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ORIGINAL RESEARCH

A comparative study on stable intertrochanteric fractures of the femur treated with proximal femoral nail versus dynamic hip screw

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ABSTRACT

Background: Intertrochanteric fractures are common in the elderly, with increasing incidence due to aging, road accidents, osteoporosis, and corticosteroid use. Effective management is essential to reduce morbidity and restore early mobility. This study compares Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) fixation for stable intertrochanteric fractures. **Methods:** A prospective interventional study was conducted from February 2022 to February 2023 at Siddhartha Government Medical College & GGH Vijayawada, including 24 patients. Patients were alternately assigned to PFN or DHS treatment, following standard surgical protocols and rehabilitation. Functional outcomes were assessed using Harris Hip Scores at 1, 3, 6, and 12 months postoperatively. Statistical analysis was performed with significance set at $p<0.05$. **Results:** PFN had a smaller incision ($p<0.01$), shorter surgery time ($p<0.01$), and less blood loss ($p<0.01$) than DHS. Hospital stay and time to full weight-bearing were slightly shorter for PFN but not statistically significant. Complication rates were comparable, with higher loss of reduction in PFN and more wound issues in DHS. At 1 month and 1 year, functional outcomes were similar, but DHS had higher Harris Hip Scores at 3 and 6 months ($p<0.01$). **Conclusion:** PFN offers advantages in surgical duration and early recovery, but DHS is a cost-effective alternative with similar long-term outcomes. In stable intertrochanteric fractures, PFN does not significantly outperform DHS. Larger studies are needed to confirm these findings.

Keywords: PFN, DHS, Inter-trochanteric fractures, Complications, Orthopaedics

INTRODUCTION

Intertrochanteric fractures are prevalent injuries observed in orthopaedic practice. It is among those who suffer catastrophic orthopaedic injuries for the senior population (1). The number of cases of this kind of fracture is rising due to heightened road traffic accidents, building activities, an ageing population, and the recent administration of high-dose steroids for COVID-19 treatment. Intertrochanteric breaks exhibit a bimodal distribution among the population. Ten percent of these fracture occur in young people with a history of collisions on the roadways while the rest is observed in the senior population with a history for minor trauma or falls at home (2). The femur is the primary weight-bearing bone in the lower limb. Fracture of the femur results in prolonged bed rest for the individual in question, which increases morbidity and mortality; therefore, careful treatment of the fracture is essential to prevent these problems.

The prevalence of fractures of the hip has escalated due to increased life expectancy and a growing frequency of motor vehicle accidents (3). Nearly fifty

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percent of hip fractures in elderly people are intertrochanteric fractures. They are predominantly observed in females prone to osteoporosis. The primary objective of treatment is to establish a framework that is secure and to return the patient to their pre-injury condition as swiftly as feasible, hence minimising consequences related to extended immobility.

The objective of treating any Intertrochanteric (IT) injury is to provide early mobility to reduce the risk of medical complications and return the patient to their pre-operative condition (4). The dynamic hip screw (DHS) is presently regarded as the benchmark device for outcome comparison, particularly for stable fractures in the intertrochanteric region. The proximal femoral nail (PFN), proposed by the AO/ASIF put in 1998, has recently achieved considerable popularity for the treatment of trochanteric fractures. The benefit of Proximal Femur Nailing fixation lies in its provision of a more (5) biomechanically stable design by minimising the distance between the hip joint and the implant. This study aimed to assess and compare the clinical and functional results of individuals with stable intertrochanteric fractures that have been treated with proximal femoral nails (PFN) and dynamic hip screws (DHS (7)).

