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EARLY OUTCOME OF USING PROXIMAL FEMORAL LOCKING PLATES IN COMMUNITED INTERTROCHANTERIC FRACTURES IN MIDDLE AGE PEOPLE

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Abstract

Background: Comminuted intertrochanteric fractures in middle-aged patients present complex treatment challenges due to unstable fracture patterns and the necessity for early functional recovery. Proximal femoral locking plates (PFLPs) offer angular stability and anatomical fixation in such scenarios, yet limited prospective data exists evaluating their effectiveness in this age group.

Objective: To evaluate the early clinical and radiological outcomes of proximal femoral locking plates in the management of comminuted intertrochanteric fractures in middle-aged patients.

Methods: This prospective observational case series was conducted from June 2023 to December 2024 at a tertiary care trauma center in LUMHS, Jamshoro, Pakistan. Twenty patients aged 35–55 years with AO/OTA type 31-A2 and A3 comminuted intertrochanteric fractures were enrolled. All patients underwent open reduction and internal fixation using proximal femoral locking plates. Functional outcomes were assessed using the Harris Hip Score (HHS), and radiological union was evaluated through serial radiographs. Patients were followed until union or complication-related intervention.

Results: The mean age was 45.6 years, with 12 males and 8 females. Fracture union was observed between 4 and 5 months (mean 4.5 months). According to HHS, 40% had excellent, 30% good, 20% fair, and 10% poor functional outcomes. Complications included three superficial infections managed conservatively and one deep infection with implant failure requiring plate removal and Ilizarov fixation. Seventeen patients completed all follow-ups.

Conclusion: PFLPs demonstrated satisfactory early union and functional outcomes in comminuted intertrochanteric fractures among middle-aged patients, supporting their use as a reliable fixation method in complex proximal femoral fractures.

Keywords: Bone Plates, Femoral Fractures, Fracture Fixation Internal, Hip Fractures, Intertrochanteric Fractures, Middle Aged, Orthopedic Procedures.

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Introduction

Comminuted intertrochanteric fractures present a formidable challenge in orthopedic trauma care, particularly in the middle-aged population where functional demands remain high and early return to mobility is often essential. These fractures, characterized by multiple fragments and instability, frequently result from high-energy trauma in younger individuals and low-energy falls in the elderly (1,2). However, in middle-aged adults—those neither fitting the classical profile of geriatric fragility fractures nor the resilience of youthful bone—treatment must strike a careful balance between mechanical stability and biological healing (3). As such, optimizing internal fixation techniques in this demographic remains a critical focus in orthopedic research and clinical practice. Traditionally, dynamic hip screws (DHS) and intramedullary devices like proximal femoral nails (PFN) have been employed in managing intertrochanteric fractures (4,5). While these implants have demonstrated good results in relatively simple fracture patterns, their limitations become evident when treating comminuted or unstable variants. The increased risk of implant failure, varus collapse, and poor control of fracture fragments in such complex configurations has driven the exploration of alternative fixation strategies (6,7). In recent years, the proximal femoral locking plate (PFLP) has emerged as a viable option, particularly in settings where conventional implants may be insufficient to achieve and maintain fracture reduction (8). PFLPs are anatomically contoured devices that allow for angular stability through the locking screw mechanism, thereby offering superior fixation in osteoporotic or fragmented bone. Their design facilitates the placement of multiple screws in the femoral head, creating a fixed-angle construct capable of withstanding axial and rotational forces (9,10). Unlike intramedullary nails, PFLPs provide direct lateral support and permit open reduction of complex fracture patterns—advantages that become especially relevant in comminuted fractures where precise anatomical alignment is crucial. Moreover, PFLPs minimize the risk of iatrogenic damage to intramedullary structures and reduce operative time in select cases, which may be beneficial in middle-aged patients with associated comorbidities or polytrauma (11,12).

