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Comparative study on evaluation of results of DHS versus PFN in management of intertrochanteric fractures femur

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Abstract
Introduction: Inter-trochanteric fractures constitute 38-50% of all femoral fractures' and 5-20% of fractures as whole. The treatments for trochanteric fractures try to regain early mobility and limit morbidity and risk of reoperations. The most currently used dynamic hip screw (DHS) and the proximal femoral nail (PFN) are both with pros and cons. The aim of this study was to compare operative management and functional outcome of femoral intertrochanteric fractures by dynamic hip screw v/s proximal femoral nail implants.
Materials and Methods: This prospective study was carried on 60 consecutive patients with intertrochanteric fractures of femur to compare our results of treatment by dynamic hip screw v/s proximal femoral nail. The patients were divided randomly in two groups A (DHS) and B (PFN) with equal number of patients (n=30) in each group. Comparison was done in terms of: duration of surgery, total amount of blood loss during surgery, timing of early mobilization and full weight bearing, radiological assessment for callus formation and bony union, complications with technical and implant failure and Harris hip score for clinical and radiological assessment at end of 12 months. Clinical assessment was done at 3, 6 and 12 months follow-up using Harris Hip Score.
Results: The mean duration of surgery was 53.24±8.67 and 69.62±12.82 minutes in group A (DHS group) and group B (PFN group) respectively. In group A (DHS group) mean blood loss was 161.80±21.84 ml and in group B (PFN group) mean blood loss was 91.90±14.98 ml, with a significant difference. In this study post-operative weight bearing and full weight bearing was seen to be significantly quicker in group B (PFN group) patients. The mean time for union in DHS group and PFN group was 4.40±0.53 months and 2.10±0.70 months respectively. The mean Harris Hip Score at 12 months follow-up was 84.18±4.68 and 88.28±3.96 in DHS and PFN groups respectively.
Conclusion: We conclude that proximal femoral nail (PFN) is a preferable form of osteosynthesis when treating intertrochanteric fractures compared to dynamic hip screw (DHS).

Keywords: Hip fractures, inter-trochanteric, DHS, PFN, Harish hip score

Introduction

Hip fractures are a major burden to both the individuals and society, leading to disability or even mortality for the elderly patients and cause huge economic cost [1, 2]. As the number of elderly people is increasing world-wide, it has been estimated that the number of hip fractures will rise to 2.6 million by 2025 and to 6.25 million in 2050 [3]. Intertrochanteric fracture, one of the most common fractures of the hip especially in the elderly, represents a major public health problem. The incidence of intertrochanteric fracture is rising because of the increase in the number of elderly population, superadded with osteoporosis. These fractures are three to four times more common in women, and the mechanism of injury is usually due to low-energy trauma like a simple fall [4]. Intertrochanteric femoral fractures significantly contribute to health deterioration and long-term morbidity and mortality. The arduous rehabilitation, functional decline, and reduced quality of life affect patient's independence and livelihood [5, 6]. Additionally, intertrochanteric femoral fractures are associated with a significant mortality risk during a hospital stay and following discharge. The reported mortality rate of intertrochanteric femoral fractures in the literature ranges from 11% to more than 30% [7].

Intertrochanteric fractures have been known since the age of Hippocrates. Sir A Cooper 1822 [8] gave the classification in the form of femoral extracapsular and intracapsular fractures. Since then the management of these fractures had changed from non-operative to operative with the advance of science and knowledge of mankind. Non operative treatment needs prolonged bed rest and traction and are mainly reserved for patients who are unfit for surgery due to other medical co-morbidities as it is associated with complications like bed sores, pneumonia, mal-union etc. Operative treatment includes reduction of fracture and stable fixation. Patients could be mobilized and early weight bearing is possible after operative modalities. Many treatment methods have been used for the reduction of intertrochanteric fractures, including dynamic hip screw (DHS), dynamic condylar screw (DCS), proximal femoral nail (PFN), unipolar and bipolar hemi-arthroplasty and external fixation. Early mobilization and prompt return to pre-fracture activity levels are the main goals of surgery. The controversy still continues over the choice of implant for the management of intertrochanteric fracture, specifically the use of proximal femoral nail (intramedullary device) versus dynamic hip screw (extra-medullary plate). The aim of this study was to evaluate and compare the results in patients having intertrochanteric fracture managed with DHS and PFN fixation.