MATERIALS AND METHODS

This prospective interventional study was conducted from February 2022 to February 2023 at the Department of Orthopaedics, Siddhartha Government Medical College & GGH Vijayawada, and involved 24 instances of stable intertrochanteric fractures in individuals over 18 years of age. The exclusion criteria included cases with a marrow cavity obstructed by another implant, malformed femur or aberrant femoral bending, narrow marrow cavity (e.g., osteopetrosis), pathological fractures, or past severe fractures. The ethical committee of the healthcare facility approved the trial, and informed consent was acquired from each patient. Patients who met the introduction and exclusion criteria were alternately treated with DHS or PFN. No patient was lost to follow-up. All patients in both groups underwent surgery performed by the same surgeon. Patients underwent surgery promptly following pertinent tests, radiography, anaesthetic assessment, and physician approval. A conventional fracture table was employed with the patient positioned supine. Given that all fractures were classified as stable, a Dynamic Hip Screw (DHS) with a three-hole side plate and an anti-rotation screw was employed in all instances. In the alternative group, a modified ultra-short Proximal Femoral Nail (PFN) [Sharma Surgicals, Chandigarh, India] measuring 18 cm in length, with a proximal diameter of 14 mm, an anti-rotation screw of 6.4 mm, and a hip screw diameter of 8.0 mm, specifically designed for the smaller Asian demographic, was utilised. Closed reduction was tried in all instances; if unsuccessful, indirect reduction utilising percutaneous or mini-open procedures was performed prior to the insertion of the PFN and DHS. Postoperatively, all patients followed an identical rehabilitation protocol, initiating dynamic quadriceps and ankle pump exercises on the first day. Early mobilisation with a walker commenced as soon as feasible, starting with non-weight bearing and subsequently transitioning to partial weight bearing based on the patient's adherence. Patients were instructed to have their first follow-up appointment four weeks after hospital release, followed by subsequent appointments every six weeks until 24 weeks postoperatively. Weight bearing was incrementally augmented based on the radiological assessment of the fracture site. Subsequent follow-up was recommended at six-month intervals for one year, followed by annual assessments. Intraoperative, early (within the first month post-hip fracture repair), and late problems (after the first month) were documented, and the clinical outcomes for each group were analysed. Patients were monitored at regular intervals of 4 weeks, 8 weeks, 12 weeks, 6 months, and annually thereafter, with functional outcomes evaluated using Harris Hip Scores. Six The collected data was subsequently analysed statistically using Student's t-test for quantitative variables such as time, blood loss, Harris hip scores, and Z ratio to determine the significance of differences between two independent proportions for qualitative demographic data. The null hypothesis indicated that the observed difference was deemed significant if the p-value was less than 0.05.

RESULTS

This study encompassed 24 cases of stabilised intertrochanteric femur fractures in individuals of both sexes from. February 2022 to February 2023. Of these, 12 cases were managed with a Dynamic Hinged Screw and 12 instances were managed with a Proximal Femoral Nail. The mean age of patients receiving PFN reached 60.67 years, while that of patients treated by DHS were 62.27 years. The mean incision length was significantly reduced in the PFN group ($p < 0.01$). The duration of operation was shorter in the PFN group, and that was significantly different ($p < 0.01$) (Table 1). The average bleeding was markedly greater in the DHS group ($p < 0.01$). The mean hospitalisation duration was marginally longer in the DHS group; however, this difference was not significantly different (Table 1). The mean period for permitting complete weight bearing was marginally extended in the DHS group; however, this difference was not statistically significant. Both groups were evaluated for early and late problems, which were then compared. The prevalence of loss of reduction was greater in the PFN group (2 cases against 1 in the DHS group), while extended drainage was more prevalent in the DHS group (Table 2); however, the difference in the incidence of both of these complications did not prove statistically significant. One instance of infection was observed in

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both the PFN and DHS groups. No instances of iatrogenic fracture, deep vein thrombosis, nonunion, or malunion were observed. The frequency of loss of reduction, implant failure, and subsequent re-operation was greater in the PFN group (Table 2), although this difference was not statistically significant. Functional outcomes were evaluated in all patients utilising the Harris hip score at one month, three months, six months, and one year follow-ups. In the D.H.S group, the mean hip score at one month was marginally lower than that of the P.F.N group, although this difference was not of statistical significance (p value > 0.05) (Table 3). At three and six-month follow-ups, the DHS group exhibited greater mean scores than the PFN group ($p < 0.01$); however, at one year, both groups achieved comparable scores ($p > 0.05$).

