

Comparing the supine and lateral positions for proximal femoral nail use in the treatment of intertrochanteric femoral fractures

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Ethics Committee Approval

Ethical approval was obtained from Malatya clinical research ethics committee (approval no. 2021/110).

All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest

No conflict of interest was declared by the authors.

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Abstract

Background/Aim: The management of unstable intertrochanteric fractures (ITF), which are becoming more common, is still a significant issue for public healthcare systems. As a result, successful fracture therapy is becoming a more crucial aspect of orthopedic practice. To treat older patients who have an ITF, this study compared the therapeutic outcomes and side effects of proximal femoral nail anti-rotation (PFNA) conducted in lateral decubitus and supine postures.

Methods: One-hundred twenty patients between the ages of 65 and 90 who underwent PFNA surgery as a result of an unstable femoral ITF brought on by low-energy trauma were included in the study, which was conducted as a retrospective cohort study. Two groups of patients were established: (1) Group L, consisting of patients who underwent surgery in the lateral decubitus position and (2) Group S, consisting of patients who underwent surgery in the supine position. Several patient characteristics were compared: (1) demographic information, (2) length of hospital stay, (3) length of surgery, (4) intra-operative blood loss, (5) incision length, (6) number of intra-operative fluoroscopies, (7) duration of activity outside of bed, (8) duration of clinical recovery of fracture, (9) surgical complications, (10) patient outcomes, and (11) Harris hip scores (HHS).

Results: Group L (60 patients) consisted of patients who underwent surgery in the lateral decubitus position, while Group S (60 patients) underwent surgery in the supine position (60 patients). The average hospital stay for patients receiving PFNA was 8.2 days for those in the supine position compared to 8.0 days for those in the lateral decubitus position. The difference between the operative times was significant ($P<0.001$) with 48.6 and 59.7 min in Groups L and S, respectively. Intra-operative blood losses in Groups L and S were 129.2 and 151.5 mL, respectively. Compared to Group S, Group L's mean incision length was much lower at 6 cm (as compared to 8 cm in Group S). The difference between the mean intra-operative radiation exposure times for Groups L and S was considerable at 9.38 versus 12.5 min. The mean times for fracture union and the HHS were not statistically different between the two groups after 12 weeks of treatment.

Conclusion: ITFs in elderly patients can be successfully treated with PFNA in either the lateral decubitus or supine position. Surgical duration, blood loss, intra-operative X-ray exposure, and incision lengths were all reduced with PFNA performed in the lateral decubitus position. As a result, treatment of ITFs in older individuals may involve PFNA fixation in the lateral decubitus position. Particularly for people with a muscular gluteal region or obese patients, the lateral decubitus position is advised.

Keywords: anti-rotation proximal femoral nail, intertrochanteric fractures, supine, lateral decubitus

Introduction

Intertrochanteric fractures (ITF) are those that involve both the trochanter major and minor and are outside the joint capsule. A prominent worry for doctors nowadays is the management of unstable ITFs, which have become more common as a result of osteoporosis and longer life expectancies [1–3]. Therefore, effective management of these fractures is a crucial component of orthopedic medicine.

Different therapeutic approaches have been developed as a result of the lengthy prosthetic surgical process, excessive tissue damage caused by a wider incision, and an abundance of comorbidities. These complicated fractures can now be treated with a variety of procedures and implants [4]. Numerous clinical and biomechanical investigations examined the outcomes of several implants, including the proximal femoral nail, the dynamic hip screw, and the gamma nail (PFN). Complications, such as cut-out, implant fracture, implant-induced femoral shaft fracture, and reduction loss, have all been linked to the use of these implants [5–7]. Recent research has demonstrated successful clinical outcomes in unstable ITFs that were treated with PFNA [8–11]. The most preferable technique in this situation is the proximal femoral nail anti-rotation (PFNA). Due to its benefits, which include simplicity of usage, smaller incisions during surgery, and quicker recovery times, this approach is frequently used. However, it is essential to have adequate training and expertise in this surgical procedure.

The surgical approach used with the PFNA has been the subject of a small number of studies in the literature. These studies only follow patients for a brief period of time; therefore, obtaining sufficient data on long-term complications and survival and revision rates is not possible. For treatment of senior patients with an ITF, we compared the clinical results and side effects of PFNA performed in the lateral decubitus and supine postures in the current study.

