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Original Research Article

Evaluation of functional outcome of intertrochanteric femur fractures treated with proximal femoral locking compression plate

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ABSTRACT

Background: The objective was to find out the clinical and functional outcome of intertrochanteric femur fractures treated with proximal femoral locking compression plate (PFLCP).
Methods: The study was conducted on patients who underwent fixation of intertrochanteric femur fractures with PFLCP in department of orthopedics, GMCH, Aurangabad from January 2020 to January 2021. The patients were assessed clinically and functionally using Harris hip score and radiological evaluation at three, six and nine months.
Results: At one year follow up, two patients had varus collapse, one had superficial infection and one had screw cut out. The mean Harris hip score at one month was 69.46 (52-76), at three months was 78.6 (58-88) and at nine months was 87.6 (64-96). The average operative time was 86.23 minutes (60-128 minutes), the average blood loss was 207.5 ml (170-250 ml) and the average time required for union was 15.16 weeks (10-24 weeks).
Conclusions: Intertrochanteric fractures treated with PFLCP provided a strong angular stable construct and showed satisfactory outcomes.

Keywords: Intertrochanteric fractures, Proximal femoral locking compression plate, Hip fractures, Osteoporotic bones

INTRODUCTION

The femur is surrounded by plenty of soft tissue envelope and is usually fractured due to high energy trauma in the young and with trivial trauma in the old. Without suitable precautions the fracture undergoes malunion, leading to varus and external rotation deformity at fracture site with shortening and limitation of hip movements.[1] Conservative methods are now indicated only for patients who are medically unfit for surgery and those who refuse surgery. Taking all factors in consideration, surgery by internal fixation is the ideal choice.[2] Factors determining the strength of fracture fixation depends on factors such as bone quality, fragment geometry, reduction and implant type and placement.[3] Complications with dynamic hip screw include uncontrolled collapse and lag screw cut-out (with or without varus collapse), medialization of shaft, uncontrolled lateralization of proximal fragment. The problems associated with cephalo medullary nails include screw cut-out/blade cut-out (including Z effect and reverse Z effect), varus deformity, lateral wall blowout during reaming, difficult insertion in curved femurs, peri-implant fractures and implant breakage.[4-6] Anatomically contoured locking plates (PFLCP) provide an angular stable construct and prevent screw cut-out and varus failure. These plates can also be used in severely osteoporotic bones and grossly comminuted fractures while maintaining the fracture biology.

METHODS

This was a prospective study, done under the guidelines of the ethical committee of the institution. A written, valid, informed consent was taken from all patients participating

in the study. A total of thirty patients with intertrochanteric femur fractures were studied. All the cases were treated between January 2020 to January 2021 in department of orthopedics, GMCH, Aurangabad. All the patients who were brought to casualty and outpatient department with intertrochanteric fractures were selected for the study.

Inclusion criteria

Adults with intertrochanteric fractures, patients willing to give consent to participate in the study, patients with isolated intertrochanteric fractures confirmed on radiographs, patients with fractures less than two weeks old and patients who were medically fit for surgery were included in the study.

Exclusion criteria

Patients with pathological fractures, patients with compound fractures, pediatric age group patients, patients with old neglected fractures, patients medically unfit for surgery and patients not willing for surgical intervention were excluded from the study.

Statistical software

The statistical software SPSS version 24.0 was used for the analysis of data. Microsoft word and excel were used for generation of tables, graphs. The data was represented as percentages and mean with standard deviation.

Implant details

PFLCP

Figure 1: Proximal femoral locking compression plate of 6 holes length with (1) 95 degree 7.3 mm locking screw; (2) 95 degree 3.5 mm locking screw; (3) 120 degree 7.3 mm locking screw; (4) 133 degree 7.3 mm locking screw; (5) 4.5 mm locking screw hole.

The PFLCP was anatomically contoured which helped it to best fit the natural shape of proximal femur. The PFLCP was available in various sizes according to the need. The first proximal hole was a 95 degree hole, the second was a 120 degree hole and the third proximal hole was a 133 degree hole. There was an intermediate hole between the first and the second hole of 95 degree but of reduced diameter. The plate length was estimated from the pre-operative radiographs of the injured as well as normal limb to estimate the length and varus,valgus angulation.

