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ORIGINAL ARTICLE

A Prospective Comparative Study of Minimally Invasive Dynamic Hip Screw and Proximal Femoral Nailing in Intertrochanteric Femur Fractures

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Abstract

Introduction: Fractures of the femur, especially Intertrochanteric type, is one of the most common fractures in the elderly. It is most commonly caused due to trivial trauma in an already osteoporotic bone. Early surgical fixation can result in early mobilization and reduced morbidity. Usage of the Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) are considered widely for fixation. This study aims to compare the functional and radiological outcomes of intertrochanteric fractures treated with minimally invasive DHS and PFN fixation. **Materials and Methods:** This study was done prospectively and it was a comparative study conducted in 2017 on 30 participants with intertrochanteric fractures. The study samples were divided equally into DHS and PFN groups, with 15 in each group. Operative parameters, recovery in postoperative period, and functional outcome were assessed by the Harris Hip Score. Serial radiographs were taken till 6 months post operatively to evaluate for radiological union. **Results:** The mean operative time was significantly lower in the PFN group (52.1 minutes) than in the DHS group (69.9 minutes). PFN allowed earlier full weight bearing (mean 3.6 weeks) compared to DHS (9.5 weeks). The mean Harris Hip Score at six weeks was significantly higher in the PFN group, but by 20 weeks, the difference was not statistically significant. Radiological assessment at six months showed excellent union in 73.3% of DHS cases and 26.7% of PFN cases (p=0.027). **Conclusion:** Both DHS and PFN are effective fixation methods for intertrochanteric fractures. PFN offers advantages in operative time and early rehabilitation, whereas DHS demonstrated superior radiological union in the present study. Implant selection should be individualized based on fracture characteristics and surgeon expertise.

Keywords: Intertrochanteric fracture, Dynamic Hip Screw, Proximal Femoral Nail, Functional outcome

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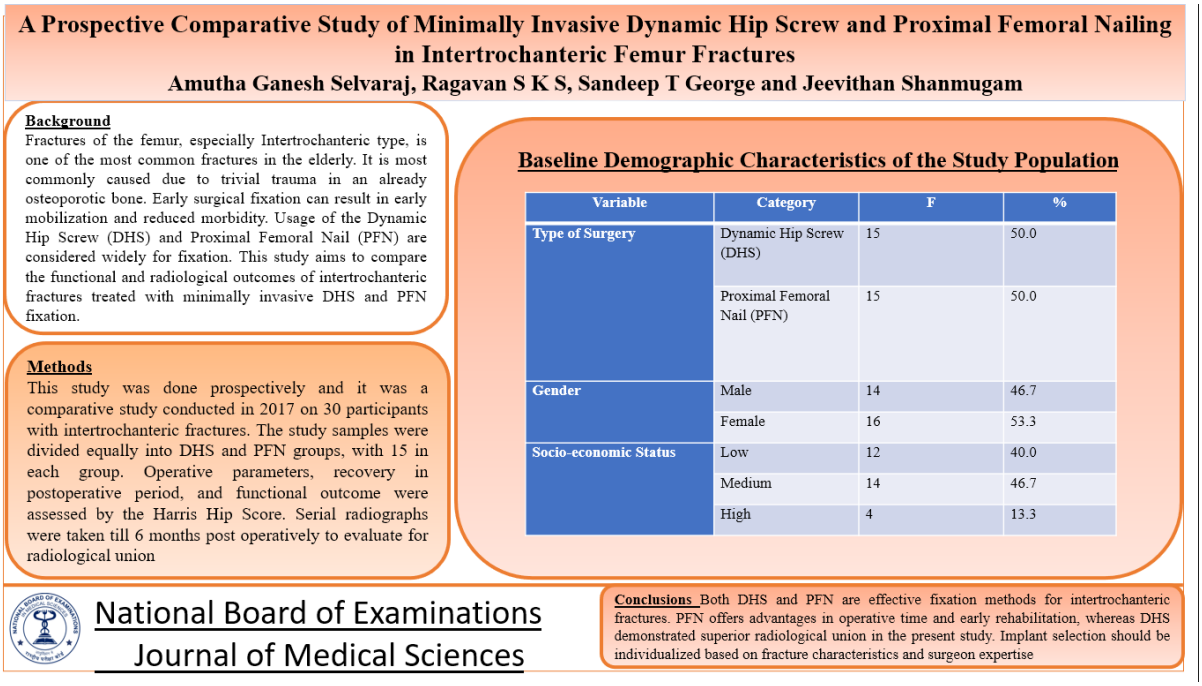
Graphical Abstract



Introduction

Intertrochanteric fractures of the femur are one of the most common fractures seen in the elderly, especially in women with osteoporosis in the postmenopausal age group. These types of injuries usually follow low-energy trauma like simple falls, which might also occur in younger individuals following high-energy impacts. With the betterment of life expectancy and the increasing prevalence of osteoporosis all around the world, the incidence of intertrochanteric fractures has been slowly increasing. This is an important cause of morbidity, mortality, and functional disability in the elderly. [1,2].

