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Dr. Santosh Veershetty Patil
Assistant Professor, Department
of Orthopaedics, Maheshwara
Medical College and Hospital,
Isnapur, Telangana, India

Management of intertrochanteric hip fractures by proximal femoral nail and dynamic hip screw fixation: A comparative study

Dr. Santosh Veershetty Patil

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Abstract

Intertrochanteric fractures are significantly increasing in older adults. Treatment choices for trochanteric fractures include intramedullary nail and extra medullary fixation, even though the appropriate treatment choices for such fractures remain controversial. The present study was aimed to assess optimal treatment option for intertrochanteric fractures to determine which method i.e. proximal femoral nailing (PFN) and dynamic hip screw fixation (DHS) gives minimal post-operative complications, minimal blood loss and minimal duration surgery. A total of 46 cases with intertrochanteric fractures attending Department of Orthopedics were recruited. Cases were randomly allocated to PFN (Group 1) and DHS (Group 2). The intra-operative, early and late complications were recorded, and the functional outcome of each group was assessed. Road traffic accidents were most common cause of fractures in both groups. In group 1, the mean length of incision (9.56 cm), duration of surgery (71.45 min), fluoroscopy time (72.66) and total intraoperative blood loss (138 ml). In group 2, the mean length of incision (15.89 cm), duration of surgery (89.18 min), fluoroscopy time (59.38) and total intraoperative blood loss (322 ml). Cases treated with PFN had excellent outcome in 21.7%, good in 69.56%, fair in 8.69% and none of the case had poor outcome. Whereas in DHS group, excellent outcome in 21.7%, good in 43.47%, fair in 21.7% and poor in 13.04%. Both PFN and DHS had similar functional outcome. However, PFN had significantly more desirable functional outcome. PFN requires a smaller incision, shorter surgical duration, less intraoperative blood loss and post-operative complication than DHS group.

Keywords: Intertrochanteric fractures, proximal femoral nailing (PFN), dynamic hip screw (DHS), Functional outcome

Introduction

The intertrochanteric fracture incidence has been significantly increasing in older adult population due to trivial trauma and osteoporosis and in younger population due to high velocity trauma [1]. The surgical management was primary treatment choice for intertrochanteric fractures. It is always aims to restore the anatomy and function without prolonged immobilization [2].

Surgical management with stable fixation allows early mobilization and reduces postoperative complications. Intramedullary fixation and extra medullary fixation are major treatment options for the intertrochanteric fractures [3]. The dynamic hip screw fixation (DHS) method is a standard implant method and commonly employed in extra medullary fixation [4]. Proximal femoral nail (PFN) is commonly used treatment method in intramedullary fixation. In recent years, PFN is extensively used in the treatment of intertrochanteric fractures because it was improved by addition of an antirotation hip screw proximal to the main screw. However, literature suggested that there are benefits and technical failures of PFN in the management of trochanteric fractures [5,6]. There is a controversial statement regarding the efficacy of PFN and DHS in the operative management of intertrochanteric fractures. The present study was aimed to assess optimal treatment option for intertrochanteric fractures to determine which method i.e. PFN and DHS gives minimal post-operative complications, minimal blood loss and minimal duration surgery.

Corresponding Author:
Dr. Santosh Veershetty Patil
Assistant Professor, Department
of Orthopaedics, Maheshwara
Medical College and Hospital,
Isnapur, Telangana, India

Material and Methods

The present prospective interventional study was conducted in the Department of Orthopedics, Maheshwara Medical College and Hospital, Isnapur, Telangana from June 2018 to March 2021. A total of 46 cases with intertrochanteric fractures attending Department of Orthopedics were recruited. Cases with intertrochanteric fracture, above 21 years of age, cases who were fit for anaesthesia and willing to participate in the study were included. Cases with fractures associate with polytrauma, pathological fractures, active infection, deformity of femur, non-traumatic disorder, abnormal bowing of femur, osteopetrosis and cases not willing to participate in the study were excluded. Informed consent was obtained from all the study participants and the study protocol was approved by the institutional ethics committee.

Study cases were randomly allocated to two groups (23 in each group) and surgically managed with proximal femoral nailing (Group 1) and dynamic hip screw fixation (Group 2). The fractures were classified according to Jensen-Michaelsen’s modification of Evans classification of trochanteric fractures. Type I & II fractures were considered as stable fractures, type III, IV & V fractures considered as unstable fractures. The study participants were evaluated as per the clinical history and mode of injury. Necessary radiological investigations such as X-ray (antero-posterior and lateral view) and complete haemogram was performed.

