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Short Versus Long Gamma Nails in Treatment of Intertrochanteric Fractures in Elderly

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ABSTRACT

Background: cephalomedullary nailing has been the most often used surgical procedure for treating peritrochanteric femur fracture patterns. Both of these so-called long and short nails are utilized to repair fractures of the peritrochanteric femur.

Patients and Methods: This study was a prospective interventional study including thirty older patients with unstable intertrochanteric fractures, 73.3% of them were males and 26.7% were females. Closed reduction and either long or short cephalomedullary Gamma nail fixation was used to treat the patients. Two groups of patients were assigned; group A patients were managed by short nails (15 patients) and group B with long nails (15 patients).

Results: The short nail group had a significantly shorter operation time than long nail group and a lower rate of blood loss with no need for blood transfusion in either group. Radiation exposure was higher in the long nails group than in the short nail groups with p = 0.001. At the 6-month final follow-up, there wasn't statistically significant difference between the 2 groups regarding VAS score (p = 0.277), Harris Hip Score (p = 0.728), neck shaft angle (p = 0.848), and average time of union (p = 0.483).

Conclusion: The use of long and short cephalomedullary Gamma nails in fixation of unstable intertrochanteric fractures in elderly achieved satisfactory clinical and radiological outcomes but short cephalomedullary gamma nailing can clearly reduce radiation exposure, operating time, and intraoperative blood loss.

Keywords: Intertrochanteric fracture, Gamma nail, Short vs long nails.

INTRODUCTION

One of the most common injuries in orthopedic treatment is an intertrochanteric fracture in an aged patient. In addition to attaining the best possible clinical and radiological results, effective treatment of bone fractures is essential for lowering the financial burden that these injuries put on international healthcare systems [(1)]. Up to 48% of all hip fractures are caused by this type of low-energy trauma [(2)].

These fractures are linked to biomechanical issues, substantial morbidity and death, and a heavy financial burden on patients and their families [(3)]. Stable and unstable fractures are the two categories of intertrochanteric fractures. The following are examples of unstable fractures: comminuted, intertrochanteric with subtrochanteric component, lack of posteromedial support, and 3 fragment fracture [(4)].

The gold standard for treating stable intertrochanteric fractures is a dynamic hip screw; nonetheless, the technical and mechanical failures of fixation of unstable intertrochanteric fractures continue to be significant problems that typically necessitate reoperations [(5)]. The thickness of the lateral trochanteric wall, which is the part of the greater trochanter that runs from the vastus ridge (where the vastus lateralis attaches) to the tip of the greater trochanter, is another measure of fracture stability. The more unstable the fracture, the more difficult the reduction will be if this wall is broken. Less than 20.5 cm of lateral wall thickness is regarded as unstable and raises the possibility of postoperative failure, particularly when extramedullary fixation is used [(6)].

In older adults, osteoporotic bone, severe fracture collapse, loss of internal fixation, and cutting out of the lag screw are typical occurrences in attempts to treat unstable intertrochanteric fractures [(7)].

It's also up for debate whether short or long Gamma nails are better for treating peri-trochanteric fractures. Distal cortical fractures are frequently the cause of the increased complication rate associated with the use of Gamma nails in the treatment of unstable intertrochanteric fractures in the elderly [(8)].

Easy usage, less blood loss and surgical time, reduced implant cost, and targeted locking bolts by distal interlocking screw insertion are some of the suggested benefits of short cephalomedullary nails. Creating a stress riser in the mid-femur, particularly in elderly individuals with osteopenia who have excessive femoral bending, is a drawback [(9)].

The purpose of this study was to compare the clinical and radiological outcomes of the management of unstable intertrochanteric fractures in the elderly using long versus short cephalomedullary Gamma nails.

PATIENTS AND METHODS

This was a prospective study including thirty older patients with unstable intertrochanteric fractures that had been admitted to the Menoufia University Hospital from February 2023 to February 2024 with a minimum of 6 months follow- up. Patients were divided into two

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groups; group A patients were managed by short nails (15 patients) and group B with long nails (15 patients). The selection of the patients was done in a sequential random sampling. Group A with odd numbers and group B with even numbers.

