

## ORIGINAL ARTICLE

# Comparative Study between Dynamic Hip Screw versus Proximal Femoral Nail Devices in the Management of Intertrochanteric Fractures

MUHAMMAD ZEB KHAN<sup>1</sup>, MUHAMMAD REHAN<sup>2</sup>, ALI SALMAN<sup>3</sup>, MALIK MOHAMMAD YASIN AWAN<sup>4</sup>, AHAD KAREEM KHAN<sup>5</sup>

<sup>1</sup>Assistant Professor Department of Orthopaedic and Spine Surgery, Sahara Medical College (Sughra Shafi Medical Complex), Narowal

<sup>2</sup>MBBS, MS Orthopaedic, Senior Registrar Department of Orthopedics Sughra Shafi Medical Complex, Sahara Medical College Narowal

<sup>3</sup>MBBS (Lahore Medical and dental college), FCPS Surgery and Allied Department of Surgery Ghurki Trust And Teaching Hospital, Lahore

<sup>4</sup>Associate professor in Orthopedics' Sahara Medical college' Narowal

<sup>5</sup>MBBS, MDMS, Shaikh Zayed Hospital, Lahore

Correspondence to: Muhammad Zeb Khan, Email: [surgeondrkh@gmail.com](mailto:surgeondrkh@gmail.com)

## ABSTRACT

**Objective:** To compare the dynamic hip screw versus proximal femoral nail devices in the management of intertrochanteric fractures

**Design of the Study:** It was a cross-sectional survey.

**Place and Duration of Study:** This study was carried at the Department of Orthopaedic and Spine Surgery, Sahara Medical College (Sughra Shafi Medical Complex), Narowal from April 2022 to September 2022.

**Patients and Methods:** In this study, 70 patients of both sexes, ranging in age from 40 to 70, had intertrochanteric fracture surgery. Two treatment groups were created by randomly dividing these patients; Group-A (n=35) patients got proximal femoral nailing while Group-B (n=35) patients underwent fracture fixation with DHS. The outcome variables that were used to compare the two groups were the frequency of infection (diagnosed clinically upon appearance of any two of the following signs within 4 weeks after surgery: redness around the wound, serosanguinous discharge, and fever >100°F). Every participant's signed informed permission was obtained.

**Results of the Study:** The age of the patients ranged from 40 years to 70 years with a mean of 54.96±8.34 years. There were 28 (40%) male and 42 (60%) female patients. 46 (65.7%) patients had Type-I and 24 (34.3%) patients had Type-II fracture according to Evan's Classification. The frequency of infection was significantly higher in the DHS group (31.4% vs. 0.0%; p=0.000) as compared to PFN group.

**Conclusion:** In patients with intertrochanteric fractures, proximal femoral nail was found to be superior to DHS in terms of a significantly reduced risk of infection, regardless of the patient's age or gender. This supports the preferred use of proximal femoral nail in future practise, provided the necessary hardware and surgical skills are available.

**Keywords:** Dynamic Hip Screw, Proximal Femoral Nail, Intertrochanteric Fractures, Infection, Evan's Classification

## INTRODUCTION

Fractures of the hip's intertrochanteric area (IT) are more common in elderly people and postmenopausal women.<sup>1</sup> High-energy trauma (RTA) is the leading cause of IT fractures in children and young adults. Because of rising rates of both car accidents and longevity, hip fractures are on the rise. It was predicted that by 2040, there will be 5.12 million cases.<sup>2</sup> Common types of hip fractures are femoral neck fractures and intertrochanteric fractures. There is a lot of morbidity associated with intertrochanteric fractures.<sup>3</sup> Longer life spans and an increase in the frequency of RTA have resulted in a major load on the global healthcare system caused by IT fractures. As a result, these breaks need to be repaired immediately.<sup>3,4</sup>