Operative protocol

All patients were given one dose of injectable third generation 30 minutes before surgery.

Anesthesia

The procedure was carried out under spinal or epidural anesthesia (with occasional general anesthesia as per indication).

Position

Patients were positioned supine on fracture table and were appropriately painted and draped. Reduction was achieved, maintained and confirmed under image intensifier paying special attention to medial and posterior cortex.

Surgical procedure

A 15 cm vertical incision was taken from tip of trochanter along the shaft of femur. Fascia lata was split in line with the incision and gluteus medius along with vastus lateralis were opened in line with the fibers. The fixed-angle guidewires were threaded to the proximal three holes of the plate and the plate was approximated to the proximal femur. First guidewire was inserted through the most proximal 95 degree hole, second through the 120 degree hole and third through the 133 degree hole making sure that the guidewires were in the center of the femoral head in anteroposterior and lateral views under the image intensifier. The screw lengths were measured using an indirect device over the guidewires and appropriate sized fully threaded screws (7.3 mm for proximal three screws and 3.5 mm for a small hole between second and third screws) were inserted. Distal screw fixation was then done. After completion of procedure, a thorough was given with normal saline and antiseptic solution. Wound was closed in layers over a suction drain and an adequate sterile dressing was done.

Postoperative care

The patients were shifted to the postoperative wards after recovery from anesthesia. The patients were administered adequate analgesia and intravenous antibiotics for 5 days and were shifted to oral antibiotics henceforth. Prophylactically, in all patients, subcutaneous low molecular weight heparin (LMWH) was given for three consecutive days.

Passive and assisted active hip, knee and ankle mobilization was started on third postoperative day except for those having severe comminution and/or osteoporosis.

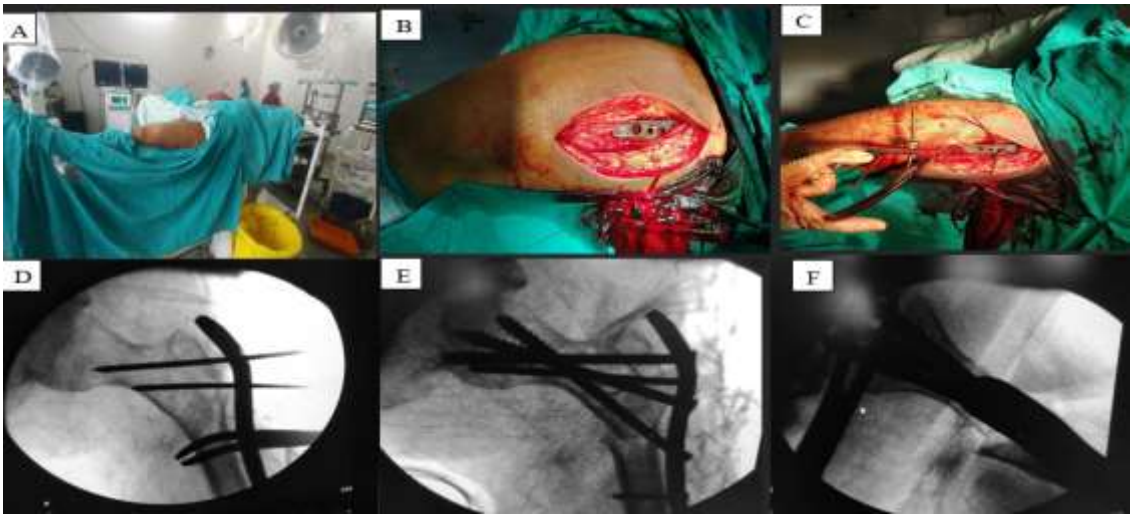

Figure 2: (A) Patient position on fracture table; (B) exposure and plate placement; (C) fracture temporary fixation with k-wires (surgical image); (D) image intensifier image of temporary fixation; (E) image intensifier-anteroposterior view; (F) image intensifier lateral views.

