



ISSN (P): 2521-3466
ISSN (E): 2521-3474
© Clinical Orthopaedics
www.orthoresearchjournal.com
2019; 3(1): 26-30
Received: 19-11-2018
Accepted: 23-12-2018

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Comparative study of functional outcome of the intertrochanteric fracture of femur managed by Dynamic hip screw and proximal femoral nail

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DOI: <https://doi.org/10.33545/orthor.2019.v3.i1a.08>

Abstract

Introduction: Intertrochanteric (IT) femur fractures comprise approximately half of all hip fractures. These fragility hip fractures occur in a characteristic population with risk factors including increasing age, female gender, osteoporosis, a history of falls, and gait abnormalities. Although the effects of PFN and DHS in treatment of intertrochanteric fractures have been reported, the results and conclusions are not consistent.

Materials and Methods: This Comparative Prospective study was conducted in a tertiary care institute ELMCH for a period of 18 months from January 2017 to June 2018. Every case with intertrochanteric fracture was treated randomly (computer generated number table) either by Dynamic hip screw (DHS) or Proximal femoral nail (PFN). A total of 80 cases were included. The patients were further divided into two groups, each of 40 cases, 40 were treated by Dynamic Hip Screw & 40 were treated with proximal femoral nail (P.F.N). All patients were followed up for nine months.

Results: In our study the mean age in the PFN group was 62.5 while in the DHS group it was 64 years. In present study the intergroup comparison of Harris Hip score between PFN and DHS group revealed that post operatively after 1 month the Harris hip score in PFN group had mean value 32.95 ± 2.65 , while the HH score in DHS group had mean 22.30 ± 0.65 . Post operatively after 3 month the Harris hip score in PFN group had mean value 57.33 ± 2.10 , while the HH score in DHS group had mean 51.90 ± 0.96 . Post operatively after 6 month the Harris hip score in PFN group had mean value 83.50 ± 0.96 , while the HH score in DHS group had mean 73.73 ± 3.30 .

Conclusion: Therefore, the study showed that PFN is better method of fixation in intertrochanteric fracture of femur.

Keywords: intertrochanteric, proximal femoral nail, dynamic hip screw, functional outcome

Introduction

Intertrochanteric (IT) femur fractures comprise approximately half of all hip fractures. The main cause of Intertrochanteric fractures is by a low-energy mechanism such as a fall from standing height. The risk factors leading to hip fractures include increasing age, female gender, osteoporosis, a history of falls, and gait abnormalities^[1].

The incidence of Intertrochanteric fracture is rising because of increasing number of senior citizens with osteoporosis. By 2040 the incidence is estimated to be doubled. Studies related to treatment of Intertrochanteric fracture are extensive. Both surgical as well as non-surgical interventions have been studied by various study modalities.

Also, there have been many numbers of studies comparing the outcome of Intertrochanteric fracture managed by dynamic hip screw versus proximal femur nail.

By doing this study, the aim was to not only to evaluate outcomes with dynamic hip screw (DHS) or proximal femur nail (PFN) but also comparison of the procedures, so that it could be evaluated which procedure is better in terms of patient compliance and long term recovery.

Materials and Methods

This Comparative Prospective study was conducted in a Department of Orthopaedics in ERA'S Lucknow Medical College & Hospital, Lucknow for a period of 18 months from January 2017 to June 2018. The study protocol was cleared for ethics by research institutional

review board. A Comparative Randomized Prospective study design was adopted. Cases were recruited from Orthopaedics OPD /emergency after history taking, physical examination. All the cases were carefully evaluated preoperatively which included detailed history to determine the cause of fracture and other diseases. The radiograph of pelvis with both hips and lateral view of the affected hip was taken. The fractures were classified using Orthopaedic Trauma Association (OTA) and AO classification. Skin traction was applied to all cases. Every case with intertrochanteric fracture was treated randomly (computer generated number table) either by Dynamic hip screw (DHS) or Proximal femoral nail (PFN). The recruited cases were explained the purpose and relevance of the study. Those willing to volunteer were included in the study after informed and written consent. A total of 80 cases were included. The patients were further divided into two groups, each of 40 cases, 40 were treated by Dynamic Hip Screw & 40 were treated with proximal femoral nail (P.F.N). All patients were followed up for nine months.

The inclusion criteria for the cases in this study was surgically fit cases more than 50 years of age with isolated intertrochanteric fracture.