Hip fractures are becoming more common as the older population lives longer. In addition, the mortality rate after a proximal femur fracture is rising, from 14% to 36% every year.<sup>5</sup> The inability of patients to resume their normal activity and independence levels prior to surgery is a key issue for patients recovering from these fractures. Half of these people need help with basic daily tasks, and a significant proportion will require long-term care after therapy is complete.<sup>6,7</sup>

Patients with intertrochanteric femur fractures have their treatment plans determined after considering their pre-fracture functional adequacy, mental status, life expectancy and social life. Trochanteric femoral fractures are often fixed with either a dynamic hip screw (DHS) or a proximal femoral nail (PFN). DHS, which was developed in the 1970s, could give the fracture both dynamic and static support.<sup>10</sup> However, subsequent fracture displacement and screw extrusion at the distal end are frequent problems associated with screw displacement. The AO/ASIF created the PFN in 1996 as a less intrusive option for treating weak trochanteric and subtrochanteric hip fractures using an intramedullary implant.<sup>11</sup> In a 2015 randomised controlled study, Pathani et al. found that patients treated with PFN had a considerably lower infection rate than those treated with DHS (6.66% vs. 33.33%; p0.05).<sup>12</sup> Ujjal et al. reported very similar findings in 2013 (0% vs. 6.6%; p=0.05).<sup>13</sup>

In the light of results of these studies, PFN appears a better implant as compared to DHS in patients with intertrochanteric fractures. Due to lack of local such published material (to the best of candidate's knowledge), there is need to repeat this trial to determine better implant in terms of frequency of infection. The results of this study will help in better management of patients with intertrochanteric fractures in future practice.

## PATIENTS AND METHODS

**Study Setting & Study Setting:** This study was carried at the Department of Orthopaedic and Spine Surgery, Sahara Medical College (Sughra Shafi Medical Complex), Narowal from April 2022 to September 2022.

**Study Design:** Randomized controlled trial

**Sample Size:** Sample size of 70 (35 in each group) was calculated with 80% power of test and 5% significance level while taking expected frequency of infection to be 6.66% with PFN and 33.33% with DHS in patients with intertrochanteric fractures.<sup>13</sup>

**Inclusion Criteria:** Patients of both sex groups with ages in the range of 20-80 years suffering intertrochanteric fracture (as per operational definition) presenting within 24 hours of trauma.

**Exclusion Criteria:** Patients who were unfit for general or spinal, patients with disturbed coagulation profile (INR≥2.5, PT/APTT prolonged ≥5 sec), steroid dependents and those on chemotherapy (as per history and clinical record of the patient were excluded from study).

**Methodology:** Our study was carried out with approval from our institution's clinical research ethics board. Pre-anesthetic tests were performed on all of the patients as usual protocol. Patients were randomly assigned to one of two groups (DHS group or PFN group) of thirty using a chit procedure with the use of sealed envelopes. Those in the DHS group underwent the procedure with the DHS implant, whereas those in the PFN group underwent the procedure with the intramedullary nail (PFN). Each participant provided informed consent after receiving comprehensive information about the study. Each operation was carried out using the standard lateral technique and image intensifier. Before any

incisions were made in the patients' skin, they were all given a single prophylactic dose of Injection Augmentin 1.2gm. An additional dose was administered if the operation lasted more than four hours. All patients were given intravenous (iv) Augmentin 1.2 gm every 8 hours for 3 days following surgery, and then switched to an oral antibiotic before being released.

Patients were monitored immediately following surgery and discharged if they were presumed stable enough. Patients were checked for infection (defined clinically as the presence of redness around the wound, serosanguinous discharge, and fever  $>100^{\circ}\text{F}$  within 4 weeks after surgery) in the outpatient clinic.

**Data Analysis:** To represent numerical variables such as age, the mean standard deviation (mean $\pm$ sd) has been applied. Categorical variables such as gender, fracture union, and postoperative infection have been presented using percentages and frequencies. Chi-square test with a cutoff of  $p < 0.05$  was used to analyse the differences in post-operative infection and fracture union rates between the two groups. To reduce the possibility of bias, all surgeries were performed by the same surgical team using the same operating method.

