

A Comparative Study of Trochanteric Fractures Treated with Hip Hemiarthroplasty or Proximal Femoral Nail — A Secondary Publication

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Abstract: *Objective:* The aim of this study was to compare the clinical and functional outcomes of patients treated with partial hip prosthesis (PHP) or double lag screw proximal femoral nailing (PFN) for unstable femoral intertrochanteric region fractures. *Material and method:* In this study, the data of 101 patients who developed grade 3-4-5 femoral intertrochanteric fractures according to the Evans-Jensen classification between 2019–2020 and were treated with cemented PHP or double screw PFN were evaluated retrospectively. The patients were evaluated in terms of postoperative follow-up time, age, gender, trauma side, American Anesthesia Society Anesthesia Risk Scale (ASA), number of comorbid diseases, total hospitalization time, amount of intraoperative bleeding, duration of surgery, and postoperative complications. *Results:* 101 patients evaluated within the scope of the study were divided into groups of 51 patients who underwent PHP (Group 1) and 50 patients who underwent PFN (Group 2). When the results were compared in terms of mean length of hospital stay, duration of surgery, amount of intraoperative bleeding, and postoperative 1-year mortality, the results were found to be statistically significant. *Conclusion:* Our study results showed that the PFN method has clinical advantages over PHP. The PFN technique is a method that can be applied quickly and safely.

Keywords: Hip fractures; Intramedullary nailing; Arthroplasty

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1. Introduction

Today, the incidence of hip fractures in the elderly population continues to increase each year with the increase in life expectancy ^[1]. In the elderly population, more low-energy hip fractures caused by traumas occur in the intertrochanteric region with a rate of up to 50% ^[2]. Because of the high morbidity and mortality after the fracture, the main aim of treatment is to obtain a stable fracture fixation in the shortest time, mobilize the patient, and transition to normal life ^[3]. In the treatment planning phase, fracture pattern and morphology are taken into consideration. The integrity of the posteromedial calcar is evaluated and the fracture is accepted as stable or unstable ^[4]. Evans-Jensen classification is the preferred classification for intertrochanteric fractures

depending on the fracture configuration, and trochanter major and minor integrity^[5]. The dynamic hip screwing (DHS) method, which is considered the gold standard in stable fracture patterns, has been associated with high failure rates in unstable fracture patterns^[6]. These results have led to the development of intramedullary nail designs that can provide more biomechanically stable fixation in unstable fracture patterns^[7]. In addition, in severe osteoporosis or comminuted fractures, arthroplasty should be considered in addition to proximal femoral nailing (PFN)^[8]. Early loading and mobilization, good functional outcome, and avoidance of osteosynthesis-related failure have been considered advantages of arthroplasty^[9]. In addition, disruption of posteromedial calcar integrity and comminuted fractures may adversely affect the results of treatment with arthroplasty^[10]. In addition, there may be an increased risk of mortality and complications related to the cement used in arthroplasty treatment^[11]. The aim of this study was to compare the clinical and functional results of PFN and cemented partial hip prosthesis (PHP) in the treatment of unstable FITC in a geriatric population.

2. Materials and methods

2.1. Subjects and evaluation criteria

The study data were collected in accordance with the Declaration of Helsinki after obtaining ethics committee approval (Gaziantep University Ethics Committee dated August 18, 2021 and reference number 2021-274). The data of 201 patients operated for FITC between 2019 and 2020 were analyzed retrospectively. Inclusion criteria were as follows: being over 65 years of age, presenting due to a simple fall, type 3,4,5 fracture according to Evans-Jensen fracture classification, PHP or PFN as the treatment method, and being operated within the first 48 hours after trauma. Patients whose follow-up data were not available, who had additional injuries, pathological fractures, and neurological deficits were excluded from the study. The patients included in the study were divided into group 1 treated with cemented PHP and group 2 treated with PFN. The groups were evaluated in terms of postoperative follow-up time, age, gender, side of trauma, American Society of Anaesthesia Anaesthesia Risk Scale (ASA), number of comorbid diseases, total length of stay, amount of intraoperative bleeding, operative time, and postoperative complications. were evaluated. Patients who died within 1 year postoperatively were included in the calculation of the mortality rate. Clinical and functional outcomes were analyzed using the Barthel activity index (BI) and Harris hip scoring (HHS).