Closed reduction was attempted in all cases to reduce fractures. Post operatively all the cases underwent rehabilitation protocol with dynamic quadriceps and ankle pump exercises being started with walker from the second and third day. Depending on the patient condition, stability of fracture and adequacy of fixation non-weight bearing and later partial weight bearing was started. All the cases were advised to follow up at the end of 6th week after discharge, 3 months and 6 months. Clinical and radiological evaluation by X-rays was done to assess the status of fracture union and signs of failure of fixation. Walking ability of each patient was recorded and compared with pre-injury walking ability using the Sahlstrand74 grading. Postoperative pain was evaluated using the four-point pain score as also used by Saudan (Excellent, good, fair and poor). The fracture union was considered as malunion if varus angulation was greater than 10 degrees.

The SPSS version 23 software was used to carry out statistical analysis relevant to the study. Descriptive statistics were used to represent demographic and clinical characteristics in the form of frequency and percentages. Student t- test, chi square test was used to compare the outcomes between two study groups. *P*<0.05 was considered as statistically significant.

Results

Table 1: Demographic details of study participants (n=46).

Demographic parameters	Group 1 (PFN) (n=23)		Group 2 (DHS) (n=23)		p-value
	Frequency	Percentage	Frequency	Percentage	
Age (In years)					
21-30	02	8.69%	02	8.69%	0.282
31-40	03	13.04%	02	8.69%	
41-50	04	17.3%	05	21.7%	
51-60	06	26.08%	05	21.7%	
61-70	06	26.08%	08	34.7%	
Above 70	02	8.69%	01	4.34%	
Gender					
Male	09	39.13%	11	47.8%	0.314
Female	14	60.86%	12	52.1%	
Laterality of fracture					
Unilateral right	10	43.47%	12	52.1%	0.261
Unilateral left	13	56.5%	11	47.8%	
Bilateral	-	-	-	-	
Mode of injury					
RTA	13	56.5%	15	65.21%	0.588
Fall from height	06	26.08%	05	21.73%	
Slipping and fall	03	13.04%	03	13.04%	
Assault	01	4.34%	-	-	
Jensen-Michaelsen’s modification of Evans classification of fracture type					
Type 1 fractures	01	4.34%	02	8.69%	0.438
Type 2 fractures	15	65.21%	10	43.47%	
Type 3 fractures	03	13.04%	08	34.7%	
Type 4 fractures	04	17.13%	03	13.04%	
Type 5 fractures	-	-	-	-	
Type 6 fractures	-	-	-	-	

Table 2: Intra-operative variables in the study participants

variables	Group 1	Group 2	p-value
	Mean ± SD	Mean ± SD	
Length of incision	9.56 ± 1.24	15.89 ± 2.03	0.0029
Duration of Surgery	71.45 ± 2.61	89.18 ± 5.63	0.0031
Fluoroscopy time	72.66 ± 6.65	59.38 ± 2.80	0.0022
Amount of blood loss	138 ± 18.96	322 ± 33.21	0.002

