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RESEARCH ARTICLE
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# PARADIGM SHIFT IN OPERATING UNSTABLE INTERTROCHANTERIC FRACTURE: ANATOMICAL LOCKING PLATE

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**Abstract**

**Background:** Intertrochanteric fracture is a common orthopedic injury sustained in the elderly population because of osteoporosis and trivial fall. Life-threatening systemic complications occur mainly due to immobility. **Materials and Methods:** We included 62 patients (40 males and 22 females) of unstable intertrochanteric fracture (AO 31 A2 and A3) attending Department of Orthopedics. They were all subjected to surgical treatment with proximal femoral locking plate (PFLP). Patients were followed up at 3rd, 6th, and 12th month for outcome variables, i.e., functional (Harris hip score, Palmer and Parker mobility score) and radiological outcomes (neck shaft angle, loss of reduction, union, and implant-related complications). Statistical analysis was done using Friedman's test after calculating the data in terms of mean and median using SPSS 20 software. **Results:** Mean age of our patients was 64 years; 40 were males and 22 females. Fifty patients sustained fracture due to trivial fall and 12 due to road traffic accidents. Thirty-five out of 62 patients had medical comorbidities. Twenty-six patients needed open reduction of fracture and 36 were close reduced. Twenty-two patients had severe comminution (AO A3 III type). Mean degree of loss of reduction was 5° in 6th month and 4° in 12th month. Union was achieved in 48 out of 50 patients at 12th month. Most of the patients achieved fair-to-good functional outcome scores at 12th month of follow-up. We noticed difficulties in fracture reduction as well as complications related to implant. **Conclusion:** PFLP is an effective implant in comminuted intertrochanteric fractures with broken lateral wall. Complications can be minimized by following the principles of locking plate meticulously.

**Keywords:** Functional outcome, proximal femoral locking plate, unstable intertrochanteric fracture

## Introduction

Intertrochanteric fractures (IT#) constitute a majority of proximal femoral fractures in the elderly population and are associated with a significantly higher rate of morbidity and mortality.[1] Twenty to

thirty percentage of elderly patients with limited physiological capacity die in the first 12 months after IT #.[1] Osteoporosis of proximal femur predisposes elderly females. The high-velocity injury is the commonest cause in young.[2]

The incidence of IT# is increasing in young because of the increased number of motor vehicle accidents[3,4] and in elderly.[5] The preferred mode of treatment of an IT# is surgical stabilization of fracture and early mobilization of the patient to prevent complications of decumbency.[4]

Difficult fracture patterns have comminution of the posterolateral cortex, greater trochanter comminution, loss of medial cortical buttress, reverse oblique pattern, subtrochanteric extension, and loss or communition of the lateral cortex.[6] Acceptable reduction and stable internal fixation are the main prerequisites for uncomplicated osteogenesis and good functional recovery.[7]

The lateral trochanteric wall is believed to be a very important factor in the stability and healing of peri-trochanteric fractures.[8] An extramedullary device such as proximal femoral locking plate (PFLP) acts as buttress support to the lateral cortex and provides stress shielding and lateral migration of fracture fragments and prevents collapse and change in neck shaft angle during fracture healing.[8,9]

There are other extramedullary and intramedullary devices described in the treatment of IT#, but several systematic reviews and meta-analysis have failed to provide insight into the suitable treatment options.[9-11]

## Materials And Methods

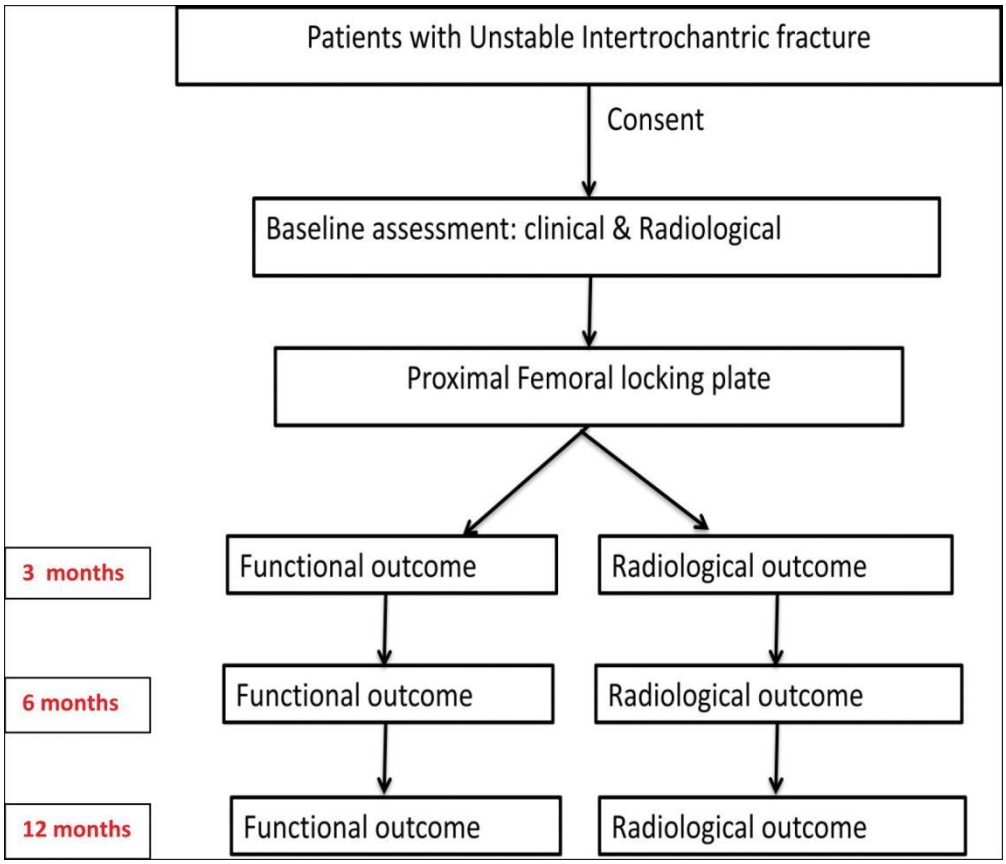
A prospective single center study was carried out in which patients with isolated displaced unstable IT# were included. Sixty-two consecutive cases of unstable IT# (AO/ASIF 31 A2, 31 A3) presenting to Department of Orthopedics within 1-week duration were identified after evaluation of their medical records and radiographs. After obtaining informed written consent, the patients underwent surgical intervention in the form of open reduction (OR)/closed reduction (CR) + PFLP fixation.