2.2. Surgical technique

All patients in the study were operated on within 48 hours after preoperative anesthetic preparation. Patients were operated on by orthopedic surgeons in our department and implant choice was randomized. All patients received 40 milligrams of low molecular weight heparin prophylaxis once a day for 1 month preoperatively and postoperatively. In addition, antibiotic prophylaxis with a single dose of 1 gram cefazolin 1 hour preoperatively and 1 gram intravenous cefazolin 4 times a day for 24 hours postoperatively was used. All patients who underwent PFN were operated in the lateral decubitus position using a double lag screw PFN system with fluoroscopic reduction control. Two 7.3 mm parallel lag screws were inserted into the femoral head and advanced 5 mm into the subchondral space (**Figure 1**). All patients who underwent PHP were operated on in the lateral decubitus position with a posterolateral approach. In cases where arthroplasty was preferred, the femoral stem was placed using cement. In addition, 1 plug was used in all cases to prevent the escape of the cement to the distal femur. A bipolar cemented prosthesis and trochanteric hook plate system was used if necessary considering the intraoperative trochanteric major integrity (**Figure 2**). Drains were placed in the patients in the PHP group for 24 hours postoperatively. All patients underwent a rehabilitation program with a physiotherapist starting from the 1st postoperative day. Patients were mobilized with the help of a walker by giving a tolerable load.

2.3. Statistical analysis

Descriptive statistics of the study data were presented as the mean and standard deviation for continuous variables and frequency and percentage for categorical variables. In terms of continuous variables, two groups (PHP and PFN) Independent samples *t*-test was used to compare the preoperative and postoperative values of the same numerical variable, and paired samples *t*-test was used to compare the preoperative and postoperative values of the same numerical variable. The chi-square test was also used to analyze the relationships between categorical variables. All analyses were performed using SPSS (version 22, IBM Company). $P < 0.05$ was considered significant.



Figure 1. Preoperative and postoperative radiographs of a 90-year-old male patient after proximal femoral nailing

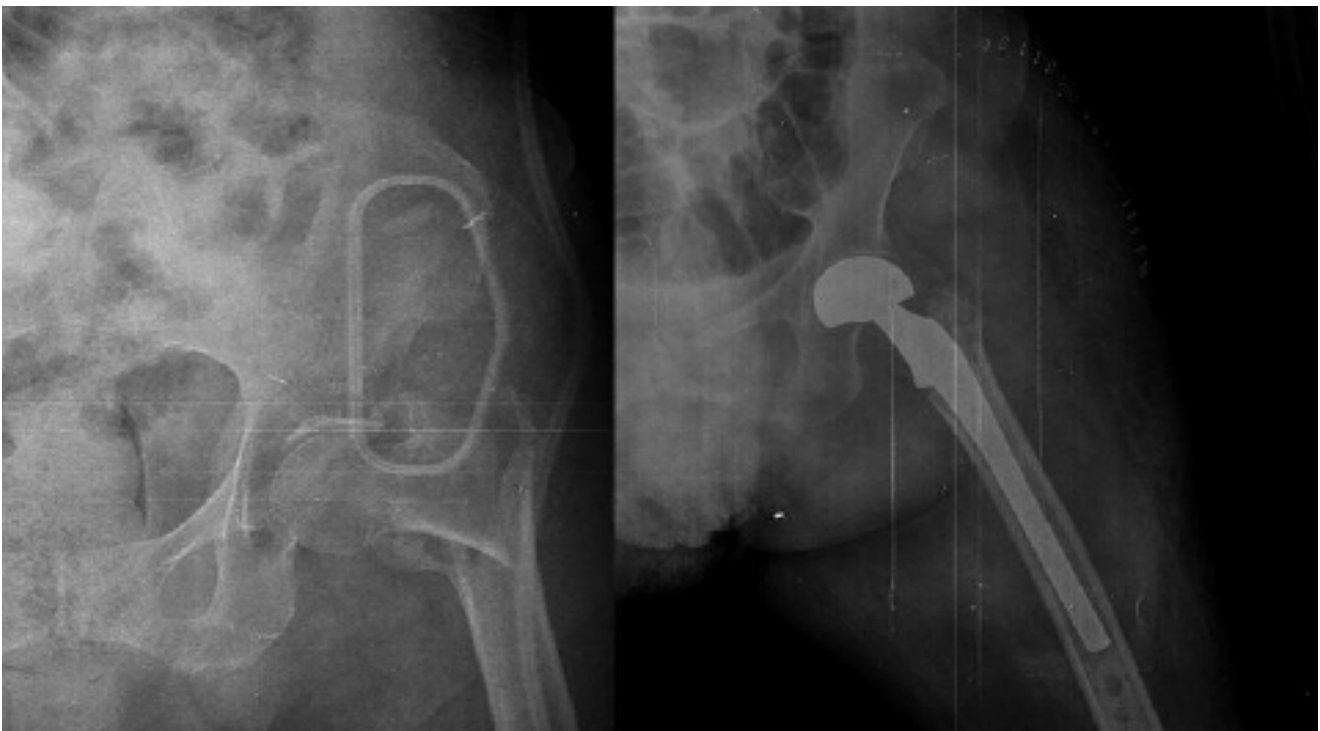


Figure 2. Preoperative and postoperative radiographs of an 85-year-old female patient after bipolar hemiarthroplasty

