DOI: http://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20175562

Original Research Article

A prospective comparative study between proximal femoral nail and dynamic hip screw treatment in trochanteric fractures of femur

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Received: 01 December 2017
Accepted: 19 December 2017

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ABSTRACT

Background: Intertrochanteric (IT) fracture is one of the most common fractures of the femur in the female and elderly with osteoporotic bones, usually due to simple falls. Not many studies compared the treatment of dynamic hip screw (DHS) and proximal femoral nail (PFN), in type II intertrochanteric fractures. Hence, this study was done to compare the management, complications, functional and radiological outcome of PFN with DHS in management of type II intertrochanteric fractures.
Methods: This prospective comparative study was conducted on 60 patients of IT fractures at Santhiram General Hospital, Nandyal, Kurnool (Dist.) during the period May 2016 to September 2017. 30 cases were operated with proximal femoral nail (PFN) and 30 by using dynamic hip screw (DHS). Intraoperative details, complications and outcome of the procedures were noted, compared and analysed statistically.
Results: The mean age in DHS group was 57.5 and PFN group was 56.5 yrs. Female preponderance was observed in the study. Most of the injuries were on right side due to slip and fall in both the groups. Mean radiographic exposure (60 sec) and duration of operation (90 min) were more in PFN group compared to DHS group. Mean blood loss was 230 ml in PFN group and 320 ml in DHS group. Better anatomical and functional results were observed in PFN group compared to DHS group.
Conclusions: PFN is the better surgical procedure for elderly patients with IT fractures in terms of reduced blood loss, shorter operating time, rotational stability, good fixation, less morbidity and good outcome (anatomical and functional).

Keywords: Intertrochanteric fractures, Dynamic hip screw, Proximal femoral nail, Management, Outcome

INTRODUCTION

Intertrochanteric (IT) fractures are commonly seen in elderly patients over the age of 70 years.[1] Incidence of these fractures has increased primarily due to increasing life span and more sedentary life style brought about by urbanization. In younger patients IT fractures occur due to high velocity trauma like road traffic accidents (RTA), whereas in older patients it is due to trivial trauma.[2] Incidence of IT is common in females than in males, because senile osteoporosis sets in female early.[3] Intertrochanteric fractures can be managed by, conservative (or) operative methods.

Conservative methods were the treatment of choice until 1960, before the introduction of new fixation devices. Conservative methods resulted in higher mortality rates ranging between 15-20%, and also complications like, decubitus ulcers, urinary tract infections, pneumonia, thrombo-embolic complications. Hence, these methods

are only indicated in conditions such as age related chronic medical conditions unfit for surgery and for non-ambulatory patients before sustaining fracture.[4,5]

Operative management for IT fractures includes extra-medullary (sliding hip screw with barrel plate- DHS and its variants) and intramedullary nailing procedures (proximal femoral nail- PFN). DHS with side plate assembly is the most commonly used device, for fixation of intertrochanteric fractures. It is a non-collapsible fixation device, which permits the proximal fragment to collapse or settle on fixation device seeking its own position of stability. However, the disadvantages such as large skin incision and more soft tissue dissection with greater blood loss replaced its use with PFN.[6]

PFN is the latest implant for management of IT fractures. This implant is cephalomedullary and has many potential advantages. Being intramedullary, load transfer is more efficient, shorter lever arm results in less transfer of stress and less chances of implant failure, the amount of sliding is limited by intramedullary location, therefore less chances of shortening and deformity. Shorter operative time, less soft tissue dissection and less blood loss and advantages of controlled impaction can be maintained.[2]

In view of these conditions, this study has been taken up to compare the management, outcome and related complications associated with treatment of IT fractures by using PFN and DHS procedures.

METHODS

This prospective comparative study consists of 60 patients with intertrochanteric fracture of femur admitted to orthopaedic wards Santhiram General Hospital, Nandyal, Kurnool (dt) during the period May 2016 to September 2017.

Inclusion criteria were patients of both sexes of age between 18-80 years, patients with all types of trochanteric fractures with no specific duration of illness. Exclusion criteria were patients with previous surgery of proximal femur, Pathologic fractures other than osteoporosis, polytrauma and who are going on chemotherapy or irradiation treatment due to malignancy and who are not willing to participate in the study.

