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Comparison of Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) Fixation for Per Trochanteric Femoral Fractures

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Research Article

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Abstract

Objective: To compare the mean per operative blood loss, operative time, post-operative pain, post-operative mobilization, infection rate and functional outcome between PFN and DHS.

Setting: Department of Orthopaedic and Spine Surgery, Hayatabad Medical Complex, Peshawar, Pakistan

Introduction: The optimal treatment of per trochanteric and intertrochanteric fractures is internal fixation via intra-medullary or extra-medullary implants. The proximal femoral nail (PFN) and dynamic hip screw (DHS) are used to fix intertrochanteric fractures.

Methodology: From July 2019 to December 2020, a total of 60 patients were randomly allocated to PFN group (30 patients) and DHS group (30 patients) using computer generated number. The patients were assessed for operative time, blood loss, post-operative pain, need for transfusion and were followed for 6 months to see the difference in Harris hip score in the two groups.

Results: Mean age of the patients was 62.3.3±6.8 in PFN group and 64.1±4.7 in DHS group. There was no significant difference in the co morbidities, ASA status, fracture type and preoperative hemoglobin between the groups. However, there was significant difference in the mean postoperative hemoglobin drop (11.9 ±0.8 vs 11.1±1.0, p= 0.002) and mean operative time (66.1±5.2 vs 88.2±7.5, p= 0.001) between the PFN group and DHS group respectively. Mean pain score at 24 hrs was also significantly lower for PFN group (6.0±0.8 vs 6.5±0.6 p= 0.01). The patients in PFN group did better and were able to mobilise early than the patients in DHS group with a statistical difference (1.6±0.6 vs. 2.4±0.5, p = 0.001). Similarly the mean total hospital stay was shorter for patients in PFN group than those in DHS group (3.7±0.8 vs 4.8±0.9, p= 0.001). At six months follow up the patients in PFN group had better functional outcome as sown by statistical difference in mean Harris Hip score (87.73±4.2 vs 82.8±3.8, p= 0.001). Union was not achieved in 2(6.7%) patients in PFN group and 6(20%) patients in DHS group.

Conclusion: PFN provides lesser per operative blood loss, shorter operative time, less post op pain, earlier post-operative recovery and mobilization, lesser infection rate and better functional outcome as compared to DHS.

Keywords: Proximal Femoral Nail; Dynamic Hip Screw; Intertrochanteric Hip Fracture

Introduction

Hip fractures are becoming increasingly common due to increasing average age of population and trauma. The number of hip fractures is expected to be reaching more than half a million in the year 2040 [1]. Hip fractures not only pose negative social and mental impact on patients but also economic burden on family and healthcare systems because of long hospital stay, increased dependence, co-morbidity and mortality [2]. Hip fractures include per trochanteric and femoral neck fractures. Per trochanteric fractures occur as a consequence of trauma by high energy force (as in younger individuals) or spontaneous falls (as in advanced-age females). Many classification systems divide per trochanteric fractures into stable and unstable [3]. Arbeitsgemein schaftfür Osteosynthesefragen (AO) classification system is commonly used now days. AO system divides per trochanteric fractures into three types: stable per trochanteric (Type A1), unstable per trochanteric (Type A2) and intertrochanteric fractures (Type A3) [4]. The optimal treatment of per trochanteric and intertrochanteric fractures is internal fixationvia implants. The intra-medullary or extra-medullary implants are proximal femoral nail (PFN) or dynamic hip screw (DHS), respectively [5]. Dynamic hip screw (DHS) has been the gold standard implant in treating per trochanteric fractures. However, when compared with the intramedullary implants, it has a biomechanical disadvantage because of a wider distance between the weight bearing axis of the body and the implant [6]. The PFN has some advantages over DHS theoretically as there is no need to fix the plate to shaft with screws, which can be difficult in osteoporotic bones. In addition, it lies closer to the line of weight bearing axis, resulting in a shorter lever arm distance between implant and hip joint, which reduces strains across the implant [2,7]. The PFN is gaining preference in treating all per trochanteric fractures in recent years. Although there are many studies showing benefits of short intramedullary nail, it is still associated with technical failures and is costly [8].

