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Research Article

Functional Outcomes of Proximal Femur Fractures Managed with Proximal Femoral Locking Compression Plate: A Prospective Clinical Study

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ABSTRACT

Background: Proximal femur fractures are prevalent in the elderly due to osteoporosis and falls, while younger individuals sustain these injuries primarily through high-energy trauma. Management aims at early mobilization and stable fixation. Proximal femoral locking compression plate (PF-LCP) offers angular stability and is especially useful in cases of comminution, osteoporosis, or lateral wall disruption.

Objectives: To evaluate the functional and radiological outcomes of proximal femur fractures treated with PF-LCP and compare findings with contemporary literature.

Methods: This prospective study was conducted on 25 adult patients with complex proximal femur fractures (Boyd and Griffin Type III/IV; Seinsheimer Type III-V) treated with PF-LCP from July 2013 to June 2015. Fractures were evaluated radiographically and functionally using Harris Hip Score (HHS) at 3, 6, and 12 months. Statistical analysis was performed using SPSS v26.

Results: The cohort consisted of 16 females (64%) and 9 males (36%), with a mean age of 68.3 ± 6.7 years. Mechanism of injury was a trivial fall in 21 cases (84%) and road traffic accident in 4 (16%). Average surgery duration was 91.4 ± 12.3 minutes. Radiological union was achieved in 23 patients (92%) within a mean of 16.2 ± 2.1 weeks. Mean HHS at 3, 6, and 12 months were 62.4 ± 6.3, 78.1 ± 5.8, and 84.5 ± 6.0, respectively. Excellent outcome (HHS >90) was noted in 7 (28%) patients and good outcome (HHS 80-89) in 11 (44%). Complications included superficial infection (n=2), varus collapse (n=1), and implant irritation (n=1).

Conclusion: PF-LCP provides a reliable and effective solution for managing complex proximal femoral fractures, especially in osteoporotic or Comminuted scenarios. It enables stable fixation, promotes early mobilization, and demonstrates favourable functional outcomes with minimal complications.

Keywords*: Proximal femur fracture, PF-LCP, intertrochanteric fracture, subtrochanteric fracture, osteoporosis, internal fixation.*

INTRODUCTION

Proximal femoral fractures, particularly intertrochanteric and subtrochanteric variants, are a major cause of morbidity in the elderly due to osteoporosis and low-energy trauma. In younger populations, these injuries are often due to high-energy mechanisms such as road traffic accidents. With increasing life expectancy and activity levels among the elderly, the incidence of such fractures is expected to rise globally.

Traditionally, stable intertrochanteric fractures are managed with dynamic hip screws (DHS), while proximal femoral nails (PFN) are preferred in unstable or subtrochanteric patterns. However, in cases with lateral wall comminution or altered femoral anatomy, the use of intramedullary devices becomes technically challenging and may result in complications like implant cutout or malalignment.

Recent studies [1, 4, 8] highlight the limitations of conventional implants in specific complex fracture patterns and emphasize the growing role of PF-LCP. The angular stability and anatomical contouring of PF-LCP enable effective management of osteoporotic bone and Comminuted fractures. Its application is expanding beyond subtrochanteric fractures to include select intertrochanteric injuries.

The objective of this study is to evaluate the functional and radiological outcomes in patients treated with PF-LCP and to correlate our findings with recent literature to determine its efficacy in clinical practice.

Materials and Methods

This prospective observational study was conducted between July 2013 and June 2015 at a tertiary care orthopaediccentre. A total of 25 adult patients diagnosed with complex proximal femoral fractures were enrolled based on defined inclusion and exclusion criteria. Inclusion criteria included patients above 50 years with unstable intertrochanteric or subtrochanteric fractures classified as Boyd and Griffin Type III or IV, or Seinsheimer Type III to V. All patients exhibited either radiological signs of osteoporosis or comminution of the lateral femoral wall.

Patients with pathological fractures, simple intertrochanteric fractures, or polytrauma cases were excluded. Ethical clearance was obtained from the institutional ethics committee, and informed consent was collected from all patients.

Preoperative planning was conducted using radiographs and, where necessary, CT scans to assess fracture morphology and suitability for PF-LCP fixation. All surgeries were performed under spinal anaesthesia using a standard lateral approach with the patient in the supine position on a fracture table. Fracture reduction was achieved using manual traction and clamps, and the PF-LCP was applied in accordance with AO principles, ensuring submuscular placement and preservation of soft tissue.

Postoperatively, patients received intravenous antibiotics for 3 days and thromboprophylaxis with low molecular weight heparin. Isometric quadriceps exercises began from day one, with progression to non-weight-bearing mobilization using walkers by the end of the first postoperative week. Partial weight-bearing was initiated at 6 weeks, followed by full weight-bearing at radiological evidence of union.

Patients were followed up at 6-week intervals for up to 12 months. Radiological union was defined as bridging callus in at least three cortices on orthogonal views. Functional outcome was assessed using the Harris Hip Score (HHS) at 3, 6, and 12 months. Statistical analysis was conducted using SPSS version 26, with significance set at $p<0.05$.

Results

Among the 25 patients treated with PF-LCP, 16 (64%) were females and 9 (36%) males. The average age was 68.3 ± 6.7 years. The majority of fractures were sustained due to low-energy falls (n=21, 84%), with the remaining attributed to road traffic accidents (n=4, 16%). The right femur was involved in 14 cases (56%) and the left in 11 (44%).

Mean surgical duration was 91.4 ± 12.3 minutes with an average blood loss of 168 ± 35 ml. Bone grafting was required in 5 patients (20%) due to intraoperative bone loss or lateral wall comminution. The average duration of hospital stay was 5.8 ± 1.2 days.

