

ORIGINAL ARTICLE

Gamma Nail versus Prixomal femur Locked plate in treatment of intertrochanteric femur fractures: one year follow-up, final radiological and clinical outcomes

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	Background Intertrochanteric femur fractures require early
Keyword: gamma nail, trochanteric	mobilization and stable fixation. Commonest methods of
femur fractures, proximal femur locked	fixation are gamma nail and proximal femur locked plate. The
plate	aim of the work: to compare the clinical and radiological
	outcomes of the two fixations methods in one year follow-up.
	Methodology: Two groups of fifty patients with
	intertrochanteric femur fractures were assigned to participate in
	this prospective study. 25 patients fixed with proximal femur
	locked plate for groub A and 25 patient fixed gamma nail for
	group B. Functional outcomes is determined by Harris Hip
	Score at the final follow-up . Recorded data such as Weight
	bearing time, mobility Score, union time and complication such
* Corresponding author: Ahmed	as infection, nonunion malunion used to assess the final
Nasser Zakı	outcome. Results In a gamma nail, the time to full weight
Mobile: 01103042059	bearing is (4.16 ± 0.37) months, in a PFLP group (5.64 ± 0.49)
	months. Postoperative infection is seen in 36% of the PFLP
E-mail:	group, compared to 8% in the GN group which is statistically
ahmed.zaki12111994@gmail.com	significant. In PFLP 44% show varus malunion compared to
	24% in gamma nail. Conclusion : the Gamma Nail appears to
	have advantages in terms of mobility outcomes, early full
	weight bearing, less postoperative infection and less malunion.

ABSTRACT

INTRODUCTION

Intertrochanteric femur fractures management are difficult, especially in older patients due to the high complication rate. A number of fixation techniques, including gamma nails and proximal femur locked plates, have been investigated for stable fixation and early mobilization ⁽¹⁾⁽²⁾. Gamma nails offer the primary benefit of reducing soft tissue disruption and enhancing stability⁽⁴⁾, while proximal femur locked plates, which are specifically favored in osteoporotic bone, improve fixation through their locking mechanism⁽³⁾⁽⁶⁾. Recent research compared the effectiveness of these two procedures, with a focus on clinical outcome, recovery time, and the frequency of complications. It was shown that gamma nail surgery was less invasive and required less time in the operating room than proximal femur locked plate surgery⁽⁸⁾⁽⁹⁾. However, the Union rate is similar for both fixing methods ⁽⁶⁾. While a number of studies have examined the effectiveness of proximal femur locked plates and gamma nails in treating trochanteric femur fractures, little is known regarding the clinical and radiological outcomes during longer follow-up periods. Because of its biomechanical properties and quicker



healing, we hypotheses the gamma nail is preferred more than the proximal femur locked plate in the treatment of trochanteric femur fractures. The goal of the study is to compare the clinical outcomes of the two fixations in order to help optimize the treatment protocol for intertrochanteric femur fractures.

PATIENTS AND METHODS

Two groups of fifty patients with intertrochanteric femur fractures were randomly assigned to participate in the trial. Proximal femur locked plate treatment for groub A with 25 patient and gamma nail treatment for groub B with 25 patient .This prospective study was carried out in the orthopedic department of Aswan University Hospital between March 2023 and April 2024. Inclusion criteria: patient more than 18 years, all type of AO classification ⁽⁹⁾.Exclusion criteria: Pathological fractures, Open fractures, pelvis or acetabulum surgery, previous surgery, Patient not fit for surgery

Preoperative data recorded: comorbidities such diabetes mellitus and hypertension, related fractures, hip and femur x-rays (antero-posterior and lateral views), and the neurovascular status of the limb. The patient had skin traction in addition to analgesics and anticoagulants.