Inclusion criteria:

- Patients who were over 60-years old, and unstable intertrochanteric fracture (Three fragments and loss of posteromedial support, comminuted, intertrochanteric with subtrochanteric component, lateral wall thickness <20.5 mm).

Exclusion criteria:

- Polytraumatized patients, pathological fractures, and patients with high comorbidity such as liver cirrhosis, renal failure on dialysis and respiratory failure. All patients who had undergone closed reduction and internal fixation with Gamma nail generation 3, short nail (180 mm) in group A and long nail (320 – 360 mm) in group B.

Preoperative evaluation:

Digital radiographs, operation records, and patient characteristics were examined one at a time. Operation time, intraoperative blood loss, duration of hospital stay, blood transfusion rate, clinical and radiological results, infections, and postoperative complications were all recorded for every patient.

Each patient's medical records, surgical reports, and digital radiographs were examined separately. For every participant, the following clinical characteristics were gathered: duration of the procedure, blood loss during the procedure, length of hospital stay, rate of blood transfusions, clinical and radiological results, infections, and complications following the procedure.

The patient was placed supine on a fracture table using fluoroscopic-guided imaging, and all treatments were carried out by orthopedic trauma surgeons at Menoufia University Hospital. Prior to making an incision, the patient was closed reduced to a posture that was close to anatomical after being sedated. Guide wires were utilized in every treatment, and femurs were reamed by hand. Patients were permitted to bear weight as tolerated after surgery.

Preoperative and 6-months postoperative X-ray assessment was performed (Figures 1 and 2).

Figure (1): (A) Preoperative X- ray of both AP and lateral hip views, (B) Postoperative X- ray with fixation by a long nail after six months.

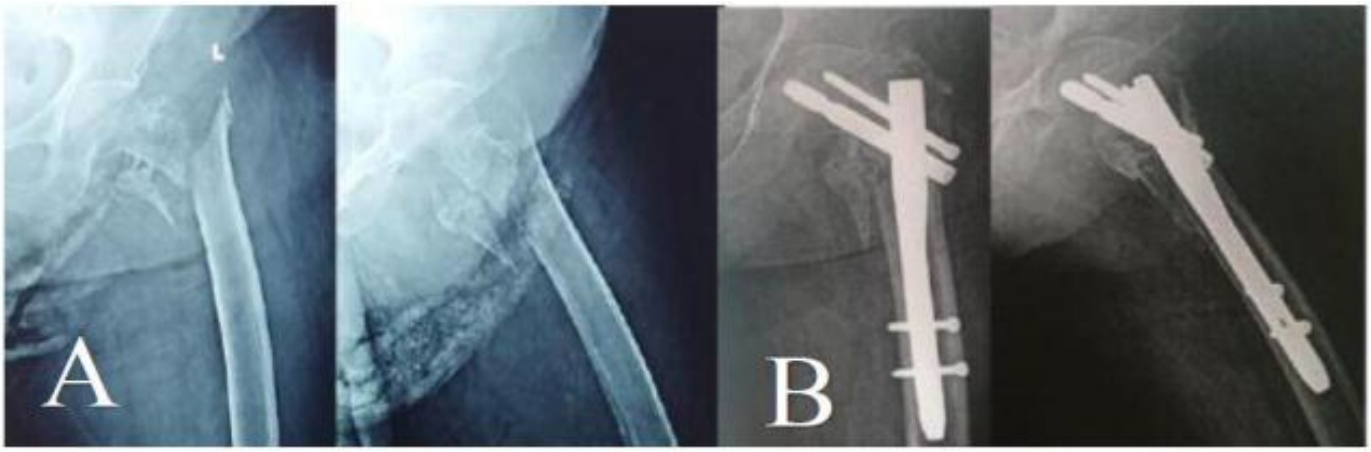

Figure (2): (A) Preoperative X- ray of both AP and lateral hip views, (B) Postoperative X- ray with fixation by a short nail after six months.

Ethical approval:

The study was authorized by Menoufia University's Institutional Review Board and Ethics Committee. The patients gave their written consent for the treatment and any potential risks. The Helsinki Declaration was followed throughout the course of the study.

