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# A comparative study between dynamic hip screw and proximal femoral locking plate in the management of unstable pertrochanteric fracture femur

**Atul N. Parshuramkar*, Pramod A. Jain, Kisan R. Patond, Aditya S. Jagdale**

Department of Orthopaedics, Mahatma Gandhi institute of medical science, Sevagram, Wardha, Maharashtra, India

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***Correspondence:**
Dr. Atul N. Parshuramkar,
E-mail: aparshuramkar@mgims.ac.in



## ABSTRACT

**Background:** Pertrochanteric fracture represent perhaps the most important public health problem facing the orthopedic surgeon today. The purpose of the present study is to compare dynamic hip screw with proximal femoral locking plate (PFLP) in pertrochanteric fracture femur.
**Method:** During the period from December 2019 to August 2021, 50 patients with pertrochanteric fracture femur who were admitted in the orthopaedics department were selected. The 25 patients treated with PFLP and 25 patients treated with dynamic hip screw according to the standardized protocol. Patients were followed up for the 1 year.
**Results**: The mean operative time and average intraoperative blood loss was more in PFLP group when compared with DHS group it was statically significant. PFLP group has marginally better functional than DHS group. There was no difference in the radiological outcome between two group.
**Conclusions:** PFLP can be feasible alternative to treatment of complex comminuted pertrochanteric fractures. It can be use in old age patients with osteoporotic bone which provide stable fixation.

**Keywords**: Complications, Dynamic hip screw, Elderly patients, Harris hip score, Kickstand screw, PFLP

## INTRODUCTION

Pertrochanteric fractures defined as fractures that extend from extracapsular basilar neck region to region along the lesser trochanter before the development of the medullary canal. Hip fractures form a large chunk of orthopedic injuries. Age at which they occur vary lot right from young people with high energy trauma having pertrochanteric fractures which are complex and comminuted due to velocity of injury to geriatric population suffering from complex comminution pertrochanteric fractures due to osteoporosis.[1] These fractures accounts for nearly 50% of fractures around hip. They continue to be a major cause of disability leading to reduced quality of life and death, 90% of pertrochanteric fractures of femur in elderly occurs commonly through osteoporotic bone due to simple fall.

In India rise in the cases of pertrochanteric fracture femur is because of increase in the number of senior citizens and this incidence is expected to double by 2040. These fractures are associated with substantial morbidity and mortality; 30% of elderly patient die within 1 year of fracture. After 1 year, patients seem to resume their age adjusted mortality rate.[2]

The present choice of treatment of pertrochanteric fractures is open reduction and internal fixation. Many internal fixation devices have been used in treatment of these fractures. Because of high incidence of complications reported after surgical treatment with each type of implant and lack of availability of one suitable implant, surgical treatment of pertrochanteric fractures has leads to evolution in design in search of a perfect implant.[3]

Type of implants used has important influence on complications of fixation. Sliding devices like the dynamic hip screw have been extensively used for these fracture fixations. However, if patients bear weight early, especially in comminuted fractures, these devices can penetrate the head/ neck, bend, break/ separate from the shaft.

One of the implants recently introduced for management of pertrochanteric fracture is PFLP. Locking plate have gained popularity due to superior biomechanical stability and better hold and grip in osteoporotic fractures. Due to plate and screw head threading interlock design, it constitutes more rigidity and stability to fixation.

Locking plates are nowadays widely used in many metadiaphyseal comminuted region, with common use being around the knee.[4]

PFLP have being used for fixation of fractures of the proximal femur. It has pre-contoured shape, providing three-dimensional fixation mechanical advantage and multi-angular stability with locking screws in the femoral head and simultaneously preserving bone stock especially in osteoporotic bone.[5]

The aim of our study is to compare the results of fixation of pertrochanteric fractures using PFLP with dynamic hip screw.

## METHODS

The present study was prospective follow up study. The present study consisted of 50 adult patients of pertrochanteric fractures of femur. The 25 patients treated with PFLP and 25 patients treated with dynamic hip screw. The study was carried out in the department of orthopedics at Mahatma Gandhi institute of medical science and Kasturba hospital, Sevagram (Wardha) from December 2019 to August 2021.

