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Original Research Article

Comparison between the outcome of proximal femoral locking compression plate and dynamic hip screw in intertrochanteric femoral fractures

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ABSTRACT

Background: Inter-trochanteric femoral fractures are associated with a high complication rate and mortality. This study aims to compare the proximal femoral locking compression plate (PFLCP) with dynamic hip screws (DHS) for inter-trochanteric femoral fractures in terms of mean bone union time.
Methods: It was a prospective randomized study conducted at the department of orthopedics, Benazir Bhutto Hospital, Rawalpindi, Pakistan from June 2015 to December 2015. Sixty patients with a diagnosis of inter-trochanteric fractures, requiring orthopedic surgery, were included in the study. After randomization thirty patients underwent PFLCP fixation and the other thirty patients underwent DHS fixation. Patient information, demographic data, and functional level were assessed. Mean bone union time and implant complications were compared for the two treatment groups.
Results: Patients who underwent PFLCP fixation demonstrated shorter bone union time (2.8±0.2 months) than those who underwent DHS fixation (3.2±0.1 months) ($p<0.000$). PFLCP group had 90% bone union whereas DHS group had 76.66% bone union at 12 weeks ($p=0.16$).
Conclusions: PFLCP is better than DHS for intertrochanteric femoral fractures in terms of shorter mean bone union time and fewer complications.

Keywords: Femoral fractures, Bone screws, Locking compression plate

INTRODUCTION

The intertrochanteric region consists of the proximal femur, distal to the neck and extends to the lesser trochanter. The majority of this region consists of highly vascularized, extracapsular, and cancellous bone. Primary hip abductor (gluteus medius) and primary hip flexor (iliopsoas) attach on the greater and the lesser trochanters, respectively. Approximately half of all the hip fractures, caused by a low energy impact, are intertrochanteric femoral fractures.[1] These fractures are associated with many complications including necrosis of the head of the femur.[2-4] Intertrochanteric fractures constitute greater than 90% of all the hip fractures in the elderly. They are responsible for 20-30% of complications and 17% of all the deaths.[5-7] The factors that increase the risk of intertrochanteric fractures include increasing age, osteoporosis, a history of falls, female gender, and abnormalities of gait.[8]

DHS, also known as the sliding hip screw, has good biological and mechanical characteristics but causes mild tissue injury.[9] Although DHS can be effectively used in the treatment of stable intertrochanteric fractures yet, the fixation of unstable intertrochanteric fractures presents a challenge. The complication rates with various implants reach as high as 20%.[10-13] The use of DHS in the treatment of unstable intertrochanteric fractures is also

associated with many complications.[10] PFLCP has been shown to overcome many problems associated with the use of DHS.[10,14] PFLCP is a preconfigured implant, which is made up of stainless steel.[14] As it is an extramedullary implant so, it has limited contact and allows angular stability to multiple fractures.[15,16] It is more efficient than other angular stable implants, especially in the bones affected by osteoporosis.[15-18] Unstable femoral fractures can also be reduced by the use of a locking plate with lateral wall buttress.[10,19,20]

In Pakistan, PFLCP is not used widely and no previous research work has been done regarding this topic in our population. In this study, we want to evaluate the efficacy of PFLCP as a treatment option in comparison with the standard treatment of DHS in our setup. The results of this study will enable us to better understand the outcome of PFLCP and improve the management of our patients.

METHODS

This prospective randomized study was conducted at the department of orthopedics, Benazir Bhutto hospital, Rawalpindi, Pakistan from June 2015 to December 2015. Ethical approval was given by the college of physicians and surgeons of Pakistan (CPSP). Sixty patients, 30-70 years of age, who required orthopedic surgery due to intertrochanteric fractures were included in the study. Patients who had a history of diabetes mellitus, chemotherapy, radiotherapy, repeated infections, drug or alcohol abuse, severe hepatic, renal or cardiac dysfunction, multiple fractures, fracture more than seven days old, disease affecting bone union including Paget's disease, Perthes disease, and metastatic bone disease were excluded. A detailed history was taken and patients were examined thoroughly.

