Al-Azhar International Medical Journal

Volume 5 | Issue 2 Article 26

2024

Section: Orthopedics

Proximal Femoral Plate Versus Proximal Femoral Nailing Fixation For Treatment Of Unstable Intertrochanteric Femoral Fractures

Ibrahim ahmed Mostafa
Department of Orthopedic Surgery, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Sameh Anwer ElSayed Abdel-Aal
Department of Orthopedic Surgery, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Mahmoud Elsayed Omar Yassin
Department of Orthopedic Surgery, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt, mahmoudyassin093@gmail.com

How to Cite This Article

Mostafa, Ibrahim ahmed; Abdel-Aal, Sameh Anwer ElSayed; and Yassin, Mahmoud Elsayed Omar (2024) "Proximal Femoral Plate Versus Proximal Femoral Nailing Fixation For Treatment Of Unstable Intertrochanteric Femoral Fractures," *Al-Azhar International Medical Journal*: Vol. 5: Iss. 2, Article 26.
DOI: https://doi.org/10.58675/2682-339X.2282

ORIGINAL ARTICLE

Proximal Femoral Plate Versus Proximal Femoral Nailing Fixation for Treatment of Unstable Intertrochanteric Femoral Fractures

Ibrahim Ahmed Mostafa, Sameh Anwer El-Sayed Abdel-Aal, Mahmoud El-Sayed Omar Yassin*

Department of Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: **The rising prevalence of osteoporosis among the elderly has been associated with an increase in trochanteric fractures. Intramedullary devices like proximal femoral nail (PFN) and proximal anatomic femur plates are used for the management of intertrochanteric femur fractures. However, there is still a lot of research to be done to determine which implant is best for treating these fractures with the fewest-possible side effects.**

Aim and objectives: **With the purpose of evaluating the efficacy of different therapies for fractures of the trochanteric region of the femur by PFN versus proximal trochantric femur plate.**

Patients and methods: **A prospective research was conducted between trauma patients (30) with unstable intertrochanteric fractures who were admitted to Alhussien Hospital (Al Azhar University). Patients were managed in a random manner either with PFN (group 1) or proximal femoral plate (group 2). The median follow-up was 10 months ranging from 7 months to 12 months, the end point of follow-up was at least for 6 months or till union.**

Results: **Both groups showed significant differences as regards Harris Hip Score (HHS), mobility score, and length of follow-up months.**

Conclusion: **In this study, researchers looked at how well the proximal locking plate and PFN worked for unstable patients (Boyd and Griffon types II and IV). Surgical time, blood loss, union time, and postoperative problems were all shown to be shorter with PFN than with proximal femur locked compression plate (PFLCP). It is crucial to fully understand PFN and be familiar with its concept, characteristics, and method of application. These findings suggest that PFNA is superior to other internal fixation methods for stabilizing unstable intertrochanteric femoral fractures.**

Keywords: Intertrochanteric fracture, Proximal femoral locking plate, Proximal femoral nail

1. Introduction

Intertrochanteric fractures are extracapsular breaks in the bone between the greater and lesser trochanters in the proximal femur. The intertrochanteric aspect of the femur is an area of dense trabecular bone located between the greater and lesser trochanters. The bony vertical wall known as the calcar femorale connects the back of the femur neck to the back of the femur shaft on the posteromedial side. The stability of a fracture depends on this structure, making it crucial. Union rates are higher and the risk of osteonecrosis is lower for metaphyseal fractures than for femoral neck fractures due to the greater blood supply to the metaphyseal region.[1]

Osteoporosis increases the risk of low-energy fractures in the elderly, but they can happen to anyone at any age. The ratio of women to men ranges from 2 to 8. In addition, these individuals tend to be older than those who sustain femoral neck fractures. High-energy mechanisms are often the cause of these fractures in the younger population.[2]

Lateral wall reconstruction plays an imperative role in maintaining the stability of these fractures and hence the functional outcome. By providing a

Accepted 12 July 2023.
Available online 7 June 2024

* Corresponding author. Department of Orthopedic Surgery, Faculty of Medicine for Boys, Al-Azhar University, Cairo, 35511, Egypt.
E-mail address: mahmoudyassin093@gmail.com (M.E.-S.O. Yassin).

https://doi.org/10.58675/2682-339X.2282

buttress effect to the lateral wall of the proximal fragment, excessive fracture collapse, significant limb shortening, varus malposition, and medialization with eventual fixation failure are prevented.[3]

Although impact direction has been shown to affect the overall risk of hip fracture, there is no clear correlation between impact direction and fracture location or morphology.[4]

Rather than contrasting open versus closed techniques, we shall distinguish internal fixation according to the extra-versus intramedullary position of the material.[5]

Nonoperative treatment is rarely indicated and should only be considered for non-ambulatory patients and patients with a high risk of perioperative mortality or those pursuing comfort care measures. The outcomes of this method of treatment are poor due to an increased risk of pneumonia, urinary tract infection, decubiti, and deep vein thrombosis.[6]

The goals of management of any hip fractures, other than reducing mortality, are to return patients safely and efficiently to their prefracture level of function without prolonged disability and preventing different complications and to give the patient sufficient independence. Rigid fixation with early patient mobilization must be considered as the standard treatment. This significantly improves the ability to walk and rapid return to normal life.[7]

Risk factors that may have an impact on hidden blood loss, such as age, presence of an unstable fracture, intramedullary fixation, and general anesthesia, have been reported.[8]

In trochanteric fracture, ORIF is performed under antibiotic prophylaxis.Thromboprophylaxis is initiated postoperatively if there is no hemorrhagic syndrome. A suction drain is reserved to wide approaches. Weight-bearing up to the pain threshold is allowed postoperatively after intramedullary nailing or in stable fracture managed by screw-plate. Only touch weight-bearing is allowed if the assembly seems less secure in unstable fracture. In elderly patients, hardware is not ablated, except in the case of infectious or mechanical complications or of prosthesis replacement.[9]

The research compares the outcomes of proximal trochanteric femur plate with proximal femoral nail (PFN) therapy for unstable trochanteric femur fractures.

2. Patients and methods

Prospective research involving trauma patients (30) with unstable intertrochanteric fractures who were admitted to Alhussien Hospital (Alazhr University). Patients were managed in a random manner either with PFN (group 1) or proximal femoral plate (group 2). The mean follow-up was ten months ranging between 7 months and 12 months, the end point of follow-up was at least for 6 months or till union.

