

A comparative study of Dynamic Hip Screw and Proximal Femoral Nail in the management of Intertrochanteric Fractures of the Femur

Sandeep Gurung, Gopalsagar DC

Abstract

Introduction

Intertrochanteric fractures account for approximately half of the hip fractures in the elderly because of the osteoporotic nature of the bone. There are various modalities to treat these fractures. The objective of this study was to compare and evaluate the clinical and radiological outcome of intertrochanteric femur fracture treated with Dynamic hip screw (DHS) and proximal femoral nail (PFN).

Methods

This study was conducted at Nepalgunj medical college, Department of orthopedics Nepalgunj over a time span of two years. A total of 52 patients were included and randomized into Dynamic hip screw (n=26) and Proximal femoral nail (n=26) group. Patient's demographic details, perioperative findings, radiological findings and follow up findings were recorded. The results were evaluated and compared.

Results

The mean age in our study was 57.63 years. Trivial fall was the most common mode of injury. There was significantly higher intraoperative blood loss in the DHS group. Radiological union and functional outcomes were similar overall, but in case of unstable fracture functional outcome was clinically better in PFN group.

Conclusion

From our study we concluded that PFN has better outcome in case of unstable intertrochanteric fractures, however in stable fracture also it has distinct advantage over DHS.

Keywords: Dynamic Hip Screw (DHS); Harris hip score; Intertrochanteric fracture; Proximal Femoral Nail (PFN); Radiological union.

Author affiliations:

Department of Orthopaedics,
Nepalgunj Medical College Teaching
Hospital, Nepalgunj, Banke, Nepal.

Correspondence:

Dr. Sandeep Gurung,
Department of Orthopedics,
Nepalgunj Medical College Teaching
Hospital, Nepalgunj, Banke, Nepal.

E mail: sgurung848@gmail.com

ORCID iD:

<https://orcid.org/0000-0002-1422-6823>

Disclosures:

Ethical Clearance: IRC-NGMC

Conflict of interest: None

Financial aid: None

Copyright information:



Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under Creative Commons Attribution License under CC-BY 4.0 that allows others to share the work with an acknowledgement of the works's authorship and initial publication of this journal.

How to cite this article:

Gurung S, DC G. A comparative study of dynamic hip screw and proximal femoral nail in the management of intertrochanteric fractures of the femur. J Soc Surg Nep. 2021 Jul; 24(1):14-8.

DOI:

<https://doi.org/10.3126/jssn.v24i1.41031>

Introduction

The incidence of hip fractures has been increasing due to higher life expectancy and rising incidence of motor vehicle accident. Approximately half of the hip fractures in the elderly are intertrochanteric fractures.^{1,2} They are largely seen in females who are predisposed to osteoporosis.³ Primary aim of treatment is to provide a stable construct and to restore the patient to pre injury status as early as possible so that complications associated with prolonged recumbency are decreased.⁴

For the treatment of intertrochanteric fractures extramedullary fixation and intramedullary fixation are the two primary options. The dynamic hip screw (DHS) commonly used in extramedullary fixation has been the standard implant for the treatment of these type of fractures,^{5,6} as it allows controlled collapse and compression at the fracture site, initiating fracture union.⁷ Proximal femur nail (PFN), a commonly used device in the intramedullary fixation was introduced by AO/ASIF group in 1997. The advantage of PFN is that it provides more biomechanically stable construct by shortening the distance between implant and hip joint, which decreases torsional strain across the implant.^{8,9}

The present study was done to evaluate and compare the clinical and radiological outcome of patients treated by PFN and DHS in intertrochanteric fractures of the femur.

Methods

The present study was conducted in Nepalgunj Medical College, department of Orthopedic Surgery within the span of two years in between January 2019 and January 2021 after the approval of ethics committee. This was a prospective, observational, hospital based, randomized study.

A total of 59 patients were enrolled in our study. Out of them, seven patients were excluded from the study. A total of 52 patients were evaluated. Inclusion criteria were adults above 18 years of age who were able to walk prior to fracture with intertrochanteric fractures of less than 3 weeks old. Pathological fracture or compound fractures were excluded from our study. The patients were assigned to one of the two treatment groups based on a computer-generated randomization table with Group A patients treated with DHS and Group B with PFN. Institutional Ethical Clearance was obtained before patient recruitment. All patients gave written consent.