Patients above 18 years of age, able to walk independently before the injury and diagnosed with unstable IT# (AO/ OTA A2, A3) attending Orthopedics emergency or OPD services, were included in the study. Patients with polytrauma, pathological fracture, previous deformity, concomitant ipsilateral limb fractures, and Grade 4 ASA Score were excluded from the study.

Demographic details and baseline investigations were done, and anesthesia consultation was sought.

Under regional anesthesia, the patient was operated using a PFLP. Fracture reduction was evaluated using the Baumgertner criterion modified by Fogagnolo et al.[12,13]

**Summary Chart**




**Statistics**

a. Sample size calculated for the study was 62 patients.

b. Independent variables:

- Age, gender,medical, comorbidities, smoker, diabetes.
- Mechanism of injury [blunt/fall from height/forklift/ ground level fall, road traffic accidents (RTAs)].

c. Outcome variables:

Blood loss, duration of surgery, non-union, malunion, varus collapse, implant fracture, femoral neck screw breakage, femoral head cut out.

1. Baseline characteristics were summarized using proportions for categorical variables and mean (SD) or median (IQR) for continuous variables.
2. Outcome measures (non-union, malunion, complication) were expressed in terms of proportions. Proportions and means were compared using the $\chi 2$ test and the Friedman test using SPSS 20 software.

**Results**

At 12th month of follow-up, two patients had an excellent outcome as per Harris hip score grading. The majority (36) of them achieved a score of 70–89 and was graded as a fair outcome. Six patients had a good outcome and six patients had a poor outcome [Table 1].

**Table 1: Summary of various study parameters at 3rd, 6th, and 12th month follow-up in AO II vs. AO III group**

| Study parameters | Follow-up ( 62 cases) | | | | | |
|---|---|---|---|---|---|---|
| | 3rd month (62) | | 6th month (54) | | 12th month (50) | |
| | AO type II (32) | AO type III (30) | AO type II (32) | AO type III (30) | AO type II (24) | AO type III (26) |
| Clinical signs and symptoms | 12 | 12 | 8 | 7 | 2 | 5 |
| Screw backout | 2 | 1 | 3 | 3 | 2 | 1 |
| Degree of loss of reduction | 8.19 ± 8.72<br>5.5 (0–30) | 7.33 ± 6.82<br>6 (0–23) | 5.31 ± 7.73<br>4 (0–27) | 7.71 ± 7.508<br>7.5 (0–25) | 1.58 ± 3.118<br>0 (0–8) | 0 ± 0.00<br>0 (0-0) |
| Harris hip score | 59.56 ± 7.89 | 56.33 ± 5.765 | 66.77 ± 10.31 | 66.93 ± 6.354 | 73.25 ± 10.67 | 74.92 ± 3.59 |
| Palmar and Parker score | 3.44 ± 0.892 | 3.33 ± 0.488 | 5.46 ± 1.45 | 5.21 ± 1.051 | 6.82 ± 1.60 | 6.92 ± 0.760 |
| Union | | | 20 | 22 | 24 | 24 |
| Malunion | | | 20 | 22 | 7 | 6 |

Harris hip score was found to be superior (59.56 ± 7.89) in the AO Type 2 group in contrast to 56.33 ± 5.765 in the AO Type 3 group. Palmar and Parker mobility scores were found to be similar in both the groups at 3rd month (3.44 ± 0.892 vs. 3.33 ± 0.488).

At 6th month of follow-up among 32 patients with AO Type 2 fracture, 16 of them presented with clinical features when compared with 14 out of 30 patients with AO Type 3 fracture. The incidence of screw backout at 6th month was 6 out of 32 in AO Type 2 fracture when compared with 3 out of 30 patients in the AO Type 3 fracture group. Twenty patients out of 32 achieved union in the AO Type 2 group when compared with 22 patients in the AO Type 3 group with varying degrees of malunion.

Median degree of loss of reduction in the AO Type 2 fracture group was 4° with a range of 0–27° when compared with the AO Type 3 group with a median collapse of 7.50° with a range of 0–25°. Harris hip score was found to be similar (66.77 ± 10.31) in the AO Type 2 group and
66.93 ± 6.354 in the AO Type 3 group. Palmar and Parker mobility scores were found to be almost similar in both the groups at 6 months (5.46 ± 1.45 vs. 5.21 ± 1.051).