### *Inclusion criteria*

Patients with age >18 years, radiologically confirmed closed fracture pertrochanteric femur classified according to Evan’s classification were included in study.

### *Exclusion criteria*

Patients with age < 18 years, open fractures, neurovascular injury, medically unfit for surgery, fracture associated with ipsilateral lower limb were excluded from the study.

Patients with above diagnosis who were fit for surgery, patients who were willing to sign a written informed consent to undergo the operative procedure.

Data analysis (statistical tool)-observed data was evaluated using EPI info 7 software.

### *Ethics consideration*

An ethical clearance was taken from the institutional ethics committee prior to initiation of study. An informed consent was taken from the patients regarding their willingness for participation in study.

All patients included in the study were managed by the following protocol.

Careful history was elicited from the patient to reveal the mode of injury and severity of trauma. All patients were thoroughly examined and carefully examined for deformity and swelling. All Patients were evaluated for neurovascular deficit. Relevant clinical findings, open injuries and other skeletal injuries were duly recorded in patients proforma. Patients were given appropriate analgesic, calcium, vitamin d3 and skin traction. Hip radiograph including Pelvis with both hips, anteroposterior and lateral view of affected hip was taken by carefully positioning the patient.

### *Operative details*

PFLP (Figure 1 and 2) after administering spinal / epidural anesthesia patient was placed on fracture traction table. Reduction of fracture was done and reduction checked with C-Arm in both AP and Lateral views. Mid lateral skin incision extending proximally from just above tip of trochanter to the level depending upon the size of the implant and fracture extension was made. Open reduction if required was obtained by open manipulation. The PFLP placed over lateral surface and checked with C Arm. The proximal holes are drilled with 5 mm cannulated drill bit. Appropriate size of 6 mm cannulated locking or cortical screws inserted after measurement. Minimum 4 screws either locking/ cortical inserted into proximal holes. Calcar screw was also inserted with same size of drill bit and screws. After confirming the proximal screws in neck and head of femur, distal screws also inserted. Distally either cortical screws of 4.5 mm inserted by using cortical drill bit of size 3.5 mm or locking screws of size 5 mm inserted by using solid locking drill bit of size 4 mm. Position of plate and screws confirmed under C arm guidance.

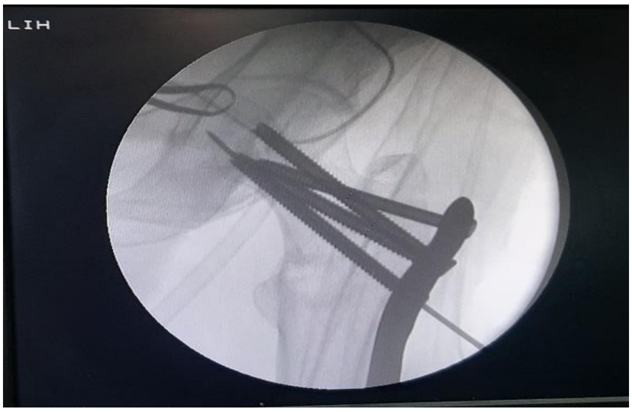


**Figure 1: AP view.**

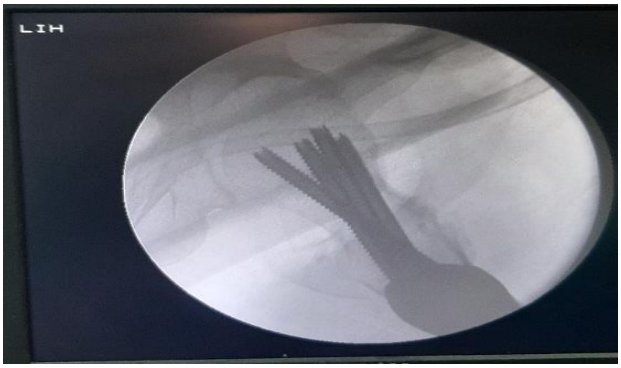

**Figure 2: Lateral view.**

***Dynamic hip screw (Figure 3 and 4)***

After administering spinal / epidural anesthesia patient was placed on fracture traction table. Reduction of fracture was done and reduction checked with C-Arm in both AP and lateral views. Mid lateral skin incision extending proximally from the greater trochanter to the level depending upon the size of the implant and fracture extension was made. Open reduction if required was obtained by open manipulation. Using the angle guide, a point of entry at the trochanteric flare is chosen under radiographic control. A 2.5 mm tipped threaded guide wire is inserted into the centre of the neck and head of the femur midway between anterior and posterior cortices to within 10 mm from the joint under image intensifier control. Length of wire outside is measured using an external measuring device to determine length of screw required.

