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Dr. Mansoor Ahmad Tali
Senior Resident, Department of Orthopaedics, GMC Srinagar, Jammu and Kashmir, India

Dr. Junaid Ali
PG Scholar, Department of Orthopaedics, GMC Srinagar, Jammu and Kashmir, India

Dr. Imtiyaz Hussain Dar
Professor, Department of Orthopaedics, GMC Srinagar, Jammu and Kashmir, India

Dr. Layeeq Ahmad Lone
PG Scholar, Department of Orthopaedics, GMC Srinagar, Jammu and Kashmir, India

Corresponding Author:
Dr. Layeeq Ahmad Lone
PG Scholar, Department of Orthopaedics, GMC Srinagar, Jammu and Kashmir, India

PFN versus DHS fixation in the management of inter-trochanteric fractures

Dr. Mansoor Ahmad Tali, Dr. Junaid Ali, Dr. Imtiyaz Hussain Dar and Dr. Layeeq Ahmad Lone

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Abstract
Introduction: Intertrochanteric fracture of the femur, one of the common fractures in the elderly, is a major source of mortality and morbidity impairment in the patients. Due to problems caused by these fractures, it is absolutely necessary to use an effective and appropriate treatment modality for such patients. Many treatment methods have been used for the reduction of such fractures and the controversy still continues over the choice of implant. The aim of this study was to evaluate and compare the results in patients having intertrochanteric fracture managed with dynamic hip screw (DHS) and proximal femoral nail (PFN) fixation.
Materials and Methods: In this study a total of 48 patients with intertrochanteric femoral fractures were enrolled and were randomly divided in two groups A and B. Patients of group A (N=29) were treated by ORIF with Dynamic hip screw and of group B (N=19) were treated by closed /open reduction internal fixation with long PFN. Functional outcomes and radiological assessment were compared at 3 months, 6 months and 12 months post operatively. All patients were followed up for a minimum period of 1 year. 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.
Results: In this study mean duration of surgery in the group A (DHS group) and group B (PFN group) were found to be 58.70 and 43.20 minutes respectively. Mean blood loss in group A (DHS group) and group B (PFN group) were found to be 169.30 ml and 97.40 ml respectively. In this study among group A (DHS group), in 17 (58.62%) patients complete union occurred in 10 to 14 weeks, while in 10 (34.48%) patients complete union occurred in 14 to 18 weeks. Among group B (PFN group), in 15 (78.95%) patients complete union occurred in 10-14 weeks and in 3 (15.79%) patients, complete union occurred in 14 weeks to 18 weeks. In the group A (DHS group), superficial infection was seen in 1 (3.45%) patient, non-union in 2 (6.90%) patients and late infection 1 (3.45%) patient. In the group B (PFN group), superficial infection was seen in 1 (5.26%) patient and non- union occurred in 1 (5.26%) patient. Mean Harris Hip Score at 12-months follow-up was 79.12±0.53 and 86.80±0.48 in group A (DHS group) and group B (PFN group) respectively.
Conclusion: PFN is a preferable form of osteosynthesis when treating intertrochanteric fractures compared to DHS.

Keywords: Hip, Intertrochanteric femoral fracture, management, DHS fixation, PFN fixation

Introduction
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 [1].
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 [2, 3]. 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% [4].

Due to problems caused by these fractures and an increase in the number of the elderly population leading to a significant increase in the incidence of these fractures, it is absolutely necessary to use an effective and appropriate treatment modality for such patients. In line with the improvements in the prevention and medical care of these fractures, orthopaedic treatment has also undergone a dramatic shift in the past decades [5]. As our understanding of the biomechanics of these fractures has evolved, implants have been redesigned to ultimately improve the standards of care [6].