Although several biomechanical and retrospective clinical studies have supported the theoretical advantages of locking plate constructs, the literature remains inconclusive about their superiority in terms of functional outcomes, especially in specific age groups. Most existing research has either focused on geriatric populations with osteoporotic bone or broadly grouped adult patients without stratifying outcomes by age or fracture complexity (13-15). Consequently, there exists a noticeable gap in evidence regarding the efficacy of PFLPs in middle-aged individuals who may possess unique physiological and functional characteristics that influence fracture healing and rehabilitation potential. Furthermore, in the context of resource-limited settings or regions where advanced intramedullary systems are either unavailable or prohibitively expensive, PFLPs may serve as a practical alternative. Their adaptability to a variety of fracture morphologies and ease of application by general orthopedic surgeons further underscores their clinical relevance. However, despite their growing use, there is limited prospective data assessing early clinical and radiological outcomes following their application in comminuted intertrochanteric fractures, particularly in the middle-aged demographic. Early outcomes are especially important, as they often determine the course of rehabilitation, patient satisfaction, and the eventual functional prognosis. Given this background, the present study was designed to prospectively evaluate the early clinical and radiological outcomes of proximal femoral locking plates in the management of comminuted intertrochanteric fractures in middle-aged patients. The objective is to determine whether PFLPs provide adequate stability, facilitate early mobilization, and result in satisfactory early healing in this specific patient group—thereby contributing meaningful data to guide future treatment protocols.

Methods

This prospective observational case series was conducted at a tertiary care trauma center in the LUMHS, Jamshoro, Pakistan, with the aim of evaluating early clinical and radiological outcomes following the use of proximal femoral locking plates in the management of comminuted intertrochanteric fractures among middle-aged patients. The study was carried out over an 18-month period from June 2023 to December 2024. Prior to participation, written informed consent was obtained from all patients after a thorough explanation of the procedure, potential risks, benefits, and

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follow-up requirements. The study included a total of 20 patients diagnosed with comminuted intertrochanteric fractures of the femur. Eligibility criteria were carefully established to ensure the selection of a homogenous patient population. Inclusion criteria comprised patients aged between 35 and 55 years, presenting with radiologically confirmed comminuted intertrochanteric fractures classified as AO/OTA type 31-A2 and 31-A3. Only closed fractures were considered, and all patients were medically stable for surgery within 72 hours of injury. Exclusion criteria included pathological fractures, open fractures, polytrauma patients with life-threatening injuries, those with a history of previous ipsilateral hip surgery, metabolic bone disorders, or unwillingness to comply with follow-up protocols (6,7).

Following admission and initial stabilization, all patients underwent detailed preoperative assessment including clinical examination, standard anteroposterior and lateral radiographs of the pelvis and affected femur, and relevant laboratory investigations. The fractures were classified using the AO/OTA classification system. All surgical procedures were performed under spinal or general anesthesia by experienced orthopedic trauma surgeons using a standard lateral approach to the proximal femur. Open reduction was achieved in all cases, followed by internal fixation using anatomically contoured proximal femoral locking plates. Intraoperative fluoroscopy was used to confirm satisfactory reduction and hardware placement. Postoperative management included a standardized rehabilitation protocol. Patients were encouraged to begin non-weight-bearing mobilization on the first or second postoperative day, followed by partial weight-bearing as tolerated, based on radiological evidence of progressive healing. Clinical follow-up visits were scheduled at 2 weeks, 6 weeks, 3 months, and monthly thereafter until fracture union was confirmed. At each visit, clinical assessment was conducted using the Harris Hip Score (HHS) as the primary outcome measure for functional recovery. Radiological healing was assessed via standard anteroposterior and lateral radiographs of the hip and femur, with specific attention to callus formation, cortical continuity, and absence of fracture line, judged by two independent radiologists blinded to the study objectives.

Data on demographic variables (age, sex), injury characteristics (mechanism of injury, side involved), surgical parameters (duration of surgery, blood loss), and postoperative course were recorded using a structured data collection form. The time to clinical and radiological union was documented in months from the date of surgery. Complications such as infections, implant-related issues, and any requirement for reoperation were also tracked, although their reporting and analysis were confined to the results section. Data were compiled and analyzed using SPSS version 25.0 (IBM Corp, Armonk, NY). Descriptive statistics such as means and standard deviations were calculated for continuous variables, while categorical variables were summarized using frequencies and percentages. The normality of continuous data distribution was assessed using the Shapiro-Wilk test. Since the data followed a normal distribution, parametric statistical tests were employed. Paired sample t-tests were used to compare preoperative and postoperative functional scores where applicable, and correlation analysis was performed to explore relationships between variables such as age, union time, and functional outcome scores. A p-value of <0.05 was considered statistically significant. Throughout the study, care was taken to ensure methodological consistency, data accuracy, and ethical adherence in line with the Helsinki Declaration. The structured and replicable methodology employed in this investigation was designed to provide meaningful insights into the early outcomes of proximal femoral locking plate fixation in comminuted intertrochanteric fractures, specifically among middle-aged individuals—a population often underrepresented in current orthopedic literature.

