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Original Article

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Intertrochanteric fracture neck treatment with percutaneous dynamic hip screw fixation technique: understanding outcomes in elderly patients

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ABSTRACT

BACKGROUND & OBJECTIVE: Femur fractures result in a high rate of mortality and morbidity. Objective was to compare effectiveness of percutaneous dynamic hip screw fixation technique (PC-DHS) and conventional open dynamic hip screw (DHS) in terms of mean operative time, wound size, pain scores, intraoperative blood loss, screening time, hospital stay at 2 weeks, mean full weight bearing mobilization at 6 weeks, mean hip Harris scores at 6 weeks and 3 months and mean radiological healing at 3 months in older patients having an intertrochanteric fracture of femur neck at tertiary care hospital.
METHODOLOGY: The study design was a prospective observation study at the Department of Orthopedics, POF hospital. The study duration was 2 years (2018-2020). The sample size was 130 with 1:1 randomization in each group. Patients were selected through nonprobability sampling (lottery method) and divided into two groups; Group A underwent PC-DHS and Group B underwent conventional DHS procedure. Data was analyzed using SPSS version 24.
RESULTS: A total of 130 patients were studied. Patients who underwent PC-DHS showed significantly low operative time ($p<0.00$), wound size ($p<0.00$), intraoperative blood loss ($p<0.00$), pain scores ($p<0.00$), hospital stay length ($p<0.00$) at 2 weeks as compared to conventional DHS. PC-DHS patients showed high Hip scores ($p<0.00$) at 3 months and at 6 months ($p<0.00$). The frequency of chronic hip pain, non-union, implant failure, avascular necrosis, chronic osteomyelitis, and deep venous thrombosis was high in conventional open DHS.
CONCLUSION: We found PC-DHS as a more effective and safe technique for intertrochanteric fracture fixation resulting in significant improvement in surgical outcomes at 2 weeks, 6 weeks, 3 months, and 6 months.

KEYWORDS: Dynamic hip screw, External fixator, Harris Hip Score, Hip fractures, Intertrochanteric fracture.

INTRODUCTION

Worldwide, Femur fractures are resulting in a high rate of mortality and morbidity [1]. Extracapsular femur fractures (Proximal) are identified as intertrochanteric fractures[2]. Evidence exists that almost 280,000 fractures occur every year in China, intertrochanteric fractures contribute to half of these fractures. These fractures are going to increase in 2040 to 500,000[3].

Elderly individuals are the most common individuals for Intertrochanteric femur fractures[4]. Major causes of Intertrochanteric femur fracture are low energy mechanism and osteoporosis. In older individuals, the main cause of this femur fracture is a ground-level fall[5]. The diagnostic procedure requires radiography (femur full-length radiograph, anteroposterior pelvis, and hip cross-table lateral view). These fractures are treated with intramedullary nailing, percutaneous compression, arthroplasty, sliding hip screw, and proximal femoral locking plate[6].

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One of the preferred treatments for intertrochanteric fracture of the femur neck is dynamic hip screw (DHS) [7]. Other minimally invasive techniques are percutaneous compression plate (PCP) using intricate and expensive techniques and instrumentation[8]. Intertrochanteric fracture of the femur neck is also treated with percutaneous surgical technique using DHS fixation[9, 10]. We could not find any proper justification for PC-DHS and conventional DHS comparison.

This study is conducted to enhance orthopedic surgeon's knowledge regarding PC-DHS efficacy. Our study hypothesis was based on the fact that PC-DHS is associated with better clinical results as compared to the conventional open DHS fixation process (postoperative pain, length of hospital stays, and mobilization time).

Objective of this research was to compare the effectiveness of the percutaneous dynamic hip screw fixation technique and conventional open dynamic hip screw in terms of mean operative time, wound size, pain scores, intraoperative blood loss, screening time, hospital stay at 2 weeks, mean full weight bearing mobilization at 6 weeks, mean hip Harris scores at 6 weeks and 3 months and mean radiological healing at 3 months in older patients having intertrochanteric fracture of femur neck at tertiary care hospital.

METHODOLOGY

A prospective observational study was conducted at POF Hospital (department of orthopaedics'), Wah Medical College, Wah Cantt. Our study duration was 2 years (2018-2020). Ethical permission was taken from the ethical committee of a respected hospital (ERC#POFH/ERC/9/18). All participating patients signed a written consent form before the study was conducted. All surgeries were conducted by a single surgeon to avoid human error.