The study subjects were excluded by any of the following criteria:

1. Cases with pathological fractures due to metastasis, tumors was excluded.
2. Compound fractures and polytrauma patients.
3. Cases who did not give informed consent.

All cases were evaluated by a physician for fitness to surgery. If associated medical conditions were detected, they were set right preoperatively. Implants which were used are shown in the following table:

Table 1: D.H.S Barrel angle (degrees)

D.H.S: Barrel angle (degrees)	130	135
No. of holes	4	5
Screw length	85 mm	90 mm
P.F.N: Nail diameter	9 mm	10 mm
Screw angle(degree)	130	135

Follow Up Protocol

All patients were followed up for a period of one year; the follow up visits were done at: 1,3,6,9 months.

The important parameters assessed were wound inspection on 3rd and 7th day and suture removal on 13th day regular follow up, at 1 month, and 3 months and 6 months and 9 months

Clinical Evaluation

1. Based on Harris Hip Score

Radiological

1. Progress of fracture healing
2. Amount of collapse
3. Complication like screw cut out, collapse of fracture and z phenomena.

Results

Among the cases majority of the cases were seen in the age group 60 to 70 years. In the PFN group 16 (40.0%) cases were in the age groups 60 – 70 years, 14 (35.0%) belonged to the age group 50 – 60 years, 8 (20.0%) belonged to 70 – 80 years and rest 2 (5.0%) were aged 80 years and more.

In the DHS group maximum 18 (45.0%) were belonged to age group 60 – 70 years, 10 (25.0%) cases in the age groups 50 – 60

years, 8 (20.0%) In the age group 70 – 80 years and 4 cases aged 80 years and more. No significant difference was found in proportion of various age groups between the PFN and DHS techniques. Hence the two treatment groups were age matched ($p=0.253$).

In the PFN group majority 29 (72.5%) were males while remaining 11 (27.5%) cases were females while in DHS group 24 (60.0%) were males and rest 16 (40.0%) were females. No significant difference was observed in male – female proportion between the two treatment groups hence the groups were matched for gender ($p=0.237$).

Table 2: Distribution of Subjects according to Fracture Type

Radiographic	PFN		DHS		Significance	
	No.	%	No.	%	chi sq	p-value
31-A1	4	10.0%	0	0.0%	17.078	<0.001
31-A2	7	17.5%	24	60.0%		
31-A3	29	72.5%	16	40.0%		

Table 3: Intergroup Comparison of Harris Hip Score between PFN and DHS Groups

Harris Hip Score	PFN		DHS		Mann-Whitney U	
	Mean	SD	Mean	SD	z - value	p-value
At 1 month	32.95	2.65	22.30	0.65	-7.81	<0.001
At 3 month	57.33	2.10	51.90	0.96	-7.25	<0.001
At 6 month	83.50	0.93	73.73	3.30	-7.78	<0.001
At 9 month	93.28	2.39	91.50	0.82	-3.05	<0.001

The intergroup comparison of Harris Hip score(HHS) between PFN and DHS group revealed that post operatively after 1 month the Harris hip score in PFN group had mean value 32.95 ± 2.65 , while the HH score in DHS group had mean 22.30 ± 0.65 .

Table 4: Intergroup comparison of general parameter (Hospital Stay) between the groups

General Parameter	PFN		DHS		Unpaired t test	
	Mean	SD	Mean	SD	t - value	p-value
Hospital stay (Days)	12.25	0.78	11.20	1.42	4.11	<0.001

Table 5: Intergroup comparison of complications between the groups

Parameters	PFN (40)		DHS(40)		chi sq	p-value
	No.	%	No.	%		
Non Union	1	2.5%	3	7.5%	1.05	0.305
Infection	0	0.0%	4	10.0%	4.21	0.040
Screw cut out	0	0.0%	1	2.5%	1.01	0.314

Discussion

There have been many numbers of studies comparing the outcome of intertrochanteric fracture managed by dynamic hip screw (D.H.S.) versus proximal femur nail (P.F.N.). By doing this study, the aim was not only to evaluate outcomes with dynamic hip screw or proximal femur nail but also comparison of the procedures, so that it can be evaluated which procedure is better in terms of patient compliance and long term recovery.

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^[2, 3]. One method to reduce the mechanical failure significantly is placing screws in "safe zone" shown by Herman *et al.*^[2]. Various studies showed PFN has several advantages over DHS^[4, 5]. 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).