Materials and methods

A retrospective cohort design was used for creating the study. The study consisted of 120 patients with unstable femoral ITFs caused by low-energy trauma, aged 65 to 90, who underwent PFNA surgery between January 2015 and January 2018. Two groups of patients were established. Group L (60 patients) consisted of patients who underwent lateral decubitus surgery, while Group S consisted of patients who underwent supine surgery (60 patients). After receiving the go-ahead from the regional ethics committee and receiving patients' informed consent, the study was launched. The Malatya Turgut Özal University Clinical Research Ethics Committee gave their approval for this work under protocol number 2021/33.

The American Society of Anesthesiologists (ASA) classification system scores used in pre-operative evaluation were collected together with demographic data about the patients, fracture type according to AO/OTA classification, and two groups were homogenized to avoid selection bias.

Inclusion criteria:

1. Patients 65 to 100 years old
2. Patients in whom radiographic imaging revealed a fracture
3. Patients who experienced a fracture within 21 days
4. Patients who were active prior to the fracture
5. Patients who signed their own or a first-degree relative's informed consent
6. Patients who could participate in the examination and treatment while conscious and alert.

Exclusion criteria:

1. Patients with fractures that were older than 21 days
2. Patients with pathological fractures
3. Individuals with an open fracture
4. Patients who experienced multiple fractures or injuries
5. Patients who could not have surgery because of conditions, such as severe decompensated heart failure, liver failure, and/or kidney failure
6. Patients with recent or ongoing infections
7. Individuals undergoing chemo and/or hormone therapy
8. Patients with inadequate follow-up intervals
9. Individuals who previously underwent hip surgery
10. Patients who were pregnant.

Evaluation

An impartial researcher evaluated the patients' clinical and functional status at the two-year post-operative follow-up. The results in the therapy groups were assessed using the Harris hip score (HHS), a metric that is frequently used to gauge functional improvement in the management of hip issues and includes parameters for range of motion, discomfort, deformity, and hip function. Demographic information was compared to length of hospital stay, length of surgery, intra-operative blood loss, incision length, time spent using fluoroscopy during surgery, time spent getting out of bed, clinical fracture recovery time, and surgical complications.

Surgical technique

The same surgical team, which included two surgeons, operated on all of the patients. Both patient groups underwent surgery while under general or local anesthesia. Each operation was carried out under fluoroscopy supervision.

The patients in the group in the supine position were left in that position, but a height was added under the hips to create a slope of 10 to 15 degrees. Once the fracture was reduced, a trochanter major-type 3.2 mm guide wire was inserted intramedullarily. The entry to the nail was widened by sending a 17 mm reamer over the guiding wire. A standard PFNA with a diameter of 10-11-12 mm and a height of 240 mm (Orthopedic Designs; MEDGAL Sp. Inc., Bialystok, Poland) was inserted. Compression was accomplished via fluoroscopy after one neck screw and two lock screws were inserted into the neck at a 130° angle. For distal locking, a screw was also provided. By offering compression that was managed by fluoroscopy, the procedure could then be completed.

The patients' positions were maintained while they were in the lateral decubitus posture, which put the afflicted limb on top. The healthy limb's hip and knee flexion were maintained during surgery to obtain lateral hip fluoroscopy. A pillow was placed between the legs. A 3.2 mm trochanter major type guide wire was then inserted intramedullarily after the fracture was reduced. The entry to the nail was widened by sending a 17 mm reamer over the guiding wire. A standard PFNA with a diameter

of 10-11-12 mm and a height of 240 mm (Orthopedic Designs; MEDGAL Sp. Inc., Bialystok, Poland) was inserted. Fluoroscopy was used to achieve compression after one neck screw and two lock screws were inserted into the neck at a 130° angle. Additionally, a screw was given for distal locking. By offering compression under fluorescence control, the procedure was ended.

In this trial, all patients received 2 g of cefazolin before and after surgical intervention as part of an antibiotic prophylaxis regimen. In addition, the patients received 0.4 ml of low molecular weight heparin once a day for 14 days. On the first post-operative day, vigorous and passive quadriceps exercises were introduced to both patient groups. On the first day following surgery, patients with good bone quality who underwent successful fracture repair were mobilized with full load. Depending on their capacity for bone repair, other patients were mobilized with a gradual increase in weight. All patients were instructed to stroll with walkers.

Statistical analysis

The ideal patient count was determined via power analysis. The ideal count was examined within the context of the study utilizing the G*Power 3.1 application. The required minimum sample size was determined to be 60 patients in each group and a total of 120 patients in the study for the outcome variables of supine and lateral decubitus positions, while the amount of Type I error (alpha) was 0.05, the power of the test (1-beta) was 0.8, the effect size was 0.5 (medium effect), the distribution ratio of the groups was 1. The alternative hypothesis (H1) included a two-tailed, two-variable independent sample t-test [12].