Results

The results of this prospective observational case series are based on 20 patients who underwent surgical fixation using proximal femoral locking plates for comminuted intertrochanteric fractures. Among the study population, 60% (n=12) were male and 40% (n=8) were female, with a mean age of 45.6 years, ranging from 35 to 55 years. Radiological union was achieved in all patients over a period ranging from 4 to 5 months. The average time to union was 4.5 months. Most patients (n=10) achieved union at 4.5 months, with 6 patients healing by 4 months and 4 patients requiring 5 months. Assessment of functional outcomes was performed using the Harris Hip Score at final follow-up.

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Of the 20 patients, 8 (40%) achieved an excellent outcome (score 90–100), 6 (30%) were classified as good (score 80–89), 4 (20%) were rated as fair (score 70–79), and 2 patients (10%) had poor outcomes (score <70). These findings highlight a favorable early recovery profile for the majority of patients. Complications were documented in four cases. Superficial surgical site infections were observed in three patients. These were managed successfully with wound dressing, antibiotics, and routine care without requiring additional surgical intervention. One patient developed a deep infection that was associated with implant failure. The locking plate was surgically removed, and the patient was subsequently managed with an Ilizarov external fixator to address non-union and infection. Patient compliance with follow-up was generally good. Seventeen of the twenty patients completed all scheduled postoperative visits. Two patients missed one visit each but returned for subsequent follow-ups, while one patient was lost to follow-up before completion of clinical evaluation. Collectively, these findings support the early functional benefit of using proximal femoral locking plates in managing complex intertrochanteric fractures in a middle-aged cohort. The complication rate remained within acceptable limits, and the majority of patients experienced satisfactory clinical and radiological outcomes in the early recovery phase.

Table 1: Patient Demographics (n = 20)

Variable	Value
Total Patients	20
Gender	
Male	12
Female	8
Mean Age (years)	45.6
Age Range (years)	35–55

Table 2: Fracture Union Time Distribution

Union Time (months)	Number of Patients	Percentage (%)
4	6	30%
4.5	10	50%
5	4	20%
Mean Union Time	4.5 months	

Table 3: Harris Hip Score Outcomes

HHS Category	Score Range	Number of Patients	Percentage (%)
Excellent	90–100	8	40%
Good	80–89	6	30%
Fair	70–79	4	20%
Poor	<70	2	10%

Table 4: Postoperative Complications and Follow-Up Compliance

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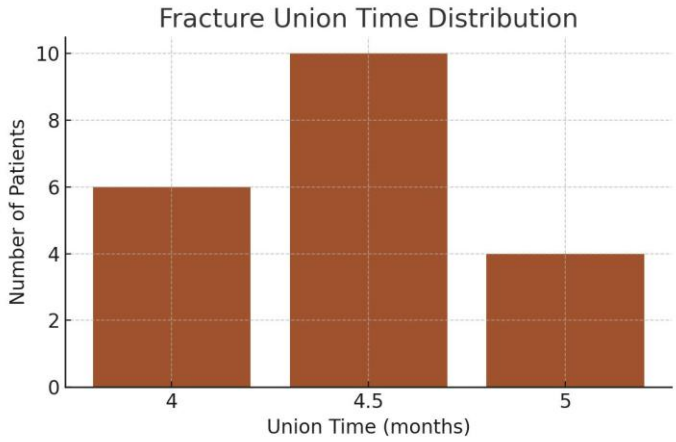
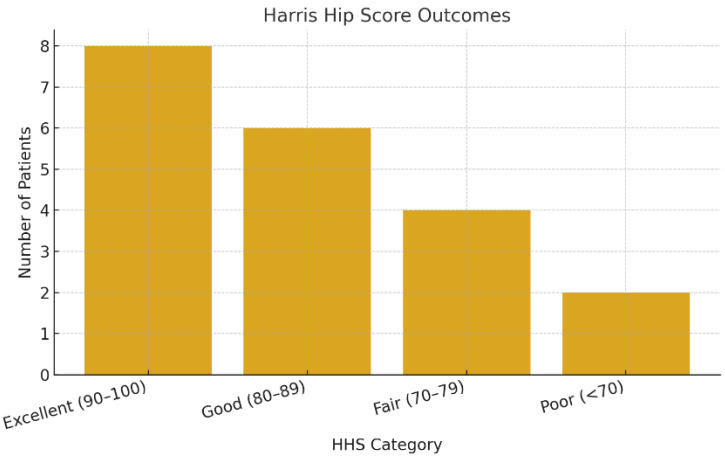
Category	Detail	Number of Patients	Percentage (%)
Superficial Infection	Managed conservatively	3	15%
Deep Infection + Implant Failure	Required implant removal & Ilizarov fixation	1	5%
Completed All Follow-Ups	Full protocol followed	17	85%
Missed One Follow-Up Visit	Returned later	2	10%
Lost to Follow-Up	No return after initial visits	1	5%





