ORIGINAL ARTICLE

DYNAMIC HIP SCREW FIXATION VS. PROXIMAL FEMUR NAIL FOR UNSTABLE PER-TROCHANTERIC FRACTURES: A COMPARATIVE ANALYSIS OF OUTCOMES AND COMPLICATIONS

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Background: There are various implant choices to fix unstable per- trochanteric fractures. The aim of this study was to compare the outcomes of dynamic hip screw and proximal femur nail for unstable per-trochanteric fractures including complications associated with both fixations. **Methods:** A retrospective analysis done on pertrochanteric fractures of femur who were treated with Dynamic hip Screw (DHS) and Proximal Femur Nail (PFN). The data was taken from our hospital hip data base for the past two years from January 2017 to January 2019. Data of 174 patients was analysed, divided in to Group A with DHS (n=122) and Group B with PFN (n=52). Follow up included X-ray (anteroposterior and lateral) views for fracture union and collapse, femur neck shortening, implant position and identification of mode of failure or collapse (cut out risk) by using tip-apex distance. The Harris hip score used to evaluate mobility status and other functional outcomes. **Result:** The mean age in years of patients treated with PFN and DHS were 55.9 and 59.8, ranging from 39-83 years. The mean of Harris hip score at 2 year was 69.28±9.99 in DHS group and 72.12±9.71 in PFN group with the *p*-value 0.31. The mean of limb shortening was 12mm in DHS and 9 mm in PFN group. In DHS group, four cases had tip-apex distance of 39 mm and reported implant cut out that needs revision of surgery. **Conclusion:** Proximal Femur Nail group demonstrated no implant cut out and less mean limb length shortening where as other parameter like functional outcomes, fracture union, rate of infection, hospital stay and postoperative pain are not significantly different in two groups.

Keywords: Per trochanteric fracture; Dynamic hip screw; Proximal femur nail; Functional outcomes

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INTRODUCTION

Each year, about 86,000 hip fractures are reported in United Kingdom alone.[1] Almost 1.3 million cases of hip fractures were reported in 1990 worldwide and it could be increased to 7–21 million by 2050.[1] Hip fractures are related to health care expenditure and have a high mortality rate over the age of 50 years.[2] Among all hip fractures, per-trochanteric fractures present with a varied range of biomechanical complexity for surgeons. According to AO/ASIF classification, the per-trochanteric fractures can broadly divide in to three groups: A1 fractures (stable per-trochanteric fracture), A2 fractures (unstable per-trochanteric fractures with medial comminution including fractured lesser trochanteric) and A3 fractures (unstable intertrochanteric fractures with or without medial comminution).[3] This complicated fracture patterns makes it difficult to choose the optimal implant for fixation.[4]

There are several implant choices for fixing unstable per-trochanteric fractures. The most commonly use implants are sliding hip screw and plate system or proximal femur nail.[5] However, minimally invasive implant that enables early weight bearing that confers a less implant failure rate is always a choice.[6] Most common type of failures are due to displacement of fracture resulting from lateral wall fractures causing lateralization of the greater trochanter, excessive shortening of the sliding hip screw, collapse of femur neck into various position and medialization of the femur shaft.[7] The medial or intramedullary types of reduction patterns, an unstable position of the screw in the femur head, and a tip-apex distance (TAD) of ≥20 mm have been reported as implant cutout risks.[8] Therefore, the correct technique of fixation is necessary to avoid implant failure.[9] Many studies in the past have provided biomechanical evidence that proximal femur nailing may provide better stability and rotational resistance than a dynamic hip screw.[10–12] However, some studies had shown similar or comparable results between two implants.[13,14]

Due to contradictory results, we aimed to compare the clinical and radiological outcomes of proximal femur nail (PFN) and dynamic hip screw (DHS) and complications associated with both procedures. We identify the early fracture union,

weight bearing and limb length shortening and we also compare the fracture union with type of fracture in both groups.

MATERIAL AND METHODS

We performed a retrospective two years analysis (Jan 2017-Jan 2019) of the patient data from the department of trauma and orthopaedics in Birmingham university hospital hip data base. A total of 174 consecutive patients with per-trochanteric fractures registered in the hospital on our hip electronic data base (Figure-1). All patients treated with DHS or PFN were identified. A total of 122 patients were managed with DHS whereas 52 were treated with PFN (Figure-2).