Out of 60, patients were randomly divided into two groups consisting of 30 in each based on preoperative variables like age, sex, mechanism of injury, side of effected injury, type of fracture and fracture geometry. Based on this 30 patients were operated with dynamic hip screw (DHS) and the other 30 were operated with proximal femoral nail (PFN).

All the patients were informed about the surgical procedure and informed consent was taken from all the patients. Complete history of the patients was recorded in a proforma. Clinical and radiological evaluation was done and admitted to ward after necessary resuscitation and splintage with skeletal traction. Complete blood, urine and X-ray investigations were done whichever are necessary. Associated injuries were evaluated and treated simultaneously. All the patients were subjected to pre-operative assessment for anesthetic risk, medical management and preferable timing for surgical management.

In this study, standard surgical techniques were selected separately for PFN group and DHS groups. In favor of economic status of the patients, we selected Indian made nails and sliding screw devices. Regular and periodic follow up was done with respect to clinical and radiological union of fracture, recognition of post-surgical failures, also functional recovery recorded. The above findings were entered into standard proforma.

In this study, the standard length PFN used was 250 mm with distal diameter of 9, 10, 11 mm. The proximal diameter of the nail is 14 mm. Proximal derotation screw of 6.5 mm and distal lag screw of 8 mm. Distal locking was done with self tapping 4.9 mm cortical screws, one in static mode and the other in dynamic mode allowing 5 mm dynamization. The nail is universal with 6 degrees of mediolateral valgus angulation and with neck shaft angle of 135 degrees. End cap was not used. For DHS procedure, the lag screw of length 60-110 mm was used. Minimum of 4 cortical screws were used to fix the side plate with the shaft (125-135 degrees). The diameter was determined by determining the diameter of the femur at the level of isthmus on an AP X-ray. All the patients were operated on a single standard fracture table under spinal anaesthesia using standard operating techniques. C-arm was used in all cases.

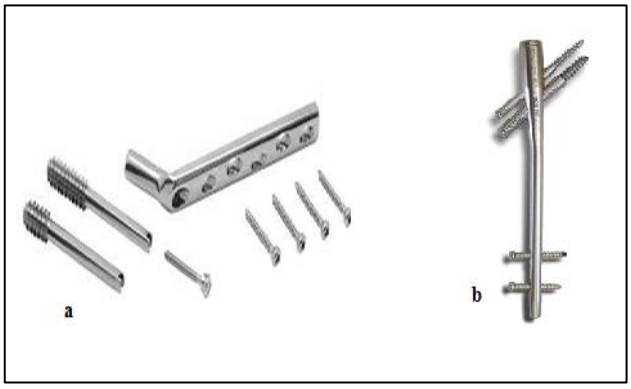

Figure 1: Insertion devices. a- Dynamic hip screw, b- Proximal femoral nail.

Intra-venous cefoperazone+sulbactum 1.5 gms I.V. was given before surgery. Intra-operatively the duration of surgery, the radiation exposure, intra-operative blood loss and any associated complications were noted.

Postoperatively, patient's pulse, blood pressure, respiration and temperature were monitored. Antibiotics

(cefoperazone+sulbactum 1.5 gms) were continued in postoperative period through I.V for 5 days and orally for 5 days. Analgesics were given as per patient's compliance. Blood transfusion was given depending on the requirement. Sutures were removed on the 10th postoperative day.

Patients were encouraged to sit in the bed after 24 hrs following surgery. Patients were taught quadriceps static exercise and knee mobilization in immediate postoperative period. Patients were taught gait training before discharge from hospital. They were allowed to walk on well leg with walker (non-weight bearing) before discharge. Only in very unstable fractures and comminuted fracture pattern, weight bearing was delayed till union progresses.

Follow up

All patients were followed up at an interval of 2 weeks until fracture union, at 12 weeks and at 6 months postoperatively. At each visit, patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening. X-ray of the pelvis with both hips was taken to assess fracture union and implant bone interaction.

Statistical analysis

Data was statistically analyzed by the SPSS (Statistical Package for the Social Sciences) 20 version. Relationship between variables was tested by Chi- Square test. Appropriate tables and charts were prepared by using Microsoft Excel.