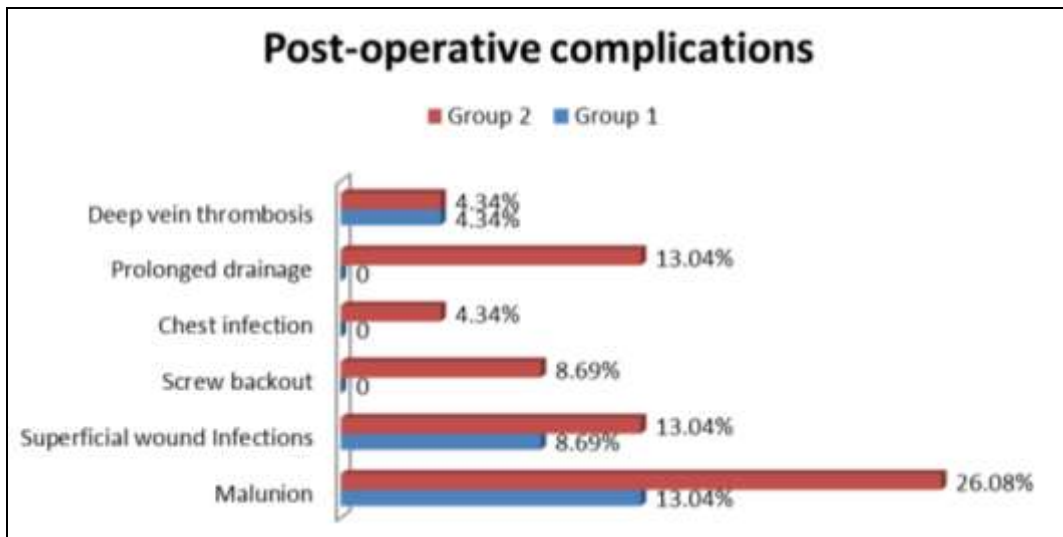


Fig 1: Postoperative complication in the study participants

Table 3: Post-operative variables in the study participants

Post-operative Variables	Group 1	Group 2	p-value
	Mean ± SD	Mean ± SD	
Post-operative pain score			
Score 1	10 (43.47%)	05 (21.73%)	0.031
Score 2	12 (52.17%)	08 (34.7%)	
Score 3	01 (4.34%)	08 (34.7%)	
Score 4	-	02 (8.69%)	
Mobility score	1.64 ± 0.40	2.31 ± 0.57	0.026
Shortening	0.69 ± 0.98	1.37 ± 0.86	0.002
Range of movement	99.12 ± 5.62	86.74 ± 8.36	0.061
Time of fracture union	13.2 ± 2.30	12.8 ± 1.66	0.628

Table 4: Overall functional outcome in both the study groups

Functional outcome	Group 1		Group 2	
	Frequency	Percentage	Frequency	Percentage
Excellent	05	21.7%	05	21.7%
Good	16	69.56%	10	43.47%
Fair	02	8.69%	05	21.7%
Poor	-	-	03	13.04%
p-value	0.0276			

Discussion

A total of 46 cases with intertrochanteric fractures attending Department of Orthopedics were recruited. Study cases were randomly allocated to two groups (23 in each group) and surgically managed with proximal femoral nailing (Group 1) and dynamic hip screw fixation (Group 2). In group 1, majority cases were between 51-70 years (52.16%), followed by 41-50 years (17.3%), 31-40 years (13.04%), 21-30 years (8.69%) and above 70 years (8.69%). In group 2, majority cases were belonged age group 51-70 years (56.4%), followed by 41-50 years (21.7%), 21-30 (8.69%), 31-40 (8.69%) and above 70 years (4.34%). The difference between two study groups was statistically not significant (p=0.282). Female participants were more than males in both the study groups (Table 1). A study by Tanay R. Prabhoo included 40 cases with mean age of 56.6 years and 58.5 years treated with PFN and DHS respectively [7].

In group 1, fractures were seen right side in 43.47% cases and left side in 56.5% cases. In group 2, fractures were seen right limb in 52.1% cases and left side in 47.8% cases. A study by Tanay R. Prabhoo noticed in PFN group, 12(60%) patients were found to have proximal femoral fractures on the left side while 8(4%) patients were having fracture on the right side.

Amongst the 20 cases operated by DHS, 9(45%) patients were found to have proximal femoral fractures on the left side while 11(55%) patients were having fracture on the right side [7]. In both groups, road traffic accidents were leading cause of injury (56.5% in group 1 & 65.21% in group 2), followed by falling from height injuries (26.08% in group 1 & 21.73% in group 2), falling by slipping (13.04% in both groups) and assault (4.34% in group 1). The difference was statistically not significant (p=0.588) (Table 1). Domestic fall was commonest cause of injury followed by road traffic accident and assault in both the study groups [7].