At 12th month of follow-up among patients with AO Type 2 fracture, 2 of them presented with clinical complications when compared with 5 out of 26 patients with AO Type 3 fracture. The incidence of screw backout at 12th month was 2 out of 24 in AO Type 2 fracture when compared with 1 out of 26 patients in the AO Type 3 fracture group. All patients achieved union in the AO Type 2 group when compared with 24 patients in the AO Type 3 group. Seven out of 24 in AO Type 2 were malunited when compared with 24 out of 26 in the AO Type 3 fracture group. Median degree of loss of reduction in the AO Type 2 fracture group was 0° with a range of 0–8° when compared with the AO Type 3 group with a further median collapse after 6 months of 0° with a range of 0–0°. The Harris hip score was found to be slightly superior (73.25 ± 10.67) in the AO Type 2 group when compared with 74.92 ± 3.59 in the AO Type 3 group. Palmar and Parker mobility scores were found to be almost similar in both the groups at 12 months (6.82 ± 1.60 vs. 6.92 ± 0.760) [Figure 4].

## Discussion

Fractures sustained due to high-velocity injury and falls lead to greater comminution and long segment fracture in order to dissipate the higher energy involved.[5]

Difficulty in fracture reduction, the need of OR and more soft tissue stripping, loss of fracture hematoma, longer duration of surgery, more blood loss, prolonged restricted mobilization, and non-weight bearing are usually required for unstable fractures [Figure 4]. The maximum number (38%) of patients in our study sustained AO type A3 fracture. The mean Harris hip score at the 12th month of follow-up was 73.25 ± 10.67 in the AO II fracture group when compared with 74.92 ± 3.59 in the AO III fracture group. There was no significant difference in outcomes based on fracture pattern (A2 vs. A3).

In another study by Mangram et al.,[14] they did not find evidence to suggest any significant association among fracture type, medical comorbidities and injury severity score.[15]

To obtaining an accurate anatomical fracture reduction is very important. Young patients may suffer more morbidity due to non-union, deformity, and osteonecrosis of the femoral head; therefore, accurate anatomical reduction becomes more important in these patients.[16] Advantages of doing CR are less blood loss, less operative time, decreased cost, and more biological as it involves less soft tissue dissection [Table 2]. Some authors argued that OR facilitates much more accurate reduction under direct vision and reduces fluoroscopic exposure.[12] In our study, we obtained a reduction in 36 patients by the closed method and performed OR in 26 patients after the trial of CR was given, but the reduction was found unacceptable according to the Baumgartner criterion.

**Implant-Related Concerns**

The PFLP used in our study is an Indian-made implant. It has three screws in head and neck and a variable number of screws on the shaft depending on the length of the implant. Different varieties of PFLP have been described [Figures 1-3]. No comparative study is available showing the advantage of one over the other.[17,18]

**Table 2 Demographic details**

| **Parameter** | | |
|---|---|---|
| Age | Mean (64.65 ± 14.97) | |
| Sex | M: F | 40: 22 |
| Unilaterality | Right: left | 26: 36 |
| Mechanism of Injury | RTA: fall | 12: 50 |
| ASA Grade | I: II: III | 26: 30: 6 |
| Fracture type | A2I: A2II: A2III | 10: 6: 16 |
| | A3I: A3II: A3 III | 4: 4: 22 |
| Type of reduction | Open: closed | 26: 36 |
| Neck shaft angle (degrees) | Median 134 (122–140) | |
| Pre-op HB | Median 10.5 (6–15.6) | |
| Av blood loss (mL) | 200 (130–640) | |
| Mean duration of surgery (min) | A2 | 169.37 ± 47.57 |
| | A3 | 214 ± 65.19 |
| Comorbidities | Yes/no | 26: 27 |
| | Asthma | 2 |
| | Diabetes | 6 |

| | | |
|---|---|---|
| | Hypertension | 12 |
| | Diabetes+Hypertension | 10 |
| | Diabetes+ Hypertension + CKD | 6 |

*CKD = chronic kidney disease

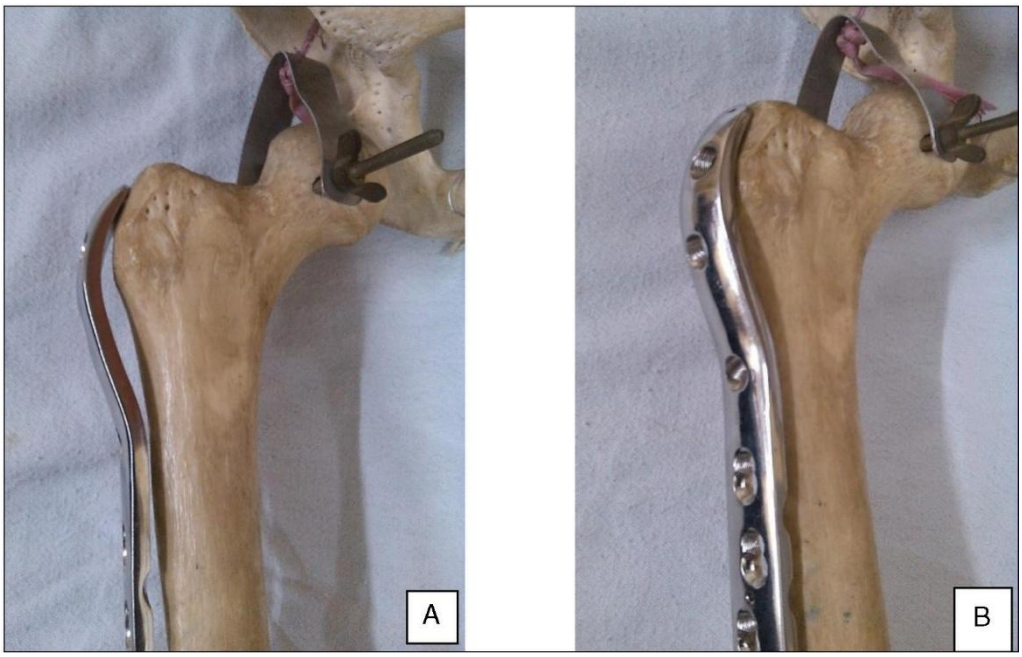



**Figure 1: (a) Gap between the plate and lateral wall in the AP view. (b) In the oblique view correct position of the plate with respect to proximal head screws**

PFLP designed by Smith and Nephew [Figure 2] has more numbers of screws in the head region and is arranged in more than one column with varying angulation in the sagittal and coronal planes. The proximal part of the plate is broader and provides larger coverage and support to greater trochanter. Hence, it increases the overall stability of the construct.