RESULTS

The study included 60 cases of trochanteric fractures of femur. Of them 30 were treated by PFN and 30 by DHS. Table 1 presents the demographic characteristics of the study participants in both the groups. The mean age in DHS group was 57.5 and PFN group was 56.5 yrs, with youngest being 18 yrs and oldest being 80 yrs. Females (DHS- 53.3%; PFN- 56.6%) are more affected in both the groups compared to males (DHS- 46.6%; PFN- 43.3%). In both the groups maximum fractures in 70% cases was due to slip and fall. Right side is the commonly affected side in both the groups. In DHS group, right side was affected in 60% cases and left side in 40% cases. Whereas in PFN group it was 56.6% on right side and 43.3% on left side. In DHS group, 30% had type I, 56.6% had type II and 13.3% had type III fractures. In PFN group 33.3% had type I, 46.6% had type II, 20% had type III fractures. It was observed that type 2 were more common in both groups.

Intraoperative details of both the procedures was presented in Table 2. Mean radiographic exposure was 60 sec in PFN group and 40 sec in DHS group. Mean duration of operation was 90 min in PFN group and 80 min in DHS group. Mean blood loss was 230 ml in PFN group and 320 ml in DHS group.

Table 1: Demographic characteristics of study participants in both the groups.

Variables	Type of surgery				Total (n=60)	P value
	DHS (n=30)	(%)	PFN (n=30)	(%)		
Age (in years)						
18-40	4	13.3	3	10.0	7	0.914
41-60	13	43.3	13	43.3	26	
61-80	13	43.3	14	46.6	27	
Sex						
Male	14	46.6	13	43.3	27	0.795
Female	16	53.3	17	56.6	32	
Mode of injury						
Slip and fall	21	70.0	21	70.0	42	
Fall from height	0	00.0	4	13.3	4	0.076
RTA	9	30.0	5	16.6	14	
Side affected						
Right side	18	60.0	17	56.6	35	0.793
Left side	12	40.0	13	43.3	25	
Type of fracture						
Type I fracture	9	30.0	10	33.3	19	
Type II fracture	17	56.6	14	46.6	31	0.690
Type III fracture	4	13.3	6	20.0	10	

Table 3 presents the intraoperative complications associated with the both procedures in study participants. in PFN group 3 cases had failure to achieve close reduction, one case had fracture of lateral cortex, 3 cases had fracture displacement by nail insertion and 2 cases had failure to put derotation screw. In DHS group 3 cases had failure to achieve close reduction and 3 cases had fracture of lateral cortex. It was observed that common

complications in both groups were more in DHS group than in PFN group. Overall complications were more in PFN (30%) group than in DHS (20%) group as shown in Figure 2.

Table 2: Intraoperative details in both the groups.

Intraoperative details	DHS (n=30)	PFN (n=30)
Mean radiographic exposure (seconds)	40	60
Mean duration of operation (minutes)	80	90
Mean blood loss (ml)	320	230

Table 3: Intraoperative complications in both the study groups.

Complications	DHS (n=30)	(%)	PFN (n=30)	(%)
Failure to achieve closed reduction	3	10.0	3	10.0
Fracture of lateral cortex	3	10.0	1	3.0
Fracture displacement by nail insertion	0	00.0	3	10.0
Failure to put derotation screw	0	00.0	2	6.0
Failure to lock distally	0	00.0	0	00.0
Jamming of nail	0	00.0	0	0
Drill bit breakage	0	00.0	0	0
No complication	24	80.0	22	73.3
Total	30	100	30	100