The fractures were classified as per Jensen's Modification of the Evans Classification of intertrochanteric fractures into stable and unstable fractures.¹⁰ All patients were operated by the same surgeons as soon as possible after relevant investigations, pre anesthesia checkup and physician clearance. The patient was placed in traction table and the fracture was reduced by close manipulation under image intensifier; if reduction was not achieved,

mini open or open reduction technique was done. Post-operative rehabilitation protocol was similar in both groups. Isometric quadriceps exercise, knee bending, abductor strengthening exercise and ankle pump exercise were advised immediately from first post-operative day. Mobilization with walker or crutches was started as early as possible with non-weightbearing initially. Weight bearing was progressively increased as per the x-ray evaluation of fracture site. The patients were followed up at 4 weeks, 12 weeks, 16 weeks, 24 weeks and 1 year. End point of our study was fracture union. Demographic details i.e., age, sex, mode of injury and fracture type and perioperative findings like intraoperative blood loss which was measured by using gauze visual analogue method,¹¹ operative time (incision to closure) and postoperative hospital stay were our secondary outcome variables. Whereas fracture union, malunion and functional outcome were our primary outcome variables. Radiologically, the presence of at least three of the four cortices with bridging callus formation and crossing in Antero-Posterior (AP) and lateral radiographs were considered as bony union. Varus angulation of more than 10 degrees was considered as malunion. Functional outcome was assessed with Harris hip score.¹²

To determine whether there were any differences between the two surgical procedures, comparisons were conducted on all study variables. Data were analysed using the IBM SPSS statistics 19. Study variables were analysed and described with means, standard deviations, medians and percentages. The outcome variables comparing between the two surgical procedures were conducted using independent sample t-tests. P-value of less than 0.05 was considered to be statistically significant.

Results

The mean age of the patients in our study was 57.63 years which ranged from 21 to 87 years; which was not significant statistically between PFN and DHS groups ($p=0.599$). There was male preponderance in our study, 67.3% of the total patients were male. The most common mode of injury was trivial fall i.e., fall with insignificant trauma which accounted for 29(55.8%) of the total cases. There were 33(63.5%) stable fractures and 19(36.5%) unstable fractures. All the fractures were classified as per Jensen's Modification of the Evans classification.¹⁰ The preoperative comparisons are summarized in **Table 1**.

Average duration of surgery was more in DHS group compared to PFN group, which was 63.15 min and 59.61 min respectively (**Table 2**) which was non-significant statistically. In our study there was statistically significant ($p < 0.001$) higher mean blood loss in DHS group with four patient requiring blood transfusion postoperatively as compared to none in PFN group (**Table 2**). All cases were reduced closely except two cases each in PFN and DHS group which needed open reduction. Duration of hospital stay was comparable. Radiological union occurred at a mean duration of 15.08 weeks and 14.31 weeks for DHS

Table 1. Patients demography between DHS and PFN group.

	DHS group (n=26)	PFN group (n=26)
Mean age (years \pm SD)	58.92 \pm 17.609	56.35 \pm 17.504
Sex (M/F)	17/9	18/8
Fracture type		
Stable	17	16
Unstable	9	10
Mode of injury		
Trivial fall	14	15
Road traffic accident	7	5
Fall from height	5	6

and PFN respectively, which was comparable. Excellent to Good results as per Harris hip score were seen in 22(84.61%) of patients treated with PFN and 19(73.07%) of patients treated with DHS (**Figure 1**). The difference in functional outcome was non-significant i.e., Harris hip score was 83.07 in DHS group and 84.53 in PFN group. But a subgroup analysis of radiological union and Harris hip score of unstable fractures was better in all patients in PFN group when compared to DHS group (**Table 3**). Five cases treated with DHS developed early complications and only two cases when treated with PFN. Whereas four cases treated with DHS had a late complication and one case treated with PFN. The details are summarized in **Table 4**.

Table 2. Perioperative and follow up comparison between DHS and PFN group.