Figure 3: Case 1; X-rays; preoperative and immediate postoperative radiographs; (A) preoperative anteroposterior view; (B) pre-operative lateral view; (C) postoperative anteroposterior view; (D) postoperative lateral view.

Figure 4: Case 2 X-rays; preoperative and immediate postoperative radiographs; (A) preoperative anteroposterior view; (B) preoperative lateral view; (C) postoperative anteroposterior view; (D) postoperative lateral view.

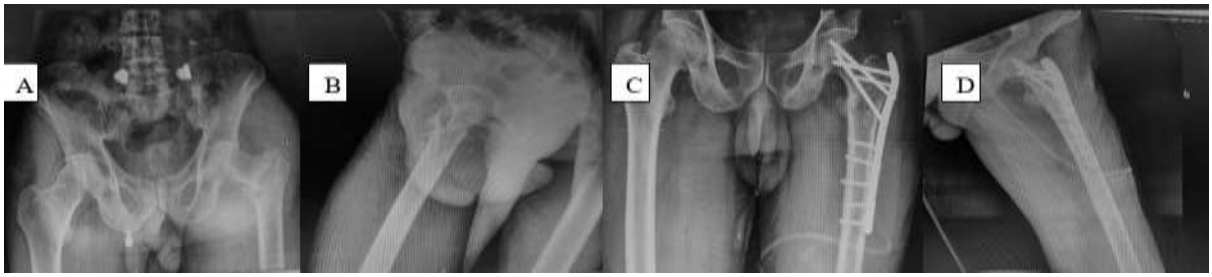

Figure 5: Case 3 X-rays; preoperative and immediate postoperative radiographs; (A) preoperative anteroposterior view; (B) preoperative lateral view; (C) postoperative anteroposterior view; (D) postoperative lateral view.

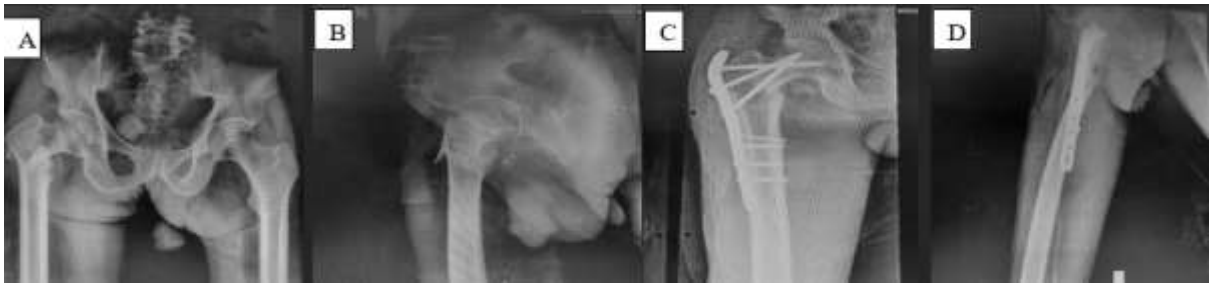

Figure 6: Case 4 X-rays; preoperative and immediate postoperative radiographs; (A) preoperative anteroposterior view; (B) preoperative lateral view; (C) postoperative anteroposterior view; (D) postoperative lateral view.

Figure 7: Case 5; X-ray at 4 months follow up shows union with good callus formation.

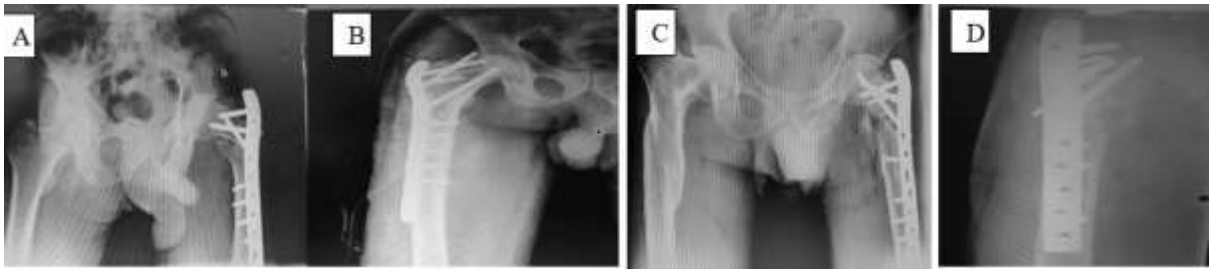

Figure 8: Complications; (A) varus collapse; (B) screw cut out; (C) non-union; (D) varus collapse.