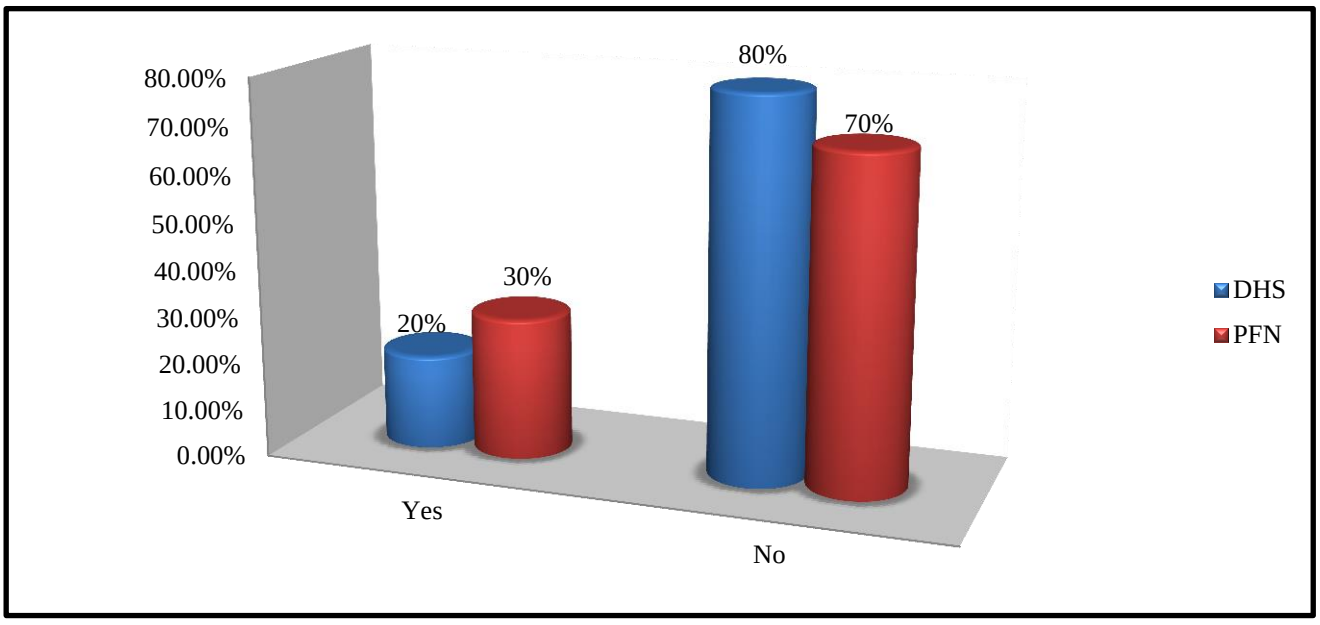

Figure 2: Percentage of overall intraoperative complications in both study groups.

Table 4: Delayed complications in both the study groups.

Delayed complications	Type of surgery			
	DHS (n=30)	(%)	PFN (n=30)	(%)
Hip stiffness	3	10.0	1	03.0
Knee stiffness	3	10.0	1	03.0
Shortening of >1 cm	5	16.6	2	06.0
Varus malunion	1	03.30	1	03.0
Implant failure	0	00.0	0	00.0
No complication	18	60.0	25	83.3
Total	30		30	