3. Findings

The data of 101 patients who met the study criteria were analyzed. Eleven of 51 patients (21.5%) in group 1 and 8 patients (16%) in group 2 died within the first 1 year and these patients were included in the mortality rates. The mean age of the patients in the study was 81.86 years (65–94) and the mean follow-up period was 19.86 months (12–28). 43 patients (52.43%) had right-sided trauma and 39 patients (47.56%) had left-sided trauma. 65 (79.26%) of the patients were female and 17 (20.74%) were male. Other demographic data and follow-up data of the study groups are shown in **Table 1**. Postoperative complications are given in **Table 2**. The mean total hospitalization time was 9.6 ± 4.94 days (4–24) in group 1 and 6.3 ± 3.57 (2–19) days in group 2, and the difference between the groups was statistically significant ($P = 0.01$). The difference in the amount of intraoperative bleeding and duration of surgery between the groups was statistically significant ($P = 0.00$, $P = 0.01$). The results were statistically significant when the 3rd month mean values of BI were compared ($P = 0.01$). When BI and HKS scoring values were evaluated statistically according to the groups, the results were not statistically significant.

Table 1. Distribution of demographic data by groups

Variables		PHP (Group 1)	PFN (Group 2)
	Number of patients	40	42
	Post-op follow-up time (month)	20.25 (12–26)	19.50 (12–28)
	Patient age	82.25 (67–92)	81.50 (65–94)
Trauma side	Right	21 (52.5%)	22 (47.6%)
	Left	19 (47.5%)	20 (42.4%)
Gender	Male	8 (20%)	9 (21.43%)
	Female	32 (80%)	33 (78.57%)
ASA score	2	1 (2.5%)	3 (7.1%)
	3	5 (12.5%)	3 (7.1%)
	4	30 (75%)	31 (73.9%)
	5	4 (10%)	5 (11.9%)
Accompanying disease	0	8 (20%)	8 (19%)
Number of diseases	1	15 (37.5%)	12 (28.6%)
	2	9 (22.5%)	10 (23.9%)
	3	6 (15%)	9 (21.4%)
	4	2 (5%)	3 (7.1%)

Table 2. Clinical scoring and complication values between groups

Variables	PHP (Group 1)	PFN (Group 2)	P value
Total hospitalization time (days)	9.6 ± 3.26 (4–24)	6.3 ± 2.73 (2–19)	0.010
Post-op first-year mortality	11 (21.5%)	8 (16%)	0.036
Pre-op Barthel	87.5 ± 1.92 (80–95)	85 ± 2 (80–95)	0.863
3-day post-op Barthel	70 ± 4.43 (50–75)	64.5 ± 3.08 (50–70)	0.010
12-day post-op Barthel	78.50 ± 4.93 (55–95)	76.5 ± 4.70 (50–85)	0.064
Harris hip score	78.7 ± 5.30 (45–80)	80.5 ± 4.09 (55–85)	0.075

Complications	Peritoneal disease	1 (2.5%)	0	-
	Deep vein thrombosis	1 (2.5%)	1 (2.3%)	-
	Splenic vein occlusion	1 (2.5%)	0	-
	Infection	2 (5%)	1 (2.3%)	-
	Mechanical complications	-	3 (7.1%)	-
	Intra-op bleeding	370 ± 24.25 (300–480)	180 ± 22.52 (70–260)	0.000
	Duration of surgery	75 ± 8.12 (65–84)	45 ± 3.89 (35–52)	0.010