The main objectives in the treatment of intertrochanteric fractures are to achieve stable internal fixation, help with early mobilization, and restore the pre-injury functional status of the patients. Prolonged immobilisation is a complication of conservative treatment along with other complications like deep vein thrombosis, pressure sores and lung infections. Therefore, the gold standard of management of Intertrochanteric fractures is surgical management as it allows early ambulation and reduces both mortality and morbidity [3].

The implant of choice for fixing of stable intertrochanteric fractures has been the Dynamic Hip Screw (DHS) since a few years, offering the advantage of controlled collapse and compression at the fracture site helping in faster union of the fracture. But for comminated or unstable fracture patterns or with posteromedial cortical disruption, the DHS has few biomechanical limitations like excessive sliding of the lag screw, varus collapse, and potential cut-out of the screw through the femoral head which can lead to implant failure [4].

The Proximal Femoral Nail (PFN) is an Intramedullary device which was invented to tackle implant failure. Using PFN has many mechanical advantages because of its shorter length of lever arm

and placing the PFN closer to the mechanical axis of the femur in a closed insertion technique that reduces soft tissue injury and blood loss. Many older previous studies have shown that PFN allows better biomechanical stability, lesser operative time and intraoperative blood loss, and leads to earlier mobilization compared to DHS, particularly in unstable fracture configurations [5–7].

Although both DHS and PFN have established roles in the management of intertrochanteric fractures, the superiority of one implant over the other with respect to functional and radiological outcomes remains a subject of ongoing debate. Few studies have found comparable long-term outcomes between the two methods, while others have highlighted the earlier rehabilitation potential associated with PFN. Hence, there is a high need for prospective comparative analyses assessing the two implants under similar clinical conditions.

In this context, our present study was done to assess the functional and radiological outcomes of intertrochanteric fractures managed with less invasive Dynamic Hip Screw and Proximal Femoral Nail, and to compare their results in terms of operative details, postoperative recovery, and early functional outcome.

Materials and Methods

The present study was a prospective comparative study done in the Department of Orthopaedics at a tertiary care teaching hospital in Tamilnadu in the year 2017. Institutional ethical committee approval was obtained before the start of the study. Written informed consent was obtained from all patients who were included in the study. The patients were managed surgically either by minimally invasive Dynamic Hip Screw (DHS) fixation or by Proximal Femoral Nailing (PFN). Confidentiality was maintained and principles of Declaration of Helsinki was adhered to throughout the study.

30 patients were included in the study where 15 patients were managed using minimally invasive DHS and 15 were managed with PFN. All patients above 40 years of age presenting with closed intertrochanteric fractures of the femur were included in the study and patients with open fractures, pathological fractures, associated shaft or neck femur fractures, or previous ipsilateral hip surgery were excluded from the study. Based on preoperative radiographs, the fractures were classified according to the classification system of Boyd and Griffin. Patients were allocated alternately into either group to be able to compare demographic and clinical distribution between the two modalities of treatment.

All patients underwent routine preoperative evaluation including clinical assessment, routine hematological investigations with radiographic confirmation of the pattern of fracture. Surgery was done under spinal or general anesthesia which was chosen based on the fitness levels of the patients. For the DHS group, a lateral approach was used with a small incision technique, and fixation was achieved using a standard 135° barrel plate after guidewire placement under fluoroscopic guidance. For the PFN group, a closed intramedullary technique was employed using a proximal femoral nail of appropriate size, inserted through a small incision over the tip of the greater trochanter. All procedures were performed by surgeons experienced in both techniques to minimize operator-related bias.

Intraoperative parameters like duration of surgery, estimated blood loss, and length of incision were noted and postoperatively, patients were administered analgesics and antibiotics according to standard protocol. Early mobilization and physiotherapy were initiated depending on the stability of fixation and tolerance of pain. The duration of hospital stay along with time taken for partial and full weight bearing were noted. Suture removal was done on the 10th postoperative day, and radiographic assessment was performed to confirm alignment and position of implant.

