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ORIGINAL ARTICLE

Comparative Study Between Short and Long Proximal Femoral Nailing in Management of Intertrochanteric Fracture in Elderly Patients

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Abstract

Background: **Elderly people frequently suffer from intertrochanteric fractures; to address the challenges associated with treating unstable fractures, trochanteric-entry intramedullary nails have been developed. Both of short and long PFN apparatuses are being used to cure the trochanteric hip fractures. Compared to long devices, short PFN have recently been shown to cause less blood loss and speed up operations. Other research, however, has revealed that a lengthy PFN may be linked to fewer ipsilateral femur fractures in the future.**

Objective: **To compare the surgical time, estimated blood loss, hospital stay and intraoperative complications and the effectiveness of short and long proximal femoral nails in treating intertrochantric fractures in older patients.**

Patients and methods: **This prospective controlled investigation whereas 20 elderly patients shared and equally distributed to double collections, each collection includes 10 patients. The first collection 10 patients achieved success short PFN procedure and the second collection 10 patients achieved success long PFN procedure.**

Results: **There were non-significant variations in the functional outcome, distance of hospital admission, or post-operative complications.**

Conclusion: **The Evaluated variables with the positive and negative results of the research medications, demonstrated the following: both nails have good clinical results. In terms of functional result, hospital stay, and surgical complications, they did not differ significantly. However, a short PFN can certainly shorten the duration of the procedure and minimally minimize intraoperative blood loss, when curing older patients with intertrochanteric femur fractures.**

Keywords: Dynamic hip screw, Femur fractures, Intertrochanteric fractures, Intramedullary nails, Proximal femoral nailing

1. Introduction

In the elderly population, trochanteric fractures are common. A straightforward fall causes 90% of trochanteric fractures in elderly patients.[1] Trochanteric fractures are classified as unstable in about 50−60% of cases.[2]

Trochanteric-entry intramedullary nails have been created to solve the problems associated with treating unstable fractures. Trochanteric-entry nail fixation is supported by an intramedullary nail fastened to a sliding screw in the fragment of the femoral neck-head. From a biomechanical perspective, the nail has significant advantages over a DHS, including a semi-closed procedure and a shorter lever arm that give greater stability and enable quick rehabilitation.[3]

Technical or mechanical problems that happened in patients with unstable trochanteric fractures and whom underwent proximal femoral nailing appear to be more closely linked to the fracture sort, the operation method, the effectiveness of the reduction, and the patient's time before weight bearing than the implant itself.[4]

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Trochanteric hip fractures are currently managed with both short and long cephalomedullary devices. Although each implant has potential benefits, the best device is still up for debate. According to recent reports, compared to long intramedullary devices, short intramedullary devices result in less blood loss and quicker operations.[5]

Other research, however, suggests that long cephalomedullary nails may be related to reduce the hazards of the ipsilateral femur fractures in the future.[6]

We think that intertrochanteric fractures in the elderly can be successfully cured with intramedullary nail fixation. Particularly in the areas of ambulation activities, bedridden-related problem reduction, and quality of life enhancement.

2. Patients and methods

The study was prospective experiment conducted between May 2021 and August 2022 on 20 patients, attending to Orthopedic Department in Al-Azhar University Hospitals and El-Obour Hospital. During the time of the study.

The study included 20 adult patients. The selected candidates were established into two collections: the first 10 patients for short PFN and the second 10 patients for long PFN.

Patients included in the study were elderly aged persons, with a femoral intertrochanteric fracture, With suitable history, suitable general and local exams and All fractures were identified on plain radiographs and categorized using the AO classification, Except the ones whom had, anaemia, bone congenital malformations, patients with hemorrhagic tendency or coagulative abnormalities, HTN persons and any fracture other than intertrochanteric fractures.

The pre-operative characteristics: as age of the participants, their sex, nationality, medical history, patient complaints, comorbidities the type of fracture, and the mechanism of injury were all documented.

All participants were observed intraoperatively and postoperatively by close watching of the vital marks as blood pressure and heart rate, volume of urine inside the catheter and until the clinical and radiological union of the fracture.

The type of the reduction, patient positioning, type of anesthesia, surgical time, expected blood loss, and intraoperative complications. Intraoperative anteroposterior (AP) and lateral radiographs of the hip were used to evaluate accuracy of the reduction and position of the lag screw within the head of the femur and Tip-apex distance (TAD).

2.1. Ethical considerations

This study was done in the department of orthopedic surgery at Al Azhar university Hospitals. The research ethics committee was accepted the start of the research.

2.2. All cases were examined using the following research techniques

All study participants were signed a written consent as determined by the ethical committee.

2.3. Statistical methods

The data was examined by means of SPSS version 15. Whereas (SPSS Inc., Chicago, IL, USA). The quantitative information was given as mean ± SD, whilst the qualitative information was presented as numbers and percentages (%). The independent student test was used to determine the significance of the difference for quantitative data, while the Chi square or Fisher's exact test was used to determine the significance of the difference for qualitative data. Statistical significance was known as a P value of <0.05 or lower. Accounting the sample size, the statistical calculator based on 95% of confidence interval and the power of the study is 80% with α-error 5. The level of significance was taken at P value < 0.050 is significant, otherwise is non-significant.