Discussion

The findings from this prospective case series offer valuable insight into the early clinical and radiological outcomes of proximal femoral locking plates (PFLPs) for comminuted intertrochanteric fractures in a middle-aged population. The observed outcomes align with growing evidence supporting the role of locking plate constructs in managing

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complex fracture patterns, particularly where anatomical restoration and stable fixation are essential. In the present study, the average union time of 4.5 months is consistent with previously reported findings. A recent study observed a mean union time of approximately 14.5 weeks in a similar patient cohort, reinforcing the potential for reliable healing timelines when using PFLPs in comminuted and unstable fracture settings (16). Functional outcomes, measured via Harris Hip Score, were predominantly rated as good to excellent in this study, echoing comparable results reported a study which documented satisfactory outcomes in the majority of their cohort treated with PFLPs (17). The complication rate, while modest, highlighted the occurrence of superficial and deep infections, including one implant failure. These results are broadly in line with complication profiles observed in previous studies, as a study reported minor infection rates and a single implant failure among PFLP recipients (18). Although locking plates provide rigid fixation, their use in comminuted fractures can be technically demanding, and improper surgical technique may increase the risk of implant-related complications, as emphasized in recent literature (19,20).

Importantly, this study focused on a middle-aged population—a group often underrepresented in intertrochanteric fracture research, which predominantly targets geriatric cohorts. This population segment presents a unique therapeutic challenge, as they possess relatively higher functional demands than older adults, yet may still exhibit variable bone quality due to early degenerative changes. The favorable early outcomes in this study support the adaptability of PFLPs in this subgroup, especially when anatomical reduction is achieved and fixation principles are meticulously followed (21). Comparative analyses between PFLPs and intramedullary devices like the proximal femoral nail (PFN) have shown mixed outcomes in literature. Several studies indicate that, PFN may offer advantages in terms of shorter operative time and faster mobilization, but that functional and radiological results at final follow-up do not significantly differ from those of locking plates (22,23). Hence, while PFLPs may not universally outperform intramedullary options, they remain a valuable alternative, particularly in cases with lateral wall involvement or when intramedullary devices are contraindicated.

The strengths of the present study include its prospective design, consistent follow-up, and use of validated clinical tools such as the Harris Hip Score for outcome assessment. The inclusion of only comminuted intertrochanteric fractures allows for focused evaluation of a complex fracture subset where implant performance is critically tested. Furthermore, strict inclusion criteria and a standardized surgical approach helped to limit confounding variables. However, the study is not without limitations. The small sample size (n=20) restricts the generalizability of the findings and limits the statistical power for subgroup analyses. Additionally, the absence of a control group or comparative arm with other fixation modalities such as PFN or DHS prevents robust evaluation of relative efficacy. Another limitation lies in the short duration of follow-up; although early outcomes are the focus, longer-term results including implant longevity, post-union complications, and patient satisfaction would offer a more comprehensive understanding of PFLP performance. Future research should prioritize larger randomized controlled trials comparing PFLPs to other implants specifically in middle-aged populations with unstable or comminuted fracture patterns. Biomechanical studies exploring construct stability in varying bone densities may further guide implant selection in this age group. Incorporation of patient-reported outcome measures and cost-effectiveness analyses could also enhance the clinical relevance of future studies. In conclusion, proximal femoral locking plates demonstrated encouraging early clinical and radiological outcomes in the management of comminuted intertrochanteric fractures in middle-aged patients. While not without limitations, the findings support their continued use as a viable fixation method in select cases, particularly where anatomical reconstruction and angular stability are critical.

Conclusion

Proximal femoral locking plates demonstrated favorable early clinical and radiological outcomes in the management of comminuted intertrochanteric fractures in middle-aged patients. The implant provided stable fixation, supported timely union, and allowed functional recovery with minimal complications. These findings support the PFLP as a reliable surgical option in complex proximal femoral fractures, especially where anatomical reconstruction is critical.

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Short Title: Early Outcomes of PFLP in I/T Fractures

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