All patients were followed up at 6, 12 and 20 weeks postoperatively and 6 months for functional and radiological union. Functional outcome was assessed using the Harris Hip Score which evaluated pain, function, absence of deformity, and range of motion. Radiological assessment of union was done using serial anteroposterior and lateral radiographs of the hip, and fracture union was defined as cortical continuity in at least three cortices. Depending on the alignment and consolidation of the fractures, the radiological outcomes at 6 months were graded as fair, good, or excellent.

All collected data were compiled and tabulated for analysis. Operative details, postoperative recovery parameters, and functional outcomes were compared between the DHS and PFN groups to evaluate the relative efficacy of both fixation methods in achieving stable fixation and early rehabilitation among patients with intertrochanteric fractures. Frequencies and percentages were used to summarize categorical variables, while continuous variables were expressed as mean ± standard deviation. Continuous variables were compared using the Mann–Whitney U test. Categorical variables were compared using the Chi-square test. A p value <0.05 was considered statistically significant.

Results

The study included 30 patients, with an equal number in the DHS group and the PFN group (15 each). A slight female predominance was seen, with 53.3% females and 46.7% males. Most patients belonged to the medium socio-economic class (46.7%), followed by the low-income group (40%) and 13.3% were from the high socio-economic group. (Table 1) The baseline demographic characteristics of the two study groups were comparable, thereby permitting meaningful comparison of operative, functional, and radiological outcomes.

Table 1. Baseline Demographic Characteristics of the Study Population

Variable	**Category**	**F**	**%**
Type of Surgery	Dynamic Hip Screw (DHS)	15	50.0
	Proximal Femoral Nail (PFN)	15	50.0
Gender	Male	14	46.7
	Female	16	53.3
Socio-economic Status	Low	12	40.0
	Medium	14	46.7
	High	4	13.3

Table 2 compares the side of fracture among patients treated with DHS and PFN. Left-sided intertrochanteric fractures were more common in both groups, accounting for 73.3% in the DHS group and 53.3% in the PFN group. Although right-sided fractures were relatively more frequent in the PFN group (46.7% vs 26.7%), the difference in side distribution between the two groups was not statistically significant ($\chi^2 = 1.292$, $p = 0.260$).

Table 2. Distribution of Side of Fracture Between DHS and PFN

Side of Fracture	DHS (n=15)	PFN (n=15)	χ^2	p-value
Right	4 (26.7%)	7 (46.7%)	1.292	0.260
Left	11 (73.3%)	8 (53.3%)		

Table 3 summarizes the comparison of operative, post-operative, and functional parameters between the two surgical techniques. The mean duration of surgery was significantly lower in the PFN group (52.1 minutes) compared to the DHS group (69.9 minutes), and this difference was highly significant ($p < 0.001$). Similarly, patients treated with PFN were operated earlier following the fracture than those treated with DHS (mean 5.8 vs 7.2 days, $p = 0.014$).

Table 3: Comparison of Operative and Post-operative Parameters in DHS and PFN Groups

Parameter	DHS (Mean ± SD)	PFN (Mean ± SD)	p-value
Operative details			
Time from fracture to surgery (days)	7.2 ± 1.85	5.8 ± 0.95	0.014
Duration of surgery (minutes)	69.9 ± 3.21	52.1 ± 2.81	<0.001
Implant details			
Lag screw length (mm)	84.5 ± 4.56	86 ± 4.35	0.364
Post-operative outcome			
Duration of hospital stay (days)	6.8 ± 1.23	6.2 ± 1.01	0.155
Time to full weight bearing (weeks)	9.5 ± 1.65	3.6 ± 0.95	<0.001
Functional outcome			
Harris Hip Score – 6 weeks	69.34 ± 3.56	81.23 ± 4.21	<0.001
Harris Hip Score – 20 weeks	80.2 ± 4.65	83.57 ± 4.93	0.064

Although there was no significant difference in hospital stay ($p = 0.155$), PFN allowed significantly earlier full weight bearing (mean 3.6 weeks) compared to DHS (9.5 weeks, $p < 0.001$). Functional outcomes were assessed using the Harris Hip Score, which showed better scores in the PFN group at 6 weeks ($p < 0.001$), although by 20 weeks, the difference between the two groups was not statistically significant ($p = 0.064$), suggesting eventual functional convergence over time.

Table 4 presents the radiological outcomes at six months. A significantly higher proportion of patients in the DHS group achieved excellent radiological union (73.3%) compared with the PFN group (26.7%) (p = 0.027).