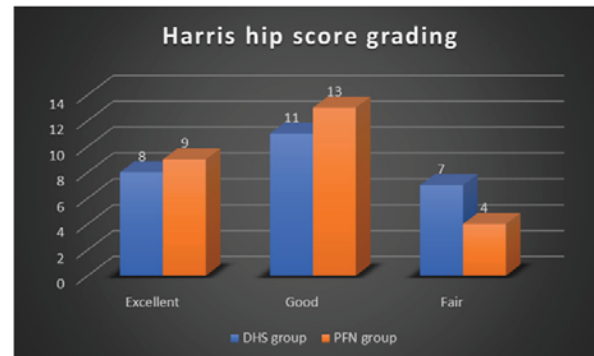
	DHS group (26)	PFN group (26)	t value	p value
Duration of Surgery (min.)	63.15 \pm 13.43	59.61 \pm 11.71	1.012	0.316
Blood loss (ml)	275.38 \pm 77.88	203.26 \pm 54.42	3.870	<0.001
Hospital stay (days)	7.50 \pm 3.48	7.26 \pm 2.66	0.268	0.790
Radiological union (wks.)	15.08 \pm 4.27	14.31 \pm 3.94	0.674	0.504
Harris hip Score	83.07 \pm 7.48	84.53 \pm 6.96	0.728	0.470

Table 3. Subgroup analysis of Functional outcome and Union between DHS and PFN groups

	Radiological union (wks.)	Harris hip score
DHS group		
Stable (17)	14.12 \pm 4.02	86.35 \pm 6.61
Unstable (9)	16.89 \pm 4.37	76.88 \pm 4.67
PFN group		
Stable (16)	14 \pm 4.13	85 \pm 7.22
Unstable (10)	14.80 \pm 3.79	83.80 \pm 6

Table 4. Complications between DHS and PFN groups

Complications	DHS group	PFN group
Early		
Guidewire breakage	1	0
Prolonged drainage	1	0
Superficial wound infection	3	2
Late		
Shortening >1 cm	2	0
Varus malunion	2	1

**Figure 1. Functional outcome comparison between DHS and PFN groups**

Discussion

Treatment of intertrochanteric hip fractures is still a major orthopedic challenge; the selection of implant for an intertrochanteric fracture is still being debated in literature. For stable intertrochanteric fractures DHS has been the gold standard fixation.¹³ Many randomized controlled trial demonstrated statistically significant advantages of PFN over DHS in terms of unstable fracture in the elderly with co-morbidities because of larger exposure, increased operative time, increased blood loss, excessive collapse with shortening and mechanical failures.¹⁴ In the early 90s PFN was developed with biomechanical and biological advantages over DHS and to improve the surgical treatment of unstable intertrochanteric fractures, as it being an intramedullary device, it prevents significant shortening of fracture site, has a lower bending moment and acts as a buttress in preventing the medialization of the shaft by compensating the function of medial column.¹⁵⁻¹⁶

**Figure 2. DHS radiograph (preoperative and immediate postoperative)**



Figure 3. PFN radiograph (preoperative and immediate postoperative)

In our study the mean age of the patients was 57.63 years. Our study nearly correlates with Sharma and Sethi¹⁷ study with average age of 61.47 years. Duration of surgery was shorter in PFN group by a mean of 3.54 min which was statistically non-significant, similar findings being noted by Saudan et al¹⁸ in 2002 with mean difference of 1 min. Baumgartner et al¹⁹ findings were not in agreement with our study as they reported in their series surgical times significantly higher in the DHS group. The mean duration of hospital stay was slightly less in PFN group. The DHS patients had significantly higher intraoperative blood loss (72.12 ml more) compared to the PFN group. Baumgartner et al, Zhao et al and Pan et al also found a significantly higher intraoperative blood loss in the DHS group.¹⁹⁻²¹ Contrary to our findings Pajarinen et al²² found no statistically significant difference of blood loss between two groups. There was no significant difference between the two groups regarding fracture union time as all fractures united at 15.08 weeks in case of DHS and 14.31 weeks in case of PFN. Whereas union time for unstable fracture when compared separately showed that PFN had a better fracture union (14.80 weeks) as compared to DHS. Our study was comparable to study of Herode et al and Klinger et al.^{23,24} The overall functional outcome of patients treated with PFN was slightly better compared to DHS which was non-significant ($p=0.470$). However, when we compared the stable and unstable fracture separately, we found that functional outcome of unstable fracture treated with PFN was clinically better than DHS group with an average Harris hip score of 83.80 and 76.88 respectively.