Surgical technique

Patient under spinal or general anesthesia lies on radiolucent orthopedic fracture table. Subsequently an intravenous dosage one gram of antibiotics from the first generation of cephalosporin, The affected lower limb was sterilized and draped starting from the umbilicus down to the foot. There are several important steps in GN fixation. In order to make imaging and access easier, the patient is positioned laterally. With internal rotation and leg traction by the assistant, we were able to complete closed reduction of the fractures. We used the awl achieve the nail entrance in the greater trochanter (GT) tip through a 2-3 cm skin incision located proximal to the GT tip. The gamma nail was then introduced, and the image intensifier was used to confirm that it was parallel to the femoral axis. It is essential that the medullary canal be reamed in order to ensure that the nail goes easily and without resistance. Using the image fluoroscopy, the lag guide wire was advanced centrally through the femoral neck and head using the GN's guided device. Reaming was then done. Under the guidance of the image fluoroscopy, the lag screw was introduced. To secure and fix the nail position, two distal locking screws is inserted (13) (14). On the other hand, through lateral approach, PFLP is applied on the proximal femur and anatomical reduction done under direct vision. To provide angular stability, the femoral head and neck are engaged by several proximal locking screws that are driven into the plate. The plate is secured to the shaft using a number of distal locking screws. ⁽¹¹⁾⁽¹⁵⁾

Postoperative follow-up:

Patients are given low dosage heparin, analgesics, and antibiotics after surgery. It is recommended to begin with passive range of motion on the first day and progress to active range as tolerated. Partial weight bearing is allowed after four to six weeks; full weight bearing is allowed if healing appears on a radiograph. A follow-up is carried out following 2 weeks, 6 weeks, 3 months, 6 months, and 1 year .The primary end measure was the frequency of postoperative complications like implant failure, varus collapse with neck shaft angle (NSA), and infection. Functional outcomes is determined by the Parker Mobility Score and Harris Hip Score at the final follow-up.

Statistical analysis:

Version 27.0 of the Statistics Package for Social Sciences (SPSS Inc., Chicago, IL, USA) was used to analyze the data. The Kolmogorov-Smirnov and Shapiro-Wilk tests for normalcy were used, and the results showed that the age data were normally distributed. The data for the other scale factors, however, did not follow a normal distribution. Continuous data were reported as median and interquartile range (Median (IQ)) or mean + standard deviation (Mean±SD). For parametric data, the Independent samples T-test was used to identify differences between the two groups; for non-parametric data, the Mann-Whitney U test was used. For non-parametric data, differences between more than two groups were found using Kruskal-Wallis H.

The Chi square test was used to identify differences between the two groups based on the percentage representation of the nominal data. Something was deemed statistically significant when a two-tailed p < 0.05.

RESULTS

The PFLP and Gamma nail mean ages were 53.32 ± 12.66 , 49.76 ± 14.81 respectively, and did not show any statistical significance. In the PFLP group, there were 10 patients (40%) with comorbidities like Dm, HTN, and renal illnesses, compared to 15 (60%) patients in the PFN group.

In a gamma nail, the time to full weight bearing is 4.16 ± 0.37 months, which is significantly less than that in a PFLP group (5.64 ± 0.49 months, p value <0.05).

	Fixation		D volue
	PFLP (n=25)	Gamma nail (n=25)	r. value
Full weight bearing time			
Min Max.	5 - 6	4 - 5	
Mean±SD	5.64 ± 0.49	4.16±0.37	
Median(Q1-Q3)	6(5-6)	4(4-4)	<0.001**

Table 1 comparison according to full weight bearing

When comparing union time in the GN group $(3.68\pm1.07 \text{ month})$ to the PFLP group $(3.8\pm0.82 \text{ month})$, union time shows no discernible difference.

There is no statistically significant difference between the two groups according to the Parker Mobility Score and Harris Hip Score.

12 (48%) patient in PFLP show postoperative complications compared to 8 (32%) cases in gamma nail group.

Postoperative infection is seen in 36% of the PFLP group, compared to 8% in the GN group which is statistically significant.

