A COMPARITIVE STUDY OF CLINICO-RADIOLOGICAL OUTCOME: DHS VERSES PFLCP IN INTERTROCHANTRIC FRACTURES OF FEMUR

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ABSTRACT:

INTRODUCTION: There have been many case series advocating the potential benefits of PFLCP for fixation of intertrochanteric fractures. But these studies are lacking in terms of guidelines regarding the type of fractures in which PFLCP has an upper hand over the gold standard implant that is the DHS. Moreover there have been very few control studies comparing these two implants. Therefore, we performed a case control study to assess: (1) If PFLCP offers better functional results and fewer complications than dynamic hip screws (DHS)? (2) Which kind of extracapsular femoral fractures would benefit from PFLCP fixation?

PATIENTS AND METHODS: A total of 60 patients with intertrochanteric femoral fractures were recruited. Thirty patients underwent PFLCP fixation, and thirty patients underwent DHS fixation. Patient information, type of fracture, functional level (as assessed by Harris hip score), bone union, and implant complications were compared for the two treatment groups.

RESULTS: The Mean duration for union in PFLCP group was 17 Weeks (12-24 weeks). The Mean duration for union in DHS group was 16 Weeks (12-28 weeks). Although there were better functional results (Harris Hip Score) in PFLCP group when compared to DHS group the difference was not statistically significant (P value= 0.06) in our study. The complications like fracture of the lateral cortex, shortening >2cm, rotational deformity, varus mal-union screw cut off phenomenon, plate lift off were more in DHS group when compared to PFLCP.

CONCLUSION: We conclude that there was no major difference between DHS and PFLCP for stable intertrochanteric fractures and PFLCP is a better alternative in fixing osteoporotic and unstable intertrochanteric fractures. Further large case control studies are needed in this regard.

KEYWORDS: Intertrochanteric Fracture, PFLCP, DHS Outcome.

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INTRODUCTION: Intertro chanteric fractures make up 45% of all hip fractures[1] and are the major cause of death and disability in elderly.[2] The reported mortality rate of intertrochanteric femoral fractures ranges from 4.5% to 22%.[3] Early operative treatment for intertrochanteric fractures is a widely accepted approach. The aim of the surgery is to achieve initial stability and early mobilisation of the patients to avoid complications, such as thrombophlebitis, pulmonary embolism, urinary, lung infection and ulcers.[4-5]

Dynamic hip screws (DHS) have been considered as the standard fixation for extracapsular femoral fracture[6] and yielded good results in the patients with stable intertrochanteric fractures.[7] However, its value for comminutted and highly unstable intertrochanteric fractures remains uncertain.

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High failure rate because of excessive impaction have been reported.[8-9]
Medialisation of shaft with varus malunion is a well known complication in these unstable fractures.

Proximal femoral locking compression plate (PFLCP) has been developed recently, which merges locking screw technology with conventional plating techniques. Theoretically, this technique could offer optimum fixation of comminutted and highly unstable fractures that are associated with more shearing and pull-outforces.[10-11] Proximal Femoral Locking Compression Plate (PFLCP) provides three dimensional fixation and angular stable fixation compared with conventional treatment, even in the case of unstable fracture in osteoporotic bone.[12]

Only few studies have compared PFLCP and DHS fixation techniques and one of them showed better bone union with the PFLCP fixation in patients with unstable intertrochanteric fracture.[13] However, whether PFLCP is better than other fixation methods remains obscure.

MATERIALS AND METHODS: 60 patients with intertrochanteric patients were included in this study and alternate cases were fixed using DHS and PFLCP. Inclusion criteria were age ≥18 years, patients with isolated trochanteric fractures. Exclusion criteria included

intracapsular femoral neck fracture; open fracture; pathological fractures due to malignancy, infection, inherited bone disorders, or a bone cyst; previous femoral fracture; and medical contraindications to surgery.