We calculated a sample size of 126 patients (rounded off to 130) with mean operative time in minutes ($\mu1$= 65, $\mu2$=49, confidence interval 95%, power of study 84%) with the help of the WHO calculator[11]. After the selection of patients, patients were randomly allocated to two different groups using the lottery method (each group contained 65 patients. Group A was treated with the PC-DHS technique while Group B was treated with the conventional open DHS technique.

All participating patients underwent the same standard protocol of hip fracture management pre-operatively (resulting in optimization of comorbidities) and epidural anesthesia regionally. Image intensifier was used for closed reduction of fracture and we used three holes 135-degree plate of DHS in each group. Postoperatively all patients were treated with cefuroxime (48 hours starting from surgery time). Analgesics and anti-thromboembolic therapy. Discharge criteria were based upon pain-free non-weight-bearing mobilization in the absence of any complication.

Patients were followed after 2 weeks, 6 weeks, 3 months, and 6 months. Effectiveness of the surgical procedure was defined as less intraoperative times, decreased wound size, less intraoperative blood loss (bleeding was measured by the addition of blood collected plastic bags, below operative field, and blood weighted swabs), pain scores and Harris hip scores.

Daily postoperative assessment was done by the same blinded-to-treatment data collector in all patients. VAS, length of hospital stay, time to full weight-bearing mobilization without pain, Harris hip scores, time to radiological healing, and general complications were recorded. The endpoint of the research was fracture healing with full weight-bearing mobilization of participants.

Patients in the Open DHS technique underwent surgery by using a manual internal fixation technique (AO-ASIF group). However, for patients in the PC-DHS group, a guided wire of 0.2 mm was used as a marker (in front of the hip). This wire was screened through an image intensifier to understand probable entry points in the skin.

The wire was entered percutaneously in the center of the femur head and neck (the process is confirmed by radiography under an image intensifier). Guided wire tip was entered into the subchondral bone (5-10mm). A Kirschner wire was driven to the superior neck of the guided wire (2mm antirotating). We made a long and deep muscle incision (extending superiorly and inferiorly) up to 2.5 cm. Over the guided wire, we performed triple reaming followed by tapping. A submuscular tunnel was created using a periosteum elevator at 135 degrees (with a hole side plate).

We measured the hip's screw length by using a depth gauge. Hip screw one size larger than the measured length was placed into the neck. We left an extra length of hip screw outside of the lateral cortex for seating facilitating side plate barrels using a 2.5 cm incision. According to protocol, A TAD of 10mm was maintained. Then a side plate of 2.5 cm was inserted in such a way that it faced the barrel laterally. After the insertion of the plate inside the submuscular tunnel, it is turned superiorly to 180 degrees using curved artery force. The process was done in such a way that now the barrel faces medially.

Now the distal end of the plate is levered (distally) using a periosteal elevator. After that, the barrel was sleeved over a lag screw. This process was done to approximate the plate with the shaft of the femur. Screw compression was done. Plate side holes were filled using three cortical screws. The plate lying parallel to the shaft of the femur was ensured by using the index finger. Closure of the wound was done without any drain and participants were followed after 2 weeks, 6 weeks, 3, and 6 months.

Data analysis was done using SPSS version 23. Descriptive statistics include the calculation of mean and standard deviation, frequency, and percentages. We used an independent t-test for the comparison of outcomes in two groups and results with p-value ≤ 0.05 were considered significant.

Inclusion Criteria were based on both genders, ages greater than 50 years, and patients diagnosed with Intertrochanteric femur neck fractures(Griffin type I and II).
Exclusion criteria were based on reverse obliquity, pathological, irreducible fractures, and subtrochanteric fractures with patients having multiple injuries.

RESULTS

In our research, 130 patients were studied. The mean age of patients was 57±5.1SD years. There were 61 (47%) male and 69(53%) female. In our study, there were 102(79%) patients in age group 51-60 years and 28(21%) in age group >60 years. There were 65(50%) patients in group A (PC-DHS) while 65(50%) patients in group B (Conventional DHS).

Type I Boyd and Griffin fractures were reported in 59(45%) patients and type II were reported in 71(55%) patients. Groups-wise statistics are reported in Table 1. No patient lost follow-up and also there was no technical difficulty in both group procedures.

Table-I:Descriptive statistics with respect to interventional groups.

Descriptive statistics	Group A (PC-DHS) n=65 n%	GroupB(Conventional DHS)n=65 n%
Gender		
Male	31(23.8)	30(23.1)
Female	34(26.2)	35(26.9)
Age		
51-60 years	50(38.5)	52(40)
>60 years	15(11.5)	13(21.5)
Boyd and Griffin-type fractures		
Type I	28(21.5)	31(23.8)
Type II	37(28.5)	34(26.2)

Table-II:Comparison between groups for outcomes at 2 weeks.