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 observational study was conducted in the Government Hospital for Bone and Joint Surgery, Barzulla, Srinagar, an associated hospital of Government Medical College, Srinagar from March 2021 to September 2022. In this study a total of 48 patients with intertrochanteric femoral fractures were enrolled. All patients were informed about the study in all respects and informed written consent was obtained. The patients were evaluated and analyzed preoperatively and underwent operation. The enrolled patients were divided randomly in two groups A and B. Patients of group A (N=29) were treated by — ORIF with dynamic hip screw (DHS) and of group B (N=19) were treated by closed /open reduction internal fixation with long proximal femoral nail (PFN).

Inclusion criteria

- Age >18 years.
- Closed inter-trochanteric fractures.
- Fractures <3 weeks old.

Exclusion criteria

- Open fracture.
- Pathological fracture.
- Old/neglected fracture of more than 3 weeks.
- Associated fractures in same limb.
- Underlying neurological condition

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. Functional outcomes and radiological assessment were compared at 3 months, 6 months and 12 months post operatively. All patients were followed up for a minimum period of 1 year. 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.

Table 1: Demographic characters of study population (N=48, Mean age 57.60)

Demographic characters		No. of patients	Percentage
Sex	Male	27	56.25
	Female	21	43.75
Age group	18-40 Years	05	10.42
	41-60 Years	26	54.16
	>60 Years	17	35.42
Mechanism of injury	Road traffic accidents	14	29.67
	Trivial trauma	34	70.83
Side	Right	26	54.17
	Left	22	45.83
Type of fixation	DHS	29	60.42
	PFN	19	39.58

Results

The mean age of the study population was 57.60 (range 28-79) years. Out of the 48 patients, 27 (56.25%) patients were males and 21 (43.75%) patients were females. The most common age group involved in this study was 41-60 years with 26 (54.16%) patients, followed by > 60 years of age with 17 (35.42%) of patients. In this study most common cause of injury was trivial trauma in 34 (70.83%) patients, followed by road traffic accidents in 14 (29.67%) patients. In 26 (54.17%) patients, the fractures occurred on the right side and in 22 (45.83%) patients on the left side, showing no significant difference (Table 1).

In this study mean duration of surgery in the group A (DHS group) and group B (PFN group) were found to be 58.70 and 43.20 minutes respectively. Mean blood loss in group A (DHS group) and group B (PFN group) were found to be 169.30 ml and 97.40 ml respectively.

In this study among group A (DHS group), in 17 (58.62%) patients complete union occurred in 10 to 14 weeks, while in 10 (34.48%) patients complete union occurred in 14 to 18 weeks. Among group B (PFN group), in 15 (78.95%) patients complete union occurred in 10-14 weeks and in 3 (15.79%) patients, complete union occurred in 14 weeks to 18 weeks.

Among group A (DHS group), mobilization started on the first postoperative day in 5 (17.24%) patients while in group B (PFN group) mobilization started on the first postoperative day in 13 (68.42%) patients. Similarly 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).

In the group A (DHS group), superficial infection was seen in 1 (3.45%) patient, non-union in 2 (6.90%) patients and late infection 1 (3.45%) patient. In the group B (PFN group), superficial infection was seen in 1 (5.26%) patient and non-union occurred in 1 (5.26%) patient.

In group A (DHS group), mean Harris Hip Score at 3-months, 6-months and 12-months follow-up was 72.42±0.38, 76.94±0.52 and 79.12±0.53 respectively. In group B (PFN group), mean Harris Hip Score at 3-months, 6-months and 12-months follow-up was 79.32±0.46, 83.60±2.54 and 86.80±0.48 respectively (Table 2).

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

Time period	Group A (DHS group)	Group B (PFN group)	P-Value
3-Months	72.42±0.38	79.32±0.46	0.0001
6-Months	76.94±0.52	83.60±2.54	0.0001
12-Months	79.12±0.53	86.80±0.48	0.0001

In group A (DHS group) 13 (44.83%) patients showed excellent results followed by good results in 11 (37.93%) patients, fair in

3 (10.34%) and poor in 2 (6.90%) patients. In group B (PFN group), 9 (47.33%) patients showed excellent results followed by good results in 8 (42.11%) patients, fair in 1 (5.26%) and poor in 1 (5.26%) patients (Table 3).