The results were comparable to study done by Giraud et al and Karanam and colleagues.^{25,26} However, Mavrogenis et al and Mereddy et al findings were not in agreement with our study; they reported poorer functional results with PFN as compared to DHS.^{27,28} Our study results indicate that PFN may be the choice of implant in case of unstable fracture when compared to DHS, but further new studies are required to undertake a detailed statistical subgroup analysis. Three patients of the DHS group had a superficial wound infection and one patient had a prolonged drainage as compared to two patients of the PFN group who had a superficial wound infection. However, all responded to local debridement and antibiotics as per culture and sensitivity. Implant removal was not required due to infection. There was no significant difference in the infection rates between two groups, similar findings were observed by Herode et al and Saudan et al.^{18,23}

Our study has several limitations; smaller sample size and shorter follow up period being the main. The outcomes measures are very simple and stratification exists. In spite of these limitations, results of this study are still encouraging. However, small differences were found between some variables, and these may reach significance with a large enough cohort. As such further new studies are needed over a longer period of time with large enough sample to do a subgroup analysis.

Conclusion

We conclude that in stable intertrochanteric fractures, both the PFN and DHS have similar outcomes; however, PFN has better functional outcome with unstable fracture. As the PFN requires comparatively shorter operative time, significantly less blood loss and relatively shorter radiological union time, it has distinct benefit over DHS even in stable intertrochanteric fracture. Hence from our study we have concluded that PFN is a better alternative fixation device than DHS in the treatment of intertrochanteric fracture. Therefore, we recommend the use of PFN in comparison to DHS in intertrochanteric fractures femur except when trochanteric entry point for the PFN is fractured.

References

1. Leung K. Subtrochanteric fractures. In: Buchholz RW, Heckman JD, Court-Brown C, editors. Rockwood and Green's fractures in adults. 6th ed. Philadelphia, Lippincott: Williams & Wilkins; 2006. p. 1827-44.
2. Lavelle DG. Fractures and dislocations of the hip. In: Campbell WC, Canale ST, Beaty JH, editors. Campbell's operative orthopaedics. Philadelphia: Mosby; 2008. p. 3237-308.
3. Kaufer H. Mechanics of the treatment of hip injuries. Clin Orthop Relat Res. 1980 Jan-Feb;(146):53-61.
4. Kaufer H, Mathews LS, Sonstegard D. Stable Fixation of Intertrochanteric Fractures. J Bone Joint Surg. 1974; 56A:899-907.
5. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomised prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991 Mar;73(2):330-4.
6. Radford PJ, Needoff M, Webb JK. A prospective randomised comparison of the dynamic hip screw and the gamma locking nail. J Bone Joint Surg Br. 1993 Sep;75(5):789-93.
7. Asif N, Ahmad S, Qureshi OA, Jilani LZ, Hamesh T, Jameel T. Unstable Intertrochanteric Fracture