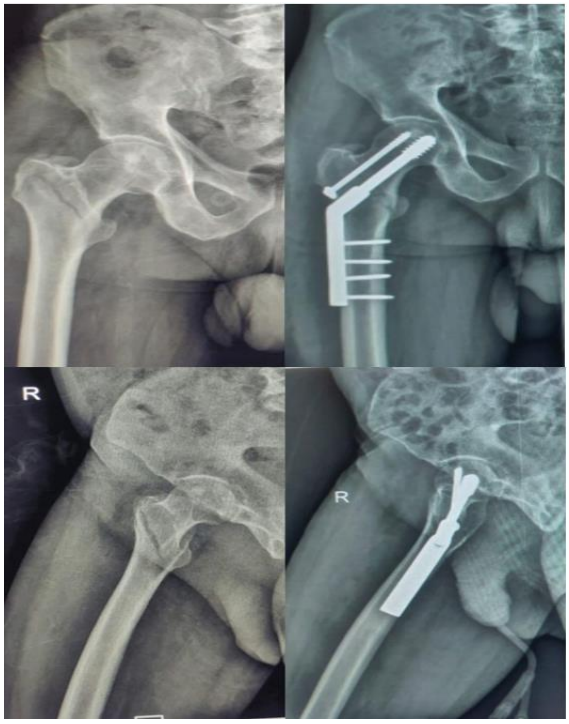

Figure 1: Preoperative and Postoperative Xrays of stable IT fracture managed with DHS.

Figure 2: Preoperative and postoperative Xrays of stable IT fracture managed with PFN.

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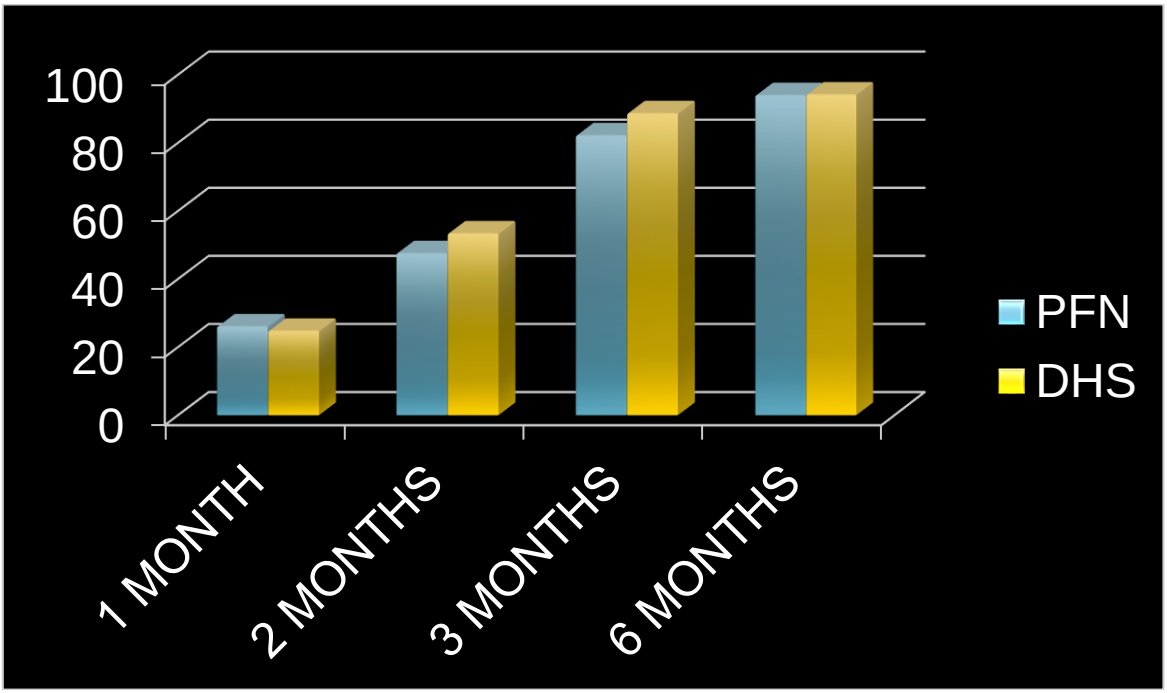
TABLE 1: SHOWING COMPARISON IN PARAMETERS IN BOTH THE GROUPS

PARAMETER	PFN	DHS	P-VALUE
MEAN AGE	60.67	62.27	
MEAN LENGTH OF INCISION (CMS)	4.9	7.9	
MEAN DURATION OF SURGERY (MINS)	56.9	69.7	
AVERAGE BLOOD LOSS (in ml)	109	223	
MEAN HOSPITAL STAY (DAYS)	9.29	10.1	
MEAN DURATION OF FULL WEIGHT BEARING (IN WEEKS)	7.2	7.8	