Outcomes	Group A (n=65) (PC-DHS)	Group B (n=65) (Conventional open DHS)	P-value
Operative duration (min)	27.7±5.4SD	44.8±3.5SD	<0.00
Wound size (cm)	2.34±0.23SD	2.94±0.15SD	<0.00
Hospital stays (days)	2.26±0.81SD	4.50±0.50SD	<0.00
Intra-operative blood loss (ml)	90.8±8.5SD	370.7±15.1SD	<0.00
Screening duration(sec)	284.9±2.7SD	284.6±2.7SD	0.544
Visual analog scores of pains	2.7±1.0SD	6.2±0.2SD	<0.00

In our study, operative duration was 27.7±5.4SD minutes in Group A and 44.8±3.5SD minutes in Group B (p<0.00). Wound size was significantly lower in group A (2.34±0.23SD cm) as compared to group B (2.94±0.15 SD cm) p<0.00. Patients in group A had lower hospital stays as compared to patients in group B (2.26±0.81 SD vs 4.50±0.50 SD days, p<0.00).

Intraoperative blood loss (ml) was significantly lower in group A as compared to group B (90.8±8.5 SD vs 370.7±15.1SD, p<0.00). Moreover, we could not find any significant difference in the screening duration of the two groups (284.9±2.7 sec vs 284.6±2.7, p=0.544). We found relatively fewer pain scores reporting in group A (2.7±1.0SD) as compared to group B (6.2±0.2SD), p<0.00 as shown in Table II.

Table III: Comparison between interventional groups for outcomes at 6 weeks, 3 months, and after 6 months.

Outcomes at 6 weeks	Group I (n=65) (PC-DHS)	Group II (n=65) (Conventional open DHS)	P -value
Full weight-bearing time of mobilization (with no pain in weeks)	4.01±0.54SD	4.21±0.62SD	0.054
Outcomes at 3 months			
Harris Hip Scores	77.9±4.5SD	65.4±1.9SD	<0.00
Outcomes at 6 months			
Harris Hip scores	79.4±3.2SD	71.0±2.8SD	<0.00
Radiological healing duration (months)	3.87±0.7SD	6.01±0.7SD	<0.00

Group A patients showed full weight-bearing mobilization with no pain at 4.01±0.54 SD weeks while group B patients showed at 4.21±0.62SD weeks (p=0.054). Harris hip scores were significantly higher in group A as compared to group B at 3 months (77.9±4.5SD vs 65.4±1.9SD, p<0.00) and at 6 months (79.4±3.2SD vs 71.0±2.8SD, P<0.00). Group A showed radiological healing is short duration as compared to group B (3.87±0.7 months vs 6.01±0.7 months, p<0.00) as shown in Table III.

General complications were lower in group I as compared to group II as shown in table 3. Post-operative X-rays of conventional DHS and Percutaneous DHS of the 65-year-old patient were shown in Figures 1 and 2 respectively.

Table IV: Complications following after 1 year of surgery in both groups.

Complications	Group A (PC-DHS)	Group B (Conventional open DHS)
Chronic hip pain	7(5.4)	9(6.9)
Non union	0(0)	1(0.8)
Implant failure	1(0.8)	1(0.8)
Avascular necrosis	0(0)	1(0.8)
Chronic osteomyelitis	2(1.5)	3(2.3)
Deep venous thrombosis	2(1.5)	4(3.1)
No complications	53(40.8)	46(35.4)

Figure 1: conventional Dynamic hip screw technique at 6 months.