The PFLP designed by Synthes [Figure 3] has only three screws in the proximal femur, and there is no expansion of plate in the proximal part. The breadth of the plate is constant throughout the length.

We observed a discrepancy in the proximal femur anatomy and fit of the implant. When screws are positioned accurately in the neck and head of the femur, the proximal plate was not abutting against the greater trochanter and a gap was seen. One of the reasons reported for the failure of PFLP is the increased distance of the plate from the bone after fixation.[19] The free length of the screw between the bone and plate increases the lever arm and results in weakening of construct on bending movements.[20] This predisposes to screw breakage, bending, loosening, and backing out [Figure 5].

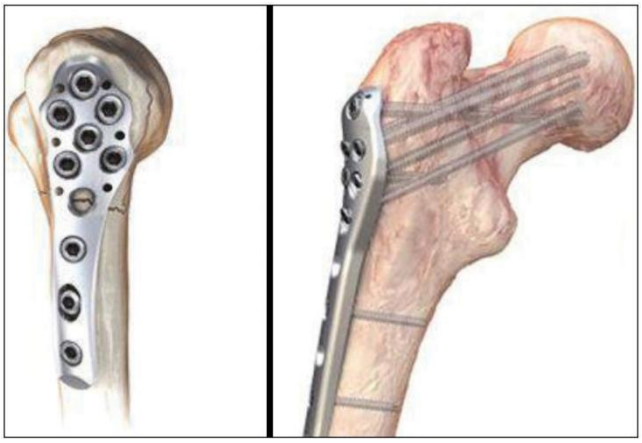


**Figure 2: AP and lateral view of Smith and Nephew PFLP**

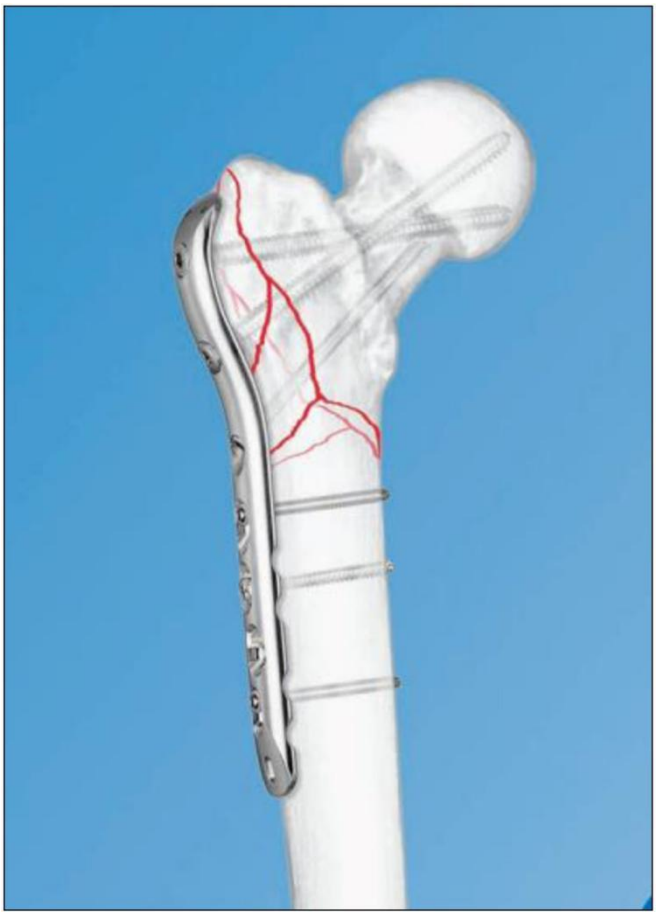


**Figure 3: PFLP designed by Synthes**

When we attempted to match the curvature of the lateral wall, the distal plate was moving away from the shaft and a triangular gap was seen between the plate and the femoral shaft. The plate was found to be proud and higher than greater trochanter on accurate positioning of neck screws. This resulted in pain on terminal abduction in 12% of our patients on follow-up.[21,22]

The discrepancy between the contour of the plate and proximal femoral anatomy is evident in fluoroscopy image.

Probably because of extensive comminution in greater trochanter, height and contour of greater trochanter were lost. Hence, it caused misfit and difficulty in plate positioning.
Probably, the use of a trochanteric hook plate or tension band wiring of greater trochanter followed by PFLP application would have helped in the accurate restoration of proximal femoral anatomy and fracture reduction.[23]
The discrepancy in a fit of the implant can be explained by the variability in the proximal femoral anatomy from patient to patient. There is no study to delineate the proximal femur anthropometric parameters in Indian population per se. Lin et al.[24] performed a study in Chinese population on anthropometric parameters of the proximal femur and concluded that anteversion is significantly higher in Chinese females when compared with Chinese males. They also found that anteversion is higher in females, irrespective of ethnicity. By findings, they advocated twisted design of a PFLP and different angulations of proximal screws.[24] The Indian implant designs are copied from the European counterparts, and the Caucasian population is anthropometrically very different from Asian population. They are well built and tall when compared with Asian counterparts. Hence, there is a mismatch between the PFLP and the proximal femur anatomy of the patients, for whom it is being used.
However, we believe that it is unlikely to interfere with the outcomes if neck screws are placed correctly as it is a locking plate, a rigid construct, and behaves similar to internal and external fixators.