Materials and Methods: This prospective study was carried on 60 consecutive patients with intertrochanteric fractures of femur from November 2020 to October 2022 in the Postgraduate Department of Orthopaedics, SKIMS Medical College, Bemina, Srinagar, to compare our results of treatment by dynamic hip screw v/s proximal femoral nail. All patients were informed about the study in all respects and informed written consent was obtained. The patients were assessed clinically and radiologically and were divided randomly in two groups A and B with equal number of patients (n=30) in each group. Group A patients were treated by ORIF with Dynamic hip screw and group B patients were treated by closed /open reduction internal fixation with long PFN.

The fractures were classified according to AO/OTA classification [9, 10]. The inclusion criteria were all skeletally matured medically fit patients with AO31 A1 & AO31 A2 types of femoral intertrochanteric fractures. The patients with open fractures, compound or pathological fractures, old/neglected fractures of more than 3 weeks, reverse obliquity patterns, subtrochanteric extension, associated fractures in same limb, medically unfit for surgery and those who did not give written consent were excluded from the study. The patients were evaluated and analyzed preoperatively and underwent operation.

All patients in our study underwent a similar rehabilitation protocol involving mobilization from the first postoperative day depending upon the physical condition of the patients, static quadriceps, knee and ankle mobilization exercises and wounds were inspected on the first post-operative day. Post-operatively, partial weight bearing with help of walkers was allowed from day 3 to 6 weeks post-operative, whereas full weight bearing with help of walkers after 6 weeks post-operative. Signs of radiological union were assessed. Regular follow up of all the treated patients was done at 6 weeks, 3 months, 6 months and 1 year postoperatively. Comparison was done in terms of: duration of surgery, total amount of blood loss during surgery, timing of early mobilization and full weight bearing, radiological assessment for callus formation and bony union, complications with technical and implant failure and Harris hip score for clinical and radiological assessment at end of 12 months. Clinical assessment was done at 3, 6 and 12 months follow-up using Harris Hip Score.

Results: In our study, in group A the mean age was 56.20 (range 23-78) years. There were 24(80%) male patients and 6 (20%) females. In this group maximum number of patients (70%) was in age group of 51-70 years, followed by 30-50 years. In group B, mean age was 59.70 (range 31-82) years. There were 19(63.33%) male patients and 11 (36.37%) females. The demographic characters of study population are depicted in table 1.

Table 1: Demographic characters of study population (N=60)

Demographic characters	Group A (DHS group, N=30)		Group B (PFN group, N=30)	
Age (Mean/ Range)	56.20	23-78	59.70	31-82
Gender				
Male (No/ %)	24	80	19	63.33
Female (No/ %)	06	20	11	36.67
Age group				
<30 Years (No/ %)	01	3.33	0	0
30-50 Years (No/ %)	05	17.67	7	23.33
51-70 Years (No/ %)	21	70.00	19	63.33
>70 Years (No/ %)	3	10.00	4	13.34
Mode of injury (No/ %)				
Road traffic accidents (No/ %)	13	43.33	09	30.00
Fall (No/ %)	17	56.67	21	70.00
Side				
Right (No/ %)t	23	76.67	17	56.67
Left (No/ %)	7	23.33	13	43.33
Bilateral (No/ %)	0	0	0	0

The mean duration of surgery was 53.24±8.67 and 69.62±12.82 minutes in group A (DHS group) and group B (PFN group) respectively. In group A (DHS group) mean blood loss was 161.80±21.84 ml and in group B (PFN group) mean blood loss was 91.90±14.98 ml, with a significant difference. In this study post-operative weight bearing and full weight bearing was seen to be significantly quicker in group B (PFN group) patients as compared to patients of group A (DHS group).