## STUDY RESULTS

The age of the patients ranged from 40 years to 70 years with a mean of  $54.96 \pm 8.34$  years. There were 28 (40%) male and 42 (60%) female patients with a male to female ratio of 1:1.5. The BMI of the patients ranged from  $21.2 \text{ Kg/m}^2$  to  $35.9 \text{ Kg/m}^2$  with a mean of  $27.70 \pm 3.59 \text{ Kg/m}^2$ . 46 (65.7%) patients had Type-I and 24 (34.3%) patients had Type-II fracture according to Evan's Classification as shown in Table 9.1.

Both the groups were comparable in terms of mean age ( $p = 0.966$ ), mean BMI ( $p = 0.563$ ) and age ( $p = 0.810$ ), gender ( $p = 0.626$ ), BMI ( $p = 0.788$ ) and Evan's fracture type ( $p = 1.000$ ) groups as shown in Table 9.2.

11 (31.4%) patients in the DHS groups developed infection as per operational definition compare to non in the PFN group. The frequency of infection was significantly higher in the DHS group (31.4% vs. 0.0%;  $p = 0.000$ ) as compared to PFN group as shown in Table 9.3. Similar significant difference was observed across all age, gender, BMI and Evan's type of fracture groups as shown in Table 9.4 – 9.7.

Table 1: Baseline Characteristics of patients included in this study

Variables	Characteristics	Participants
Age	Mean $\pm$ SD	54.96 $\pm$ 8.34
	40-55 years	39 (55.7%)
	56-70 years	31 (44.3%)
Gender	Male	28 (40.0%)
	Female	42 (60.0%)
BMI (Kg/m <sup>2</sup> )	Mean $\pm$ SD	27.70 $\pm$ 3.59
	20-30 Kg/m <sup>2</sup>	51 (72.9%)
	>30 Kg/m <sup>2</sup>	19 (27.1%)
Evan's Type	Type-I	46 (65.7%)
	Type-II	24 (34.3%)

Table 2: Baseline Characteristics of patients included in our study

Variables	Characteristics	PFN	DHS	P value
Age (years)	Mean $\pm$ SD	55.0 $\pm$ 8.24	54.91 $\pm$ 8.56	0.966
	40-55 years	20 (57.1%)	19 (54.3%)	0.810
	56-70 years	15 (42.9%)	16 (45.7%)	
Gender	Male	15 (42.9%)	13 (37.1%)	0.626
	Female	50 (57.1%)	22 (62.9%)	
BMI (Kg/m <sup>2</sup> )	Mean $\pm$ SD	27.95 $\pm$ 3.50	27.45 $\pm$ 3.72	0.563
	20-30 Kg/m <sup>2</sup>	25 (71.4%)	26 (74.3%)	0.788
	>30 Kg/m <sup>2</sup>	10 (28.6%)	9 (25.7%)	
Evan's Type	Type-I	23 (65.7%)	23 (65.7%)	1.000
	Type-II	12 (34.3%)	12 (34.3%)	

Table 3: Comparison of Frequency of Infection between the Groups

Infection	Study Group		Total	P value
	PFN	DHS		
Yes	0(0.0%)	11(31.4%)	11(15.7%)	0.000*
No	35(100.0%)	24(68.6%)	59(84.3%)	
Total	35(100.0%)	35(100.0%)	70(100.0%)	

## DISCUSSION

In recent years, the average life duration of the endeavour has been growing, and at the same time, the population of individuals in their later years has been growing. The older population in our country has led to a rise in the occurrence of intertrochanteric femur fractures. According to a review of the relevant literature, the female-to-male ratio of intertrochanteric femur fractures varies throughout severities and persists despite this.<sup>14</sup> The objective of this study was to compare the frequency of infection in proximal femoral nail versus dynamic hip screw in treatment of patients with intertrochanteric fracture.