The inclusion criteria were all patients with unstable trochanteric fracture of the femur in all age groups.

The exclusion criteria were stable trochanteric fracture, infected cases, revision cases, pathological fractures caused by tumor lesions, previous inability to walk, and associations with prior fractures that might impede rehabilitation.

2.1. Methods

The methods of examination: on admission to the hospital, each participant was required to undergo the following clinical and radiological examinations: clinical assessment, preoperative radiological assessment, and laboratory investigations.

The methods of treatment were as follows: preoperative management, anesthesia, operative techniques, postoperative care, and methods of evaluation.

Operative techniques:

2.2. Proximal femoral locked plate surgical technique

Surgery is performed with the patient lying supine over the operating fracture table. Traction is applied and anatomically satisfactory reduction is achieved preoperatively under fluoroscopic control, in both anteroposterior and lateral views Fig. 1.

2.3. Proximal femoral nail surgical technique

Positioning of the patient: Once the anesthesia was administered, the patient was transferred to the fracture table. A well-padded perineal post was put between the patient's limbs and both feet were supported to well-padded foot holders. The supine position was used in all patients and the trunk was kept tilted away from the fractured side and the ipsilateral arm was strapped across the chest wall.

The technique of reduction: The traction was applied to the affected limb to restore length and neck shaft angle to avoid varus or valgus deformity Fig. 2.

Fig. 1. Showing anatomical reduction and inserting the plate under fluoroscopy.

2.4. Approach and introduction of the guide wire

A longitudinal incision was made starting at the tip of the greater trochanter and extended proximally for about 10 cm Fig. 3.

The guide wire was introduced in the medullary canal of proximal fragment crossing the fracture site, into the distal fragment aiming at the distal intercondylar region by closed manipulation under image intensifier Fig. 4.

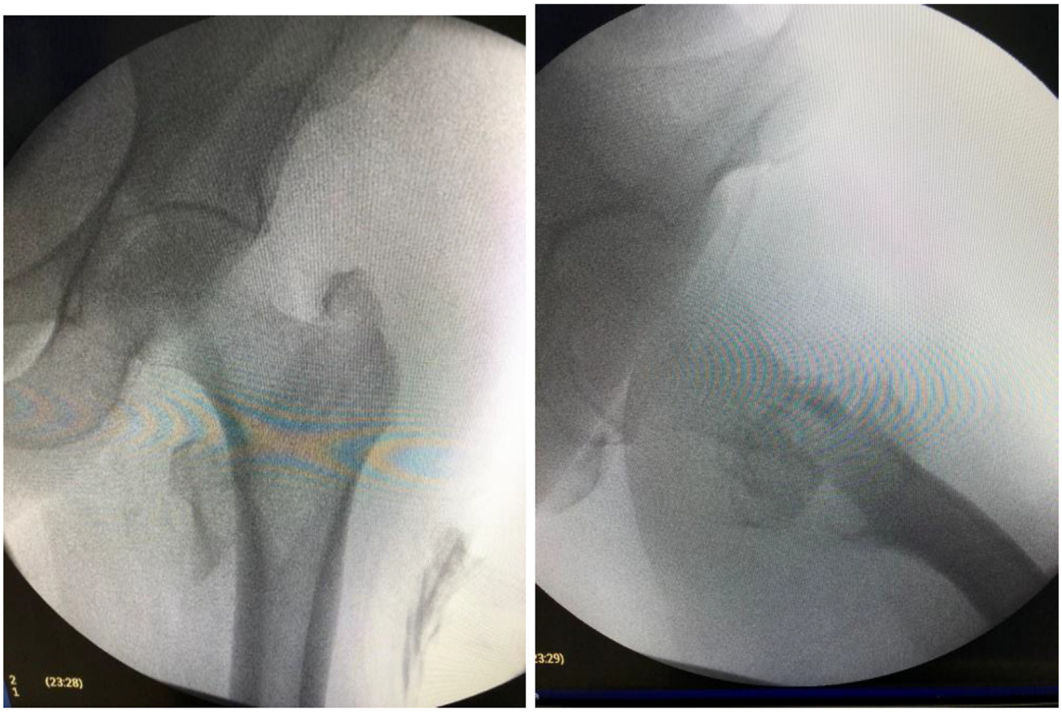


Fig. 2. Pictures show closed reduction of intertrochanteric fracture.