3. Results

In our study total number of patients was (20). In which we used short PFN in 10 patients and long PFN in 10 patients Table 1.

Table 1. Age-Sex and Comorbidities distribution in the participated collections.

Variable	Group I (n = 10)	Group II (n = 10)	P
Age (years)			
Mean ± SD	72.2 ± 10.67	73.9 ± 11.46	0.735
Sex			
Female	5 (50%)	6 (60%)	0.653
Male	5 (50%)	4 (40%)	
Smoking	3 (30%)	2 (20%)	0.606
Diabetes Mellitus	3 (30%)	2 (20%)	0.606
Hypertension	3 (30%)	5 (50%)	0.361
Cardiac disease	0	1 (10%)	0.307
Cancer prostate	1 (10%)	0	0.307
Alzheimer	0	1 (10%)	0.307
Renal	1 (10%)	0	0.307

T: independent sample T test.
NS, P value > 0.05 is considered non-significant.

Table 2. Fracture characteristics in both groups and it included associated fractures, side of fracture, mechanism of fracture and type of fracture according to AO classification.

	Group I ($n = 10$)	Group II ($n = 10$)	t/χ2	*P*
Associated fractures	1 (10%)	0	1.05	0.305
Side				
Right	7 (70%)	6 (60%)	0.219	0.639
Left	3 (30%)	4 (40%)		
Mode				
RTA	0	1 (10%)	2	0.368
Fall from height	1 (10%)	0		
Fall on the ground	9 (90%)	9 (90%)		
Type				
A1.3	0	1 (10%)		
A1.2	2 (20%)	2 (20%)		
A2.2	5 (50%)	1 (10%)	6.67	0.155
A2.3	1 (10%)	5 (50%)		
A3.3	2 (20%)	1 (10%)		

This table shows: no statistical significance difference (*P* value > 0.05) among the studied participants as regard age and sex and Comorbidities distribution Table 2.

X^2: Chi-square test. NS: *P* value > 0.05 is considered non-significant. This table demonstrates that no statistical significance variations between the studied groups as regard side, mechanism of injury and type of fracture Table 3.

This table demonstrates that, group II had a significantly longer operation than group I. However, when it came to hospital stays and blood transfusions, there was no discernible difference between the two collections. And Regarding group I:

Table 3. Intraoperative and postoperative features between the participated collections.

	Group I ($n = 10$)	Group II ($n = 10$)	T	*P*
Hemoglobin (g/dl)				
Mean ± SD	11.85 ± 1.07	12.37 ± 1.09	1.08	0.296
Skin incision (cm)				
Mean ± SD	7.3 ± 1.16	6.7 ± 1.34	1.07	0.298
Blood loss (cc)				
Mean ± SD	177.0 ± 63.95	180.0 ± 72.57	0.098	0.923
TAD (mm)				
Mean ± SD	22.01 ± 2.79	22.3 ± 2.67	0.246	0.809
Operative time (min)				
Mean ± SD	57.9 ± 8.45	68.7 ± 6.67	**3.18**	**0.005**
Hospital stay (days)				
Mean ± SD	3.3 ± 1.89	3.5 ± 1.72	0.248	0.807
Blood transfusion	1 (10%)	1 (10%)	–	1
No complication	8 (80%)	8 (80%)	4	0.406
Local site pain	1 (10%)	0		
Periprosthetic fracture	1 (10%)	0		
Superficial infection	0	1 (10%)		
Mortality	0	1 (10%)		

NS, *P* value > 0.05 is considered non-significant; T, independent sample *T* test.

Table 4. Functional evaluation between the participated collections.

	Group I ($n = 10$)	Group II ($n = 10$)	t/χ^2	*P*
Excellent	2 (20%)	2 (20%)	3.08	0.380
Good	6 (60%)	7 (70%)		
Fair	2 (20%)	0		

X^2, Chi-square test; NS, *P* value > 0.05 is considered non-significant.

one patient (10%) suffered from local site pain (anterior thigh) and one patient (10%) suffered from periprosthetic fracture also Regarding group II: one patient (10%) suffered from superficial infection, and one patient (10%) died from unrelated cause Table 4.

The table demonstrates that no statistical significance variations between the studied groups as regard to functional evaluation.