	Fixation		D vialue
	PFLP (n=25)	Gamma nail (n=25)	r. value
Infection			
No	16(64%)	23(92%)	0.017*
Yes	9(36%)	2(8%)	0.017
Non union			
No	25(100%)	25(100%)	-
NSA			
Interoperative			
Min Max.	95 - 138	95 - 135	
Mean±SD	125.04±13.76	122.52±14.67	
Median(Q1-Q3)	130(119-135)	129(112.5-130)	0.278
After 3 m			
Min Max.	95 - 138	95 - 135	
Mean±SD	$120.04{\pm}14.51$	122.52±14.67	
Median(Q1-Q3)	128(110-131.5)	129(112.5-130)	0.761
Malunion			
No	14(56%)	19(76%)	0.126
Varus	11(44%)	6(24%)	0.130
DVT			
No	23(92%)	25(100%)	0.149

Table 2comparison according to postoeprative complications



Yes	2(8%)	0(0%)	
NV			
Intact	25(100%)	25(100%)	-
LLD			
No	23(92%)	22(88%)	0 (27
Yes	2(8%)	3(12%)	0.037
Device failure			
No	22(88%)	25(100%)	0.074
Yes	3(12%)	0(0%)	0.074
Union time			
Min Max.	3 - 5	3 - 6	
Mean±SD	3.8±0.82	3.68±1.07	
Median(Q1-Q3)	4(3-4.5)	3(3-4)	0.331
Revision			
No	22(88%)	25(100%)	0.074
Yes	3(12%)	0(0%)	0.074
Mortality rate			
No	22(88%)	22(88%)	1 000
Yes	3(12%)	3(12%)	1.000

At final follow up, There were 11 (44%) cases of varus malunion (NSA<120°) complained in the PFLP group, compared to 6 (24%) cases in the GN group. Between the 11 cases of varus malalignment that recorded in group A there were 5 cases were in normal alignment with accepted early post-operative NSA (133 \pm 2.74) and later on shifted to this unaccepted varus malalignment with NSA (108 \pm 2.74), this shift was not recorded in GN group which is statistically significant.

In the PFLP group, 2 (8%) patients reported DVT, and three patients experienced device failure but 0% in GN group.

No reported cases with cut through, metal failure or avascular head necrosis in both groups .

Table 3show varus shift in PFLP groub

	PFLP (n=25)	PFLP (n=25)	
	Interoperative	After 3 months	P. value
Varus shift			<u></u>
Min Max.	130 - 135	105 - 110	
Mean±SD	133±2.74	108 ± 2.74	
Median(Q1-Q3)	135(130-135)	110(105-110)	0.025*



(A) (B) (C) (D) (E) Figure 1 show a case of male patient 59 years old with trochanteric femur fracture fixed with PFLP (A) preoperative x ray (b) intraoperative c arm (C) early postoperative x ray (D) x ray after 3 months (E) x ray after 12 month



(A)

(B)

(C)

(D)

Figure 2 show a case of 62 male patient with trochanteric femur fracture fixed with gamma nail

(A) Show preoperative x ray (B) intraoepartive c arm (C) early postoperative x ray (D) x ray after 12 month

DISCUSSION

Since human life expectancy has increased, the geriatric population will increase, which means that more people will get intertrochanteric fractures in the future. The gamma nail is a commonly used procedure for treating intertrochanteric fractures, combining intramedullary nails with a sliding hip screw. It promotes healing by increasing rigidity at fracture sites, but can cause complications like stress fractures and main nail breakage. ⁽⁶⁾⁽⁸⁾

. The PFLP, an extra medullary fixation device, is bound by tension band principles, requiring stable support at the posterior inner-side trochanter. Complications like screw breakage and coxa vara are more likely in cases with displaced lesser trochanters ⁽¹⁰⁾. Two techniques for fixing intertrochanteric femur fractures are GN and PFLP. The results of our study, reported that both GN and PFLP are



successful in treating intertrochanteric femur fractures. Gamma nail has advantage of early full weight bearing, higher mobility scores and less complications than PFLP

The mean time for complete weight bearing differed statistically significantly between the PFLP group (5.64 ± 0.49 months) and the Gamma nail group (4.16 ± 0.37 months). This because the load is distributed along the femur and the gamma nail has stable fixation. The extra medullary position of the implant and the requirement for bone healing on the plate and screw are the causes of the delay in weight bearing in PFLP. Han et al. reported that the gamma nail provided a faster complete weight-bearing time than the PFLP. They also suggested that, in terms of early complete weight-bearing, PFLP was not superior to gamma nail; this might be investigated further with a larger sample size ⁽⁹⁾.