The triple reamer is set to the length already measured and reaming is done over the guide wire under radiographic control. A tap is used to prepare the bone after which the lag screw of appropriate length is inserted. The position of the lag screw is again checked on image intensifier. The barrel is the slipped over the lag screw. The guide wire is removed and plate is fixed to the shaft of femur with screws. Traction is the released and the fracture is compressed with the 19 mm compression screw. A suction drain is inserted and wound is closed in layers.

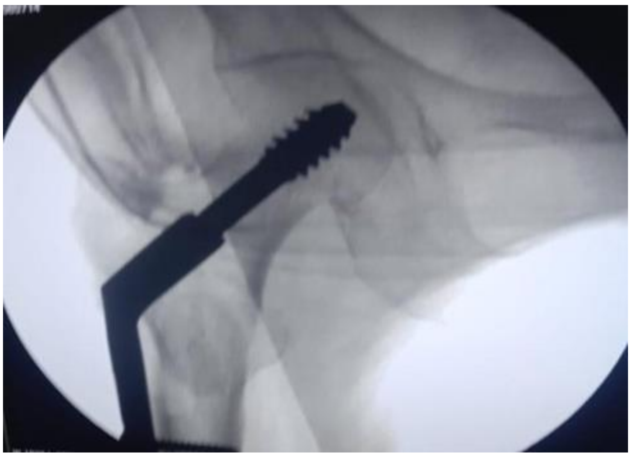

**Figure 3: AP view.**

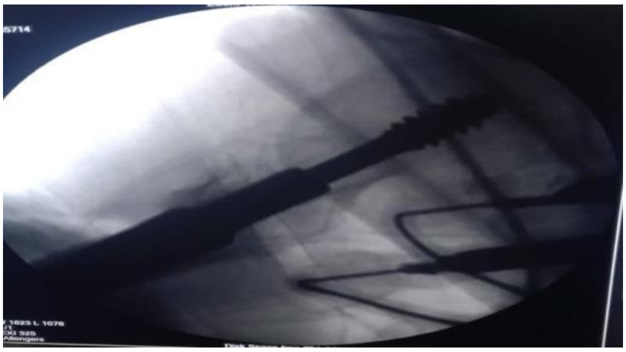

**Figure 4: Lateral view.**

***Post-operative***

The limb was elevated on pillow. Static quadriceps exercises started on the same day of surgery. Check dressing done on 2$^{nd}$ post-operative day. Suction drainage removed after 48 hours. Active quadriceps and hip flexion exercise started on 6$^{th}$ and 7$^{th}$ post-operative day. Sutures removed on 14$^{th}$ day after surgery. Partial weight bearing and walking started at about 6 weeks post operatively or depending on radiological union. Full weight bearing walking allowed after assessing for clinical and radiological union.

Follow up was done at 6 weeks, 3 months and 6 months or till radiological union of fracture. Functional outcome was assessed according to Harris hip score wherein patient was given a score out of 100.[6]

## RESULTS

Present study conducted from December 2019 to August 2021. In this study total of 50 cases of pertrochanteric fractures treated by using proximal femoral locking compression plate and dynamic hip screw were evaluated.

**Table 1: Epidemiological comparison.**

| Parameters | DHS | PFLP |
|---|---|---|
| **Female: Male** | 14:11 (1.3:1) | 10:15 (1:1.5) |
| **Mean age (Years)** | 62.6 | 62.79 |
| **Mechanism (p=0.26)** | | |
| RTA | 6 (24%) | 3 (12%) |
| Domestic fall | 19 (76%) | 22 (88%) |
| **Evans classification, (p=0.3)** | | |
| Type IV | 18 (72%) | 21 (84%) |
| Type V | 7 (28%) | 4 (16%) |
| Left: Right | 12:13 | 13:12 |
| Length of incision | 12 CM | 16 CM |
| Duration of surgery (Mean) | 60 minutes | 80 minutes |
| Blood loss (Mean) | 280 ml | 360 ml |

P value by chi square test found to be not significant.