There is continuous controversy over the benefits of using one implant over the other in terms of operative time, intra and postoperative complications, postoperative pain, early mobilsation and risk of infection. We conducted this study to show which implant is better in terms of operative time, per op blood loss, postoperative pain, early mobility, and hospital stay, frequency of union, infection and functional outcome (using mean Harris Hip score).

Patients and Method

This was a prospective randomized study carried out in a tertiary care hospital, Department of Orthopedics and Spine Surgery, Hayatabad Medical Complex Peshawar from July 2019 to December 2020. After approval from the institutional ethical committee, 60 patients with per trochanteric fractures were included in the study. The sample size was calculated using 95% confidence interval, 95% power of the test, mean Harris score and 10% lost to follow-up rate [9]. Patients between 25 to 75 years having AO type A1, A2 and A3 intertrochanteric fracture of femur diagnosed on history, clinical examination and radiograph were included in the study. Patients with high anesthesia risk (ASA-IV), pathological fracture, previous surgical intervention on the affected hip and metabolic bone disease diagnosed on history, clinical examination, baseline investigations and radiograph were excluded from this study. Written informed consent was obtained from all the patients and/or attendants after explaining the purpose of the study. Patients were randomly divided in DHS group and PFN group using random allocation number. All patients were operated by a consultant surgeon with more than 2 years' experience under general anesthesia (GA) or spinal anesthesia. All patients had preoperative intravenous antibiotics and were continued for 5 days. Intraoperative time was noted for all patients. All drains were removed after 24 hours of surgery and wounds were inspected on second and fourth postoperative day. Mean pain score was calculated for both groups using visual analog score on 1st and 2nd post op day. Regular follow up was done at 2nd, 6th, 12th week, and 6th month with history, clinical examination, and imaging. The mean Harris score was calculated on 6th month for functional outcome.

Data was analyzed using SPSS version 20. Quantitative data like age, operative time, pain score, early mobility, hospital stay and Harris hip score was described with mean and standard deviation (SD). Qualitative variables like gender, comorbidities, laterality, fracture type, infection and non-union was described as frequencies and percentages. Comparison of DHS and PFN was done using chi-square test. Independent sample t-test was applied to compare mean scores between the groups. P- Value < 0.05 was considered statistically significant.

Results

The baseline characteristics of 60 patients are presented in table1, of which 30(50%) were each in PFN and DHS groups. Overall there were 36(60%) males and 24(40%) females. In PFN group, there were 16(53%) males and 14(47%) females. In DHS group, there were 20(67%) males and 10(33%) females Table 1.

Variables		PFN (%) N=30	DHS (%) N=30	P value
Age ± SD		62.3.3±6.8	64.1±4.7	0.2
Gender	Male	16	20	0.4
	Female	14	10	
Comorbids	DM	10	7	0.5
	HTN	14	11	0.6
	IHD	7	6	0.7
ASA status	I	18	15	
	II	9	9	0.5
	III	3	6	
Laterality	Right	17	16	0.7
	Left	13	14	
Fracture	A1	8	5	
	A2	7	10	0.5
	A3	15	15	
Wound infection		2	5	0.4
Fracture union		2	6	0.1

Chi square test for categories, T test for numeric data.
Table 1: Baseline characteristics.

Mean age of the patients was 62.3.3±6.8 in PFN group and 64.1±4.7 in DHS group. There was no significant difference in the co morbidities between the groups. Therefore pre-operative ASA status between the groups also was not significant. There were 13(22%) AO type A1, 17(28%) AO type A2 and 30(50%) AO type A3 fractures in the study and there distribution between the groups was not significant.

There was no significant difference between the preoperative hemoglobin of both the groups as shown in Table 2. However, there was significant difference in the mean postoperative hemoglobin drop (11.9 ±0.8 vs 11.1±1.0, p= 0.002) and mean operative time (66.1±5.2 vs 88.2±7.5, p= 0.001) between the PFN group and DHS group respectively. Mean pain score at 24hrs was also significantly lower for PFN group (6.0±0.8 vs 6.5±0.6 p= 0.01) but we did not find any significant difference at 48 hrs. The patients in PFN group did better and were able to mobilise early than the patients in DHS group with a statistical difference (1.6±0.6 vs 2.4±0.5, p = 0.001). Similarly the mean total hospital stay was shorter for patients in PFN group than those in DHS group (3.7±0.8 vs 4.8±0.9, p= 0.001). At six months follow up the patients in PFN group had better functional outcome as sown by statistical difference in mean Harris Hip score (87.73±4.2 vs 82.8±3.8, p= 0.001).