4. Discussion

In the UK, the incidence of females suffering from proximal femur fractures, a common consequence of osteoporosis, is 418 per 100 000 people.[7] Which are intertrochanteric in nature about half of it.[8]

The most public surgical management for intertrochanteric fractures is either a dynamic hip screw (DHS) or an intramedullary nail (IM). The pattern and stability of the fracture serve as the primary deciding factors between these two methods, with unstable or reverse oblique fractures favouring IM nailing. The cephalocondylic technique is typically used for 8IM nailing proximal femur fractures, which involves inserting a metal nail through the greater trochanter.[9]

IM nailing, as opposed to rigid extramedullary compression devices, permits some strain across the fracture location, and the resulting compressive and shear forces help to promote osteochondral secondary bone repair.[10] Shorter nails are less expensive.[11]

Despite the fact that they have historically been linked to a higher risk of peri-implant fracture.[12]

For more unstable intertrochanteric fracture patterns, long nails may be appropriate,[13] function to shield a larger portion of the femur.[14] and can make up for an expansive proximal femoral canal.[10]

Although they have the distinct danger of perforating the anterior cortex of the distal femur, they have also been linked to longer operating room times, radiation exposure, and blood loss.[15]

This study's primary objective was the comparison of the effectiveness of short and long PFN in treating elderly diseased persons with intertrochanteric fractures. The following were the study's main findings:

According to the current study, the first Group contained 10 patients and divided into 5 males and 5 females, with a mean age of 71.4 ± 11.68 years between the two divisions.

Regarding age and sex, there is no discernible difference between the groups. The current study, which aims to reduce the number of reoperations required for patients 65 and older who have short or long PFN, **supported by Sop *et al.*** as they clarified that There were 893 patients in the research (600 patients treated with a short PFN vs. 293 treated with a long PFN). Patients from both groups had similar ages and sexes.[16]

The current trial demonstrated that there was no significance variation found among the participants as regard comorbidities. Nevertheless, according to **Womble *et al.***, patients with the following chronic health conditions were more likely to receive a long nail: as diabetes (short = 20.8% vs. intermediate = 46.2% vs. long = 26.9%, $P = 0.023$); chronic obstructive pulmonary disease (short = 22.9% vs. intermediate = 23.1% vs. long = 9.4%, $P = 0.014$); and hypertension (short = 68.8% vs. intermediate = 87.2% vs. long = 66.9%, $P = 0.036$).[17]

We discovered that there was no notable variation in the fracture characteristics between the two investigated groups with regard to fracture location and mechanism of injury.

Supported by **Li *et al.*** as they observed that there was no significance variation between the participants in relation to fracture location and mode of injury, which is consistent with our findings.[18]

Regarding the classification of fractures among the analysed groups, we discovered The groups' differences are not determined to be statistically significant.

However, **Guo *et al.*** showed that in our investigation, short PFN was treaded by A2 fractures much more frequently ($P = 0.037$). It is conceivable that the lengthier PFN was required the more unstable the fracture was.[19]

Hemoglobin, skin incision, and blood loss were of non-significant difference between the both collections in the current investigation we discovered. In accordance with the findings of the current investigation, **Guo *et al.*** found that there was no significant variation in haemoglobin levels between the both collections, but the intraoperative loss of blood was (90.7 ± 50.6) in the short group and was significantly lower than that in the long group (127.8 ± 85.9) ml ($P = 0.004$).[19]

In the current investigation, we discovered that there was no discernible change in TAD between the two groups. Dragosloveanu et al. found that As a result, the differences were not statistically significant ($P = 0.98$). The average TAD was 17.8 ± 1.69 mm for the long collection and 18.1 ± 1.53 mm for the short collection, which is similar with the current study.[20]

In the current trial, we discovered that collection II operating time was higher than in collection I. However, when it came to hospital stays and blood transfusions, there were no significant variations between the both collections.

In accordance with our findings, **Shin *et al.*** whereas they reported that group II had surgery for 57.87 min as opposed to 45.65 min for group I ($P = 0.003$). The length of the hospital stay, however, did not differ significantly ($P = 0.201$).[16]

The incidence of ipsilateral femur fracture was 10% in the short collection and 0% in the long collection, and this difference was not significance statistically.

Moreover **Guo *et al.*** also discovered no statistical significant variations in postoperative complications distribution between the studied groups, and neither group experienced intraoperative complications. Following surgery, there was a case of periprosthetic fracture without osteonecrosis in both groups.[19]

One patient (10%) in group I experienced localised pain in the anterior thigh. One patient (10%) in group II experienced a superficial infection, and one patient (10%) passed away in the second week due to an underlying condition. The groups' differences are not determined to be statistically significant. Additionally, Hulet et al. observed that there were no variations between the short and long PFN as regard the entire complications (adjusted $P = 0.73$), failure (adjusted $P = 0.78$), or death (adjusted $P = 0.62$).

Regarding functional evaluation of the investigated participants in this study, we discovered that there is no significant variation between the groups. Dragosloveanu et al. findings 's that the short nail group continued to exhibit improved functional outcomes after a year, though they were not statistically significant, provide evidence in favour of this ($P = 0.28$).[20]

5. Conclusion

Both short and long PFN are effective treatment for intertrochanteric femur fractures, both have good functional and structural outcomes and acceptable complication rates. However short PFN is superior to long PFN and showed statistically significant differences in shorter operative time, hospital length of stay, but no significant relation between complications and type of the nail,

however the long PFN is preferable in patients with severe osteoporosis to decrease possibility of occurrence of fracture of ipsilateral femur close to the distal end of the nail.

Limitations of our study include Both short and long PFN are effective treatment for intertrochanteric femur fractures. However short PFN is superior to long PFN and showed statistically significant differences in lowering operative time, and hospital length of stay.

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

There are no conflicts of interest.

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