**Post-Operative Follow-Up**

**Loss of reduction**

Healing of intertrochanteric fracture occurs by abundant cancellous bone formation. In our study, maximum collapse (loss of reduction) occurred at 6th month coupled with forces acting on the fracture site as the patient started to progressively weight bear on the operated limb [Figure 6].
Collapse is evident by the change in neck shaft angle and degree of loss of reduction on follow-up radiographs. Kim et al. in 2011 reported 49 cases of radiographic failures out of 178 cases. Among 49, 2 were stable and 47 were unstable fractures. More than 50% of the failures occurred in unstable fractures with osteoporosis. They recommended that dyanmic hip screw (DHS) should not be used in these patients.[25,26]
In our study, loss of reduction in the OR group (11.4 ± 8.79°) was observed to be three times higher than the CR group (3.19 ± 4.26°) at follow-up visits [Table 3]. At 12th month, there was no loss of reduction occurring in the CR group, but collapse and loss of reduction continued to happen even at 12th month in the OR group. This may be explained by more comminution and degree

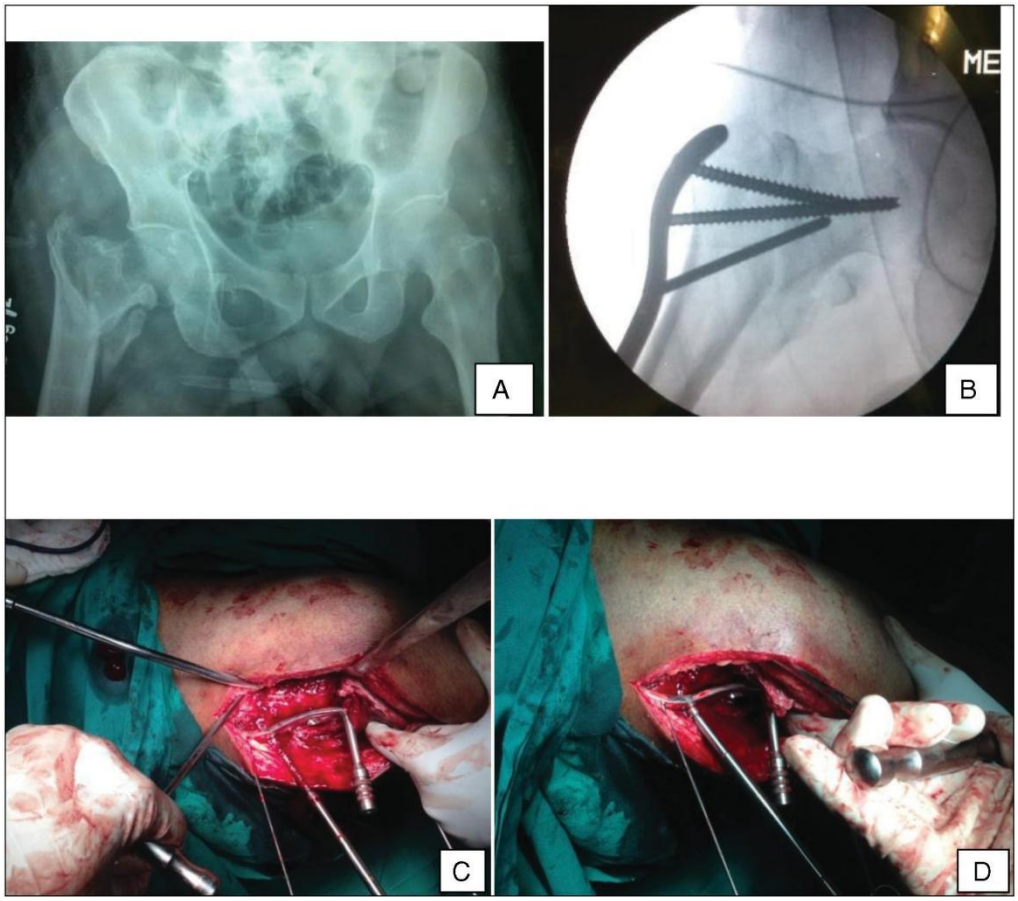



**Figure 4: (a) Pre-operative X-ray. (b) Intraoperative fluoro image. (c and d) Intraoperative image showing difficult plate placement**