Static and dynamic quadriceps strengthening exercises were started.

Drain was removed after 48 hours. Alternate followed by complete suture removal was done on day 14.

Follow up

The patients were followed up according to the protocol and relevant data was collected at six weeks, three months, six months and nine months after operation with clinical and radiographic assessment for the progress of fracture healing and other complications. The functional outcome was assessed by Harris hip score.[7]

RESULTS

Gender

There was a male preponderance in the study. Male were 80% while females were 20% of the study population.

Age

Mean age in years was 59.04 years. There was a bimodal age distribution among young adults and older age group. Most of the cases belonged to the age group of more than 70 years.

Side

Right side was more commonly affected than left side.

Table 1: Results.

Parameters	Range	Mean±SD
Age (in years)	32-95	59.04±18.45
Duration of surgery (in minutes)	60-128	86.23±19.52
Blood loss (in ml)	170-250	207.5±26.51
Hospital stay (in days)	8-14	10.53±2.04
Harris hip score (in months)		
1	52-76	69.46±6.30
3	58-88	78.6 ±7.63
9	64-96	87.6 ±7.83
Union time (in weeks)	10-24	15.16±4.16

Mode of injury

In young adults the most common mode of injury was high velocity trauma and in old age it was due to domestic fall.

Fracture pattern

The fractures were classified according to AO-OTA classification and most of the cases in our study belonged to 31A2-2 (23.31%) followed by 31A2-1 (16.66%).

Duration of surgery

The mean duration of surgery was found to be 86.23 minutes.

Blood loss

The average blood loss was 207.5 ml of blood.

Period of hospitalization

The average period of hospitalization was found to be 10.53 days in our study.

Complications

Majority of the patients had no complications (83.31%). Complications seen were superficial infection (3.31%), varus collapse (6.66%), screw cut-out (3.31%) and non-union (3.31%).

Clinical and functional evaluation

The evaluation was done using the Harris hip score and 70% of patients had excellent outcomes, 16.66% patients had good outcome, 10% of patients had a fair outcome and only 3.31% of patients had a poor outcome. The mean Harris hip score at 1 month was 69.46, at 3 months was 78.6 and at 9 months was 87.6.

Time for fracture union

The average time required for fracture union in our study was 15.16 weeks.

DISCUSSION

Due to increase in longevity and road traffic accidents, the incidence of intertrochanteric fractures were increasing exponentially making it a growing concern for orthopedic surgeons worldwide. These fractures were known to occur in older individuals with co-morbidities which made the management of such fractures challenging.[8,9]

Fractures of the upper end femur made up for more than half of hip fractures in old age.[10] A simple fall can result in such fractures in 6th-7th decade. We saw a bimodal distribution, in younger individuals it was due to road traffic accidents and in elderly it was due to simple fall and associated osteoporosis.[11]

Conservative management had a very limited role in the management of intertrochanteric fractures in the modern age due to associated problems of conservative management like bedsore, DVT, hypostatic pneumonia.[12] The role of conservative management was only limited to patients who were medically unfit for surgery.

The fixation method ranged from dynamic hip screw (DHS) in stable fractures and intramedullary devices in unstable fractures which had some theoretical advantage over DHS because they didn't depend on the lateral cortex which was a problem in osteoporotic bones. The failure rates of these unstable fractures treated with DHS ranged from 6-30%.[13-17] Fogagnolo et al found that the intraoperative technical and mechanical complication rate to be as high as 23.4%.[18] Uzun et al reported non-union 5.7%, secondary varus displacement 25.7%, screw cut-out 5.7%, reverse Z effect 14.3%.[19]

Many internal fixation devices had been used in treatment of intertrochanteric fractures because of high incidence of complications reported after using these surgical implants. There was a lack of a satisfactory implant in the surgical treatment of intertrochanteric fractures which had led to a series of evolution in the development of a perfect implant.