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	13	44.83	9	47.37
Good	80-90	11	37.93	8	42.11
Fair	70-79	3	10.34	1	5.26
Poor	<70	2	6.90	1	5.26

Discussion

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.

The dynamic hip implant was once the gold standard for treating trochanteric fractures, particularly stable fractures [7]. Dynamic Hip Screw works on the principle of controlled collapse of fracture [8]. It has complications like varus collapse at fracture, shortening of femoral neck, rotational instability and implant failure [9-11]. But lately from 1990 there has been a change of trend towards intramedullary devices. 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 [12]. Intertrochanteric femoral fractures with reverse oblique pattern and sub-trochanteric extension showed high failure rates, complications and requirement of revision surgeries with dynamic hip screw, therefore the use of Proximal femoral nails is superior in such cases [13, 14].

In this study mean age of the study population was 57.60 years, which is significantly lower as compared to various studies published. In our study both DHS and PFN patients were comparable in terms of age and sex. 34 (70.83%) patients had trauma due to trivial fall in the patients above 60 years of age, while 14 (29.67%) patients had sustained fracture because of road traffic accidents, which were young patients of age less than 60 years. Cummings and Nevitt in 1994 [15] 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. In this study there was not a significant difference between the sides of fracture, as 26 (54.17%) patients had sustained fracture on right side and 22 (45.83%) patients had fracture on left side.

For group B (PFN group), a shorter operative time was achieved compared to group A (DHS group). However, we did not see a difference between stable or unstable fracture due to the small sample size in each subgroup. Our study shows that the average duration of surgery for group A (DHS group) was 58.70 minutes which is greater than average time required for group B (PFN group) which is 43.20 minutes. The same trend was seen for intraoperative blood loss that group B (PFN group) had less blood loss compared to group A (DHS group). The shorter operative time and less blood loss might be due to the smaller incision and reduced muscle injury. The PFN implant is also placed through a minimally invasive approach without opening the fracture site, while DHS requires a larger incision [16, 17].

Normal healing time of a fracture is about 12 weeks. Intertrochanteric non-union should be suspected in patients with persistent hip pain that have radiographs revealing a persistent radiolucency at the fracture site 4 to 7 months after fracture fixation. Progressive loss of alignment strongly suggests non-union, although union may occur after an initial change in alignment, particularly if fragment contact is improved [18]. Most of the patients were mobilized within 5 days of surgery whether treated by DHS or PFN. Radiological union was achieved within 14 weeks in approximately 67% cases in both the groups and in between 14-18 weeks in most of the remaining cases. In group A (DHS group), 2 (6.90%) went into non-union and 1 (5.26%) in the group B (PFN group). Saudan *et al* [19] found 7 (36.8%) non-union cases in DHS group and 1 (5%) in PFN group.

We have not faced any intra-operative complications in any of the two groups. In the group A (DHS group), superficial infection was seen in 1 (3.45%) patient, non-union in 2 (6.90%) patients and late infection in 1 (3.45%) patient. In the group B (PFN group), superficial infection was seen in 1 (5.26%) patient and non- union occurred in 1 (5.26%) patient.

The patients were followed up and the two groups were compared for the final functional outcome at the end of 1year. The average Harris Hip Score was assessed, the score being 79.12±0.53 in the group A (DHS group) and 86.80±0.48 in the group B (PFN group) (statistically not significant). In group A (DHS group) 13 (44.83%) patients showed excellent results followed by good results in 11 (37.93%) patients, fair in 3 (10.34%) and poor in 2 (6.90%) patients. In group B (PFN group), 9 (47.33%) patients showed excellent results followed by good results in 8 (42.11%) patients, fair in 1 (5.26%) and poor in 1 (5.26%) patients. The result indicates no difference in the functional outcome between the two surgeries.

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).

Conflict of Interest: Not available

Financial Support: Not available

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