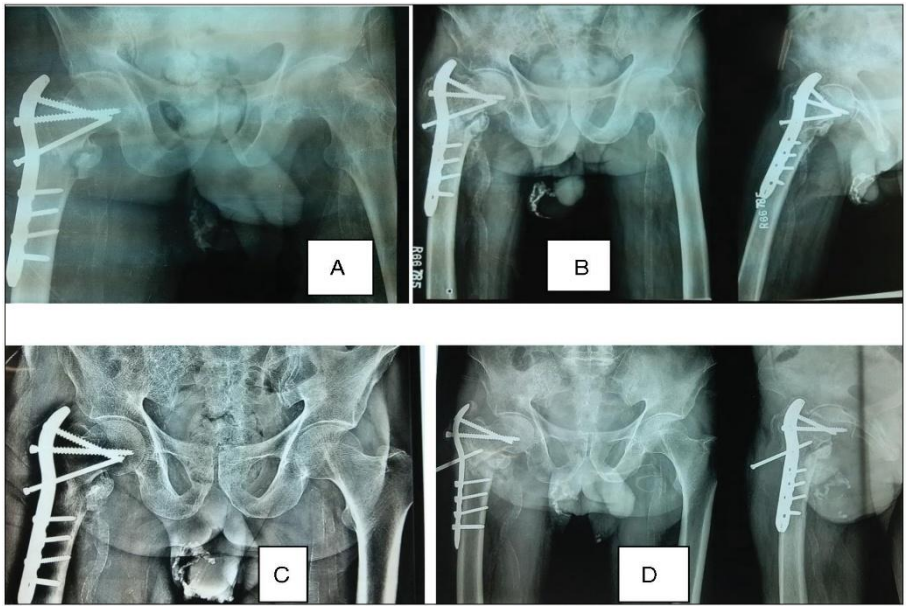



**Figure 5: Serial X-rays demonstrating screw backout. (a) 1 month, (b) 3 months, (c) 6 months, and (d) 10 months**

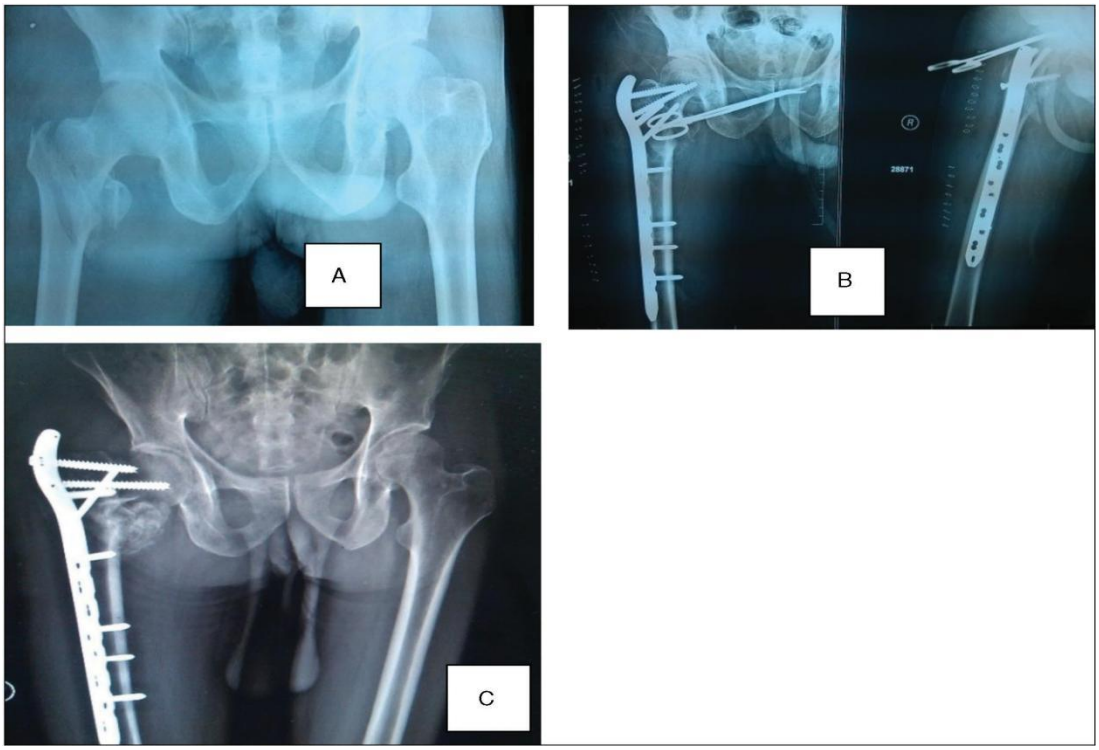



**Figure 6: (a) Pre-operative X-ray. (b) Post-operative AP view. (c) Follow-up X-ray at 2 months**

**Table 3: Follow-up loss of reduction, Harris hip score and Palmar score at 3rd, 6th, and 12th month in all cases**

| Follow-up duration (months) | Degree of loss of reduction median (interquartile range) | Harris hip score median (interquartile range) | Palmar and Parker mobility score median (interquartile range) |
|---|---|---|---|
| 3rd | 5 (2–7.5) | 59 (53.50–63.50) | 3 (3–4) |
| 6th | 4 (0–12) | 68 (63.50–71.50) | 5 (5–6) |
| 12th | 0 (0–8) | 74 (72–78) | 7 (7–7.75) |
| *P*-value | 0.00 | 0.01 | 0.00 |

*Friedman test, degree of freedom = 2

of osteoporosis in the OR group. In similar studies, Gunadham et al.[27] reported a loss of reduction in 8% of the cases and Hu et al.[4] reported in 15.55% of the cases.

**Implant failure: Screw backout/broken screws**

Proximal femoral nail has a shorter lever arm, decreased bending movement, and less rate of mechanical failure.[28] proximal femoral nail (PFN) is shown to be stronger than DHS as it can tolerate multi-fold higher static and cyclical loading.[39] PFN compensates for the function of the medial femoral column and prevents medialization of the shaft.

