Research Article

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Reliability and Outcome Predictors of Proximal Femoral Locking Compression Plate Osteosynthesis at a Nigerian North-Eastern Tertiary Hospital

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Abstract

Background

The choice of proximal femur locking compression plate (PFLCP) for fixation of proximal femur fractures has evolved over the years with occasional poor outcome especially with complex intertrochanteric fractures.

Objective

To evaluate the reliability of PFLCP with regards to radiologic union and to determine predictors of poor outcome.

Materials and methods

Single center retrospective cross sectional study at a Nigerian tertiary hospital, where data of patients who have attained skeletal maturity with intertrochanteric (IT) and subtrochanteric fractures who had PFLCP fixation between1st October 2019 and 30th September 2021 was analyzed. Poor outcome defined as mechanical failure, non-union and varus collapse were statistically analyzed (P value 0.05) against possible predictive variables.

Results

A total of 28 patients, with mean age of 51.75±18.7 years, age range of 20-95 years, mean body mass index (BMI) of 27.23±0.8kg/m2 and M: F of 1.8:1 were studied. Unstable IT fracture was the most common fracture seen in 12 patients (42.8%), followed by stable IT fracture (35.7%) and subtrochanteric fracture (21.4%). Radiologic union was achieved in 20 patients (71.4%) and poor outcome of mechanical failure/non-union, varus collapse seen in 3(10.7%) and 5(17.8%) patients respectively. There was a statistically significant association between obesity and mechanical failure (P value 0.001) and also a significant association between unstable IT and varus collapse (P value 0.011).

Conclusion

An excellent outcome was achieved with PFLCP fixation, however obesity and unstable IT fractures were predictors of poor outcome.

Keywords: PFLCP, Intertrochanteric, Subtrochanteric, Obesity, Mechanical Failure, Non-Union, Aarus Collapse.

1. Introduction

The incidence of proximal femur fractures is on the rise in developing countries like ours, due to both low energy osteoporotic fracture in the elderly and high energy MVA in the young. The operative treatment of such proximal femur fractures has evolved over time and various implants have been used for fixation [1]. The proximal femur locking compression plate (PFLCP), although suitable for fixation of proximal femur fractures especially where there is poor bone stock, however its success is dependent on careful attention to biomechanical principles and potential pitfalls [2]. While some studies have shown a satisfactory outcome of PFLCP in treatment of such fractures others have shown otherwise [3-7].

The predictors of poor outcome in PFLCP are still a subject of research with many suggesting that it's a poor choice for unstable trochanteric fractures [3, 6, 8].The purpose of this study was to show the reliability of PFLCP with regards to bone union and to determine the predictors of poor outcome in the treatment of proximal femur fractures.

2. Materials and Methods

The study was a single center retrospective cross sectional study conducted at Abubakar Tafawa-balewa Teaching Hospital (ATBUTH), a tertiary referral centre located in North-eastern Nigeria. A 2-year retrospective data of all skeletally matured patients that presented with any of the stable IT, unstable IT or sub trochanteric fractures, who had consented for surgical treatment with PFLCP between 1st October 2019 and 30th September 2021 and have completed a follow-up for 1 year were included. Patients with pathologic fractures, medically not fit for surgery or declined surgery were excluded from the study. Following approval from the ethics committee, clinical and radiologic data was collected including demographics, mechanism of injury, laterality, duration before presentation, diagnosis, fracture site, body mass index (BMI) and Singh index.

3. Surgical Approaches

All operative interventions were performed by the orthopaedic surgeons in the department. Exposure of the proximal femur was performed using the direct lateral approach with subarachnoid block (SAB) or epidural anaesthesia. Meticulous tissue dissection and handling was done.Proximal femur locked plate fixation for intertrochanteric and subtrochanteric fractures utilized a proximal femur plate with 3 proximal holes at 135 degress,120 degrees and 95 degrees for 6.0mm locking cancellous screw fixation into the femoral head and neck. The distal holes for femoral shaft fixation were fixed using 4.5mm non-locking or 5.0mm locking screws utilizing the lateral subvastus approach to the proximal femur.

Surgical wound was irrigated with normal saline in all cases where surgery time exceeds 90 minutes and active redivac drain inserted. All Patients received 1.5gram of ceftriaxone/sulbatam at the point of SAB/epidural anaesthesia and intravenous antibiotics was continued for atleast 72 hours after surgery and oral 3rd generation quinolones (levofloxacin) subsequently for 10 days based on local antibiotic protocol.

4. Postoperative Care

High risk Patients received subcutaneous clexane 40-80 iu daily for atleast 72hours and subsequently oral dabigatran (pradaxa), 110mg daily for 1 month. Functional exercises of the lower extremities were commenced 48hours after surgery including isometric muscle contraction and relaxation, abduction, hip and knee extension not exceeding 90°. Activity intensity and frequency were determined based on individual tolerance.