In our study the mean age in the PFN group was 62.5 while in the DHS group it was 64 years. The study conducted by Ranjeetesh *et al.*^[4] observed that the average age of the patient was 62.3 years. These observations were similar to the findings of Kumar *et al.*^[6] Similar finding was observed in a study conducted by Cyril Jonnes, MS; Shishir SM, MS; Syed Najimudeen, MS (2015)^[7] compared the functional and radiological outcome of PFN with DHS in treatment of Type II Intertrochanteric fractures. 30 alternative cases of type II Intertrochanteric fractures of hip were operated using PFN or DHS were studied. Average age of fracture recorded was around 60 years. A higher age at presentation has been reported by Age at the time of fracture has been reported by Harrington and Johnston, Hunter, Kuderna *et al.*, Zickel, Cuthbert and Howat, Poigenfurst and Schnabl, Laskin *et al.*, Hall and Ainscow, Saudan, Lubbelee A, Sadowski C, and Tyllionksi *et al.*^[8-17] In present study the PFN group majority 29 (72.5%) were males while remaining 11 (27.5%) cases were females while in DHS group 24 (60.0%) were males and rest 16 (40.0%) were females. No significant difference was observed in male – female proportion between the two treatment groups hence the groups were matched for gender. In addition 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^[3].

In contrast Mundla MKR *et al.*^[18] reported that 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.*^[5]

A preponderance of female sex has been reported by Harrington and Johnston, Kuderna *et al.*, Poigenfurst and Schnabl and Laskin *et al.*^[8, 10, 11, 12] The reason for the difference could be because of high number of road traffic accident cases included in the study. Males are more susceptible to road traffic accidents and hence the preponderance of males in our study.

A higher prevalence of stable fractures has been reported by Kuderna *et al.*^[10] We had 50% prevalence of both stable and unstable fractures. In present study in the PFN group majority 29 (72.5%) of the cases had 31–A3 fracture type while 7 (17.5%) had 31–A2 fracture type and remaining 4 (10.0%) cases had 31–A1 fracture type. In the DHS group majority 24 (60.0%) of the cases had 31–A2 fracture type and remaining 16 (40.0%) had 31–A3 fracture type. None of the subjects had fracture type 31–A1 in DHS group. A significant difference was observed in fracture type between the two treatment groups.

Similar finding was observed in a study conducted by Cyril Jonnes, MS; Shishir SM, MS; Syed Najimudeen, MS (2015)^[7] compared the functional and radiological outcome of PFN with DHS in treatment of Type II intertrochanteric fractures. 30 alternative cases of type II intertrochanteric fractures of hip were operated using PFN or DHS were studied. Average of fracture recorded was around 60 years. Type of fracture was not significantly associated with DHS and PFN group. Type II fracture was more among 60 cases (18 cases) followed by type

III (16 cases). 13 cases had type I and IV fracture respectively. Study conducted by Kumar R., Singh R.N and Singh B.N. (2012)^[4] compared the outcome of 50 cases with intertrochanteric fractures treated with DHS and PFN. The average operating time for the patients treated with PFN was 55 min as compared to 87 min in patients treated with DHS. Zhao C *et al.* (2009) discussed characters of proximal femoral nail and dynamic hip screw for treating type A1, A2, A3 of after reviewing 104 cases with intertrochanteric fractures. Suranigi *et al.* conducted a study in which it was found that the most common type of fracture was type II There was no Type I pattern of fractures in their study {source : Suranigi SM, Shetty N, Shah HM. Study Comparing the Advantages of Proximal Femoral Nail Over Dynamic Hip Screw Among Patients with Subtrochanteric Fracture. J Med Thesis. 2014; 2(1):35-8}.

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^[19].

In present study among the fracture cases 44 were due to slip on floor, 34 were fractured due to road traffic accident and rest 6 were fractured due to assault. In the PFN group 20 (50%) were the cases of slip on floor, 18 (45.0%) were the cases of road traffic accident and rest 2 (5.0%) were the cases of assault. In the DHS group 24 (60%) were the cases of slip on floor, 16 (40.0%) were the cases of road traffic accident and rest 4 (10.0%) were the cases of assault. No significant difference was observed in mode of trauma between the two treatment groups. 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^[20].

In addition, Mundla MKR *et al.*^[18] found that 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 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^[3].