According to our findings, there is not a significant variance in either group's Parker mobility score or Harris hip score. Parker Palmer mobility scores did not show a significant difference between the two groups. Wutphiriya-angkul et al. although this specific PFLP was initially designed to treat intertrochanteric femur fractures, the manufacturer states that it is most effective when used to treat unstable intertrochanteric femoral fractures. The PFLP increased rotation resistance at six fixed points at the proximal femur, hence reducing the probability of lateral femoral wall re-injury. Specifically, in cases whose intramedullary nails were not an option due to extensive comminuted lateral walls, the PFLP fared better than the gamma nail ⁽¹⁹⁾. Wutphiriya-angkul found no difference in the Harris hip score between the two groups ⁽¹⁹⁾.

. 12 (48%) patient in PFLP show postoperative complications compared to 8 (32%) cases in gamma nail group. As GN has limited approach and minimal soft tissue handling, Nine (36%) cases show postoperative infections with statistical significance difference compared to 2 (8%) cases in gamma nail group. Because of its more invasive and expansive approach, PFLP increases the amount of soft tissue that is exposed to infectious pathogens during surgery. Additionally, the intramedullary position of the gamma nail offers a more infection-resistant environment. Two (8%) cases of deep vein thrombosis (DVT), eleven (44%) cases of Varus malunion and three (12%) cases of device failure occurred in the PFLP group. The Gamma Nail group, on the other hand, had six (24%) cases of varus malunion , three(12%) cases of leg length disparity and with no statistically significant difference.

Between the 11 cases of varus malalignment that recorded in group A, there were 5 cases were in normal alignment with accepted early post-operative NSA (133 ± 2.74) and later on shifted to unaccepted varus malalignment with NSA (108 ± 2.74) , this shift was not recorded in GN group which is statistically significant.. There has been debate regarding the impact of an implant's neck-shaft angle on cut-out. Kukla's clinical revealed a marked rise in cut-outs in implants with greater angles ⁽²⁰⁾. Conversely, biomechanical research indicates that greater angles lead to less cut-out because they improve screw sliding and impaction at the fracture site ⁽²⁰⁾. No significant difference show in our study regarding this parameter

According to Han et al., there were no significant differences in complications between the two groups ⁽⁹⁾. Furthermore, Wutphiriya-Angkul found no significant difference in problems between the two groups when comparing these two treatment approaches ⁽¹⁹⁾. A research by Domingo et al. included 295 patients who had unstable intertrochanteric fractures and were treated with PFN. They discovered that the surgical method is straightforward, that the quantity of problems reported was acceptable, and that the overall outcomes were similar to those of prior investigations.⁽⁶⁾ .According to Banan et al. study on 50 patients with unstable trochanteric fractures, the only instance of implant failure in PFN was observed seven months after surgery.⁽²⁾



RECOMMENDATION:

- When selecting the best fixing technique, it's critical to take into account the characteristics of the patient, including age, bone density, and fracture type.
- It is important that surgeons have adequate training and expertise in both procedures in order to lower the likelihood of intraoperative complications.
- Early surgical procedures to lessen malreduction-related problems
- Delay full weight bearing till radiological union.
- Soft tissue handling with shortening of operation time to decrease postoperative infection
- Assure valgus positions with NSA more than 130⁰
- Early passive range of motion from the first days, active range as tolerated

Limitations of the study; small sample size, one center study and different experiences and skill levels of the orthopedic surgeon who performed the surgeries

CONCLUSION:

Based on the results of study, our findings demonstrated that that both GN and PFLP are successful in treating intertrochanteric femur fractures. Gamma nail has advantage of early full weight bearing , higher mobility scores and less complications than PFLP

Disclosure of interest

The authors declare that they have no competing interest.

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Authors contributions;

Hesham Hamed Refae: writing and reviewing of the manuscript,

Ahmed nasser zaki; study design, performing the surgeries, data collection and

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