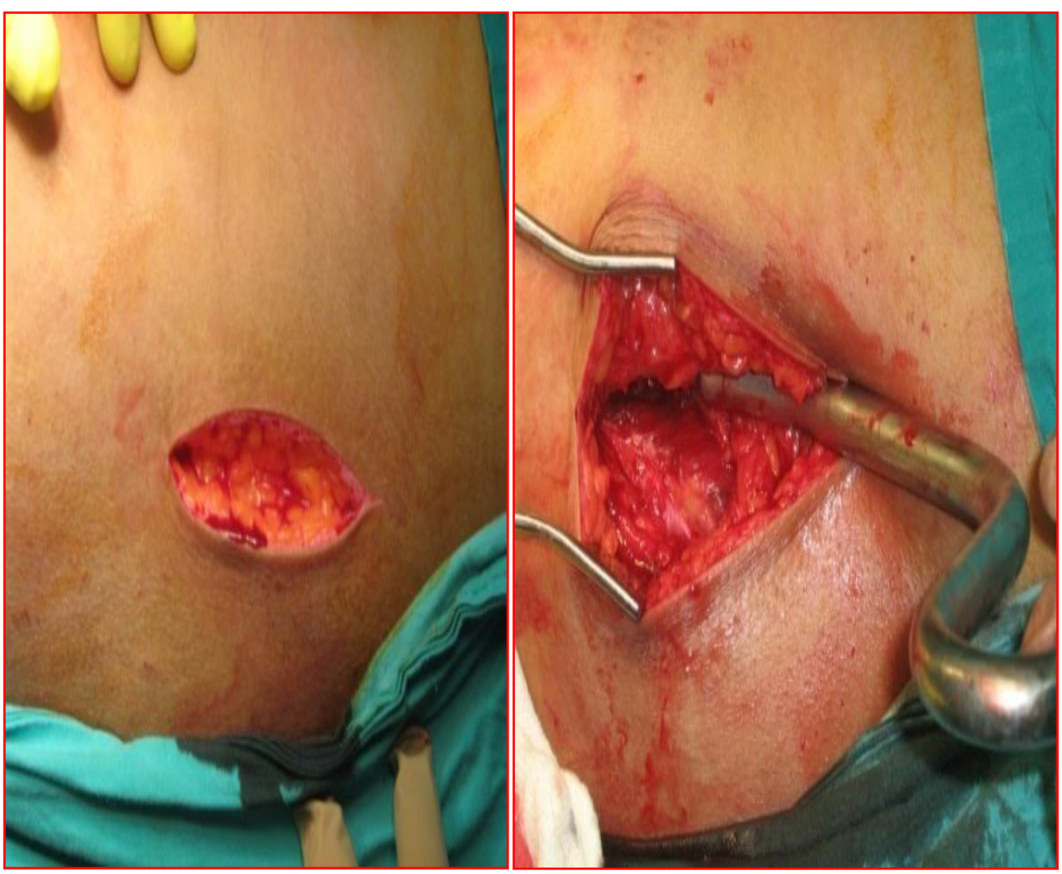


Fig. 3. Pictures show surgical incision during fixation using proximal femoral nail.

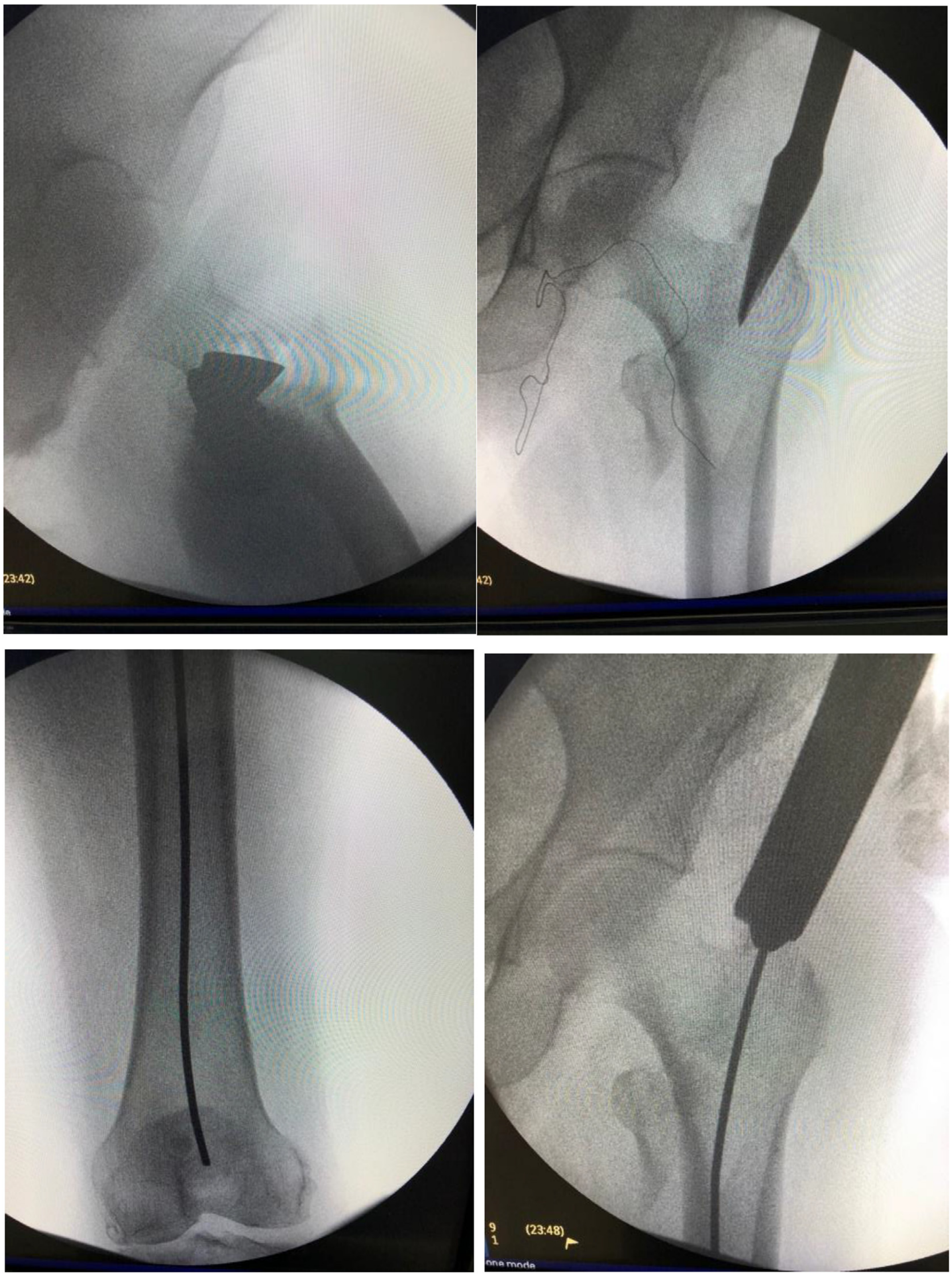


Fig. 4. Entry point and guide wire insertion.