Hsueh et al.[29] did a study in 937 patients with intertrochanteric fracture treated with a dynamic hip

screw for the evaluation of risk of lag screw cut-out. They emphasized that tip apex distance (TAD) is the most important factor for the prevention of cut-out after accurate reduction of fracture fragments. But the

concept of TAD cannot be extrapolated to PFLP.[30] The PFLP is a fixed angle construct and does not allow collapse to occur in the healing of the intertrochanteric fracture.[31,32]
In our study, we observed six cases of screw backout and one case of broken screws. Schneider et al.[33] attempted to identify the underlying mechanism of failure of the PFLP and observed that plate failure occurs consistently if there is screw deviation of more than 2° from the nominal axis. This demonstrates how crucial and important is screw placement in proximal femur in overall stability and preventing failure of PFLP.
Gunadham et al.[27] reported 23.8% of the cases of the broken implant and Asif et al.[34] reported 3 cases of broken implant among 25 cases. Premature weight-bearing was cited as an important cause.
Some implant-related failures were observed in our study. Type A2 III intertrochanteric fracture was treated with CR and PFLP using the MIPPO technique. The patient was allowed weight-bearing after evidence of union was seen at follow-up radiograph.
The patient was started partial weight-bearing with axillary crutches at 8 weeks and full weight-bearing after 3 months of surgery. Serial follow-up radiographs showed progressive backout of kickstand screw and gradual loss of neck shaft angle due to varus collapse [Figure 6].
The patient presented with complaints of pain and palpable screw head over the lateral aspect of upper thigh at 5 months. Under local anesthesia, the screw was removed percutaneously using a stab incision. It was found to be loose and easily removable. Clinical examination, radiograph, and blood parameters were not suggestive of infection, and cultures obtained from the surgical site were reported sterile.
In a case of implant failure, the patient reported after 2 months with broken screws and varus loss of reduction. The patient was not compliant with the post-operative rehabilitation protocol and instructions. Patient was ambulating unaided with full weight-bearing.
It was a AO Type A2 III intertrochanteric fracture treated with OR and PFLP, reduction was acceptable, and the patient was doing well in the post-operative period.
Due to make of the implant and biomechanics, maximum stress concentration over the implant occurs just below the trochanter. Lower neck screw and kickstand screw suffer maximum stress during axial loading.[35] This is evident by failure occurring commonly due to plate breakage at the subtrochanteric region and to lower neck screw breakage.

**Union**

**About 96.7% (60) of the patients achieved union by**

6 months. One patient had a non-union following infection. Around 67.74% (41) of the patients achieved clinical and radiological union at 3rd month with < 10° of loss of reduction and malunion due to collapse. Incidence of malunion was more in the AO Type A 3 group when compare with the A 2 group. This is easily explained by the fracture pattern, and more comminution is leading to more collapse and loss of reduction in the A 3 group when compared with the A 2 group.
About 81.25% (26) of the patients in the CR group achieved union at 6 months, and all of them united at 12 months' follow-up. In the OR group, there was 72.72%

(16) union at 6 months and one patient did not achieve union even at the 12th month. It got complicated with infection and warranted implant removal and external fixator application.[36] Other studies showed 95.55%[25] and 92%[4] union after 1 year.

Union was achieved in 60 out of 61 patients in our study. Hu et al.[4] showed union in 43 out of 45 cases and Asif et al.[34] achieved union in 23 out of 25 cases at 1 year of follow-up and 86%[27] in another study.

**Outcome scores**

Harris hip score and Palmar and Parker mobility score continued to increase from 3rd month to 12th month. The magnitude of increase was more in the first 6 months when compared with the next 6 months. This is attributed to progressive fracture healing, reduced pain, and regaining range of motion at the hip. Loss of pain and range of motion regain at the hip occur early in the first few months of post-operative period and these two factors are a major component of Harris hip score when compared with mobility component. This explains greater increase seen in the first 6 months when compared with the next 6 months.

Harris hip score and Palmar and Parker mobility score had only minimal difference in A 2 and A 3 groups at 3rd, 6th, and 12th month; however, patients in the A 2 group had higher value in the 3rd month compared with patients in the A 3 group but at subsequent visits at 6th and 12th month. Patients in A 3 had higher values when compared with those in the A 2 group.

This finding emphasizes on the fact that outcome does not completely depend on the fracture pattern.[14] It also depends on other systemic factors, presence of medical comorbidities, adequate rehabilitation, and physiotherapy.[37,38]

Harris hip score and Palmer and Parker mobility score followed rising trend during the follow-up period in both the groups. Scores were significantly higher in the CR group when compared with the OR group. The difference between scores of the two groups decreased after 6 months. In the CR group, score was significantly higher than that of the OR group at 12th month.

Asif et al.[34] showed the following results with Harris hip score: 56%—excellent, 8%—good, 4%—fair, and 8%—poor at 1-year follow-up.

Our series showed the following results: 4%—excellent, 12%—good, 72%—fair, and 12% showed poor results at 12 months of follow-up. Harris hip score is likely to improve in future as fracture consolidation occurs with time.

**Infection**

In our study, one patient suffered from implant infection [Figure 7]. One out of 27 cases of PFLP had superficial infection and was treated with debridement in another