SPSS Statistics software 19 (SPSS Inc., an IBM Company, Somers, NY) was used for the statistical studies. Clinical information was presented as a number, a percentage, or a mean (standard deviation [SD]). Two categorical variables were compared using the Wilcoxon and Pearson Chi-Squared tests (χ^2). We used the Student's t-test for continuous variables. Statistics were deemed significant at $P < 0.05$.

Results

Table 1 displays age, gender, broken side, and AO type. No discernible variations in the fundamental traits between the groups in the supine and lateral decubitus positions were found.

Table 1: General characteristics of the lateral decubitus and supine position groups

	Group L (n = 60)	Group S (n = 60)	P-value
Age (years)	86.4 (74–101)	85.76 (71–102)	0.950*
Sex (male/female)	28 / 32	27 / 33	0.573**
Injured side (left/right)	36 / 24	37 / 23	0.745**
AO type			
31-A1	12	14	
31-A2	44	43	0.872**
31-A3	4	3	

*Wilcoxon-test; **Pearson Chi-Squared, Group L: the lateral decubitus position, Group S: the supine position

Table 2 displays information about hospital stay duration (days), operation duration (min), blood loss (mL), incision length (cm), X-ray fluoroscopy exposure time, activity time spent outside of bed (h), Harris values, and bone union duration. In patients receiving PFNA, the average length of hospital stays was 8.0 days in the lateral decubitus position and 8.2 days in the supine position ($P < 0.001$). The disparity between the operating times of 48.6 min for Group L and 59.7 min for Group S was substantial. Intra-operative blood loss in Group L was 129.2 mL while in Group S it was 151.5 mL. Group L's incision was 6 cm long, which was

much shorter than 8 cm in Group S. Compared to Group S patients, participants in Group L received significantly less intra-operative radiation (9.38 versus 12.5 min). The HHS and average fracture union times were not statistically different between the two groups after 12 weeks of treatment.

Table 2: Operative and clinical parameters of the lateral decubitus and supine position groups

	Position	Mean	SD	P-value*
Hospital stays (day)	L	8.0	2.49	0.954
	S	8.2	3.85	
Operation time (min)	L	48.6	26.3	<0.001
	S	59.7	20.1	
Length of incision (cm)	L	6.0	1.4	<0.001
	S	8.0	1.7	
X-ray fluoroscopy exposure time (min)	L	9.38	1.9	<0.001
	S	12.50	2.7	
Harris values	L	84.1	4.466	0.451
	S	83.8	4.280	
Union time (week)	L	12.0	2.784	0.788
	S	11.9	2.899	

* Wilcoxon-test, Group L: the lateral decubitus position, Group S: the supine position, SD: standard deviation

A total of three clinical problems were seen in each of the two groups (Table 3) and included deep vein thrombosis and both superficial and deep wound infections. One supine patient experienced a superficial wound infection that was treated with intravenous antibiotics. Two problems occurred in the group that had been in the lateral decubitus position. One patient experienced a severe wound infection that was treated with intravenous antibiotic treatment and debridement. Another patient received three months of treatment with the vitamin K antagonist, warfarin, for a deep vein thrombosis that was detected by color Doppler sonography in the first post-operative week.

Table 3: Complications in the lateral decubitus position and supine position groups after treatments

Complication	Group S (n = 60)	Group L (n = 60)
Deep vein thrombosis	0	1
Superficial wound infection	1	0
Deep wound infection	0	1

Group L: the lateral decubitus position, Group S: the supine position

Discussion

The incidence of intertrochanteric fractures has been increasing in recent years as a result of an increase in life expectancy resulting from improved health care and quality of life. For the purpose of treating intertrochanteric fractures, numerous approaches have been suggested [4,5]. Among these, PFNA was created using a simpler and easier procedure than other implants to obtain greater fixation strength in the presence of osteoporotic bone. By compressing the bone, the neck screw used in PFNA achieves a precise fit and necessitates less bone removal than a single screw. The neck screw is more resistant to cut-out than other frequently used screw systems, according to bio-mechanical testing [13–16].