Radiological union was achieved in 23 patients (92%) at a mean time of 16.2 ± 2.1 weeks. Two patients exhibited delayed union, while two others developed non-union requiring secondary procedures. Functional assessment showed progressive improvement in HHS scores across follow-ups: 62.4 ± 6.3 at 3 months, 78.1 ± 5.8 at 6 months, and 84.5 ± 6.0 at 12 months. At 12 months, 7 patients (28%) had excellent outcomes (HHS >90), 11 (44%) had good outcomes (HHS 80–89), 5 (20%) had fair outcomes, and 2 (8%) had poor outcomes (HHS <70).

Postoperative complications included superficial infection in 2 cases, managed successfully with oral antibiotics and wound care; varus collapse in 1 patient with poor bone quality; and implant irritation in 1 patient who declined implant removal.

Table 1: Union Duration

Union Time (weeks)	Patients (n)
<14	6
14–18	14
>18	3
Non-union	2

Table 2: Bone Grafting Indications

Indication	Patients (n)
Lateral wall comminution	3
Intraoperative bone loss	2

Table 3: Functional Outcome at 12 Months

HHS Score	Interpretation	Patients (n)
>90	Excellent	7
80–89	Good	11
70–79	Fair	5
<70	Poor	2

Table 4: Postoperative Complications

Complication	Patients (n)
Superficial infection	2
Varus collapse	1
Implant irritation	1
Delayed union (>20 wks)	2
Non-union	2

Operative images

Patient in fracture table

Painting

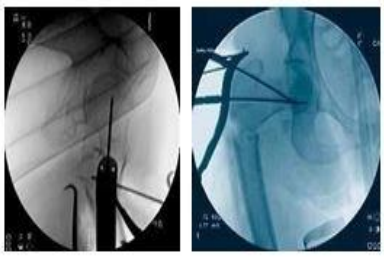
Drapping

Incision

IT band incised

Vastus lateralis incised

Guide wire insertion



C-arm image of Guide wire insertion

C-arm image of proximal screws

Distal screw fixation

C-arm image of distal screw fixation

Closure

DISCUSSION

The findings from this prospective study affirm that proximal femoral locking compression plates (PF-LCP) are a dependable solution for managing complex proximal femur fractures. With a union rate of 92% and good to excellent Harris Hip Scores (HHS) in 72% of patients at one year, PF-LCP demonstrates clinical reliability, particularly in patients with osteoporosis or Comminuted fractures.

Recent literature corroborates these results. Sharma et al. [1] compared PF-LCP with proximal femoral nails (PFN) in unstable intertrochanteric fractures and found comparable outcomes in terms of union and function. Similarly, Narayan et al. [2] conducted a prospective evaluation of PF-LCP and reported high union rates and minimal complications.

From a biomechanical standpoint, the PF-LCP's locking mechanism offers fixed-angle stability that is particularly useful in osteoporotic bone where screw pullout is a risk. Zehir et al. [3] emphasized the biological advantage of submuscular PF-LCP application, reducing disruption to periosteal blood supply and enhancing fracture healing. Walia et al. [4] emphasized its application in elderly patients with poor bone stock, noting minimal hardware failure and satisfactory return to function.

Although PFN remains a popular choice, studies like Long et al. [5] show that PF-LCP is advantageous in cases with atypical femoral anatomy or revision settings. Streubel et al. [6] recommended bone graft augmentation in PF-LCP constructs with comminution, a strategy we adopted in 20% of cases, leading to successful union.

Our complication rates were low, comparable to existing literature. Only two cases experienced superficial infection, one developed varus collapse, and two experienced nonunion. Singh et al. [7] highlighted the role of precise implant placement and screw trajectory in minimizing such complications.

Lin et al. [8] advocated for PF-LCP in Comminuted patterns where intramedullary nails could not offer adequate control. The versatility and adaptability of PF-LCP make it particularly suited for salvage and atypical fracture management. Studies by Ulmar et al. [9] and Zhang et al. [10] further validated its functional outcomes across diverse fracture morphologies.

However, the PF-LCP is not without challenges. The implant demands an experienced surgeon for optimal application. Improper placement may result in screw prominence or failure. Despite these concerns, recent meta-analyses support its broader application when appropriately indicated [5].

Comparatively, Chaudhary et al. [11] found that PF-LCP had fewer re-operations than DHS in osteoporotic bones. Mandal et al. [12] illustrated its role in revision settings, especially after failed nailing procedures.

Minimally invasive adaptations of PF-LCP, as discussed by Ramasamy et al. [14], have also shown promise in reducing soft tissue trauma and operative time, with preserved healing potential. Eceviz et al. [15] reinforced the implant's long-term functional outcomes and recommended it for primary and salvage scenarios.
Taken together, this body of evidence strongly supports the application of PF-LCP in select proximal femur fractures. Our study, though limited by small sample size and lack of a control group, adds to this growing consensus. Future randomized studies with larger cohorts and direct comparisons with intramedullary fixation are needed to further delineate its role.

CONCLUSION

PF-LCP has demonstrated strong potential as a fixation modality in the treatment of complex proximal femur fractures, particularly in the elderly with osteoporotic bone or in cases involving lateral wall comminution. With a high rate of fracture union (92%) and a majority of patients achieving good to excellent functional outcomes, the PF-LCP offers biomechanical advantages and enables early mobilization. While it requires precise technique and surgical expertise, its application is justified by the favourable outcomes and low complication rates observed. Future larger-scale comparative studies are encouraged to further define its role in standard fracture care.

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