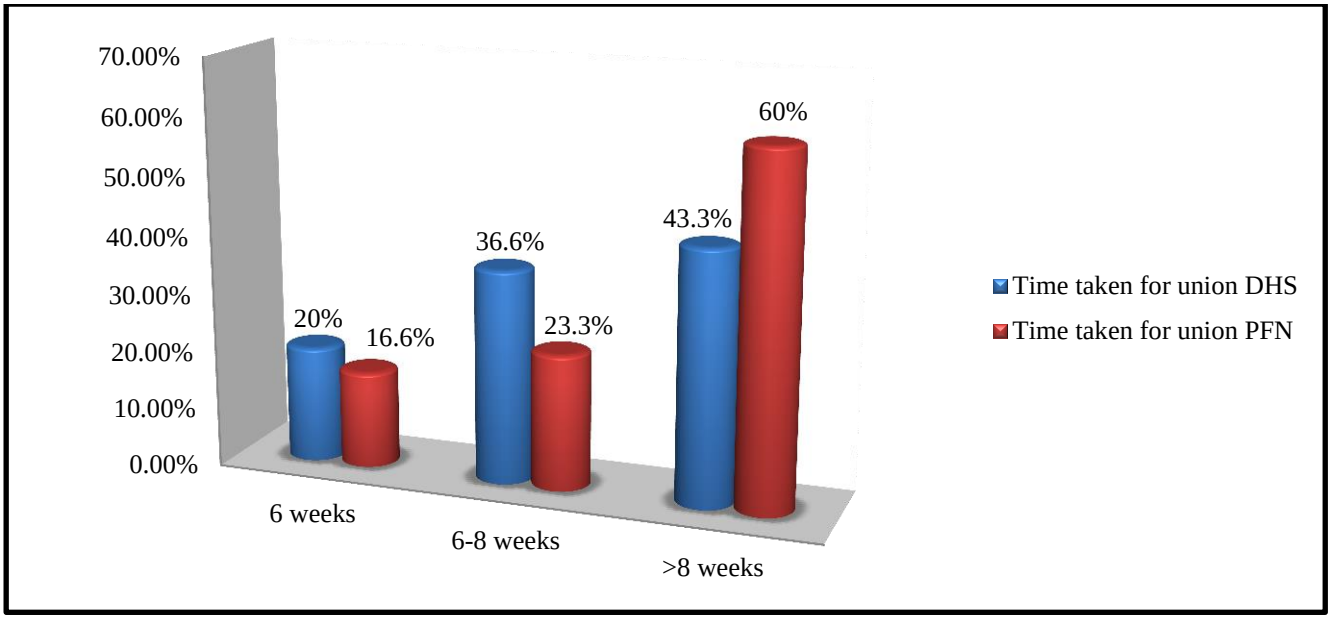

Figure 3: Time taken for union vs. type of surgery.

Delayed complications were shown in Table 4. In the current study in DHS group 3 cases had hip stiffness, 3 cases had knee stiffness, 5 cases had shortening more than 10mm and 1 case had varus malunion. In PFN group 1 case had hip stiffness, 1 case had knee stiffness, 2 cases had shortening more than 10mm and 1 case had varus malunion. We observed that delayed complications were more in DHS (40%) group than in PFN (16.6%) group.

In the present study, in DHS group 20% had union in 6 weeks, 36.6% in 6-8 weeks and 43.3% in more than 8 weeks. In PFN group 16.6% had union in 6 weeks, 23.3% in 6-8 weeks and 60% in more than 8 weeks. It was observed that union occurred earlier in DHS group. However, there was no statistically significant association between time taken for union and type of surgery (p=0.409) as shown in Figure 3.

Table 5: Anatomical and functional outcome in both groups.

Outcome	Type of surgery				Total	P value
	DHS (n=30)	(%)	PFN (n=30)	(%)		
Anatomical results						
Shortening of >1 cm	5	16.6	1	03.3	6	0.008
Varus deformity	2	06.6	1	03.3	3	
Restriction of hip movement	3	10.0	1	03.3	4	
Restriction of knee movement	3	10.0	1	03.3	4	
No complication	17	56.6	26	86.6	43	
Functional results						
Excellent	15	50.0	22	73.3	37	0.072
Good	7	23.3	7	23.3	14	
Fair	5	16.6	1	03.3	6	
Poor	3	10.0	0	00.0	3	

Outcome of the study in terms of anatomical and functional results were given in Table 5. In DHS group, 5 cases had shortening more than 1cm, 2 cases had varus deformity, 3 cases had restriction of hip movements and 3 cases had restriction of knee movements. In PFN group 1 case had shortening more than 1cm, 1 case had varus deformity, 1 case had restriction of hip movements and 1 case had restriction of knee movements. On assessment of functional outcome excellent results were found in 50%, good in 23.3%, fair in 16.6% and poor in 10% in DHS group. In PFN group 73.3% had excellent results, 23.3% had good results and 3.3% had fair results. It was observed that better anatomical and functional results were observed in PFN group compared to DHS group.

DISCUSSION

The management of IT fractures is still associated with many failures. The reason is being attributed to biomechanics of fracture and surgical technique variables

and due to high stress concentration that is subjecting to multiple deforming forces. For many years, research is going on to find out an ideal implant device for the fixation of IT fractures which are more common in elderly patients. But still an ideal implant has not yet being evolved. Research is going on from the dates back to Smith-Peterson (1960) to till date.

In early 90's, PFN was developed with biomechanical advantages over DHS and has become more prevalent in use. PFN was also not without failures; still mechanical failures remain a major concern.[7,8] One method to reduce the mechanical failure significantly is placing screws in "safe zone" shown by Herman et al.[9] Various studies showed PFN has several advantages over DHS.[10,11] The present study has been made to compare the management of trochanteric with the use of sliding hip screw (DHS) and intramedullary nail device (PFN).

We have grouped 60 patients with IT fractures into 2 groups, 30 patients each; which were admitted to the orthopaedic wards of Santhiram General Hospital, Nandyal, Kurnool District.