Statistical analysis

On an IBM compatible computer, SPSS version 26 was used to tabulate and analyze the obtained data. Numbers (No.) and percentages (%) were used to represent qualitative data. The mean± SD was used to express quantitative data. Fisher's exact test, Student t test (t), and Mann-Whitney U test were employed. $P \leq 0.05$ was considered significant.

RESULTS

Total number of the studied patients was 30 patients, 73.3% of them were males. The largest percentage were working. Half of studied patients were smokers. Fifty-three percent of them had medical comorbidities. The most common medical comorbidity among studied patients was hypertension representing about 36.7%. Mean of age was 71.47±8.63 (Table 1).

Table (1): Demographic characteristics of studied patients.

Variable		No. of studied patients (n=30)	
		No.	%
Sex	**Male**	22	73.3
	Female	8	26.7
Occupation	**Working**	20	66.7
	Retired	10	33.3
Smoking	**Smoker**	15	50
	Non-smoker	15	50
Comorbidities	**Present**	16	53.3
	Absent	14	46.7
Age (Years)	**Mean ± SD**	71.47±8.63	
	Range	60-95	

Regarding postoperative clinical and radiological evaluation, the short and long nail groups did not vary statistically significantly regarding VAS at six months postoperative and Harris Hip Score. The short nail group did not vary statistically significantly from long nail group regarding neck shaft angle, frequency of union, time of union, and tip apex distance (Table 2).

Table (2): Implant type in relation to postoperative clinical and radiological evaluation.

	Variable	Short nail (n=15)	Long nail (n=15)	Test of significance	p-value
VAS (6 months)	Mean ± SD Range	1.92±0.86 1-4	2.47±1.46 1-6	U=1.09	0.277
Harris Hip Score	Mean ± SD Range	75.46±20.13 30-92	71.33±20.52 26-96	t=0.35	0.728
Neck shaft angle	Mean ± SD Range	130.85±1.52 128-133	130.40±1.88 127-135	t=0.72	0.477
Union (3 cortices) (No and %)	Present Absent	13 (86.7%) 2 (13.3%)	15 (100%) 0 (0%)	FE=2.14	0.483
Time for union (Months)	Mean ± SD Range	5.15±1.35 3-6	4.80±1.52 3-6	t=0.65	0.519
Tip apex distance (mm)	Mean ± SD Range	19.38±2.43 16-26	19.33±2.23 15-23	t=0.059	0.954

Regarding operative data, the short nail group was significantly better than the long nail group regarding surgery time, blood loss, and radiation exposure (Table 3).

Table (3): Implant type in relation to operative data.

Variable	Short nail (n=15)	Long nail (n=15)	Test of significance	p-value
Surgery time (Minutes)				
Mean ± SD	49.67±11.26	76.00±16.39	U=4.04	<0.001*
Range	30-75	55-120		
Blood loss (ml)				
Mean ± SD	138.67±52.63	222.67±57.88	U=3.37	0.001*
Range	80-300	120-350		
Radiation exposure (mGy)				
Mean ± SD	2.97±0.37	4.33±0.35	t=10.33	<0.001*
Range	2-4	4-5		

*: Significant

The short and long nail groups did not vary statistically significantly regarding hospital stay (p = 0.242).
Regarding postoperative complications, the groups with short and long nails did not vary statistically significantly. Four patients of short nail group had implant-related complications. Screw backout, periprosthetic fracture, screw cutout and screw penetration; each complication was found in one different patient. Infection occurred in five patients, two patients in the short nail group and three patients in long nail group, the mean operative time in infected patients was 69±15.16 minutes, which was higher than the mean operative time in non-infected patients (61.6±19.9) without statistically significant difference (Table 4).

Table (4): Implant type in relation to postoperative complications.