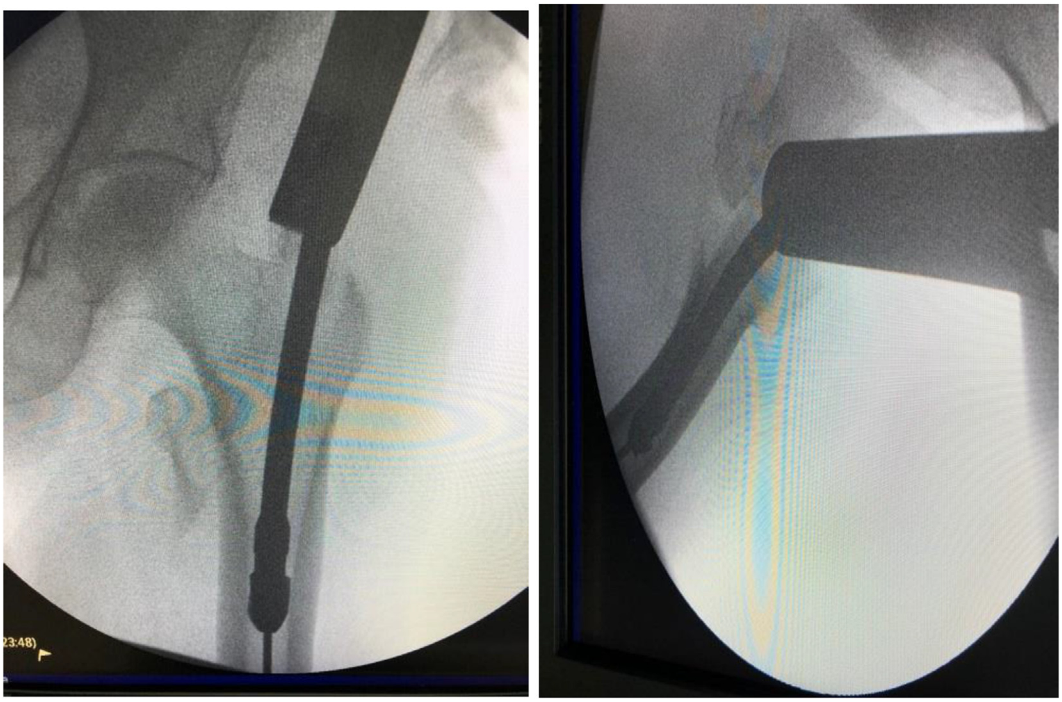


Fig. 5. Reaming of the medullary canal.

2.5. Reaming of the medullary canal and nail size determination

Fig. 5.

2.6. Introduction of the nail

The ball-tipped reaming guide wire was changed by non-ball-tipped guide wire over the plastic tube Fig. 6.

2.7. Proximal locking

Positioning of the nail was then checked to ensure that the lag screw and the antirotational screw would be placed within femoral head and neck in both anteroposterior and lateral planes Figs. 7 and 8.

2.8. Distal locking

The distal-locking 4.5 mm cortical screws use a 3.5 mm drill that was inserted under fluoroscopic guidance using a distal target device.

The wounds were then closed in layers Figs 9 and 10.

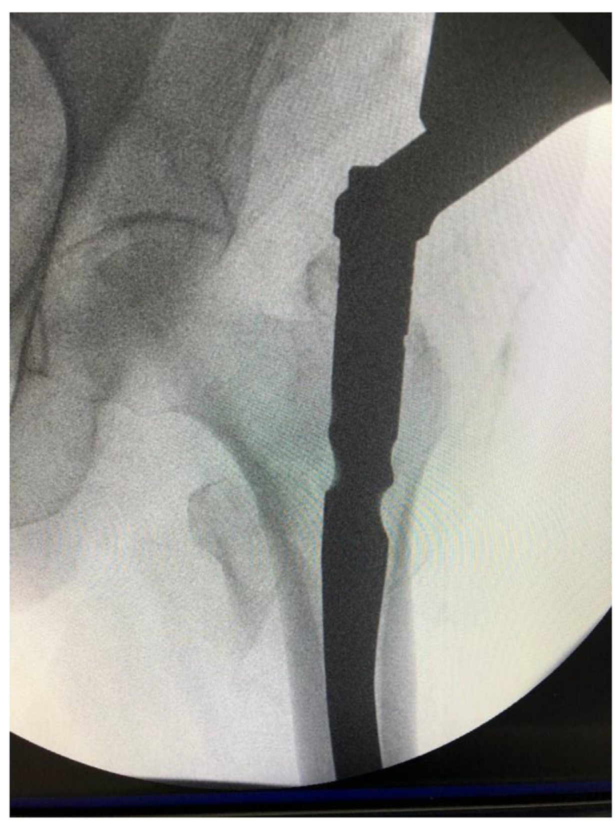


Fig. 6. Introduction of the nail.

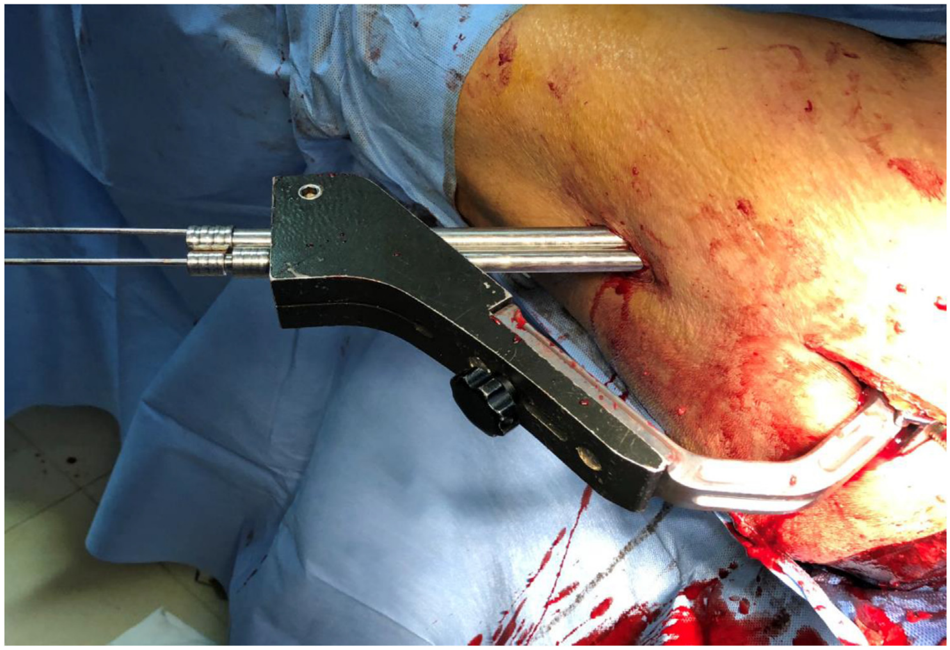


Fig. 7. Proximal locking system.

2.9. Statistical analysis

The SPSS Statistical Package will be used to gather, enter, and evaluate the data. The quantitative information will be displayed using a mean value and SD. Quantitative information will be shown as a number and a percentage. *P* values of less than or equal to 0.05 indicate significant results, while *P* value greater than 0.05 will be statistically nonsignificant.

3. Results

Table 1.

In group A, the mean age was 40.12 ± 3.54, 10 were male, six work at office, four home, five hospital, six

Fig. 8. Proximal locking.