Among group A (DHS group), in 2(6.67%) patient the union time was 2-3 months, in 18 (60%) it was 3-4 months, in 8 (26.67%) it was more than 4 months and non-union occurred in 2 (6.66%) patients. The mean time for union in DHS group was 4.40±0.53 months. Among group B (PFN group), in 26 (52%) patients the union time was 1-2 months, in 22(44%) patient the union time was 2-3 months and in 2(4%) it was 3-4 months. The mean time for union in PFN group was 2.10±0.70 months. The difference in mean union time was significant, with a higher union time in DHS group in comparison to PFN group.

The mean Harris Hip Score was 75.28±3.56, 81.42±2.28 and 84.18±4.68 at 3-months, 6-months and 12-months follow-up respectively in group A (DHS group). In group B (PFN group), mean Harris Hip Score was 81.32±4.46, 84.92±3.54 and 88.28±3.96 at 3-months, 6-months and 12-months follow-up respectively (Table 2). 11 (36.67%) patients of group A (DHS group), 15 (50%) in group B (PFN group) showed excellent results followed by good results in 14 (46.67%) of both groups. Fair results were seen in 3 (10%) patients of group A (DHS group) and in 1 (3.33%) patients of group B (PFN group). Poor results were seen in 2 (6.67%) patients of group A (DHS group) (Figure 1).

Table 2: Comparison of mean Harris Hip score at 3 months, 6 months and 12 months between two groups

Groups	Time intervals		
	1-Months	6-Months	12-Months
Group A (DHS group)	75.28±3.56	81.42±2.28	84.18±4.68
Group B (PFN group)	81.32±4.46	84.92±3.54	88.28±3.96
P-Value	0.0001		

Table 3: Grade according to modified Harris Hip score.

Grade	Range	Group A (DHS group)		Group B (PFN group)	
		Frequency	Percentage	Frequency	Percentage
Excellent	>90	11	36.67	15	50.00
Good	80-90	14	46.67	14	46.67
Fair	70-79	3	10.00	1	3.33
Poor	<70	2	6.67	0	0

Discussion

In today's world with better medical facilities and ongoing advances in science and medical field the average life span of people has greatly increased. This has led to increasing geriatric population and their problems. One very common fracture in the older age group is Intertrochanteric fractures of femur. In 1990, of the total world's incidence of hip fracture, Asia alone accounted for 26% of the cases. By 2025 this figure could rise to 37% and up to 45% by 2050. In the elder age group, most of the fractures are osteoporotic, resulting from a trivial fall whereas these injuries in young require high energy trauma. The intertrochanteric femur fractures are often difficult to be reduced and fixed in their anatomical position. The aim of management of these fractures have changed over the years with the advance of science from non-operative to operative measures to achieve early mobilization and less bedridden complications. Implants for the internal fixation are also being continuously evolved in course of time from fixed nail plate devices to sliding hip screw plates to intramedullary devices.

Intertrochanteric fracture treatment is heavily influenced by fracture type and bone quality. DHS was the preferred treatment modality for intertrochanteric fractures until the last few decades [11], works on the principle of controlled collapse of fracture [12]. It has complications like varus collapse at fracture, shortening of femoral neck, rotational instability and implant failure [13-15]. Intramedullary devices, such as the PFN, were developed to address the shortcomings and complications associated with conventional extra-medullary devices, including non-union, re-operation rates, and mal-union, particularly in unstable fractures [16-18]. Intramedullary devices (Proximal femoral nail) are close to the mechanical axis of femur so moment arm is less in them leading to less tensile stress thus behaving as load sharing devices [19]. Recent data show that intra-medullary devices can achieve union rates of up to 100% compared to extra-medullary devices [20]. Despite promising results with PFN, its overall efficacy in stable fractures remains contentious [21]. We compared the functional and radiological outcomes in stable inter-trochanteric fractures treated surgically with either PFN or DHS. For all cases, we also compared intraoperative blood loss (mL) and surgery duration (in minutes).