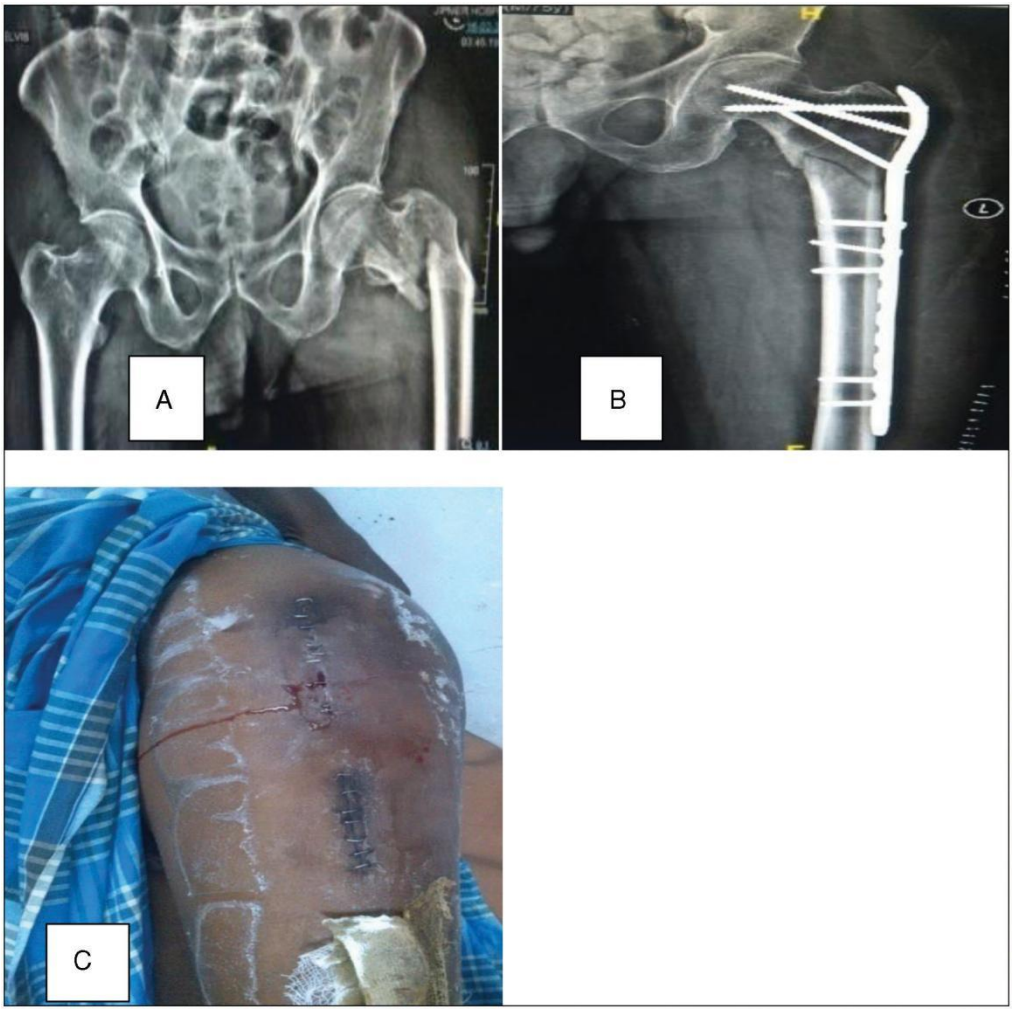



**Figure 7: (a) Pre-operative X-ray. (b) Post-operative AP view. (c) Surgical wound at 1 month**

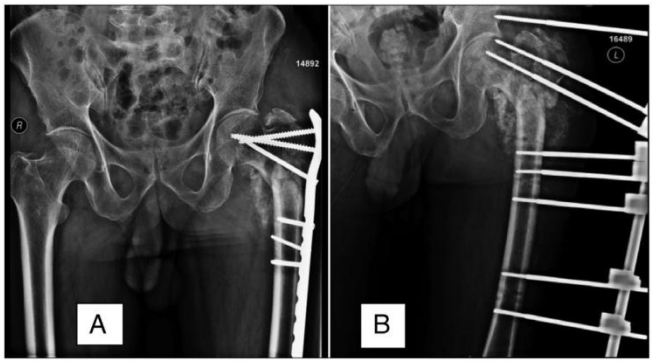



**Figure 8: (a) Post-debridement X-ray at 7 weeks. (b) After 1 month of implant removal and external fixator application**

study.[34,39] Yet another meta-analysis did not show any significant difference in the wound infection in relation to various implants used for intertrochanteric fracture.[9,40]

Case of type II DM, HTN, CKD, chronic smoker, and alcoholic with AO Type A3 I fracture was treated with the MIPPO technique. Post-operative period was uneventful and was discharged on 10th day with clean wounds.

The patient presented 2 weeks later with frank infection and seropurulent discharge, after two consecutive debridements and persisting infection at local site with deteriorating general condition of the patient [Figure 8]. Implant removal and external fixator application were done at the third surgery.
During debridement, sequential cultures were taken from different planes of the wound. All the cultures grew Pseudomonas aeruginosa and Acetobacter baumanii.
The patient was treated with suitable antibiotic according to culture and sensitivity report, but persisting infection and poor general condition of the patient coupled with medical comorbidities necessitated implant removal and external fixator application.
In our series, there was one case of infection which necessitated removal of implant and application of external fixator, one case of screw breakage, and six cases of screw backout.
No case of plate breakage and periprosthetic fracture was seen.

**Limitations of the study**

In the present study, the longest follow-up was for 12 months. Further long-term follow-ups are required to note any late complications.
Patients in our institute were operated upon by different surgeons in the trauma operation theater. This may explain early complications in the learning curve period.
There were a few number of patients in each AO subtype, so comparative study could not be done.
The study with larger sample size with randomization to PFLP, DHS, and PFN groups with extended follow-up will establish the implant of choice for trochanteric fracture healing.

**Conclusion**

The PFLP is a useful device in the management of unstable intertrochanteric fracture of the femur with success rate when the principles of locked plating are adhered to.

1. An accurate reduction should be achieved with the restoration of neck shaft angle before locking plate fixation.
2. Guiding block was not used over plate for screw fixation. This could cause cross-threading and back out of screws on follow-up.
3. All the screws should be carefully locked over the plate intraoperatively.
4. The patient should be allowed gradual weight-bearing, only when callus formation and evidence of union are seen on X-ray.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**Ethical approval**

Ethical approval was obtained from the Institute Ethics Committee.

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