Surgical Procedure: Under suitable anaesthesia, fracture reduction and fixation were carried out in the supine position with traction table. Open reduction was carried out in fractures which were highly communitted and in cases where closed reduction was not satisfactory. The fracture was either fixed with a DHS or a PFLCP. For fixation with a PFLCP, a longitudinal incision along the great trochanter was taken and iliotibial band was incised. The plate was slid distally in the submuscular plane using a distal counter incision (about 4.0 cm) at the level of the tip of the plate. Three locking neck screws were inserted at 95^0, 120^0 and 135^0 following a guide wire. The two proximal screw holes are designed for 7.3 mm cannulated locking screws and the third locking hole is designed for 5.0 mm cannulated locking screws. Locking screws were then inserted into the shaft through the combi holes in the plate. The combi holes provide the surgeon with the flexibility to achieve plate-to-bone apposition as well as axial compression. (Figures 1, 2 and 3). The wound was then closed in layers over a negative suction drain. DHS fixation was performed using conventional techniques that have been previously described.[14]

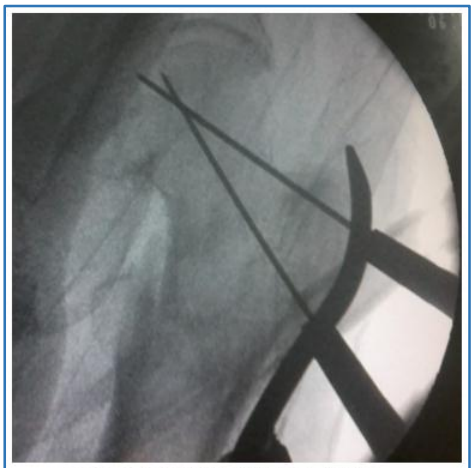

Fig. 1: PFLCP TECHNIQUE

Fig. 2: PFLCP TECHNIQUE

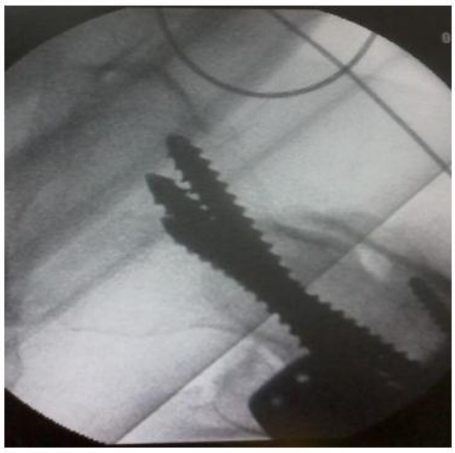

Fig. 3: PFLCP TECHNIQUE

Antibiotics were given for 24hr post-operatively and analgesics were given as required. Patients were allowed to perform quadriceps-strengthening exercises the next day. Partial weight-bearing was allowed. Sutures were removed on post op day 14. Full weight-bearing was allowed 6 weeks after surgery in cases of stable intertrochanteric fractures, and was delayed till patients had no pain and bone union was confirmed by X-ray in cases of unstable intertrochanteric fractures. Patients were seen postoperatively at 6 weeks, 3 months, 6 months, and 12 months. Anteroposterior (AP) and lateral radiographs were performed at each follow-up visit. During each follow up, assessment was made of hip and knee function and limb shortening. Radiological evidence of callus with no tenderness was regarded as bone union. The time to union, medialisation of the shaft, neck-shaft angle, limb shortening, varus collapse, and functional outcome using Harris hip score (HHS) were assessed. HHS is based on a total of 100 points in different categories like pain, function, functional activities and range of movements. The score is reported as 90-100 for excellent results, 80-90 being good, 70-79 fair, 60-69 poor, and below 60, a failed result.

Data Collection: The following data were collected: patient's demographic information, medical history, causes and classification of each fracture, fracture union, the time to union, osteosynthesis complications, wound infection, deep vein thrombosis, pulmonary embolism and cardiovascular events. Bone union was defined if AP and lateral X-ray showed bone formation across fracture site within 6 month after fixation. Delayed union was defined if bone union occurred 6 to 9 months after fixation. Non union was defined if patients had consistent pain and bone union failed to occur even after >9 months after fixation.

RESULTS: The study was limited to age group between 40-75 years. Mean age for PFLCP group was 56.7 years and mean age for DHS group was 57.3 years. No significant differences were identified between groups with respect to age, gender, co-morbidities, fracture classification, or preoperative medical treatment.