Variables	PFN N=30	DHS N=30	P value
Pre op HB	13.1±0.7	12.6±1.1	0.09
Post op HB	11.9±0.8	11.1±1.0	0.002
Operative time	66.1±5.2	88.2±7.5	< 0.001
Pain at 24h	6.0±0.8	6.5±0.6	0.01
Pain at 48h	3.4±0.6	3.6±0.8	0.2
Mobilization day	1.6±0.6	2.4±0.5	< 0.001
Hospital stay	3.7±0.8	4.8±0.9	<0.001
Harris hip score	87.73±4.2	82.8±3.8	<0.001

Student T test
Table 2: Outcomes and mean values.

Union was not achieved in 2(6.7%) patients in PFN group and 6(20%) patients in DHS group with no significant difference. In terms of complication, there were 2(6.7%) post op infection in PFN group and 5(16.7%) in DHS group.

Discussion

Per trochanteric fractures of the femur are very common fractures, encountered on daily basis in any trauma and Orthopedic unit. Most of them occur in elderly patients (>60 years) after a simple ground level fall because of osteoporotic bones. Our study also has a similar mean age of patients. Osteoporosis is more common in females at this age but this study has more number of male patients than females [10]. As these fractures are mostly treated surgically, DHS has been used as the most common implant for these fractures for many decades now but from the past decade intramedullary devices are gaining popularity [11]. One of these is PFN which we used in our study.

Our mean operative time was significantly lower for the PFN group which is also showed by Sharma, et al. in their study [12]. Per operative blood loss for PFN group is significantly lower in our study showed by post op drop in Hb levels. This is also confirmed by Shen, et al. and Muzzafar, et al. it is most probably due to smaller incisions for the PFN implant [13,14].

Mean pain at 24 hrs was also significantly lower for PFN group ($p<0.05$) but we did not find any significant difference at 48 hrs. We also found that patients in Pfn group were able to mobilize earlier than DHS group as is also shown by other studies [15]. Mean hospital stay of patients in PFN group was lesser in our study because these patients were able to mobilize early due to lesser pain at 24hrs and so were discharged earlier. In a study by Moroni, et al. mean Harris Hip Score at 6 months were 62 in patient treated with DHS which is lower than the mean Harris Hip Score of cases managed with DHS in our study (82.8±3.8) [16]. Khaqan Adeel, et al. in their study showed that mean Harris Hip score was significantly better for the PFN group throughout except at 12 months when it became non-significant between the 2 groups [9]. Our follow up was for 6 months and our finding is that mean Harris Hip score is significantly better for the PFN group.

Infection was found to be lesser in the PFN group by multiple studies [9,17]. Our finding were consistent with this as there were 2(6.7%) post op infection in PFN group and 5(16.7%) in DHS group. Our non-union was also higher in DHS group and most probably it was due to the increase frequency of infection in DHS group. Seven patients were lost to follow and excluded from the study. This study is our first attempt to quantify the short term results of surgical treatment of per trochanteric fractures by different implants. The strength of this study is its prospective randomized design and rigorous follow up of the patients. The limitations of the study are its short sample size, lack of comparison of cost for PFN and DHS and shorter follow up duration. However as indicated by a higher mean Harris Hip score at six months we did not follow the patients for longer duration. Different studies show lesser operative time and less amount of blood loss for PFN group, therefore PFN may be used in high risk patients who are not fit for more blood loss and longer anesthesia. Further large-scale RCTS with longer follow-ups are required to confirm definitive advantages of PFN or intramedullary devices over DHS implant.

Conclusion

Our conclusion is that PFN provides lesser per operative blood loss, shorter operative time, less post op pain, earlier post-operative recovery and mobilization, lesser infection rate and better functional outcome as compared to DHS.

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