Most of patients in present study were from age group 18-80 years. Mean age in years for group operated by PFN was 56.5 years. Mean age in years for group operated by DHS was 58.5 years. Mean age in years both groups combined was 57.5 yrs. These observations were similar to the findings of Kumar et al.[12]

In our study out of 60 cases, 27 patients (45%) were males and 33 patients (55%) were females. Females are more affected than males. Similar observations were also made by Kumar et al.[12] In contrast to these findings males are more affected with IT fractures in the study done by Jonnes et al in which it was noted that out of the 30 patients, 16 patients (53%) were males and 14 patients (47%) females.[10]

In the current study most common mode of injury for IT was slip and fall (70%), followed by road traffic accident (23.3%). Patients with slip and fall mode of injury were older whereas patients with RTA were younger. The results in the present study were in agreement with an earlier study by Jonnes et al who reported that trivial trauma (77%) was most common mode of injury followed by road traffic accidents (23%) for the intertrochanteric fractures.[10]

Among all 60 cases, right side IT fractures were common accounting for 58.33% than left side (41.66%) which was comparable with previous studies. On contrast, study done by Kumar et al observed more IT fractures on left side (29 cases) than right side (21 cases).[12]

In our study, type II Boyd and Griffin fractures were common, consisted of 51.66%. Type I and Type III were 31.66% and 16.6% respectively. Suranigi et al conducted a study in which it was found that the most common type of fracture was type II.[13] There was no Type I pattern of fractures in their study. The current study correlates with above study. Similar findings were also found in a study conducted by Ravi Shankar et al. which showed that 60% of the patients had type II fracture.[14]

In the current study mean duration of surgery required for PFN was 90 min and for DHS it was 80 min. Similar observations was noticed by Faisal et al.[15] This was in contrast with the findings of Kumar et al.[12]

In our study mean blood loss was 230 ml for PFN group and 320 ml for DHS group. This difference in lesser blood loss in PFN procedure was due to less tissue damage. Similar observations were also done Suranigi et al and Faisal et al.[13,15]

In this study it was observed that mean radiographic exposure was 60 sec in PFN group and 40 sec in DHS group. The reasons for the less radiation exposure in DHS procedure were no need for placement of plate and cortical screw insertion did not need facility of the image intensifier and radiation exposure was only needed in placement of guide wire and positioning of the Richard's screw. Whereas in PFN procedure more radiation exposure was needed for the insertion of three guide pins, two proximal screws and distal locking screw. Ravi Shankar et al found that radiation exposure in PFN group was 40sec and in DHS group it was 30 sec.[14]

In our study among the PFN group, 3 cases (10%) were found to have failure to achieve closed reduction, 1(3%) case had lateral cortex, 3(10%) cases had displacement by nail insertion and 2cases (6%) had failure to put derotation screw. In those cases operated by DHS, 3 (10%) cases had difficulty in closed reduction and 3 cases had lateral cortex. These results conclude that that PFN procedure was technically difficult compared to DHS procedure which is in line with the studies Jonnes et al and Faisal et al.[10,15]

In our study average hospital stay was 17.13 days for DHS and 16.86 days for PFN. This was similar to the studies of Bhatti et al.[16]

There were less delayed complications in the PFN group compared to DHS group in the current study, which was supported by the studies Faisal et al and Bhakat et al.[17] DHS treatment involves wide surgical exposure there by involves considerable blood loss. Also, complications such as varus collapse, implant cut-out was commonly associated with it. So delayed complications may be more with DHS procedure. PFN procedure involves less surgical incision hence less blood loss. No complications such as Z effect and reverse Z effect were seen.

The average time taken for union in PFN group was 10 weeks and 12.3 weeks in DHS group. The findings in the current study were supported by Kumar et al and Sankar et al.[12,14] Mean time for full weight bearing in DHS group

was 14.8 weeks whereas it was 10.6 weeks in PFN group. These findings were similar to the studies of Pajarein et al.[18]

In the present study, it was observed better anatomical and functional results were found in PFN group compared to DHS group. Similar observation was also made by Sankar et al.[12]

CONCLUSION

The findings of the study, concluded that PFN is better than DHS in terms of reduced blood loss, shorter operating time, rotational stability, good fixation, less morbidity and good outcome (anatomical and functional). PFNs also proved to be more useful in difficult fractures with a subtrochanteric extension or reversed obliquity. These benefits of PFN treatment made it as superior method for stable fixation in elderly, in osteoporotic intertrochanteric fractures and subtrochanteric fractures.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Mundla MKR, Shaik MR, Buchupalli SR, Chandranna B. A prospective comparative study between proximal femoral nail and dynamic hip screw treatment in trochanteric fractures of femur. Int J Res Orthop 2018;4:58-64.