Variable	Short nail (n=15)		Long nail (n=15)		Test of significance	p-value
	No.	%	No.	%		
Screw back out						
Present	1	6.7	0	0	FE=1.03	1.000
Absent	14	93.3	15	100		(NS)
Periprosthetic fracture						
Present	1	6.7	0	0	FE=1.03	1.000
Absent	14	93.3	15	100		(NS)
Screw cut out						
Present	1	6.7	0	0	FE=1.03	1.000
Absent	14	93.3	15	100		(NS)
Screw penetration						
Present	1	6.7	0	0	FE=1.03	1.000
Absent	14	93.3	15	100		(NS)
Thigh pain						
Present	4	26.7	5	33.3	FE=0.16	1.000
Absent	11	73.3	10	66.7		(NS)
Wound condition						
Good	13	86.7	12	80	FE=0.24	1.000
Infected	2	13.3	3	20		(NS)

In a patient with a short nail implant, we also documented a peri-implant femur fracture. After 3 weeks, a fall from ground level caused the fracture. The patient received surgery and a lengthy nail exchange (Figure 3).

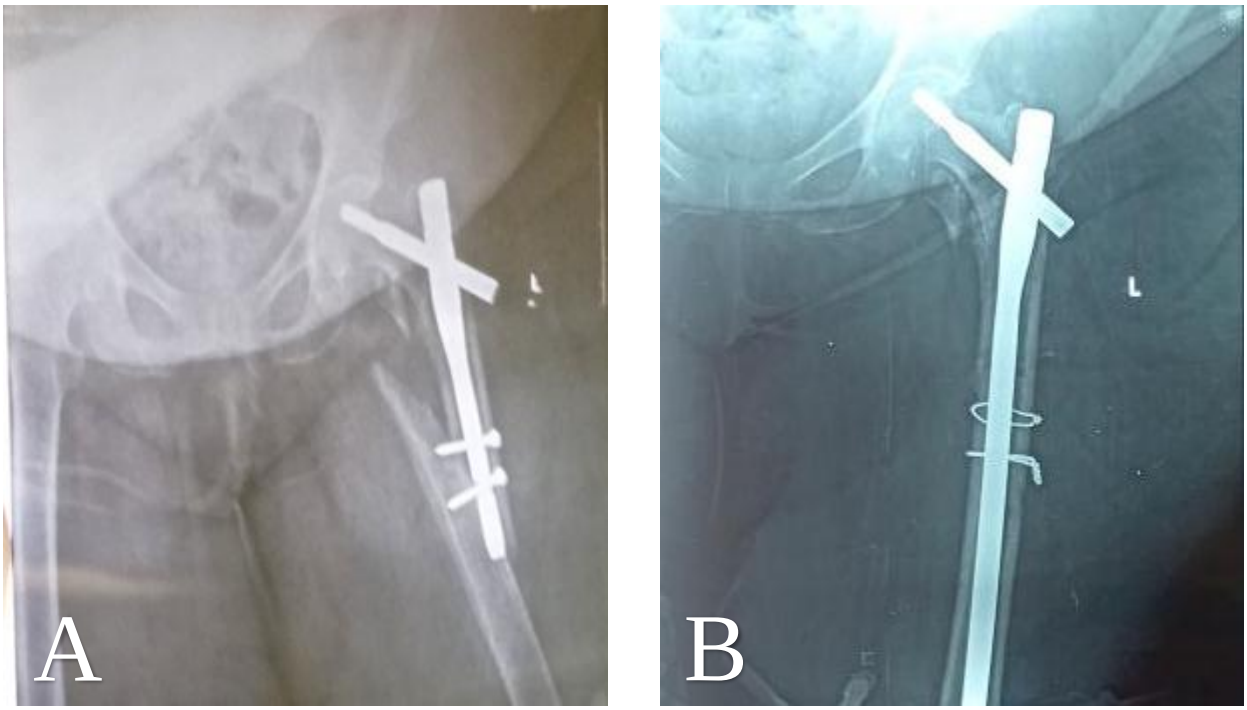

Figure (3): Peri-implant femur fracture in a patient with a short nail implant (A). The patient was surgically treated with exchange with long nail (B).

DISCUSSION

In older people with osteoporosis, hip fractures are a major reason for worry. Hip fractures are associated with a considerable rate of morbidity and death. A fall is the cause of over 90% of hip fractures [(10)]. For stable intertrochanteric fractures, dynamic hip screws are the gold-standard of care; nevertheless, for unstable fractures, fixation failures, both technical and mechanical, continue to be significant problems that typically necessitate reoperations [(11)].