In our study both DHS and PFN patients were comparable in terms of age and sex. The mean age for DHS patients was 56.20 years and for PFN group was 59.70 years. The mean age for both the groups combined was 57.95 years. The main reason for fracture was trivial fall at home (mostly in the bathroom) in the patients above 60 years of age while younger patients had road traffic accident and fall from height as the major cause for fractures. Cummings and Nevitt in 1994 [22] explained the reason for this as inadequate protective reflexes, reduced energy below critical threshold, inadequate local shock absorbers e.g. muscle and fat around hip and inadequate bone strength at the hip on account of osteoporosis or osteomalacia in the older age group.

Compared to the literature, our study found that the PFN procedure's mean duration was roughly 69.62±12.82 minutes longer than the DHS procedure (53.24±8.67) minutes. Longer time for patient positioning and preparing could be a contributor. Although the senior consultant responsible for the cases was always scrubbed, some of the surgeries were done by senior-level trainees, and the learning curve can contribute to increased time. Studies contrasting the results of PFN and DHS have largely demonstrated that the PFN procedure was quicker than DHS [23, 24]. Few studies indicated that the lengths of the two procedures were comparable [25]. According to Das *et al*. analysis, PFN lasted longer when the nature of the fractures was more complicated [26]. In our study, we observed greater intraoperative blood loss during DHS in comparison to PFN. This is what was previously reported in the literature, where greater blood loss during DHS has been observed [27-30].

We have not faced any intra-operative complications in any of the two groups. In this study superficial infection was seen in 3 patient in both groups, late infection in 1 (3.33%) patient DHS group for which debridement was done and the patients were continued on intravenous antibiotics. Non-union occurred in 2 (6.67%) patients DHS group. Radiological union was achieved within 16 weeks in approximately 83% cases in both the groups and in between 16-24 weeks in most of the remaining cases. In DHS group, 2 cases (6.67%) went into non-union and none in the PFN group. Saudan *et al.* [31] found 7 (36.8%) non-union cases in DHS group and 1 (5%) in PFN group.

The patients were followed up and the two groups were compared for the final functional outcome at the end of 1year. The mean Harris Hip Score was 75.28±3.56, 81.42±2.28 and 84.18±4.68 at 3-months, 6-months and 12-months follow-up respectively in group A (DHS group). In group B (PFN group), mean Harris Hip Score was 81.32±4.46, 84.92±3.54 and 88.28±3.96 at 3-months, 6-months and 12-months follow-up respectively. 11 (36.67%) patients of group A (DHS group), 15 (50%) in group B (PFN group) showed excellent results followed by good results in 14 (46.67%) of both groups. Fair results were seen in 3 (10%) patients of group A (DHS group) and in 1 (3.33%) patients of group B (PFN group). Poor results were seen in 2 (6.67%) patients of group A (DHS group).

The PFN is a good minimal invasive implant of unstable proximal femoral fractures, if closed reduction is possible. If

open reduction of the fracture becomes necessary and several fragments are found (especially of the greater trochanter), a dynamic hip screw (DHS) with the trochanter stabilizing plate is preferred. PFN has given a better result in terms of functional and anatomical outcomes as compare to DHS. Intramedullary Nailing is widely used for fixation of such fractures with claims of less operating time, minimized wounds, immediate weight bearing, faster mobilization and less morbidity in terms of prevention of excessive collapse and limb length discrepancy and implant failure. Considering all above studies Intramedullary Fixation Nail appears to be a better option for unstable inter- trochanteric femur fracture. The current study has several limitations that should be considered when interpreting the results. Firstly, the study was conducted at a single center, which may limit the generalizability of the findings to other settings. The sample size was also relatively small, which may limit the study's statistical power, and the follow-up period was relatively short, which may not have allowed for the detection of some long-term complications or outcomes. Despite these limitations, the study also has several strengths. The study compared two commonly used surgical techniques for intertrochanteric hip fractures, which is a clinically relevant and important topic.

Conclusion

Several fixation techniques have been proposed to enhance the clinical outcome of intertrochanteric fracture treatment. In addition to retaining the benefits of primary haematoma, the minimally invasive surgical approach without exposing the fracture region causes minimal soft tissue injury and reduces the risk of infection. Therefore, we conclude that proximal femoral nail (PFN) is a preferable form of osteosynthesis when treating intertrochanteric fractures compared to dynamic hip screw (DHS).

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