The average age of the participants in this study was  $54.96 \pm 8.34$  years. There were 28 male patients (40%) and 42 female patients (60%) for a male to female patient ratio of 1:1.5. When comparing the DHS and PFN groups, the infection rate in the former was 31.4% (vs 0%,  $p = 0.000$ ). Mulay et al. in 2015 (14% vs. 6%;  $p < 0.05$ ) found similar percentages.<sup>15</sup> Similar significant differences in infection frequency between DHS and PFN were also found by Harisudhan et al. in 2014 (13.3% vs. 0%;  $p < 0.05$ ).<sup>16</sup> In the case of DHS, the infection rate was 31.4% (vs 0%,  $p = 0.000$ ), whereas in the PFN group it was 0%. A similar percentage was discovered by Mulay et al. in 2015 (14% vs. 6%;  $p < 0.05$ ).<sup>15</sup> Furthermore, in 2014, Harisudhan et al. discovered statistically significant variations in infection frequency between DHS and PFN (13.3% vs. 0%;  $p < 0.05$ ).<sup>16</sup>

Walia et al. (2013) found a similar demographic profile among Indian patients with a mean age of  $52.1 \pm 6.8$  years. A statistically significant difference was also found between DHS and PFN in terms of infection frequency (11.1% vs. 0%;  $p < 0.05$ ).<sup>17</sup> According to a comparable survey conducted by Mallikarjun et al. (2014), the average age of the Indian population was 58.57 years, and women made up a significantly larger proportion of the population than men did (1:2.3). They also noticed that DHS infections were much more common than PFN infections (6.66 percent vs. zero percent;  $p < 0.05$ ).<sup>18</sup> Additionally, Sridhar et al. (2014) observed a similar mean age of 56.218.4 years, with a slighter male predominance (52.38% vs. 47.62%). However, they found no statistically significant difference in the infection rates between DHS and PFN (10.53 percent vs. 8.33 percent;  $p > 0.05$ ).<sup>19</sup>

The current study is the first of its kind in the local community, and its findings demonstrate the superiority of PFN over DHS in terms of considerably higher incidence of fracture union and decreased frequency of postoperative infection across all patient demographics. In conclusion, the study's premise that PFN is superior to DHS in preventing postoperative infection and facilitating fracture union was supported. Thus, it can be argued that, going forward, the proximal femoral nail should be favored over the DHS in patients with intertrochanteric fractures in order to maximise the likelihood of union. Most of these patients were above the age of sixty-five, and we found that there was a significantly higher proportion of women than men. This finding may be linked to postmenopausal osteoporosis. There is sufficient data to suggest that women who go to an orthopaedic outpatient clinic for treatment should be offered minimal replacement to reduce their risk of perthrochanteric fracture.<sup>20</sup>

Patients of all ages, sexes, body mass indexes, and fracture types benefited from PFN's much lower infection rate compared to DHS, as shown in this first-of-its-kind study in the local population. Based on these findings, it is recommended that, when treating patients with intertrochanteric fractures, proximal femoral nail shoulder be used instead of DHS if the requisite hardware and expertise are available.

## CONCLUSION

In patients with intertrochanteric fractures, proximal femoral nail was found to be superior to DHS in terms of a significantly reduced risk of infection, regardless of the patient's age or gender. This supports the preferred use of proximal femoral nail in future

practise, provided the necessary hardware and surgical skills are available.