In present study the intergroup comparison of Harris Hip score between PFN and DHS group revealed that post operatively after 1 month the Harris hip score in PFN group had mean value 32.95±2.65, while the HH score in DHS group had mean 22.30±0.65. Post operatively after 3 month the Harris hip score in PFN group had mean value 57.33±2.10, while the HH score in DHS group had mean 51.90±0.96. Post operatively after 6 month the Harris hip score in PFN group had mean value 83.50±0.96, while the HH score in DHS group had mean 73.73±3.30. Post operatively after 9 month the Harris hip score in PFN group had mean value 93.28±2.39, while the HH score in DHS group had mean 91.50±0.82. In addition, Harris Hip score was significantly more among PFN group as compared to DHS group in the study at 2 weeks period. PFN group had better HARRIS HIP SCORE than DHS group but not statistical significant at 4 weeks to 1years. Similar finding was seen in a study conducted by Ranjeetesh Kumar, R.N. Singh and B.N. Singh (2012)^[4] compared the outcome of 50 cases with intertrochanteric fractures treated with Dynamic Hip Screw and Proximal Femoral nail. Result showed that the patients treated with PFN started early ambulation as they had better Harris Hip Score in the early period (at 1 and 3 month) similar finding was observed in a study conducted by Chaitanya *et al.* (2015)^[21] who compared the results of Intertrochanteric fractures by DHS over Proximal Femoral Nailing. 60 patients of Intertrochanteric fractures, 30 were treated with sliding hip screw with plate and

30 were treated by an intra medullary hip screw. Harris hip score did not show any significant change in both the group from one month to 1 year period. Harris hip scores of D.H.S and P.F.N for 6 months and 1 year follow up were same (94.2 for D.H.S, 94.6 for P.F.N).

In present study the intergroup comparison of Intra Op parameters between PFN and DHS group revealed that the blood loss in PFN group had mean value 167.25 ± 12.24 ml, while the blood loss in DHS group had mean 266.00 ± 41.06 ml. The duration of surgery in PFN group had mean value 56.78 ± 5.03 min, while the duration of surgery in DHS group had mean 88.50 ± 12.11 min. The incision size in PFN group had mean value 4.54 ± 0.74 cm, while the incision size in DHS group had mean 7.20 ± 1.09 cm. In addition, mean blood loss was significantly less among PFN group as compared to DHS group in the study. Mean blood loss was 252 ml in DHS and 81.67 ml in PFN group. Similar finding was seen in a study conducted by Ranjeetesh Kumar, R.N. Singh and B.N. Singh (2012)^[4] compared the outcome of 50 cases with Intertrochanteric fractures treated with Dynamic Hip Screw and Proximal Femoral nail. The average blood loss was 100 and 250 ml in PFN and DHS group respectively. Similar finding was observed in a study conducted by Chaitanya *et al* (2015)^[21] who compared the results of Intertrochanteric fractures by DHS over PFN. 60 patients of Intertrochanteric fractures, 30 were treated with sliding hip screw with plate and 30 were treated by an Intramedullary hip screw. Mean blood loss in PFN group was 96 ml and in DHS group mean blood loss was 233 ml.

In present study the intergroup comparison of complications between PFN and DHS group revealed that the non union in PFN group was found in 1 (2.5%) case while in DHS group it was found in 3 (7.5%) cases. The infection in PFN group was not found in any case while in DHS group it was found in 4 (10.0%) cases. The screw cut out in PFN group was not found in any case while in DHS group it was found in 1 (2.5%) case.

In addition, non-union was the only complication among PFN group. Bedsore, deep infection, shortening and superficial infection were other complication among DHS group. Similar finding was observed in a study conducted by Chaitanya *et al* (2015)^[21] who compared the results of Intertrochanteric fractures by DHS over Proximal Femoral Nailing. 60 patients of Intertrochanteric fractures, 30 were treated with sliding hip screw with plate and 30 were treated by an intra-medullary hip screw. Complications among DHS group was Infection and non-union and in PFN group complication were related to implants and medical related complications.

Conclusion

Therefore, the study showed that PFN is better method of fixation in Intertrochanteric fracture of femur in the patients with respect to functional outcome (union of the fracture, return to functional activity, morbidity and implant failure), intra operative parameters (total duration of surgery, intraoperative blood loss and intraoperative complication). However further more studies are recommended for more detailed research outcomes.

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