Table 4: Radiological Outcome at 6 Months (X-ray Assessment)

Category	DHS (n=15)	PFN (n=15)	p-value
Fair	0 (0%)	2 (13.3%)	0.027
Good	4 (26.7%)	9 (60.0%)	
Excellent	11 (73.3%)	4 (26.7%)	

Discussion

In the present prospective study, comparison between the minimally invasive Dynamic Hip Screw (DHS) and the Proximal Femoral Nail (PFN) was done mainly focusing on the functional and radiological outcomes in the management of intertrochanteric fractures of the femur. The mean age group corresponded to the typical demographic profile of intertrochanteric fractures noted by most studies, showing that it is most common among elderly osteoporotic females, attributed to increased susceptibility to low-energy trauma [1,2]. The slight female predominance noted in our study is similar to previous reports linking the higher incidence to post-menopausal bone loss, osteoporosis and fragility due to increased age [3].

The mean operative duration in our study was lesser in the PFN group compared to the DHS group, underscoring the procedural advantage of intramedullary fixation. This observation is consistent with previous studies done by Zhang et al. (2014) [4], who observed that a smaller incision was only needed for PFN fixation, thereby minimal soft-tissue dissection, and reduced blood loss. Similar findings were made by Saudan et al. (2002) [5], who observed that PFN attains fixation through a closed technique with lesser operative trauma. In the present study, the mean time from fracture to surgery was also lesser in the PFN group. This fact could be due to its simpler preoperative preparation and shorter operative setup time.

The postoperative recovery outcomes were favourable for PFN in terms of earlier full weight bearing achieved in an average of 3.6 weeks compared to 9.5 weeks in the DHS group. This finding is consistent with the studies done by Jonnes et al. (2016) [6] and Kumar et al. (2013) [7], both of whom delineated that intramedullary fixation, especially of unstable fractures enables early rehabilitation and mobilization. Early ambulation allows better functional outcomes, and also reducing the incidence of complications of surgery and immobilisation in elderly.

The functional outcomes were assessed using the Harris Hip Score. It showed a statistically significant difference in favour of PFN at 6 weeks, though the difference became insignificant by 20 weeks. This finding substantiates the conclusions of previous studies which showed faster and earlier recovery with PFN but comparable long-term outcomes with DHS [6,8]. Hence, while PFN offers mechanical and early functional

advantages, both implants can provide satisfactory long-term results when appropriately indicated and technically executed.

Radiological outcomes in the current study illustrated that DHS attains a higher rate of excellent union at 6 months compared to PFN, in contrast with earlier studies done by Zhang et al. (2014) [4] and Parker and Handoll (2010) [9], which reported marginally faster union rates with intramedullary devices. The difference in our present study can be attributed to variations in fracture pattern, implant positioning, or the learning curve associated with PFN insertion. However, both groups achieved satisfactory union without major complications such as implant breakage or non-union, consistent with the results of previous randomized and meta-analytic trials [5,7,9].

Overall, the present study reiterates that minimally invasive DHS and PFN are effective treatment options for intertrochanteric fractures. PFN has an upper hand in terms of lesser operative time and soft-tissue disruption, and earlier functional recovery, whilst DHS demonstrated superior radiological union in the present study with fewer technical difficulties. The choice of implant should therefore be individualized based on fracture stability, patient comorbidity, and surgeon expertise.

The findings of the present study are also supported by recent evidence. A large systematic review and meta-analysis by Rasul et al. [10] demonstrated that PFN offers significant advantages in operative parameters and early postoperative recovery while maintaining comparable long-term functional outcomes to DHS. Similarly, Backman et al. [11] reported superior postoperative rehabilitation outcomes with intramedullary devices compared to DHS. Recent studies by Ripon et al. [12] and Zhou et al. [13] further confirmed the benefits of PFN in terms of shorter operative duration, earlier mobilization, and improved early functional scores. These contemporary findings reinforce the observation of the present study that PFN provides superior early functional recovery, although both fixation methods yield satisfactory long-term outcomes.

Limitations

The present study has certain limitations. The sample size was relatively small, with only 30 patients included, which may limit the generalizability of the findings. The follow-up period was limited to six months and may not fully reflect long-term functional and radiological outcomes. Although fractures were classified according to the Boyd and Griffin classification, subgroup analysis according to fracture stability was not performed. Larger multicentric studies with longer follow-up are recommended to validate these findings.

Conclusion

Both minimally invasive Dynamic Hip Screw (DHS) fixation and Proximal Femoral Nailing (PFN) were successful in the surgical management of intertrochanteric fractures. PFN offered advantages of shorter operative time, reduced soft-tissue injury, and earlier mobilization, while DHS demonstrated superior radiological union in the present study. Although PFN showed earlier functional recovery, long-term outcomes were comparable between the two techniques. Hence, implant selection should be individualized based on fracture

characteristics, patient factors, and surgeon expertise.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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