## REFERENCES

- Alpantaki K, Papadaki C, Raptis K, Dretakis K, Samonis G, Koutserimpas C. Gender and age differences in hip fracture types among elderly: a retrospective cohort study. *Maedica*. 2020 Jun;15(2):185.
- Li XP, Zhang P, Zhu SW, Yang MH, Wu XB, Jiang XY. All-cause mortality risk in aged femoral intertrochanteric fracture patients. *Journal of Orthopaedic Surgery and Research*. 2021 Dec;16:1-8.
- Lu Y, Uppal HS. Hip fractures: relevant anatomy, classification, and biomechanics of fracture and fixation. *Geriatric orthopaedic surgery & rehabilitation*. 2019 Jun 28;10:2151459319859139.
- Choi HG, Lee YB, Rhyu SH, Kwon BC, Lee JK. Mortality and cause of death postoperatively in patients with a hip fracture: a national cohort longitudinal follow-up study. *Bone Joint J*. 2018 Apr;100(4):436-42.
- Vestergaard P, Rejnmark L, Mosekilde L. Has mortality after a hip fracture increased? *J Am Geriatr Soc* 2007;55:1720-6.
- Kesmezacar H, Ayhan E, Unlu MC, Seker A, Karaca S. Predictors of mortality in elderly patients with an intertrochanteric or a femoral neck fracture. *J Trauma* 2010;68:153-8.
- Blomfeldt R, Törnkvist H, Eriksson K, Söderqvist A, Ponzer S, Tidermark J. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. *J Bone Joint Surg Br* 2007;89:160-5.
- Rupprecht M, Grossterlinden L, Ruecker AH, de Oliveira AN, Sellenschloh K, Nüchtern J, Püschel K, Morlock M, Rueger JM, Lehmann W. A comparative biomechanical analysis of fixation devices for unstable femoral neck fractures: the Intertan versus cannulated screws or a dynamic hip screw. *Journal of Trauma and Acute Care Surgery*. 2011 Sep 1;71(3):625-34.
- Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, Szyzkowitz R. The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a follow-up of 15 months. *Acta Orthopaedica Scandinavica*. 2003 Jan 1;74(1):53-8.
- Rupprecht M, Grossterlinden L, Ruecker AH, de Oliveira AN, Sellenschloh K, Nüchtern J, Püschel K, Morlock M, Rueger JM, Lehmann W. A comparative biomechanical analysis of fixation devices for unstable femoral neck fractures: the Intertan versus cannulated screws or a dynamic hip screw. *Journal of Trauma and Acute Care Surgery*. 2011 Sep 1;71(3):625-34.
- Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, Szyzkowitz R. The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a follow-up of 15 months. *Acta Orthopaedica Scandinavica*. 2003 Jan 1;74(1):53-8.
- Pathania VP, Manish S, Sanjay G, Kaushik SK. Management of intertrochanteric fracture by P.F.N vs D.H.S: a comparative study. *J Evo Med Dent Sci* 2015;4(13):6741-50.
- Ujjal B, Ranadeb B. Comparative study between proximal femoral nailing and dynamic hip screw in intertrochanteric fracture of femur. *Open J Orthop* 2013;3:291-5.
- Koval JK. Intertrochanteric fractures. In: Koval JK, Zuckerman DJ (Eds.). *Atlas of orthopaedic surgery*. Philadelphia: Lipincott Williams Wilkins; 2004. p.232-9
- Mulay S, Gouri F, Mahajan U. Treatment of Inter-trochantric Fracture by PFN or DHS. *Int J Healthcare Biomed Res* 2015;3(3):209-15.
- Harisudhan SR, Kanthimathi B. Comparative study of the management of inter-trochanteric fractures: proximal femoral nail versus dynamic hip screw. *Int J Modn Res Revs* 2014;2(10):459-62.
- Walia JP, Tailor H, Mann HS, Gupta AC, Rehncy JS, Singh S. A comparative study of 30 cases of trochanteric fracture femur treated with dynamic hip screw and proximal femoral nailing. *Hip*.2013;1(11):6-10.
- Mallikarjun GB, Arunkumar NK. A study to compare outcome of proximal femoral nailing and dynamic hip screw fixation for intertrochanteric fractures of femur. *Eur J Biomed Pharm Sci*. 2014;1(3):256-63.
- Sridhar M, Neelakrishnan R. Study of various modalities of surgical management of unstable intertrochanteric fractures. *Int J Sci Res Edu*. 2014;2(10):2090-108.
- Habib MK, Khan RDA, Rakha A. Comparison between Dynamic Hip Screw and Proximal Femoral Nail in Patients with Pertrochanteric Fractures. *Ann Punjab Med Coll*. 2020;14(2):144-8.