0	0
Moderate	10	17
Exuberant	15	8
Neck-shaft angle		
<120°	2	3
120-130°	23	22
>130°	0	0



Figure 1: Clinical images patient operated with PFN; A, B and C showing fracture site preoperatively, immediate postoperatively and united fracture at 6 months; D, E and F show range of motion of hip joints at 6 months.

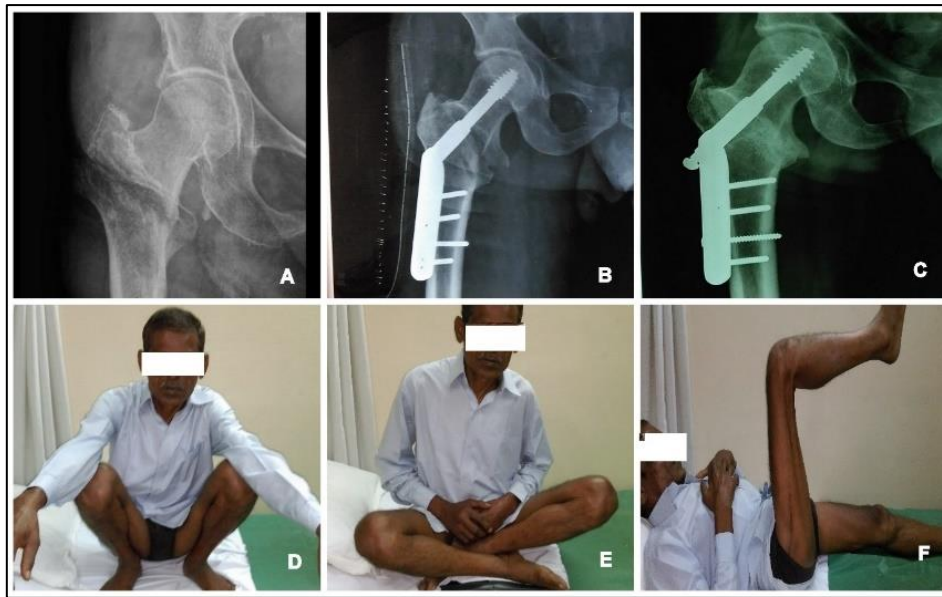


Figure 2: Clinical images patient operated with DHS; (A, B and C) showing fracture site preoperatively, immediate postoperatively and united fracture at 6 months; D, E and F show range of motion of hip joints at 6 months.

DISCUSSION

In this study, an attempt was made to compare the functional outcome of patient with intertrochanteric fractures treated by two different fixation devices, the extramedullary dynamic hip screw fixation and the intramedullary proximal femoral nail using Harris Hip score functional criteria. The study was conducted on 50 patients (25 cases by PFN and 25 cases by DHS) of intertrochanteric fractures attending outpatient/casualty of Department of Orthopedics, Batra Hospital and Medical Research Center, New Delhi from April 2015 to March 2016.

In our study females were more affected (68%) than males (32%). The higher incidence of females is because of higher tendency for osteoporosis as compared to males. This observation in our series was supported by the study of Dahl who had 65% of female patients in their study.⁶ In the study by Domingo et al three out of four (76%) patients were females and 71 % females were there in a study by Ahrengart et al. Wang et al after their study suggested that increased levels of Follicle stimulating hormone after menopause causes stimulation of osteoclasts leading to increased incidence of osteoporosis and fractures in postmenopausal females.⁷⁻⁹ The mean age of patients in our study was 63.08 years with the minimum age 24 years and maximum age of the patient was 72 years. The mean age of patients in PFN group was 63.96 years whereas the mean age of patients in DHS group was 62.02 years suggesting that the elderly age group is most commonly affected group with Intertrochanteric fractures. Our view is also supported by the studies conducted by Kumar et al, Simmermacher et al, Domingo et al and Boldin et al where the average age of patients was 69.3 years, 76.7 years, 80

years and 73 years respectively.¹⁰⁻¹² In our present study, mode of injury in more than half of patient in both PFN (76%) and DHS (80%) was slip and fall. However, in 20% patients of PFN group and 12% patients of DHS group the mode of injury was road traffic accident and in 4 % and 8% patient's mode of injury was fall from height in PFN group and DHS group respectively. It indicates that trivial trauma in the form of slip and fall is the most common mode of injury for Intertrochanteric fracture of femur and this observation is supported by Jonnes et al in their study they found that intertrochanteric fractures due to trivial trauma (77%) was the most common mode of injury, followed by road traffic accidents (23%). Similar observation was made by Boldin et al.^{12,13} In our study type 2 fracture (Boyd and Griffin) 64% (32 cases) was more common than type 1 fracture. Out of 25 patients in PFN group 17 (68%) patients had type 2 fracture and 8 (32%) patients had type 1 fracture. In patients with DHS group 15 (60%) patients had type 2 fracture and 10(40%) patients had type 1 fracture pattern.