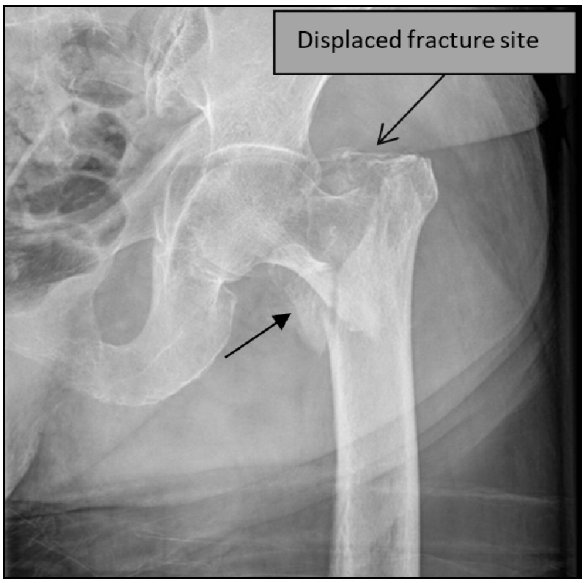

Figure-1: A 55 years old male x ray showing displaced per trochanteric fracture after road traffic accident

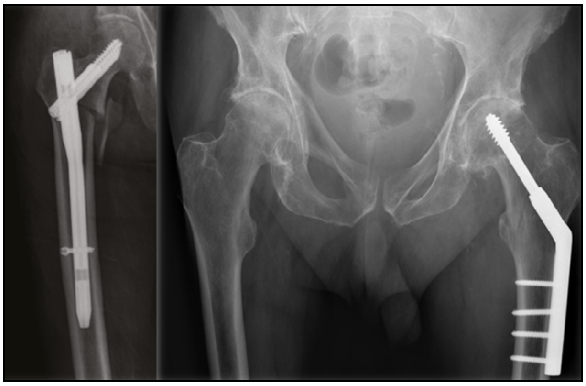

Figure-2: A. post-operative x rays showing fixation of proximal femur nailing in per trochanteric unstable fracture. B. Dynamic hip screw fixation.

All patients who had the surgery and had either PFN or DHS were included in this study. We also included patients who were readmitted for any complication requiring surgery due to implant related complications and patients who had attained mobilization and had a minimum follow up of 2 years after PFN and DHS. We excluded patients who had DHS used for intracapsular fracture fixation. Patients who died or did not achieve mobility due to other medical complications were also excluded. However, patients who could not be followed for a minimum of two years and readmission for causes other than implant related problem were also excluded.

According to the operative notes available, all patients were operated under spinal/regional anaesthesia after optimizing all co-morbidities. For DHS, all patients were operated in the supine position on traction table under image intensified guidance. First of all, fracture reduced by longitudinal traction and longitudinal traction was maintained up to final implantation. The lateral incision was made according to the length of implant in all patients. In other group, PFN were performed in supine position and hip placed in slightly adduction position to facilitate insertion of the nail under image intensifier on traction table. According to the post-operative records, intravenous broad spectrum anti-biotic were started just before surgery and continued for 24 hours. Appropriate physiotherapy was commenced from first post-operative day.

Follow up included X-ray (anteroposterior and lateral) views for fracture union (malunion and non-union) and collapse, femur neck shortening (limb length shortening), implant position and identification of mode of failure or collapse. Less than 50% contact between the proximal and distal fragments was considered mal-united fracture site. Non-union was defined as lack of union after six months of follow-up. The functional outcomes ascertained by a validated objective Harris hip score to evaluate mobility status and other functional outcomes.[15] The statistical analysis was done by using software SPSS version 24.0, using descriptive statistical methods and Man Whitney U test was used to compare the variables. The p-value <0.05 considered statistically significant.

Study was performed with the ethical standard of Helsinki Declaration. The study exempts by Birmingham University Hospital Institutional Review Board approval as it was a retrospective analysis; however, hospital permission was taken before extracting the data.

RESULT

The total male patients in DHS group were 45 and female were 77. In PFN group, the male patients

were 18 and female were 34 as given in Table 1. In our series, majority of the cases were seen in the age group of 41–60 years and 60–80 years. The mean age in years of patients treated with PFN and DHS were 55.9 and 59.8, ranging from 39–83 years respectively. In DHS group, 37% of the patients used to walk with support (stick and walker) while in PNF group, 30% of the patients walk with support after surgery. Other associated injuries are mentioned in Table-1.

Table-1: Demographic and Clinical Details of Patient

Parameters	Group A Dynamic Hip Screw	Group B Proximal Femoral Nail
No of patients	122	52
Age	55.9	59.8
Sex distribution	M=45, F=77	M=18, F=34
Mode of injury	RTA=45% Fall= 55%	RTA= 52% Fall= 48%
Fracture type	A-1= 37 A-2= 70 A-3=15	A-1=17 A-2=34 A-3=1
Associated injuries	• Distal radius fracture in 2 patients (4.8%) • Proximal tibia fracture one patient (2.4%)	• Proximal humerus fracture in one patient with (2.4%)

The mean duration of hospital stay was 9.89 days in DHS group and 9.28 days in PFN group. The time of fracture union was assessed after six months post operatively according to medical record available. In DHS group, the mean fracture union was 15.3 weeks and in PFN it was little early on 14.6 weeks. The mean of limb shortening was 12mm in DHS group and in PFN group, it was 9mm respectively. Full weight bearing was allowed for DHS group after mean time of 12 weeks and for PNF group it was allowed after 8–10 weeks.