- Fixation - Is Proximal Femoral Locked Compression Plate Better Than Dynamic Hip Screw. *J Clin Diagn Res.* 2016 Jan;10(1):RC09-13.
8. Kish B, Sapir O, Carmel A, Regev A, Masrawa S. Full weight bearing after unstable per and subtrochanteric fracture using proximal femur nail. *J Bone Joint Surg Br.* 2001;83:289.
 9. Steinberg EL, Blumberg N, Dekel S. The fixation proximal femur nailing system: biomechanical properties of the nail and a cadaveric study. *J Biomech.* 2005 Jan;38(1):63-8.
 10. Jensen JS. Classification of trochanteric fractures. *Acta Orthop Scand.* 1980 Oct;51(5):803-10.
 11. Ali Algadiem E, Aleisa AA, Alsubaie HI, Buhlaiah NR, Algadeeb JB, Alsneini HA. Blood Loss Estimation Using Gauze Visual Analogue. *Trauma Mon.* 2016 May 3;21(2):e34131.
 12. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am.* 1969;51(4):737-55.
 13. Jensen JS, Sonne-Holm S, Tøndevold E. Unstable trochanteric fractures. A comparative analysis of four methods of internal fixation. *Acta Orthop Scand.* 1980;51(6):949-62.
 14. Wong TC, Chiu Y, Tsang WL, Leung WY, Yeung SH. A double-blind, prospective, randomized, controlled clinical trial of minimally invasive dynamic hip screw fixation of intertrochanteric fractures. *Injury.* 2009 Apr;40(4):422-7.
 15. Kulkarni GS, Limaye R, Kulkarni M, Kulkarni S. Intertrochanteric fractures. *Indian J Orthop.* 2006;40(1):16-23.
 16. Labronici PJ, Da Silva RF, Viana AMS, Blunck SS, Franco JS, Neto SR, et al. Is there a difference in the positioning of sliding screws between stable and unstable extracapsular fractures? *Rev Bras Ortop.* 2015 Feb 24;50(1):30-7.
 17. Sharma A, Sethi A, Sharma S. Treatment of stable intertrochanteric fractures of the femur with proximal femoral nail versus dynamic hip screw: a comparative study. *Rev Bras Ortop.* 2017 Nov 8;53(4):477-81.
 18. Saudan M, Lübbecke A, Sadowski C, Riand N, Stern R, Hoffmeyer P. Pertrochanteric fractures: is there an advantage to an intramedullary nail?: a randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. *J Orthop Trauma.* 2002 Jul;16(6):386-93.
 19. Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extramedullary fixation for the treatment of intertrochanteric hip fractures. *Clin Orthop Relat Res.* 1998 Mar;(348):87-94.
 20. Zhao C, Liu DY, Guo JJ, Li LP, Zheng YF, Yang HB, et al. [Comparison of proximal femoral nail and dynamic hip screw for treating intertrochanteric fractures]. *Zhongguo Gu Shang.* 2009 Jul;22(7):535-7. [Article in Chinese].
 21. Pan X-h, Xiao D-m, Lin B-w: Dynamic hip screws (DHS) and proximal femoral nails (PFN) in treatment of intertrochanteric fractures of femur in elderly patients. *Chin J Orthop Trauma.* 2004; 7: 785-89.
 22. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E. Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation. *J Bone Joint Surg Br.* 2005 Jan;87(1):76-81.
 23. Herode P, Shroff A, Sadaria M, Jeegar P. Comparison of PFN (Proximal femoral nail) and DHS (Dynamic hip screw) in treatment of Intertrochanteric femur fractures. *Surgical Update: Int J surg Orthopedics.* 2018;4(1):37-44.
 24. Klinger HM, Baums MH, Eckert M, Neugebauer R. [A comparative study of unstable per- and intertrochanteric femoral fractures treated with dynamic hip screw (DHS) and trochanteric butt-press plate vs. proximal femoral nail (PFN)]. *Zentralbl Chir.* 2005 Aug;130(4):301-6. [Article in German].
 25. Giraud B, Dehoux E, Jovenin N, Madi K, Harisboure A, Usandizaga G, Segal P. [Pertrochanteric fractures: a randomized prospective study comparing dynamic screw plate and intramedullary fixation]. *Rev Chir Orthop Reparatrice Appar Mot.* 2005 Dec;91(8):732-6. [Article in French].
 26. Karanam V, Kumar UA, Teja SP, Teja CV. PFN v/s DHS in stabilization of intertrochanteric fractures: A comparative study. *Int J Orthop Sci.* 2019;5(2):750-4.
 27. Mavrogenis AF, Panagopoulos GN, Megaloikonomos PD, Igoumenou VG, Galanopoulos I, Vottis CT, et al. Complications After Hip Nailing for Fractures. *Orthopedics.* 2016 Jan-Feb;39(1):e108-16.
 28. Mereddy P, Kamath S, Ramakrishnan M, Malik H, Donnachie N. The AO/ASIF proximal femoral nail antirotation (PFNA): a new design for the treatment of unstable proximal femoral fractures. *Injury.* 2009 Apr;40(4):428-32.