Patients were mobilized with either bilateral axillary crutches or Zimmer's frame 48 hours after surgery on non-weight bearing until radiological union was achieved. After discharge Patients underwent follow-up at 6 weeks, 3 months, 6 months and 1 year (fig 1 and 2). Immediate post-operative xray s were done to assess for fracture reduction, while follow-up radiographs were done to assess union, non-union,mal-union(varus collapse),Mechanical failure(screw loosening, implant breakage and other parameters).

5. Reliability of pflcp was Assessed Using the Rate of Radiologic Union and Poor Outcomes were Defined as Mechanical Failure/Non-Union or Varus Collapse.

All data were analyzed using SPSS 23 software. Categorical data was presented as descriptive statistic and chi square test to test for statistical significance of the variables (age, sex,duration of presentation, BMI, singh index) against outcome measures. Continuous data were described as mean and standard deviation with t-test for statistical significance. The predictors of PFLCP failure in proximal femur fractures using logistic regression analysis, at 95% confidence interval and at a P-value of 0.05.

Figure 1: PFLCP in a sixty-five -year old woman who sustained sustained communited subtrochanteric fracture

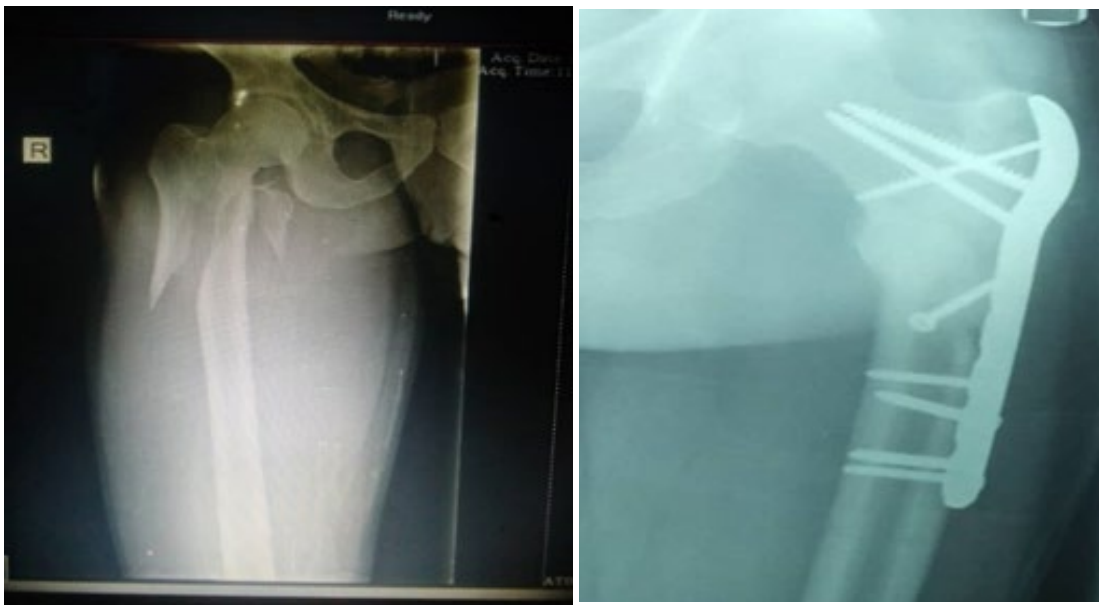

Figure 2: a Intertrochanteric fracture in a forty-two -year old male b Underwent PFLCP and achieved satisfactory fracture healing.

6. Results

A total of 28 patients (18 male, 10 female), whom have met the criteria for inclusion in this study were retrospectively analyzed. The mean age of participants was 51.75± 18.7 years, with age ranging from 20-95 years. Male accounted for 64.2% of patients with a M: F of 1.8:1. Eight patients (28.5%) presented within the first week of injury, while 20 patients (71.5%) presented after 1 week with RTA as the most common mechanism of injury in 16patients (57.1%) followed by osteoporotic fractures resulting from trivial indoor/outdoor fall in 42.7% of patients (Table 1).

INJURY HISTORY	MALE(N=18)	FEMALE(N=10)	Total
Duration at presentation(%)			
< 1week	5(17.8)	3(10.7)	8(28.5)
1-4 weeks	5(17.8)	2(7.1)	7(24.9)
4- 12 weeks	4(14.3)	2(7.1)	6(21.4)
>12 weeks	4(14.3)	3(10.7)	7(24.9)
Mechanism of injury(%)			
RTA	13(46.4)	3(10.7)	16(57.1)
Trivial indoor fall	3(10.7)	5(17.8)	8(28.5)
Outdoor fall	2(7.1)	2(7.1)	4(14.2)

Table 1: Perioperative variables

The mean BMI of the patients is 27.23±3.08kg/m2 with 42.6% having a BMI of <25kg/m2 and 3 patients (10.7%) had BMI ≥30kg/m2 Table 2.