4. Discussion

The aim of treatment in intertrochanteric fractures is to mobilize the patient in a short time and to enable the patient to reach the functional capacity of his/her previous life and to avoid possible complications ^[12]. In addition, the elderly patient population requires consideration of the duration of surgery, the potential for intraoperative side effects, the amount of intraoperative bleeding, and the risk of morbidity and mortality in the postoperative period in terms of the selection of the ideal surgical technique ^[13]. The mean age of the patients in our study was 81.86 years (65–94), 65 (79.26%) were female and 17 (20.74%) were male. A meta-analysis has shown that the mean age ranged between 79.4 and 83.7 years and the proportion of females ranged between 82% and 50% ^[14]. The high number of female patients in the study groups may be explained by increased bone fragility due to osteoporosis in the postmenopausal period ^[15]. In addition, the number of comorbidities and ASA scoring risks were similar between the groups in our study, which indicates that we can make comparisons between the study groups. When the intraoperative bleeding amounts were analyzed, the mean intraoperative bleeding was 370 (300–480) ml in group 1 and 180 (70–260) ml in group 2. In addition, the mean operation time was 75 (65–84) minutes in group 1 and 45 (35–52) minutes in group 2. According to the results, the amount of bleeding was higher and the operation time was longer in the group in which PHP was performed. Korkmaz *et al.* ^[16] reported the mean operation time as 95 minutes in the group in which PHP was performed and 61.8 minutes in the group in which PFN was performed, but they showed that there was more bleeding and need for blood transfusion in the group in which PCP was performed. Luo *et al.* ^[17] showed that the mean amount of bleeding in the PFN group was 100 ml, the mean amount of bleeding in the PHP group was 300 ml and a longer operation time was needed in the PHP group. The results showed that PFN is a technically less invasive method. We think that this accelerates the patient's return to normal life. In addition, less bleeding reduces the need for blood transfusion and the risk of transfusion-related complications decreases. When total hospitalization duration was analyzed, the mean value was found to be 9.6 (4–24) days in group 1 and 6.3 (2–19) days in group 2 and this difference was statistically significant. Tang *et al.* ^[18] reported the mean hospitalization time as 14 days in the group in which PHP was performed and 11 days in the group in which PFN was performed. Kim *et al.* ^[19] reported the mean hospitalization time as 14 days in the PHP group and 8 days in the PFN group. The data in the literature show that the PFN technique provides closed fixation without opening the fracture line with less incision and shorter surgery ^[20]. This leads to less dressing follow-up and faster recovery of the patient's general condition. As a result, a shorter hospitalization period is required. In terms of clinical scores, BI values at 3 months postoperatively were statistically significantly higher in group 1. This shows that PHP has the advantage of early mobilization and the ability to give more BI and HHS at 12 days post-operation. When we look at the monthly values, even though the clinical scoring values were higher in group 2 patients who underwent the PFN technique, there was no statistically significant difference. Ju *et al.* ^[21] performed a

meta-analysis on randomized controlled trials and found that the results of the PCS after PHP and PFN were similar in 5 studies. Regarding the complications, postoperative peroneal nerve injury was observed in 1 patient (2.5%) in group 1 and returned to normal at postoperative 6th month. One patient (2.5%) showed signs of DVT in the lower extremity during hospitalization and received medical treatment. SVO was diagnosed in one patient (2.5%) and controlled with medical treatment. In one patient (5%), superficial infection findings were observed and oral antibiotics and dressing follow-up were sufficient. In group 2, 1 patient (2.3%) had lower extremity DVT findings and medical treatment was sufficient. One patient (2.3%) had superficial infection findings and oral antibiotic treatment was sufficient. Two patients (4.7%) had Z-effect and screw revision was performed. In one patient (2.3%), loss of reduction was observed in postoperative follow-up and revision surgery was performed. In our study, the results were similar between the groups in terms of infection and DVT risk. Koyuncu *et al.* [22] found that Z-effect is a specific mechanical complication of PFN with a rate of 1.8–11%. Yu *et al.* [23] compared the results of PHP and PFN in patients with unstable intertrochanteric fractures and reported that PFN had a higher risk of mechanical complications and the early mobilization advantage of PHP reduced the risk of complications. In addition, the risks of hip dislocation, aseptic loosening, peroneal nerve palsy, intraoperative death, cardiac rhythm problems, and cement-related complications should be considered after PHP [24]. In our study, 11 patients (21.56%) in the group in which PHP was performed and 8 patients (16%) in the group in which PFN was performed died within the first 1 year. Görmeli *et al.* [25] found 1-year mortality rates of 25.3% in the group in which PHP was performed and 11.7% in the group in which PFN was performed. In line with this information, it is possible to say that although PHP has the advantage of mobilization in the early period, it may cause an increase in the risk of mortality in the long term. This study has some limitations. Firstly, the study was retrospective and retrospective data were investigated. In addition, although the group demographic data were similar, the patients were randomly selected. Moreover, inclusion criteria were carefully determined in terms of homogeneity of the study and patients were evaluated accordingly.

5. Conclusion

In this study, we compared the clinical and functional results of two surgical methods, PFN and PHP, in the treatment of unstable femoral intertrochanteric fractures. Our results showed that the results of treatment with PFN are superior to PHP in unstable fractures. In unstable intertrochanteric fractures, the PFN technique has the advantages of rapid application, less intraoperative bleeding, and shorter operation time. On the other hand, although PHP allows early motion and mobilization, it should be considered that it may be associated with increased mortality rates in the long term.

Disclosure statement

The authors declare no conflict of interest.

Author contributions

Data collection and processing: Orhan Büyükbeci, Savaş Güner, Burçin Karşlı
Analysis and interpretation: Savaş Güner, Bahri Bozgeyik, Kamil İnce
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