In our study compared epidemiological statistics between DHS and PFLP (Table 1). In DHS 14 female and 11 males, while in PFLP 10 female and 15 male were present. Mean age of patient was 62.6 years in DHS and 62.79 was in PFLP. 18 Patients with fracture type IV and 7 patients with type V were present in DHS, while in PFLP 21 patients with type IV and 4 patients with type V present. PFLP has longer incision (16 cm) than DHS (12 cm). Mean duration of surgery for DHS (60 minutes) is shorter than PFLP (80 minutes). PFLP has more intra-op blood loss than DHS.

**Table 2: Harris hip score comparison.**

| Grades | DHS, n (%) | PFLP, n (%) |
| --- | --- | --- |
| **Excellent** | 4 (16) | 5 (20) |
| **Good** | 9 (36) | 10 (40) |
| **Fair** | 8 (32) | 9 (36) |
| **Poor** | 4 (16) | 1 (4) |

P value=0.5(by chi square test) not significant.

Harris score of postoperative patients were compared between DHS and PFLP (Table 2). DHS has 4 patient with excellent score, 9 with good, 8 with fair and 4 with poor Harris hip score in follow up. While PFLP has 5 patients with excellent, 10 with good, 9 with fair and 1 with poor Harris hip score in follow up.

**Table 3: Postoperative complication comparison.**

| Complication | DHS, n (%) | PFLP, n (%) |
| --- | --- | --- |
| **Implant failure (Non-union/ malunion)** | 5 (20) | 1 (4) |
| **Screw back out** | 1 (4) | 1 (4) |
| **Varus collapse** | 0 | 2 (8) |
| **Wound infection** | 2 (8) | 0 |

Postoperative complications were compared between DHS and PFLP (Table 3). In DHS, 5 patients had implant failure, 1 had screw back out with 2 patients with wound infection. While, In PFLP 1 patients had implant failure, 1 with screw back out and 2 with varus collapse in follow up.

***PFLP***

Figure 5 shows preoperative x ray of patient operated with PFLP. Figure 6 is 6 months postop x-ray of same patient while Figure 7 is cross leg seating of same patient at 1 year.

**Figure 5: Pre-op x-ray.**

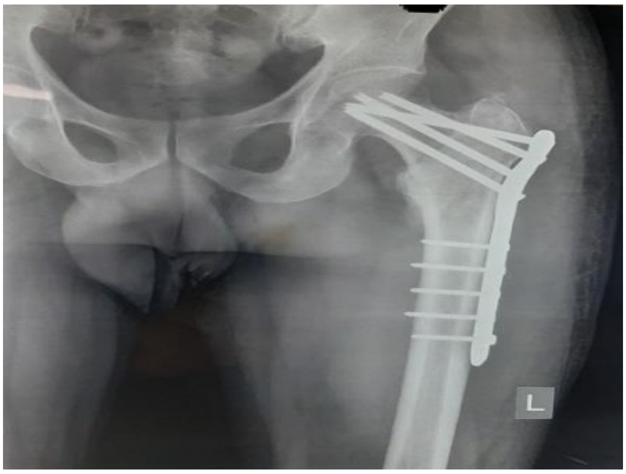


**Figure 6: 1 year follow up.**

**Figure 7: Cross leg seating.**

***DHS***

Figure 8 shows preoperative x ray of patient operated with DHS. Figure 9 is 1-year postop x ray of same patient.