The 5.0 mm proximal femoral locking compression plate was a limited contact, angular stable construct which was specifically designed for fractures in the proximal femoral region.[20] The screw head locks into the PFLCP unlike

conventional compression plate, thereby creating an angular, stable construct.[21] Thus, the proximal femoral locking plate did not fail at screw bone interface and provided a strong anchor in osteoporotic bones.[22,23] There were multiple locking screw holes in the plate and therefore various options were available to treat complex fractures. Close plate-to-bone contact was not needed and the PFLCP can also function as an internal external fixator which minimized the pressure on the periosteum enabling better biological healing.[24,25]

In the current study we attempted to study, evaluate, document and measure our efficiency in the management of intertrochanteric fractures using PFLCP. This study was conducted on a total of 30 patients with intertrochanteric fractures treated with PFLCP.

In the present study, the mean age was found to be 59.04±18.45 years against 55.3±17.9 years and 59.6 years according to Prabhat et al and Shah et al respectively.[28,29] Our study also showed a bimodal distribution of patients. The first peak occurred in young age where patients had high velocity trauma and the second peak occurred in older age group where there was osteoporosis and a simple fall could result in a fracture.

The fracture pattern we most commonly encountered was 31A2-2 whereas Hodel et al and Lee et al found it to be 31B2 and 29A2 respectively.[26,32]

In the present study, the mean operative time was found to be 86.23±19.52 minutes while Agarwal et al and Lee et al found it to be 93 and 151.6 minutes respectively.[26,27]

The mean blood loss in our study was found to be 207.5±26.51 ml as compared to 200 ml in the study by Govindasamy et al.[31] We measured the blood loss by mop counts, that is, each fully soaked mop containing 50 ml of blood.

The mean hospital stay for patients included in our study was 10.53±2.04 days against 8.19±2.04 days in study by Agarwal et al.[29]

The complications that we found were that one patient (3.31%) had superficial infection, two patients (6.66%) had varus collapse, one patient (3.31%) had screw cut-out and one patient (3.31%) had non-union. The patients who had superficial infection were given prolonged antibiotics and the infection healed completely. Lee et al in his study mentioned that four patients (15.3%) had loosening of screws, two patients (7.69%) had delayed union and one patient (3.84%) had deep infection.[26] Agarwal et al in his study found that one patient (3.84%) had non-union and two patients (7.69%) had superficial infection.[29]

In the present study, we found the average Harris hip score at 3 months to be 69.46±6.30, at 6 months to be 78.6±7.63 and at 9 months to be 87.6±7.83.

The average Harris hip score found in studies by Agarwal et al, Lee et al and Ibrahim et al was 88.4, 69.1±17.9 and 84.5 respectively.[26,29,30] In our study, 21 patients (70%) had excellent outcome, 5 patients (16.66%) had good outcome, 3 patients (10%) had fair outcome and 1 patient (3.31%) had poor outcome.

We have used the radiological evidence of callus at the fracture site as the criteria of union. The mean time for fracture union was found to be 15.16±4.16 weeks as compared to 18.04 weeks and 17 weeks in the study by Agarwal et al and Sasnur et al respectively.[27,29]

This study needed further evaluation with a larger number of patients and a longer follow up.

CONCLUSION

Intertrochanteric femur fractures are one of the most frequently encountered fractures by orthopedic surgeons all over the world.

Various fixation methods are available for treatment of intertrochanteric femur fractures which range from DHS to intramedullary devices but these are associated with many complications. PFLCP is a limited contact, angular stable construct unlike conventional plates. This plate also provides a strong anchor in osteoporotic bones.

A prospective study was carried out in 30 patients of radiologically confirmed intertrochanteric fractures. We made an attempt to study the efficacy of management as well as the rate of infection and complications in patients treated with PFLCP. Patients were regularly followed up and clinical and radiological assessment was done at successive visits. The data collected was analyzed and it was concluded that PFLCP is a good option for treating complex proximal femoral fractures especially those with poor bone stock with low complication rates. However, this needs further evaluation with a larger sample size.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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