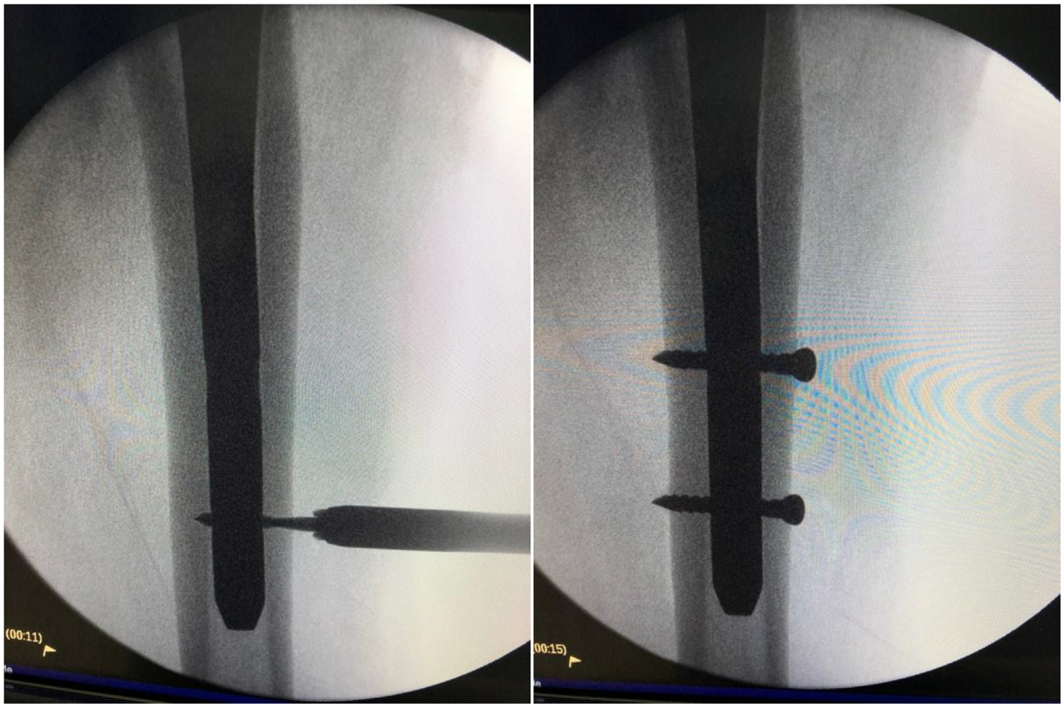


Fig. 9. Distal locking.

smoking, and two alcohol. In group B, the mean age was 39.3 ± 3.51, nine were male, five work at office, six home, four hospital, five smoking, and one alcohol.

This table reveals that both groups had similar age, sex, occupation, smoking, and alcohol habits Table 2.

In group A, the mean operation time in minutes was 32.5 ± 4.6, the mean intraoperative blood loss in ml was 30.9 ± 4.9, there were 4 with number of patients transfused (%), and 7 with operation with spinal anesthesia (%). In group B, the median operation time in minutes was 40.9 ± 5.5, the mean intraoperative blood loss in ml was 35.2 ± 6.5, there were seven with number of patients transfused (%), and eight with operation with spinal anesthesia (%).

This table demonstrates that there were no appreciable distinctions between the two groups with respect to procedural specifics Table 3.

This table reveals that laboratory investigation was comparable between groups with no statistically significant differences Table 4.

In group A, the mean Harris Hip Score (HHS) at 1 month, 23.5 ± 5.3, at 3 months, 66.5 ± 10.1, and at 6 months was 81.9 ± 9.1. The mean reduction in mobility score was 1.8 ± 0.5, length of follow-up months was 32.5 ± 3.2.

In group B, the mean HHS at 1 month, 24.2 ± 6.1, at 3 months, 68.2 ± 14.1, and at 6 months was 82.9 ± 9.3. The mean reduction in mobility score was 2.4 ± 0.8, length of follow-up months was 29.5 ± 3.0.

Substantial variations were between the two groups in terms of HHS, mobility score, and number of follow-up months Table 5.

In group A, there were 3 with prolonged drainage hematoma, 2 with superficial infection, and 3 with deep venous thrombosis.