In our study, the average time interval between injury and surgery was 2.68 days in patients of PFN group and 3.04 days in patients in DHS group. Mean duration of hospital stay was insignificantly ($p>0.05$) lower in patients of PFN (7.12 ± 1.13) than DHS (7.52 ± 1.01) days. This observation is supported by the study of Saudan et al and Giraud et al in both the studies hospital stay was comparable in both the groups with no statistically significant difference.^{14,15} There was no significant difference in level of pain at 6 months between the group of patients treated with PFN or DHS which is similar to results in the study by Matre et al, Saudan et al and Parker et al.^{17,18} In both the groups majority of patients did not have any limp, could use stairs with the help of railings and sit on a normal chair for one

hour or more without any difficulty. Patients in both the groups were comparable in terms of requirement of support while walking, the distance walked without difficulty, ability to put on shoes and socks and ability to use public transport. There was no statistically significant difference in both the groups for functional variables mentioned above, similar to the observations made by Matre et al and, Saudan et al.^{14,16} At the end of 6 months follow up in patients who were treated with PFN 9 (36%) patients had functional grade in excellent category, subsequently 7 (28%), 5 (20%), 4 (16%) patients had good, fair and poor functional grade respectively. While, in patients who were treated with DHS, at the end of 6 month follow up 7 (28%) patients had functional grade in excellent category, subsequently 10 (40%), 6 (24%), 2 (8%) patients had good, fair and poor functional grade respectively. Mean Harris hip score at final follow up (6 months) was insignificantly ($p>0.05$) lower in patients of PFN (82.64 ± 12.39) than DHS (84.60 ± 10.39). Insignificant difference of Harris hip score between the two groups is supported by the series of Giraud et al where the mean Harris hip score was 60 in the intramedullary group and 59 in the screw-plate group.¹⁵ Similar results were seen in study by Kumar et al where he also did not find any significant difference ($p>0.05$) between the two groups in term of Harris hip score.¹⁸ Radiologically signs of fracture union in the form of Callus formation was seen in all 50 patients at final follow up similar to the results in the study by Kumar et al where fracture union was seen in all the patients at a mean of 12 weeks. Same results were also observed in the series by Gupta et al where no significant difference was seen in the time taken for union between two groups.^{19,20} Decrease in neck shaft angle suggestive of varus collapse of fracture was seen in 2 (8%) patients in PFN group and 3 (12%) patients in DHS group. However, this difference was statistically non-significant. Similar findings were seen in the study by Kumar et al where varus malunion was seen in 13% patients in DHS group and no case of varus malunion was seen in patients treated with PFN.¹⁹

The complications that we encountered in our study were wound infection, varus collapse of fracture and screw cut out. In our series, 3 patients of the DHS group had superficial wound infections as compared to two patients in the PFN group whereas one patient in DHS group developed deep wound infection as compared to none in PFN group. The superficial wound infections in both the groups were treated on outpatient basis with oral antibiotics and healed without any surgical intervention or need for readmission. One patient in DHS group that developed deep wound infection was readmitted and wound was explored, and debridement was done, need for implant removal did not arise and finally the wound healed well without any further complications. The higher number of wound infections in the DHS group may be attributed to the longer incisions and more soft tissue handling in this group as compared to the PFN group. However, there was statistically no significant difference ($p>0.05$) between the two groups regarding occurrence of

infection. This view is supported by similar findings in the study by Kumar et al who did not find any difference in infection rate between two groups. Saudan et al and Parker et al also did not find any significant difference in the infection rates between the two groups in their series.^{14,17,18} 2 (8%) patients in the PFN group had varus collapse of fracture whereas 3 (12%) patients in the DHS group had varus malunion. Varus malunion may be due to early collapse and backing out of screws. There was statistically no significant difference ($p>0.05$) between the two groups regarding malunion. One (4%) patient in the DHS group had a hip screw cut through. This was seen involving a type 2 fracture pattern and may be due to osteoporosis or comminution. Patient was advised removal of implant but refused. Z effect and reverse Z effect was not seen in any of the patients similar to the study by Kumar et al where varus malunion and hip screw cut out were the only complications reported.¹⁹ In a similar study by Gupta et al no cases of Z effect and reverse Z effect were noted.²⁰ The incidence of implant related mechanical complications was similar in the series by Giraud et al.¹⁵ However, the hardware related complications were not significant statistically. Periprosthetic fracture was not seen in any of the patients in both groups in our study either intraoperatively or postoperatively similar to the findings of Boldin et al, Saudan et al and Kumar et al in their series.^{12,14,19}

CONCLUSION

So, on the basis of our study we can conclude that as results of functional assessment of DHS and PFN in the treatment of intertrochanteric fracture femur is comparable. Treatment of choice depends on surgeon preference and facilities available. Closed reduction and internal fixation with PFN should be preferred in patients with highly osteoporotic bones as use of DHS in such patients may lead to screw cut out through femoral head. The learning curve for the treatment of fractures by DHS was smaller as compared to PFN, hence surgeons with limited experience should prefer DHS as compared to PFN for type 1 and type 2 (Boyd and Griffin) intertrochanteric fractures. Both the implants DHS and PFN in their own right are excellent modalities in the management of intertrochanteric fractures of the femur however, a large multicentric study with larger sample size is required to generalize the result of our study to general population.

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