GRAPH 1: MEAN HARRIS HIP SCORE AT 1 MONTH, 2 MONTHS, 3 MONTHS AND 6 MONTHS

TABLE 3: SHOWING COMPLICATIONS IN BOTH THE GROUPS

Complications	PFN	DHS
Early		
Iatrogenic fracture	0	0
Prolonged drainage	0	2
Infection	1	1
DVT	0	0
Late		
Loss of reduction	2	1
Implant failure	0	0
Second Surgery	0	0
Mean Shortening	5.3mm	5.5mm
Non Union	0	0
Mal Union	0	0
Death	0	0

DISCUSSION

Intertrochanteric fractures provide a significant problem to orthopaedic surgeons. In addition to attaining union, the objective is to restore optimal function in the shortest time possible with minimal problems (8). The objective in managing intertrochanteric fractures has shifted towards attaining stable fixation, facilitating early mobilisation and rehabilitation, and restoring the patient's functional and psychological independence by reintegrating them into their pre-injury home and work settings. Laparoscopic treatment of intertrochanteric fractures facilitates the attainment of all aforementioned objectives and is currently the preferred therapeutic approach (9). Our study aimed to examine, assess, document, and quantify the utilisation of PFN and DHS in the management of fractures of the intertrochanteric area.

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This study examined intraoperative observations, complications, and functional outcomes between two groups of individuals matched for demographic and preoperative factors, treated with Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN), respectively (10). The average incision length was over 2 cm shorter in the PFN cohort than in the DHS group. This was analogous to the results observed in several other investigations, such as those conducted The duration of surgery was reduced by an average of 12.8 minutes in the PFN group. While the time for implant fixation was comparable in both groups, the wound closure time was significantly prolonged in the DHS group, likely due to the larger incision and more extensive dissection in comparison with the percutaneous technique used in PFN. Comparable results were seen by Pan et al., (11) Saudan et al.,(12) Shen et al., (13) and Zhao et al.(14) The average blood loss was greater in the DHS group; however, it was not clinically significant enough to necessitate blood transfusion, as just one patient in the DHS group required it. The mean duration of hospital stay and the period for permitting full weight bearing were both somewhat shorter in the PFN group. Initial problems comprised superficial infections and extended wound discharge in the DHS group, which were absent in the PFN group and cleared with routine dressings. The lengthier incision and extensive dissection in DHS cases likely contributed to these outcomes; nonetheless, no instances of deep infection were seen (15). The incidence of technical errors was greater in the PFN group, with three cases (9.67%), compared to one instance (3.48%) in the other group.

Reduction loss manifested as varus collapse in three instances of implant failure (one in the DHS group and two in the PFN group). Of these three cases, one required reoperation, and in one instance (PFN), the laterally impinging screws were excised under local anaesthesia following fracture consolidation. The mean shortening at the final follow-up was similar in both groups. This study differed from most others, likely due to the fact that all instances were of the stable kind. Intertrochanteric fractures that were minimised during the operation left less opportunity for the sliding mechanism of the Dynamic Hip Screw to induce any shortening (16). Mean Harris hip scores were computed at one month, three months, six months, and annual follow-up, and compared between both groups. Initially, the functional scores for the DHS group were marginally inferior; however, at the three and six-month follow-ups, it was observed that the DHS patients performed somewhat better than the PFN group. This was likely attributable to abductor lurch during ambulation and a little reduced range of abduction in the PFN group compared to DHS patients(17). Nevertheless, at annual follow-ups, the results in both groups were comparable, likely attributable to the restoration of abductor strength with gradual physiotherapy. Consequently, a comparable end clinical outcome may be attained with the DHS at a significantly lower cost than the PFN, as observed by Sharma et al. and Giraud et al (18).

A likely weakness of this study was its reduced sample size. Certain data, such as the incidence of technical errors, implant failure, and the necessity for second surgeries, were not statistically significant in our study, likely due to its limited sample size, despite being reported in numerous previous publications (19).

CONCLUSION

PFN offers enhanced biomechanical strength, reduced surgical length, less invasive procedures, and expedited weight-bearing capability. The current investigation yielded analogous findings, indicating that PFN facilitates a considerably shorter surgical procedure with a reduced incision, resulting in fewer wound-related problems. The double screws of the PFN do not offer any enhanced retention of the head in comparison to the DHS. The PFN is a far more expensive implant than the DHS, although yields nearly identical final outcomes. In stable IT fractures and the PFN does not outperform the DHS regarding shortening at the last follow-up. The ultimate functional result is comparable for both implants.

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