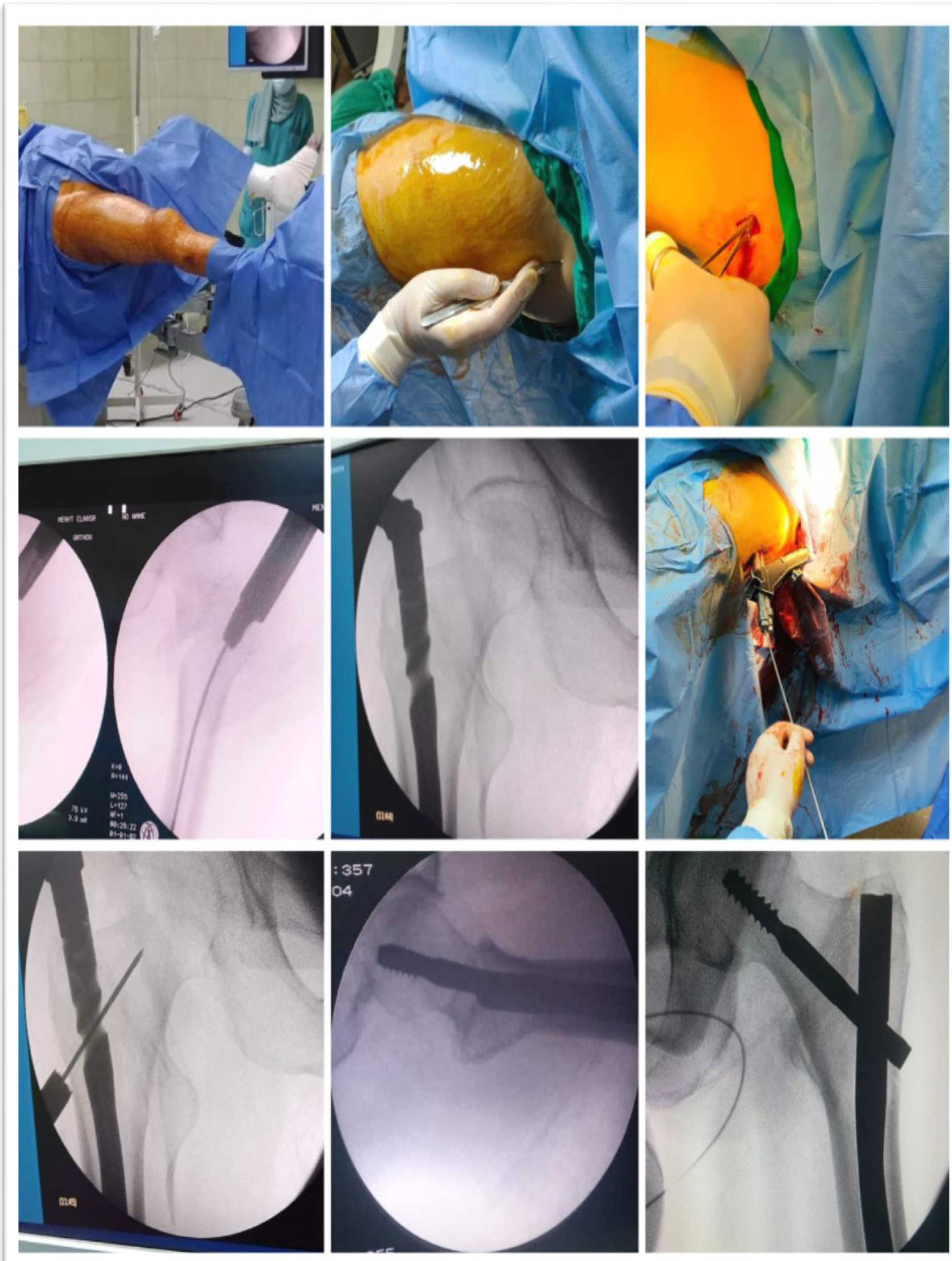


Fig. 10. Showing anatomical reduction and inserting the nail under fluoroscopy.

Table 1. Comparison of the examined groups in terms of demographic information.

	Group A (n = 15)	Group B (n = 15)	Test	*P*
Age			T = 1.017	0.97
Mean ± SD	40.12 ± 3.54	39.3 ± 3.51		
Sex			0.14	0.70
Male	10	9		
Female	5	6		
Occupation			0.602	0.74
Office	6	5		
Home	4	6		
Hospital	5	4		
Smoking	6	5	0.14	0.70
Alcohol	2	1	0.37	0.54

T, Two-Sample Independent *t* Test; χ^2, Chi-square test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.

Table 2. Operational differences between groupings.

	Group A	Group B	Test	*P*
Operation with spinal anesthesia (%)	7	8	0.13	0.71
Operation time in minutes	32.5 ± 4.6	40.9 ± 5.5	T = 1.429	0.51
Intraoperative blood loss in ml	30.9 ± 4.9	35.2 ± 6.5	T = 1.759	0.30
Number of patients transfused (%)	4	7	1.29	0.25

T, Two-Sample Independent *t* Test; χ^2, Chi-square test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.

Table 3. Comparison between the studied groups regarding laboratory investigations.

	Group A	Group B	Test	*P*
AST (U/L)	26 ± 8.54	25.0 ± 7.6	1.26	0.66
ALT (U/L)	25.5 ± 8.76	25 ± 7.12	1.51	0.44
Total bilirubin (mg/dl)	0.9 ± 0.20	1.0 ± 0.22	1.2	0.76
INR	1.2 ± 0.12	1.4 ± 0.2	1.21	0.72
PT (s)	12.6 ± 2.1	12.9 ± 2.2	1.09	0.86
Hemoglobin 'Hb' (g/dl)	13.8 ± 1.94	11.4 ± 1.44	1.81	0.27
Platelet ($x10^3/ml^3$)	182.10 ± 8.16	184.9 ± 12.22	2.24	0.14
BUN	35.0 ± 3.9	36.52 ± 3.95	1.025	0.96
Creatinine	0.92 ± 0.18	0.96 ± 0.22	1.14	0.46

T: Two-Sample Independent *t* Test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.
ALT, alanine transaminase; AST, aspartate transaminase; PT, prothrombin time.

Table 4. Comparison between the examined groups regarding HHS, mobility score, and length of follow-up months.

Mean HHS	Group A	Group B	Test	*P*
1 month	23.5 ± 5.3	24.2 ± 6.1	1.32	0.60
3 months	66.5 ± 10.1	68.2 ± 14.1	1.9881	0.21
6 months	81.9 ± 9.1	82.9 ± 9.3	1.044	0.93
Mobility score				
Mean reduction in mobility score	1.8 ± 0.5	2.4 ± 0.8	2.56	0.08
Length of follow-up months	32.5 ± 3.2	29.5 ± 3.0	1.137	0.81

T: Two-Sample Independent *t* Test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.
HHS, Harris Hip Score.

Table 5. Comparison between the examined groups regarding complications.

Early	Group A	Group B	Test	*P*
Prolonged drainage hematoma	3	1	1.15	0.28
Superficial infection	2	1	0.37	0.54
Deep venous thrombosis	3	1	1.15	0.28

χ^2: Chi-square test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.

Table 6. Comparison between the studied groups as regards complications.

Late	Group A	Group B	Test	P
Late infection	5	2	1.67	0.19
Deep-wound infection	4	2	0.83	0.36

χ^2: Chi-square test.
p: *P* value for comparing between different categories.
*: Statistically significant at *P* less than or equal to 0.05.

In group B, there was 1 with prolonged drainage hematoma, 1 with superficial infection, and 1 with deep venous thrombosis.

There were substantial variations between both groups regarding early complications Table 6.

In group A, there were five with late infection, fourwith deep-wound infection.

In group B, there were two with late infection, two with deep-wound infection.