The most common surgical method for treating peritrochanteric femur fracture patterns throughout the last years is cephalomedullary nailing [(9)]. There are several different nail implant styles, including ones that differ in length. Peritrochanteric femur fractures are treated with both of these so-called short and long nails [(12)].

In our study we had evaluated and compared the clinical and radiological outcomes of the management of intertrochanteric fractures in the elderly using long versus short Gamma nails.

After six months, although not statistically significant, the short nail group nevertheless produced superior outcomes; hence, nail length may not have an impact on the long-term functional outcome (P=0.728). We discovered research in the literature that showed respectable and similar outcomes with relation to Harris Hip Score [(13)]. **Sellan *et al.*** [(14)] found no clinical significance while observing a higher Harris Hip Score for the short nail group. According to one theory, elderly individuals with inadequate motor skills needed to return to baseline are typically the ones who sustain these fractures.

The operating time for the short nail group was 27 minutes less than that of the long nail group. In contrast to the other patient group, when the distal screw is fastened freehand with the use of intraoperative fluoroscopic imaging, this outcome is the result of using an aiming guide for the short nail. Additionally, **Zhang *et al.*** [(13)] showed that the average length of hospital stay is unaffected by the operating time. Additionally, we discovered that the long nail group experienced a much greater intraoperative blood loss. The longer distal reaming distance required for the insertion of the long nail and the longer operating time may be related to this.

Radiation exposure was higher in long nails 2.97±0.37 mGy and 4.33±0.35 mGy in short nail groups with p = <0.001. This may be due to free hand technique for distal locking screws in long nails in the system we had used. However, even with higher dose in long nails, this dose still too small to cause problems.

In our study nonunion was only present in 13% of short nail group. Fracture healing depends on several factors including bone quality, comminution of the fracture, comorbidities, smoking, general patient condition and we can't attribute nonunion only to the type of implant.

There were not statistically significant differences in the postoperative complications, however we did see one screw cutout in the short nail group. The most common reason for reoperation is a screw cutout, which is typically brought on by a screw malposition (lag screw too anterior or too superior), an increased tip apex distance, and severe osteoporosis. According to **Baumgaertner *et al.*** [(15)], to avoid screw cutoff, the tip apex distance should be less than 25 mm. There were no statistically significant differences

between the groups in our investigation, according to the tip apex distance.

In a patient with a short nail implant, we also documented a peri-implant femur fracture. After 3 weeks, a fall from ground level caused the fracture. The patient received surgery and a lengthy nail exchange. Periprosthetic fracture in short nails may be due to lack of internal splintage mechanism of the nail of the medulla (thin nail), any firm conclusion is impossible to make.

Concerning rates of breakage at the distal tip of the implants (8%–11%) were shown by early experience with short nail designs at the start of the 1990s [16]. As **Bhandari *et al.*** [17] showed, these failures could have been caused by the earlier nail designs. Older nails had more medial-lateral bend and larger lag screw, which allows removal of more bone from the trochanteric region. In their 2009 meta-analysis, they concluded that peri-implant fracture was not an issue with modern nail designs.

We found thigh pain present in 26.7% of short nails and in 33.3% of long nails (p = 1.000).

In this study infection was found in 13.6% of short nail groups and 20% of long nail groups with no significant difference. Possible causes of high infection rate in our study may be due to multiple comorbidities and lower immunity in the geriatric population in our community.

Infection occurred in five patients, two patients in the short nail group and three patients in long nail group. The mean operative time in infected patients was 69±15.16 minutes, which is higher than the mean operative time in non-infected patients (61.6±19.9) without statistically significant difference (p- value 0.440). Two of the five infected patients were diabetic, which also may contribute to such complication.

Limitations of the study included small number of individuals, short time of follow-up and the old age of the patients which made follow visits difficult.

We recommended doing such study on a big number of individuals, lengthen follow-up time and perform the study in multiple centers.

CONCLUSION

Long and short intramedullary nails are both potential internal fixing options for femoral intertrochanteric fractures in patients over the age of 60. Short Gamma nails led to quicker operation periods, lesser projected blood loss, and less radiation exposure.

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