Minimally invasive techniques have recently become more popular in orthopedic surgery. Positive operative outcomes, such as significant operation time extension, excessive fluoroscopy exposure, and subpar clinical outcomes, have been reduced to a minimum as a result of increasing clinical experience and data from biomechanical and clinical studies. Most recent studies have reported that minimally invasive surgical techniques result in better radiological and clinical outcomes with shorter surgical times [6,8,15,17–19]. For all patients in our study, we favored a minimally invasive approach. We obtained superior clinical results, earlier patient mobilization, and fewer surgical complications. These findings are in line with those in the

literature, and we believe that elderly patients should undergo minimally invasive procedures.

Clinics can use the PFNA technique in a variety of positions. Both the lateral decubitus and supine positions are suitable for nailing the femur. The anesthesiologist is more physiologically comfortable when the patient is in the supine posture. Additionally, this position is favored in patients with significant lung distress, additional lower limb fractures, and spinal injuries. Obese people have more difficulty getting to the trochanter major when they are supine, but [20–24]. To reach the trochanter major, the extremities should be provided with adduction and internal rotation, especially in patients with a muscular gluteal area or those who are obese. These two patient characteristics could result in a substantial trochanter fracture, loss of reduction in the fracture, changes in neck shaft angle, and anteversion. Even with a decent anterior-posterior view of the proximal femur during the fluoroscopy, it may be challenging to get a good lateral image [20,21,24]. Therefore, a need to improve surgical procedure knowledge and experience is present. The supine position is suggested in a very small number of studies. In one of these investigations, Ding et al. [25] used the supine position to treat 45 patients with femoral ITFs. These authors came to the conclusion that closed reduction and anti-rotational intramedullary nailing in the supine position, which have the advantages of minimal trauma and low complications with excellent clinical outcomes, are safe and feasible ways to treat femoral ITFS. In the current investigation, traction of the extremity was carried out during the surgical intervention for reduction purposes in patients who underwent surgery while lying on their backs. Additionally, a radiolucent table was used for supine patients who were undergoing surgery. Although we were able to obtain a decent anterior–posterior image of the proximal femur in our patients during fluoroscopy, we had trouble obtaining a good lateral image. We spent less time preparing for the procedure when the patient opted for the supine position. Our lateral decubitus incision was less extensive than in Ding's study [25]. Our difficulties were comparable. Our clinical results, HHS, and bone union times were all comparable to the Ding study. The supine posture did not significantly outperform the lateral decubitus position according to the study's findings.

The lateral decubitus position eliminates the need for a traction table, facilitates conversion to open surgery when necessary, and provides a good lateral view of the proximal femur [20,21,26]. It also makes it simpler to locate and prepare the entry point for the intramedullary nail. Possible traction table side effects are avoided, including crush syndrome, pudendal, sciatic, and femoral nerve palsies, perineal injuries, compartment syndrome, and avulsion of the inferior epigastric artery in the opposite extremity [27]. Studies on surgical positions for patients with intertrochanteric femur fractures were reviewed by Xue et al. [28]. They discovered that PFNA in the lateral decubitus position, as opposed to PFNA in the supine position, was associated with a shorter operation times, less hospital stays, blood losses, the number of intra-operative X-rays, length of the incision, and activity outside of bed, indicating that the intervention should be performed in the lateral position. Similar to Xue [28], Li et al. [26] studied both techniques in their research and reached the same conclusions in which performing the procedure in the lateral

decubitus position was preferable. According to the author, patients treated with PFNA in the lateral decubitus position as opposed to the supine position experienced significantly better intra-operative parameters after 12 weeks of treatments (operation time, incision length, intra-operative blood loss, and intra-operative radiation exposure). Nevertheless, the final functional results of the older patients' intertrochanteric fracture treatments did not significantly differ from one another.

Although PFNA fixation in the lateral decubitus position was demonstrated to be a useful choice for the treatment of ITFs, more conclusive studies on early surgery and longer follow-up time are required to justify its use. The treatment of intertrochanteric fractures in elderly patients who cannot endure the lateral decubitus posture with PFNA has significant limitations. Our study is restricted by its retrospective study design, small patient population, and brief follow-up period. Future research must include more cases and longer follow-up periods.

Conclusion

The findings of this study demonstrate that treating intertrochanteric fractures in older individuals with PFNA in the lateral decubitus and supine positions was successful. However, PFNA performed in the lateral decubitus position resulted in reduced blood loss, a lower intra-operative X-ray count, and a shorter incision. As a result, the treatment of ITFs in older individuals may involve PFNA fixation in the lateral decubitus position. The lateral decubitus position offers a similar number of advantages as the supine position.

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