The mean of Harris hip score was 69.28±9.99 in DHS group and 72.12±9.71 in PFN group (*p*-value 0.31). There was statistically insignificant difference between the functional outcomes of two groups. In this series, 4 patients reported implant cut out in DHS group at 7 weeks postoperatively. The most important factor for DHS cut out was TAD above 25 mm. In DHS group, total 7 patients have TAD above 25 mm but only four cases cut-out having TAD 39 mm and needs revision surgery. Among those 4 cut out cases, two patients had intact vascular supply at proximal femur therefore, treated with PFN. Other two cases were treated by long neck cemented arthroplasty due to avascular necrosis of proximal femur. In PFN group, one patient had TAD above 25 mm, but didn't require any revision of surgery. Other associated complications that have observed are listed in table-2. However, there was no mortality reported in this series due to surgery in any of the group.

DISCUSSION

In the last few decades, the treatment approaches for per-trochantric fracture have changed. Many implants have been devised and revised. The objective of this study was to assure whether there is any difference in functional recoveries of DHS and PFN treatment approaches. The fixation of per-trochantric fracture by DHS was considered the gold standard treatment but now it seems that PFN have more positive and better outcomes.[16,5] Many authors comparing DHS with PFN fixation reported almost similar outcomes and complications and observed no obvious differences among the outcomes of these fixations.[17–19]

In this analysis, we have compared DHS fixation with PFN for unstable per-trochanteric fracture. Our result suggested that PFN fixation was better than DHS as it reported significantly less post-operative complications, less re operation rate and early weight bearing. Furthermore, our results highlight the fact that there is higher risk of implant cut out in DHS group than PFN, in cases where TAD >20 mm. In our study, the TAD above 25mm is found in 7 patients of DHS group and one patient in PFN group, whereas only 4 patients reported implant cutout in DHS (TAD=39 mm) that require revision surgery. Nevertheless, in Zehir S *et al*.[16] study, 7 patients had screw cutout in PFN and 8 patients in DHS group respectively, whereas 3 patients of DHS undergone arthroplasty due to severe cutout. In our study, among 4 cut out cases in DHS group two patients were treated with PFN. For other two patients, long neck cemented arthroplasty was done due to avascular necrosis of proximal femur.

However, some studies have reported superiority of PFN over DHS fixation.[20,11,12] Still there has been a trend of using DHS for fixing per-trochanteric fractures.[17] There are certain biomechanical limitations associated with DHS fixation. The long lever arm of the DHS prevents early weight bearing that can increase surgical complications especially in elderly patients. If prematurely allowed, then all forces act on non-healed fracture site and may negatively influence the healing process.[21] The weight bearing status in the present analysis was also early initiated in PFN group at 8 weeks due to greater cyclic loading and 12–14 weeks in DHS group. Thus, DHS fixation may notbe a good option for elderly osteoporotic patients because of limited number of holes and screws.[21,22] The rate of complication reported in our study was almost similar in both groups. However, the meta-analyses from ten studies reported by Zeng *et al*.[23]

found that PFN had decreased risk of complications and also reduced risk of fixation failure. Contradictory to the author Huang *et al*.[24] reported similar risk of reoperation for both approaches in their meta- analysis; hencethey did not specify the implant failure rate. In the current study, the implant failure rate was 2.4%.

Pajarinen *et al*. conducted a randomized post- operative rehabilitation study comparing DHS with PFN for the management of pertrochanteric fracture. They had suggested that PFN may allow quicker post-operative recovery and restoration of walking ability as compare to DHS. Our results are consistent with previous literature that patients treated with PFN started early weight bearing, walking and return back to their activities earlier as compare to DHS group.[25]

We identified that proper selection of implant in the unstable fractures, age of the patient, fracture configuration, anatomical reduction, quality of bone; lateral wall commination and TAD all are considerable factors to avoid implant failure.

Limitations of the study: However, this study has some limitations, including the fact that it was retrospective, had no pre-set treatment goals considering reposition and TAD, and there was no evaluation of bone mineral density, make a further prospective study necessary for more concrete conclusions. Therefore, this analysis can be used as a framework for future experimental researches on similar topic.

CONCLUSION

PFN is better implant in terms of early weight bearing and fracture union. Besides, PFN also shows less cut out rate and less mean limb length shortening. However, DHS and PFN, both give similar functional outcomes after two year follow up.

AUTHORS' CONTRIBUTION

KM, AMS: Conceptualization, data collection, literature search, data interpretation, write-up, proof reading. ZAK, AWZ: Literature search, data analysis, data interpretation, write-up, proof reading.

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