PERIOPERATIVE VARIABLES	RADIOLOGIC UNION(n=20)71.4%	VARUS COL-LAPSE(n=5)17.8%	MECHANICAL FAILURE/NON-UNION(n=3)10.7%	P-VALUE
Age in years(mean 51.75±18.7)%				
16-30	3(10.7)	1(3.6)	0(0)	
31-45	5(17.6)	2(7.1)	0(0)	
46-60	5(17.6)	1(3.6)	1(3.6)	
61-75	6(21.4)	1(3.6)	0(0)	
>75	1(3.6)	0(0)	2(7.1)	

Sex(%)				
Male	13(46.4)	3(10.7)	2(7.1)	
Female	7(25)	2(7.1)	1(3.6)	
BMI in kg/m²(mean 27.23±3.08)%				
18.5-<25	8(28.6)	1(3.6)	0(0)	
25- <30	12(42.6)	2(7.1)	0(0)	
>30	0(7.1)	2(7.1))	3(10.7)	0.001,df 4
	0(0)	2(7.1)	3(10.7)	Fischer exact test 0.100
Fracture diagnosis (%)				
Stable Intertrochanteric	7(25)	0(0)	3(10.7)	0.011,df 4
Unstable intertrochanteric	7(25)	5(17.8)	0(0)	
Subtrochanteric	6(21.4)	0(0)	0(0)	

Table 2: Perioperative variables and Outcome measures of PFLCP fixation

Stable intertrochanteric fractures was seen in 10 patients (35.7%) while unstable intertrochanteric and subtrochanteric fractures were seen in 12patients (42.8%) and 6 patients (21.4%) respectively (table 2). Radiologic union was achieved in 20 patients (71.4%) and poor outcome of mechanical failure/non-union and varus collapse was seen in 3(10.7%) and 5(17.8%) respectively. There was a statistically significant association between unstable intertrochanteric fracture and varus collapse (P value 0.011, df 4). Statistically Significant relationship was also seen between BMI and mechanical failure/non-union of PFLCP (P value 0.001, df 4, Fisher's exact 2 sided significant test of 0.100), amongst those with obesity.

7. Discussion

The age and sex distribution of the studied participants are similar to findings by and who found a mean age of 51.47 years and 55 years respectively, found a mean of 66.8 years slightly higher than ours. The M;F in this study of 1.8:1 may be due to more outdoor activities, driving and other laborious activities engaged by men which make them more prone to RTA, and other studies have also reported a higher male ratio[1, 3, 7].

Unstable intertrochanteric fracture was most common, accounting for 42.8% with higher incidence in those >60 years and this is in tandem with the findings by and that found 58% and 50% respectively of proximal femur fractures to be unstable intertrochanteric fracture [4,7]. Satisfactory radiological union was achieved in 71.4% and this can be attributed to careful perioperative planning and good intraoperative reduction. And reported similar findings, but found an excellent union rate of 92% in patients with unstable IT fractures treated with PFLCP [1, 5, 6].

Poor outcome of mechanical failure/non-union and varus collapse was seen in 3 patients (10.7%) and 5 patients (17.8%) respectively. In a study of 273 consecutive patients with trochanteric fractures showed a similar non-union rate with PFLCP and a much higher varus collapse rate of 35% in unstable intertrochanteric fractures [8]. found a similar varus collapse rate with however a higher overall treatment failure rate o f41.4%. Several studies have shown unstable intertrochanteric to be associated with poor outcome similar to the finding in this study that showed a statistically significant association with varus collapse.

A BMI of ≥30kg/m2 was associated with poor outcome with a statistically significant association with mechanical failure/non-union, similar to a study by [5-9]. There is paucity of studies on the association between high BMI and poor outcome in PFLCP fixation. From our study obesity and unstable intertrochanteric fractures are the major predictors of mechanical failure/non-union and varus collapse with a statistically significant P values of 0.001 and 0.011 respectively.

8. Conclusion

PFLCP fixation showed satisfactory radiologic union in stable intertrochanteric, unstable intertrochanteric and subtrochanteric fractures. An excellent outcome can be achieved with careful preoperative preparation and meticulous intraoperative reduction. In patients with BMI of ≥30kg/m2 (obesity) and those with unstable intertrochanteric fractures, PFLCP may not be the best choice of fixation considering that these variables are predictors of poor outcome.

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Compliance with ethical standard

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical Approval: Ethical approval was obtained from the ethical board of Abubakar Tafawa-balewa University Teaching hospital, Bauchi to obtain the data of patients that have undergone proximal femoral locking compression plating and the study was in absolute compliance.

Informed Consent N/A

Author Contribution: All authors have been directly involved with the various aspects of the study. We attest to the fact that all authors have participated in the research, read the manuscript, attest to the validity and legitimacy of the data.

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Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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