The intertrochanteric fracture was defined as a hip fracture that occurs between the greater and the lesser trochanters. The Boyd and Griffin classification system was used in the study.[21]

Patients were examined thoroughly before the surgery. Necessary investigations such as hemoglobin, blood group and Rhesus (Rh) typing, urine for albumin, sugar, bleeding time, and clotting time were carried out. The baseline heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial blood pressure (MAP) were recorded for all patients using a monitor.

Patients gave written informed consent before participating in the study. After the baseline investigations were carried out, an administrative assistant assigned a numerical registration number to the patients by using a lottery method. After considering the inclusion and exclusion criteria, patients were then randomly allocated into the two groups; group A (PFCLP fixation) and group B (DHS fixation).

The PFLCP was inserted through a direct lateral incision, which was centered over the greater trochanter and the lateral aspect of the femoral shaft. The fracture was reduced by using an image intensifier. The bony fragments were provisionally held in position with Kirschner wires and reduction forceps. A partially threaded cancellous screw was inserted into the proximal 7.3 mm hole to achieve better fracture compression for the reduction of per trochanteric fractures. After installing the rest of the locking screws, the cancellous screw was subsequently replaced with a locking screw. The distal end of the plate was secured with a mixture of locking and cortical screws depending on the fracture configuration.

For DHS fixation, the patient was placed in a supine position on the operating table and an attempt was made to possibly reduce the fracture, under an image intensifier. The proximal femur was approached laterally by 15-20 cm straight incision, two fingers width, proximal to the greater trochanter. Splitting the iliotibial tract lengthwise, the proximal femoral shaft was exposed without retracting the periosteum. DHS screw and plates were positioned, stabilized and fixed with appropriate measurements.

Both implants were purchased from international supplier Medonix. Surgeries were performed by orthopedic specialists with a minimum experience of 30 cases. All patients were given the same standard postoperative care.

Follow-up was done in the out-patient department at the intervals of two, four, and 12 weeks and the bone union were assessed radiologically at that time. Patients whose fractures did not unite after 12 weeks were followed until union. All the data was recorded on the specially designed Performa attached as annexure filled by the researcher.

Data was analysed using the statistical package for social sciences (SPSS) version 22. Means and standard deviations were calculated for quantitative data like age and union time. Frequency and percentages were calculated for analysis of qualitative data like gender and type of implant. Union time of both groups was compared by independent samples t test. Effect modifiers like age, gender, and duration of fracture were controlled by stratification. A $p \leq 0.05$ was considered as significant.

RESULTS

The mean age of the population was 57.8 years (range 30-70 years). Twenty-five (41.6%) of the patients belonged to the 54-61 years age group followed by 20 (30.3%) in the 62-70 years group (Table 1).

Out of the total study population, 41 (68.47%) were females while 19 (31.6%) were males. Thirty (50%) of the cases were due to low energy trauma (slips and falls) corresponding to the etiology of inter-trochanteric

femoral fractures. Right lower limb was more commonly affected than the left. The Boyd and Griffin classification was used in the study, according to which 50 (83.3%) fractures were falling in Boyd and Griffin type one fracture of the proximal femur (Table 2).

Table 1: Age distribution of the patients, (n=60).

Age group (years)	Number of cases	Percentage (%)
30-37	02	03.3
38-45	08	13.3
46-53	05	08.5
54-61	25	41.6
62-70	20	33.3

Table 2: Nature of trauma, side of the fracture, and type of fracture, (n=60).

Variables	Groups	Number of cases	Percentage (%)
Nature of trauma	Motor vehicle accident (RTA)	20	33.33
	Fall from height	10	16.67
	Slip and fall	30	50
Side of fracture	Right	40	66.67
	Left	20	33.33
Type of fracture	Type I	50	83.33
	Type II	10	16.67

Out of all the cases, 30 (50%) healed normally, 20 (33.33%) had delayed healing, and 10 (16.67%) had shortening while none of the patients had superficial infection. Demographics of patients among group A and group B are given in Table 3.

Table 3: Demographic details of the patients with in groups, (n=30).