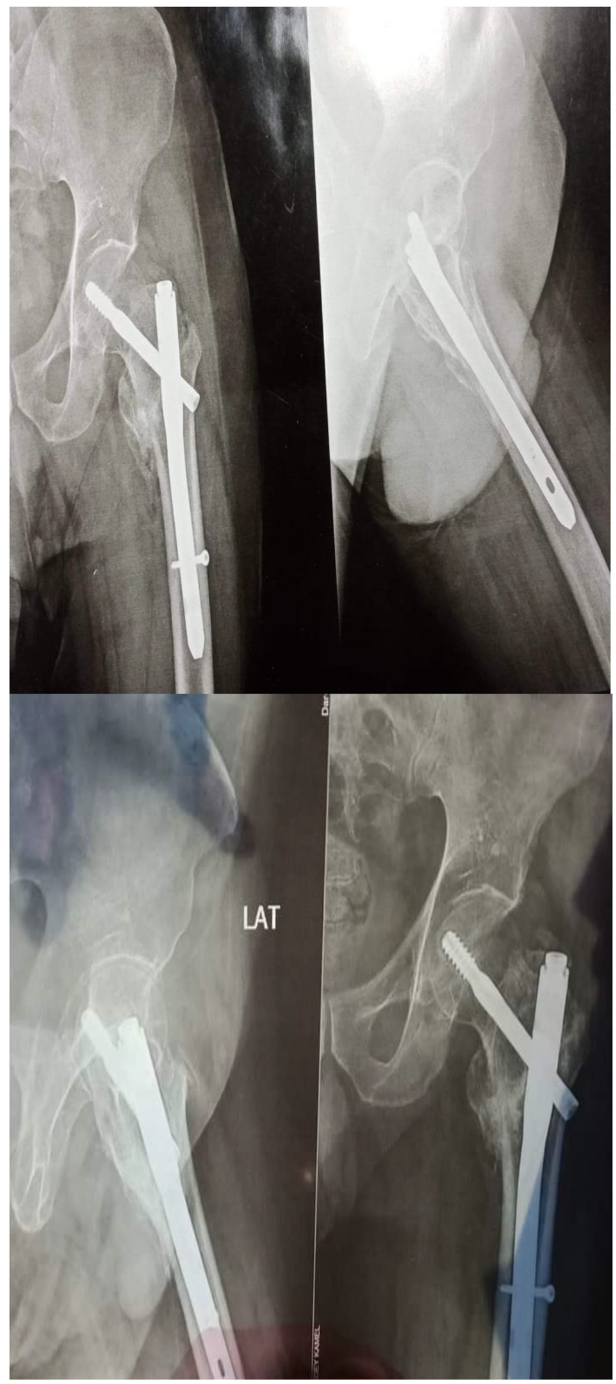
The table below demonstrates the statistically substantial variations between the two groups regarding the occurrence of late complications.

3.1. Case presentation

3.1.1. Case 1

History: A 49-year-old male patient who was involved in a car accident and suffered a left femur intertrochanteric fracture (AO-CLASSIFICATION: 31-A2). No more wounds. No current medical conditions and no history of procedures. The procedure was performed four days after the incident. The patient had followed-up for 1 year post-operatively with excellent scoring at the end of follow-up.

Preoperative radiography.



Radiography after 45 days of operation Radiography 6 months after operation.

3.1.2. Case 2

History: A male patient, 45 years old, had a domestic fall at home and developed intertrochanteric fracture (AO-CLASSIFICATION: 31-A2) of the left femur. No more wounds. No current medical conditions and no history of procedures. The procedure was carried out five days after the trauma. The patient had followed up for 20 months postoperatively with excellent scoring at the end of follow-up.

Preoperatively radiography.

After 45 days postoperation After 6 months postoperation.

4. Discussion

Intertrochanteric fractures are those that involve the region between the greater and lesser trochanters. About 45% of hip fractures are intertrochanteric fractures. Hip fractures would affect 2.6 million people worldwide by 2025 and 4.5 million people by 2050, according to Gulberg *et al.*[10] However, these numbers might increase to 37% in 2025 and 45% in 2050.[11]

One of the most often-treated orthopedic injuries is a trochanteric fracture, which is brought on by high-energy physical trauma in younger patients and low-energy physical trauma in two senior patients. These wounds result in unstable fractures in around half of the cases.[12]

This research demonstrated that there were no significant differences in terms of age, sex, occupation, smoking, or alcohol use between the two groups.

Mashhour *et al.* showed that the femoral nail and bolted plate clusters' respective mean ages of the included cases were 57.7 and 59.3 years, respectively. They were divided into 4 (40%) men and 6 (60%) women in the main meeting, although the ratio was comparable in the other gathering.[13]

Haq *et al.* who compared the therapy of unstable intertrochanteric fractures with damaged lateral walls between reverse distal femur locked compression plate (DFLCP) and PFN support this research by demonstrating that there were negligible differences in terms of sex and age between the two groups.[14]

This investigation showed that there were no significant differences in the operational details between the two groups.

Taqi *et al.* showed that the average amount of time between a trauma and a surgical procedure was 04 ± 1.27 days. Surgery took an average of 96.5 ± 13.7 min in group A and 57.69 ± 12.3 min in group B ($P = 0.03$). Blood loss in group A was determined at 445 ± 27.3 ml, whereas it was 230.65 ± 24.5 ml in group B.[15]

The lengthy soft tissue dissection and fracture reduction mentioned by Taqi *et al.* may be the reason for the prolonged procedure and greater blood loss with proximal femur locked compression plate (PFLCP). The notion of lateral wall stabilization in unstable per-trochanteric fractures is a newer and widely acknowledged hypothesis that cannot be addressed only with PFLCP.[16]

Table 7. Comparison between our study and other studies.

1	Our study	Mashhour *et al.*	Haq *et al.*	Taqi *et al.*
Mean age	40	56	59	58
Operative time	32.5 min in plating, 40.9 in nails, nonsignificant	78 min of plating 52 m in nailing significant	More in plating significant	More in plating significant
Blood loss	30.9 ml in plating 35.2 ml in nails, nonsignificant	More in plating	More in plating	More in plating
Infection	More in plating Nonsignificant	Equal results in both groups, nonsignificant	More in plating	Equal results in both groups, nonsignificant
Harris hip score at 3 months	Lower in group A versus group B, nonsignificant	Higher in nails group, nonsignificant	Significantly higher in nails group	Higher in nails group nonsignificant
Harris hip score at 6 months	Insignificant differences between the two groups	Higher in nails group, nonsignificant	Significantly higher in nails group	Nonsignificant

This investigation cleared that there were significant differences between both groups regarding HHS, mobility score, and length of follow-up months.

Haq *et al*. support this study, they showed that compared to the reverse-DFLCP group, the PFN group's median HHS was considerably greater. The median percutaneous cancellus screw (PCS) and multiple cancellus screw (MCS) of the SF-12 score significantly differed across the groups, and more patients had excellent or good HHS.[12]

Hasan *et al*. showed that regarding Harris hip, the arthroplasty group's final scores ranged in mean from 68.6 to 85. Range in the PFN group was 72.4–83.01. At the conclusion of the research, the arthroplasty group had a higher HHS.[17]

According to Chong *et al*., who performed arthroplasty and reported a median Harris hip score of 80.6 ± 9.3 at the conclusion of a 2-year follow-up period, these data explain why many surgeons choose arthroplasty for the management of unstable trochanteric fractures in the elderly.[18]

This investigation reported that there were substantial variations in early complications between the two groups. Regarding late complications, there were substantial differences between the two groups.