The mean difference between intra-operative variables was statistically significant between two study groups. In group 1, the mean length of incision was 9.56 cm, duration of surgery was 71.45 min, fluoroscopy time was 72.66 and total intraoperative blood loss was 138 ml. In group 2, the mean length of incision was 15.89 cm, duration of surgery was 89.18 min, fluoroscopy time was 59.38 and total intraoperative blood loss was 322 ml (Table 2). A study by Tanay R. Prabhoo observed high blood loss in DHS group but the radiation exposure was less as compared to the PFN group. Duration of surgery, hospital stay and implant failure was found to be more among patients in DHS group [7]. The Comparison of early and late intra operative complication rates was not statistically significant between study groups [8]. A study by Anmol Sharma *et al.* noted that the mean length of incision (P<0.01), duration of surgery (P<0.01) was less in PFN group and radiation exposures were significantly more in PFN group. Average blood loss was more in DHS group (P<0.01) [3]. In this study the mean length of incision was less in PFN group than DHS group, which was comparable with the studies by Pan *et al.* and Zhao *et al.* [12, 13]

The post-operative complication was observed in group 1 such as malunion (13.04%), superficial wound infection (8.69%) and deep vein thrombosis (4.34%). In group 2, malunion (26.08%) was commonest complication, followed by superficial wound infection (13.04%), prolonged drainage (13.04%) and deep vein thrombosis (4.34%) (Figure 1). A study by Venkatesh Gupta SK, Veera Shekar Valiseti noted prolonged drainage, hematoma, superficial infection and deep vein thrombosis [8]. In group 1, the postoperative pain score was 1 in 43.47% of cases, 2 in 52.17% and 3 in 4.34% cases. In group 2, the postoperative pain score was 1 in 21.73% of cases, 2 in 34.7%, 3 in 34.7% cases and 4 in 8.69% cases. The difference of pain score between two study groups was

statistically significant ($p=0.031$). In group 1, the mean post-operative mobility score was 1.64, post-operative shortening was 0.69, post-operative range of movement was 99.12 and time period of fracture reunion was 13.2. In group 2, the mean post-operative mobility score was 2.31, post-operative shortening was 1.37, post-operative range of movement was 86.74 and time period of fracture reunion was 12.8. The mean difference of post-operative study variables between two study groups was statistically significant ($P<0.05$) (Table 3). The overall functional outcome in group 1 treated with proximal femoral nailing was excellent in 21.7% cases, good in 69.56% cases, fair in 8.69% cases and none of the case had poor outcome. The overall functional outcome in in group 2 treated with dynamic hip screw fixation was excellent in 21.7% cases, good in 43.47% cases, fair in 21.7% cases and poor in 13.04% cases (Table 4). A study by Tanay R. Prabhoo found excellent functional outcome in 5 cases, good in 10 cases, fair in 4 cases and poor in 1 case in DHS group. Whereas in PFN group 7 cases had excellent results 12 cases had good results, 1 case had fair results and none had poor results (7). A study by Venkatesh Gupta SK, Veera Shekar Valiseti observed 37.5% excellent results, good results in 54.1%, fair results in 6.6%, and poor results in 1.6% cases in DHS group and 66.2% excellent results, good results in 28.2%, fair in 5% and none had poor function outcome in PFN group (8). The results of above studies are compatible with the functional outcome of the present study.

A study by Tanay R. Prabhoo concluded that PFN emerged to be superior to DHS in unstable intertrochanteric fractures [7]. A study by Venkatesh Gupta SK, Veera Shekar Valiseti concluded that DHS and PFN have matched outcomes in stable trochanteric fractures and PFN has greater functional outcome with unstable fractures [8]. A study by Anmol Sharma *et al.* concluded that PFN provides a shorter surgery with smaller incision. However, the incidence of technical errors was significantly higher in PFN than DHS [9]. A meta-analysis by Xiao Huang *et al* concluded that PFN fixation shows the same effectiveness as DHS fixation [10]. A clinical trial by Adams CI *et al.* concluded that the use of an intramedullary device in the management of intertrochanteric femoral fractures is still associated with a higher but non-significant risk of postoperative complications and is not recommended in place of standard treatment modality like dynamic hip screw and plate [11]. A study by Xianshang Zeng *et al.* concluded that PFN had better functional outcomes than DHS among elderly cases with osteoporosis [14]. A study by Herode P *et al.* concluded that both fixative methods are accurate, tested & needs good surgical skill. There is no much difference in complications in these two techniques [15].

Conclusion

The results of the present study conclude that in the management of stable intertrochanteric fractures, both proximal femoral nailing and dynamic hip screw had similar functional outcome. However in the management of unstable fractures PFN had significantly more desirable functional outcome. PFN requires a smaller incision, shorter surgical duration and had less intraoperative blood loss. Post-operative complication was less in PFN group than DHS group. Hence, proximal femoral nailing is a better fixation tool for intertrochanteric fracture of femur than dynamic hip screw.

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