The clinical and radiologic outcomes were compared between PFLCP and DHS fixation in patients with stable and unstable intertrochantric fractures. Fall was the major cause of fracture in both the groups. The average follow up in the PFLCP group was 12.9 months (8-18months). The average follow up in the DHS group was 14.6 months (6-19 months). The Mean duration for union in PFLCP group was 17 Weeks (12-24 weeks) (Fig. 4, 5 and 6).

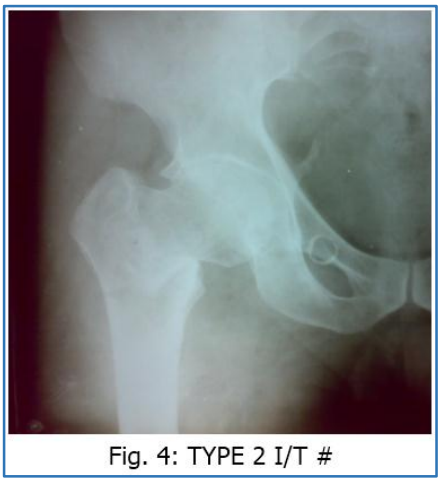

Fig. 4: TYPE 2 I/T #

Fig. 5: 6 WEEKS FOLLOW UP WITH PFLCP

Fig. 6: 1 YEAR FOLLOW UP WITH PFLCP

The Mean duration for union in DHS group was 16 Weeks (12-28 weeks). (TABLE 1).

	Type of fracture (Boyd and Griffin)	No. of cases	Average time of union in weeks	Varus collapse	Shortening (>2cm)
DHS	I	10	14	1	0
	II	8	15.4	1	0
	III	8	16	2	2
	IV	4	18.6	3	2
PFLCP	I	10	14	0	0
	II	8	16.5	1	0
	III	8	18	1	0
	IV	4	19.5	1	0

Table 1: Radiological outcome According to Type of Fracture and Implant

There were 15 excellent, 9 Good and 6 Fair results in PFLCP group with no poor results. In DHS group there were 13 excellent, 8 Good, 4 Fair and 5 poor results. Although there were better functional results (Harris Hip Score) in PFLCP group when compared to DHS group the difference was not statistically significant (P value= 0.06). (TABLE 2)

Functional Outcome (Harris Hip Score)	PFLCP	DHS
Excellent	15	13
Good	9	8
Fair	6	4
Poor	0	5

Table 2: Functional Outcome

COMPLICATIONS: In PFLCP group, in 5 of 30 cases, there was failure to put all three locking screw in neck and head, the third screw could not be accommodated in the neck after putting 2 neck screws (Fig. 7). There were no instances of drill bit breakage or guide wire breakage. There were 3(10%) cases with varus malunion with shortening of less than 2cm, 2(6.66%) cases with delayed union and no cases with non union. In 2(6.66%) cases there was implant failure. The mode of failure was screw breakage. (TABLE 3) (Fig. 8).

Complications		
	PFLCP	DHS
Implant Failure	2(6.6%)	4(13.3%)
Limb shortening	3(10%)	7(23%)
Deep infection	0	1(3.3%)

Table 3: Complications

Fig. 8: Breakage of Neck Screw with Varus Malunion

In the DHS group shortening of more than 2cm was noted in 4 out of 30 cases (13.33%). There was 1(3.33%) case with rotational deformity, deep infection was seen in 1(3.33%) case (Fig 9) and bed sore in 1(3.33%) case.

Fig. 9: DHS Screw Cut Out With Infection

There were 7(23%) cases with varus malunion and 5(16.66%) cases with delayed union. No cases with non union. In 4(13.33%) cases there was implant failure. The mode of failure was superior screw cut out in 3(10%) cases (Fig. 10) and plate lift off in 1 case(3%) (Fig. 11).