Taqi *et al*. showed that both groups were free of both superficial and deep infections. In group A, there were two (6.5%) incidences of implant failure, while there were none in group B. In group A, 29 (93.5%) patients had the radiological union, but in group B, all patients had it. In total, two (6.5%) patients in group A who had implant failure from early weight-bearing received treatment with a PFN and underwent follow-up care until union. In group A, the union process took between 19 and 28 weeks (23.5 ± 4.3 weeks); in group B, it took between 15 and 18 weeks (16.5 ± 4.8 weeks). At a follow-up of 30 weeks, the variance in the average radiological union score (RUST) between group A (5.466 ± 2.03 months) and group B was not statistically substantial.[15]

In Taqi *et al*. study, in the PFLCP group, they found one nonunion instance, but none in the PFN group.[15] Taqi *et al*. study shows 79.3% appeared in the PFLCP group, whereas the PFN group scored 93.1% outstanding and good.[13] Sahin *et al*. Harris hip scores were observed in 11 (24.4%) patients with excellent scores, 19 (42.2%) patients with good scores, nine (20%) patients with moderate scores, and six (13.3%) patients with bad scores.[19]

Hasan *et al*. showed that in the arthroplasty group, there were a total of 12 (3.47%) reported cases, compared with 11 (1.79%) instances in the PFN group. Although not statistically significant, the rate of thromboembolic complications was greater in the group receiving arthroplasty.[17] Table 7.

4.1. Conclusion

Two methods for stabilizing unstable femurs, the proximal locking plate and the proximal femoral nail, were compared in this study (Boyd and Griffon types II and IV). Surgical time, blood loss, union time, and postoperative problems were all shown to be shorter with PFN than with PFLCP.

It is crucial to fully understand PFN and be familiar with its concept, characteristics, and method of application. Results like these suggest that PFNA is the best internal fixation option for managing unstable intertrochanteric femoral fractures.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were NO conflicts of interest.

References

1. Karakus O, et al. The relationship between the type of unstable intertrochanteric femur fracture and mobility in the elderly. *J Orthop Surg Res*. 2018;13:1−5.
2. Kani KK, et al. Fragility fractures of the proximal femur: review and update for radiologists. *Skeletal Radiol*. 2019;48:29−45.
3. *Injury*. 2019 Apr;50(4):939949. https://doi.org/10.1016/j.injury.2019.03.032. Epub 2019 Mar 18.
4. Gotfried Y. The lateral trochanteric wall: a key element in the reconstruction of unstable pertrochanteric hip fractures. *Clin Orthop Relat Res*. 2004;425:82−86.
5. Attum B, Pilson H. *Intertrochanteric femur fracture*. 2020:1−12.
6. Tawari AA, Kempegowda H, Suk M, Horwitz DS. *What makes an intertrochanteric fracture unstable in 2015? Does the lateral wall play a role in the decision matrix?*. 29. 2015:4−9.
7. Wang F, Meng C, Cao X-B, Chen Q, Xu X-F, Chen Q. Hemiarthroplasty for the treatment of complicated femoral intertrochanteric fracture in elderly patients. *Zhong Guo Gu Shang*. 2018;31:818−823.
8. Eltorky A, Nawawy W El, Aly M, Ahmed AI, Ismail AMB, Bessada B. Treatment of unstable trochantric fractures using proximal femoral locked plate. *Med Sci*. 2020;8:585−594.
9. Bonnevialle P, Saragaglia D, Ehlinger M, Tonetti J, Maisse N, Adam P. Trochanteric locking nail versus arthroplasty in unstable intertrochanteric fracture in patients aged over 75 years. *Orthop Traumatol Surg Res*. 2011 (June);6:1.
10. Gulberg B, Johnell O, Kanis JA. World-wide projection for hip fractures. *Osteoporos Int*. 1997;7(5):407−413.
11. Manikandan R. *A comparative analysis of the functional outcome in intertrochanteric fractures between dynamic hip screw and proximal femoral nailing: a prospective study*. PhD thesis. Kulasekharam: Sree Mookambika Institute of Medical Sciences; 2020.
12. Sahin O. Polytrauma in the geriatric population: analysis of outcomes for surgically treated multiple fractures with a minimum 2 Years of follow-up. *Adv Ther*. 2022;39:2139−2150.
13. Mashhour MA, et al. Comparison between the results of management of recent unstable proximal femoral fractures by proximal femoral nailing and locked plating, 5 *Benha J Appl Sci*. 2020;5(1):55−65.
14. Haq RU, Manhas V, Pankaj A, Srivastava A, Dhammi IK, Jain AK. Proximal femoral nails compared with reverse distal femoral locking plates in intertrochanteric fractures with a compromised lateral wall; a randomised controlled trial. *Int Orthop*. 2014;38:1443−1449.
15. Taqi M, et al. *Treatment and outcomes of proximal femoral locking plate versus proximal femoral nail in unstable pert-trochanteric fractures (boyd and griffin type III & IV)*. 2021.
16. Taqi M, Tasneem M, Akhtar M, Naqshband MS, Faraz S, Gillani S, et al. Treatment and outcomes of proximal femoral locking plate versus proximal femoral nail in unstable pert-trochanteric fractures (boyd and griffin type III & IV).
17. Hasan MR, et al. Proxmal femoral nail vs prothetic replacement for treatment of unstable trochantric fractrures in elderly, A systematic review, 6 *Benha J Appl Sci*. 2020;5(2):281−287.
18. Chong CP, Savige JA, Lim WK. Medical problems in hip fracture patients. *Arch Orthop Trauma Surg*. 2010;130:1355−1361.
19. Sahin S, Ertürer E, Oztürk I, Toker S, Seckin F, Akman S. Radiographic and functional results of osteosynthesis using the proximal femoral nail antirotation (PFNA) in the treatment of unstable intertrochanteric femoral fractures. *Acta Orthop Traumatol Turcica*. 2010;44:127−134.