**Figure 8: Pre-op x-ray.**

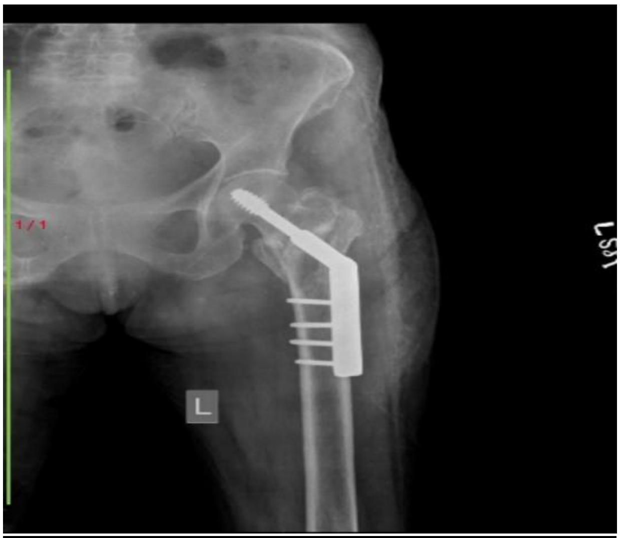


**Figure 9: 1 year follow up.**

## DISCUSSION

Pertrochanteric fractures tend to heal, owing to their vascular, metaphyseal and extrasynovial location. However, they tend to malunite, resulting in shortening, varus, medialisation of the shaft, and external rotation deformity. 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 and fractures with loss of lateral buttress (greater trochanter).[7,8] Osteoporotic hips are at high risk of instability and comminution[9.] Stable intertrochanteric fractures have cortical contact after reduction, without a gap medially, posteriorly, and laterally.[10,11] This contact prevents fracture displacement into varus or retroversion when forces are applied to the proximal femur.[12,13] However, in unstable intertrochanteric fractures with reverse obliquity, medial displacement of the shaft tends to occur secondary to adductor muscle pull.[13] 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 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 is used. Using a DHS in a fracture without a lateral buttress inevitably leads to medialisation of the shaft, and hence deformity, non-union, and screw cutout.[14] In such fractures, a trochanteric buttress plate or an intramedullary implant may be useful, and the DHS system is not recommended.[15] More bone is preserved in fixation using a locking plate. An intramedullary device or a locking plate device with a trochanteric lateral wall buttress can maintain reduction for unstable intertrochanteric fractures until union. This plate is designed to have a lateral trochanteric buttress to prevent lateralisation of the proximal fragment. The PFLP is fixed with many multi-directional smaller diameter screws to hold the head at 95º and 135º directions and to preserve more cancellous bone. The two 135º fully threaded 6.5 mm cancellous screws provide a medial buttress. The trochanteric flange prevents excess lateralisation of the proximal fragment. The two 135º screws and one 95º screw can counter the collapse. All these screws are locking and are inserted through a jig to prevent fracture collapse and medialisation of the shaft by improving the stability of the plate-screw interface. In unstable intertrochanteric fractures with a large posteromedial void treated with a DHS, varus collapse could occur, owing to the implant breaking off at the neck or the DHS lag screw toggling within the head. There was also an increased valgus neck-shaft angle, as the screw moved in the head. All patients in the DHS group were operated on with a short barrel plate, which increased the risk of jamming of the lag screw. In such a situation, a collapsing implant acts as a non-collapsing implant, which further increases the risk of toggling of the screw within the head and can lead to implant cut-out or failure. Reducing the posteromedial fragment should be attempted whenever possible. In our study, no patient in the locking plate group showed medialisation of the shaft with lateralisation of the greater trochanter, which was due to the trochanteric buttress flange. The amount of medialisation of shaft determines the length of the abductor lever arm. The treatment plan for unstable intertrochanteric fractures differs from that for stable fractures. Using an implant with a trochanteric flange decreases lateralisation of the proximal fragment, thereby improving the abductor lever arm. A non-collapsing locking plate helps to maintain reduction until union with less risk of limb shortening or varus collapse. Nonetheless, in osteoporotic unstable intertrochanteric fractures fixed with a locking plate, movement can occur within the head, leading to varus collapse. In osteoporotic patients, the challenge is not only to attain adequate fixation but also to achieve healing with a compromised biology. Some compression at the fracture site can aid bone healing. In some unstable intertrochanteric fractures, there is no lateral buttress against which compression can be achieved when a sliding extramedullary implant is used.

Limitations of our study include limited sample size, no correlation of results to severity of osteoporosis and shorter period of follow up due to coCOVID-19 restrictions.

## CONCLUSION

PFLP can be feasible alternative to treatment of complex comminuted pertrochanteric femur fractures which prevents medialization of shaft. Kickstand screw provided comparatively greater axial stiffness, less torsional stiffness, and equivalent irreversible deformation in cyclic loading when compared with the blade plate.

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*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

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