Demographic details	Variables	Group A, PFLCP*	Group B, DHS**
Population age (years)	Mean ± SD	56.5±2.4	58.2±2.1
Gender	Males	10	09
	Females	20	21
Affected side	Right	20	20
	Left	10	10
Classification	Type I	25	25
	Type II	05	05

*PFLCP-Proximal femoral locking compression plate, **DHS-Dynamic hip screw

Mean union time for group A was 2.8±0.2 months and for group B was 3.2±0.1 months. Difference between the mean union time was statistically significant (p<0.000). All the patients were followed at two, four, and 12 weeks.

At each follow-up, radiograph of the operated hip with the upper half of the femur was taken and assessed. Patients having non-union after 12 weeks were followed until union. In group A (PFLCP fixation), 27 (90%) cases while in group B (DHS fixation), 23 (76.7%) cases showed a good union of fracture after 12 weeks (Table 4). The distribution of these frequencies was statistically insignificant (p=0.16).

Table 4: Functional result of the study in terms of union time, (n=30).

Result	Union (%)	Non-union (%)	P value
Group A	27 (90)	3 (10)	0.16
Group B	23 (76.67)	7 (23.23)	

DISCUSSION

The mechanisms of DHS and PFLCP differ from each other. The collapse of a fracture is controlled in DHS whereas PFLCP prevents any shortening or collapse of the fracture. Hence, the advantage of PFLCP is that it causes lesser limb shortening than DHS. PFLCP is also associated with a lower risk of varus collapse and screw cut-out.[22]

The mean age in our study was 57.8 years (56.5±2.4 years in the PFLCP group and 58.2±2.1 years in the DHS group). Similarly, according to a study by Agrawal et al the mean age was 55.23 years for DHS group and 56.46 years for PFLCP group. This is because increasing age is associated with an increased risk of fractures. Most of the patients in our study fell in the age group 54 to 61 years (41.6%). Agrawal et al also showed that most of the patients (38.46% in DHS group and 42.3% in PFLCP group) were between 60 to 70 years of age.[22] According to some studies the bone mineral density (BMD) decreases with age, which is associated with an increased risk of fractures.[23,24] The risk of falls also increases with age thus causing an increased incidence of fractures in this age group.[25] Increasing age also increases the risk of osteoporosis.[26]

In our study, most of the study participants were females (68.47%). Whereas in the study by Agrawal et al most of the patients were males (65.38% in the DHS group and 57.69% in PFLCP group).[22] The risk of osteoporosis is increased four times in women aged 50 and above.[26]

In our study, the most common cause of fractures was slips and falls (50%). Similar results were observed in the study by Agrawal et al (77% in the DHS group and 73% in the PFLCP group).[22]

Our study showed that out of all the patients 10 (33.33%) had delayed healing. However, in the study by Chinmoy et al none of the patients in the PFLCP group had delayed union while only one patient had delayed union in the DHS group.[27] None of the patients in our study developed

superficial infection whereas in the study by Chimnoy et al two patients in the PFLCP group and one patient in the DHS group developed superficial infection.[27] In another study by Suman et al only one patient in the DHS group developed superficial infection.[28] In our study limb shortening was observed in 10 (16.67%) of the patients whereas in the study by Suman et al three patients in the DHS group and only one patient in the PFLCP group developed limb shortening.[28]

In our study, the mean union time for PFLCP group was 2.8±0.2 months while that for DHS group was 3.2±0.1 months. These results were similar to those of a study by Zhnong et al in which the mean union time for the PFLCP group was 3.3±0.2 months while that for the DHS group was 4.3±0.1 months.[29] Similarly, in the study by Dhamangaonkar et al the mean bone union time for the PFLCP and DHS groups was 14.6±3.1 weeks and 16.5±3.1 weeks, respectively.[10] The current rule for the intertrochanteric fractures is "No lateral wall, no hip screw".[30] The use of DHS causes an uncontrolled collapse with medialization of the femoral shaft because of the lack of lateral osseous buttress. This results in non-union, varus collapse, and femoral head screw cut out. In contrast, PFLCP provides angular stability for the treatment of femoral fractures. PFLCP is also useful in osteoporotic and unstable fractures of the proximal femur.[14]

The limitations of our study were smaller sample size and shorter period of follow-up.

CONCLUSION

PFLCP fixation offers better functional outcomes in terms of shorter mean bone union time. Further studies with a large number of patients and long term follow up is needed to determine the optimal implant for the internal fixation of intertrochanteric femoral fractures.

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