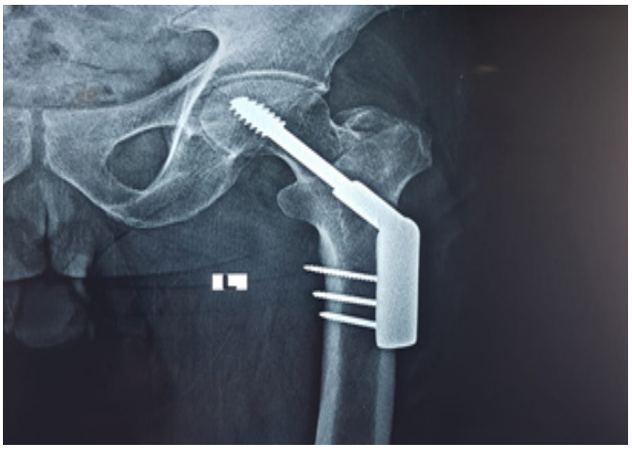
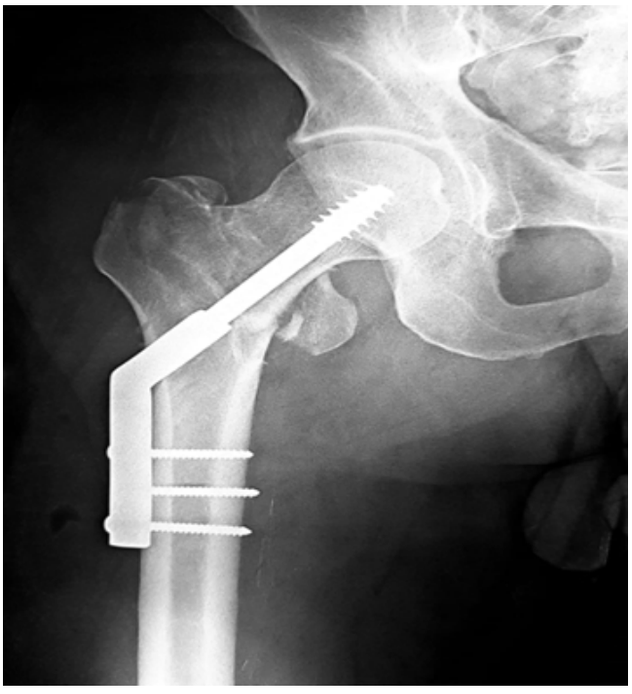


Figure II: Percutaneous Dynamic Hip Screw fixation technique at 6 months.



DISCUSSION

Previously Conventional DHS was considered as gold standard [12]. However, currently, the new process of intertrochanteric femur neck fracture fixation is now being compared with the gold standard [13]. Current literature reported that hip fracture surgery with a minimally invasive technique is safe and leads to better post-operative outcomes including decreased bleeding and postoperative pain [14].

In the present study, we found that the PC-DHS technique showed better outcomes including operative time, wound size, intra-operative blood loss, pain scores, and hospital stay as compared to conventional DHS. However, several reports confirmed that advances in percutaneous techniques had improved orthopedics surgery outcomes including improvement in cosmesis, hospital stay reduction, and decrease in wound healing problems[15,16]. A similar study reported that operating time was higher in the learning period of PC-DHS, however, after that, it was shorter than conventional DHS[17].

Another study reported that PC-DHS is more beneficial for patients who underwent intertrochanteric fracture fixation of the hip[18]. Our study results were in line with these research articles but our sample was higher than these studies.

In our study, PC-DHS was an appropriate and more effective technique in terms of high Hip Hariss scores, decreased time of radiological healing, and full weight-bearing mobilization with no pain in short duration. Evidence exists that PC-DHS is a minimally invasive technique for per trochanteric hip fracture fixation. It consists of two narrow hip screws (sliding) and a plate. It significantly increases radiological healing in short duration and lower intraoperative blood loss as compared to the proximal femoral locking plate procedure [19].

Moreover, PC-DHS is reported as a promising result generator with effective economic consideration and perceived better outcomes. Some studies preferred the use of the PC-DHS technique due to operating team familiarity with similar instruments. This simple technique is effective in decreasing patients' morbidity in cost cost-effective manner [20 ,21]. The frequency of complications was high in conventional open DHS as compared to PC-DHS, however, another similar study reported that chronic hip pain is very common in Conventional DHS [22]. Evidence exists that the incidence of chronic osteomyelitis is higher in conventional DHS procedures [23].

LIMITATIONS: We need to conduct a randomized controlled trial on this subject with details cost analysis that could not be studied in our research. The generalizability of the study is limited because the research was conducted at a single center.

CONCLUSION

We found PC-DHS a more effective and safe technique for intertrochanteric fracture fixation resulting in a significant reduction in operating time, blood loss, pain scores, and hospital stay at 6 weeks. Full weight bearing with mobilization at 6 weeks and significantly high Hips Hariss scores and short duration of radiological healing as compared to conventional DHS at 3 and 6 months follow up.

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Muhammad Ikram: Substantial contributions to the conception and design of the work.
Nadia Gul : Drafting the work..
Sajid Ejaz Rao: Interpretation of data for the work
Sadia Ijaz: Acquisition, analysis and interpretation of data for the work.
Munawer Latif Memon: Reviewing it critically for important intellectual content
Sohail Muzammil: Final approval of the version to be published.