Fig. 10: DHS Screw Cut Out

Fig. 11: DHS Plate Lift Off

DISCUSSION: The treatment of intertrochanteric fracture is still associated with some failures. The reasons are attributed to biomechanics, overestimation of potentials of new surgical techniques and new implants, or poor adherence to established procedures. Fractures through intertrochanteric line of upper end of femur and peritrochanteric fractures unite readily no matter what treatment is used because the broad fractured surface are richly supplied with blood and there is seldom wide spread displacement. But these fractures have a tendency to unite in malposition of varus and shortening of limb unless necessary intervention is done, hence affecting the function. Thus, it is important to achieve near-anatomic reduction and maintain it till union, but this is not feasible when a DHS is used, as intra-and post-operative collapse may occur and lead to shortening or medialisation of the shaft, especially in unstable intertrochanteric fractures, including fractures with a large posteromedial void, reverse oblique fractures with subtrochanteric extension,[15] and fractures with loss of lateral buttress (greater trochanter) (Fig. 12).

Fig. 12: Lateral Cortex Fracture With Excessive Collapse and Medialisation Of Shaft

Osteoporotic hips are at high risk of instability and comminution.[16] Prolonged immobilisation in unstable fractures after surgery to prevent shortening and varus collapse on weight bearing, is complicated by problems like hypostatic pneumonia, decubitis ulcers especially in these elderly population. The successful restoration of stability and early mobilisation reduce the morbidity/mortality rates associated with prolonged immobilisation.

Fixation using a DHS may lead to implant failure secondary to unimpeded co-axial collapse of the proximal fragment with medialisation of the shaft. The use of a locking plate prevents the collapse. The screw may back out of the DHS side plate, owing to increased stresses at the screw plate junction. This problem can be tackled using a non-collapsing implant with a locking neck and shaft screws.

The greater trochanter is the only structure resisting proximal fragment lateralisation when a collapsing extramedullary implant like a DHS is used. Using such a device in a fracture without an intact greater trochanter i.e the lateral buttress inevitably leads to medialisation of the shaft, and hence deformity, malunion, and screw cut-out. In such fractures, a locking compression plate which can act as a trochanteric buttress or an intramedullary implant may be useful, and the DHS is not recommended.[17] Moreover fracture of the greater trochanter is one of the known complications during insertion of lag screw of DHS. In our study, no patient in the locking plate group showed medialisation of the shaft with lateralisation of the trochanteric fragment, which was seen in 23% of cases in DHS group which was more in unstable fractures.

Insertion of a single lag screw in DHS requires reaming a lot of cancellous bone from the neck. In one of the study,[13] it was found the volume of bone reamed was 8586 mm^3 for one DHS lag screw (12.5 mm in diameter, 70 mm in length) and 6965 mm^3 for 3 locking screws (each 6.5 mm in diameter, 70 mm in length) placed through the proximal femoral locking plate. More bone is preserved in fixation using a locking plate which is recommended in case of osteoporotic fractures which constitute majority of these fractures.

The proximal femoral locking plate is fixed with many multi-directional smaller diameter screws to hold the head at 95^0, 120^0, 135^o directions and to preserve more cancellous bone. The two fully threaded 6.5 mm cancellous screws provide a medial buttress. The neck screws add to the stability of fixation by preventing collapse of the head and neck. The trochanteric flange prevents excessive lateralisation of the proximal fragment.

The use of the locking plate with non-collapsing screws can prevent varus collapse, but 3 cases (10%) of patients in the locking plate group had varus collapse. This probably was due to inability to insert all 3 neck screws (5 out of 30 cases) or because of a large posteromedial void or gross osteoporosis of proximal femur. In DHS group 7 cases (23%) had varus collapse.

The complications like fracture of the lateral cortex (10% in DHS), shortening>2cm (13% in DHS), rotational deformity (3% in DHS), varus maluninon (23% in DHS vs 10% in PFLCP) screw cut off phenomenon (10% in DHS), plate lift off (3% in DHS) were more in DHS group when compared to PFLCP. But in our study it is not statistically significant because of small study sample.

The functional outcome with PFLCP was better than DHS at 6wks, 3months, 6months and 12 months though it was not statistically significant in our study.

CONCLUSION: The PFLCP can be a feasible alternative for fixation of intertrochanteric fractures by providing angular stability and preventing collapse at fracture site thereby preventing varus collapse. We conclude that there was no major difference between DHS and PFLCP for stable intertrochanteric fractures and PFLCP is a better alternative in fixing osteoporotic and unstable intertrochanteric fractures. Further studies on osteoporotic patients with bone mineral density analysis are needed.

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