

Comparison of Mortality Rates and Functional Scores of Proximal Femur Nail and Partial Hip Arthroplasty in Intertrochanteric Femur Fractures: A Retrospective Study

PFNA ve Parsiyel Kalça Artroplastisi Uygulanan İntertrokanterik Femur Kırıklarının Mortalite Oranları ve Fonksiyonel Skorlarının Karşılaştırılması: Retrospektif Çalışma

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ABSTRACT

Objective: Intertrochanteric femur fractures are common fractures with increasing life expectancy. The aim of treatment is to provide early mobilization and pre-fracture function in patients. In this study, we aimed to compare the mortality and function scores of two treatment modalities (proximal femoral nail and bipolar hemiarthroplasty) commonly used in the treatment of intertrochanteric femur fractures in a secondary care hospital.

Materials and Methods: The study was planned for patients who underwent proximal femoral nail (PFNA) and bipolar hemiarthroplasty (BHA) due to femoral intertrochanteric fracture in a second-care hospital between 2017 and 2020. The data from a total of 199 patients were analyzed retrospectively. The operation method, age, sex, vitality, operation time, and hospitalization were recorded. The short form-36 (SF-36) questionnaire, recorded at the last visit, was evaluated in the surviving patients.

Results: No significant difference has been found for gender and age compared to the operation method. However, the mortality rate of BHA is found to be higher than the rate of PFNA ($p<0.001$). Compared to the time of death, no significant difference is found between operation methods. The operative time and hospitalization were significantly lower in the PFNA ($p<0.01$, $p<0.05$; respectively). At postoperative measurements, SF-36 physical functioning, energy/fatigue, emotional well-being, social functioning, pain, general health, and total scores were higher in the PFNA.

Conclusion: In this study, PFNA has low mortality and high functional scores in treating femoral intertrochanteric fractures. Therefore, PFNA is safer in a secondary hospital treating femoral intertrochanteric fractures and is recommended as a primary treatment option.

Keywords: Intramedullary nail, Mortality, Hemiarthroplasty, Intertrochanteric fractures, Femoral fractures.

Received: 07.06.2022

Accepted: 04.03.2023

Geliş Tarihi: 06.07.2022

Kabul Tarihi:03.04.2023

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doi:<http://dx.doi.org/10.12996/gmj.2023.67>

ÖZET

Amaç: İntertrokanterik femur kırıkları yaşam beklentisini artmasıyla sık karşılaşılan kırıklardır. Tedavide amaç, hastalarda erken mobilizasyon ve kırık öncesi fonksiyonu sağlamaktır. Bu çalışmada ikinci basamak bir hastanede intertrokanterik femur kırıklarının tedavisinde yaygın olarak kullanılan iki tedavi yönteminin (proksimal femoral çivi ve bipolar hemiarthroplasti) mortalite ve fonksiyon skorlarını karşılaştırmayı amaçladık.

Yöntem: Çalışma, 2017-2020 yılları arasında ikinci basamak bir hastanede femoral intertrokanterik kırık nedeniyle proksimal femoral çivi (PFNA) ve bipolar hemiarthroplasti (BHA) uygulanan hastalarda planlandı. Toplam 199 hastanın verileri retrospektif değerlendirildi. Ameliyat yöntemi, yaş, cinsiyet, mortalite, ameliyat süresi, hastanede yatış süreleri ve yaşayan hastaların son kontrollerinde kaydedilen short form-36 (SF-36) anketi incelendi.

Bulgular: Ameliyat yöntemine göre cinsiyet ve yaş açısından anlamlı fark yoktu. Ancak BHA'nın ölüm oranı PFNA'ya göre daha yüksekti ($p<0.001$). Ölüm zamanına göre operasyon yöntemleri arasında anlamlı bir fark yoktu. Ameliyat süresi ve hastanede kalış süresi PFNA'da anlamlı olarak daha düşüktü (sırasıyla $p<0.01$, $p<0.05$). SF-36'ya göre fiziksel fonksiyon, enerji/yorgunluk, emosyonel iyilik hali, sosyal fonksiyon, ağrı, genel sağlık ve toplam skorları PFNA'da daha yüksekti.

Sonuç: Bu çalışmada, femur intertrokanterik kırıklarının tedavisinde uygulanan PFNA düşük mortalite ve yüksek fonksiyonel skorlara sahipti. Bu nedenle ikinci basamak bir hastanede, femur intertrokanterik kırıklarının tedavisinde PFNA daha güvenli ve PFNA'yı birincil tedavi seçeneği olarak öneriyoruz.

Anahtar Sözcükler: İntamedüller çivi, Mortalite, Hemiarthroplasti, intertrokanterik kırık, Femur kırığı.

INTRODUCTION

Since the second half of the 20th century, life expectancy was significantly increased worldwide, especially in developed countries. In Turkey, while the life expectancy was 39.41 years old in 1950, today, it increased to 77.77 years old (1). With the increase in the elderly population, intertrochanteric femoral fracture cases were also increased (2). While these fractures can occur in young and elderly populations, they are more common in elderly patients due to low-energy trauma due to osteoporosis. It is also seen 2-8 times more frequently in females (3).

The aims of treating intertrochanteric femur fracture were early mobilization of the patient, prevention of surgical and clinical complications, and rapid and stable union of the bone.

The success of the treatment varies according to many factors, such as the patient's age, gender, comorbidities, and operation method (4). The main surgical treatment methods for these fractures are proximal femoral nail (Figure 1), bipolar hemiarthroplasty (Figure 2), dynamic hip screw, and angled plates (4). The most commonly applied method for this fracture type is proximal femoral nail (PFNA) in younger patients (4). On the other hand, bipolar hemiarthroplasty (BHA) is more frequently used in elderly patients because of the low-quality bone and osteoporosis. However, this method considers the mortality rate to be higher (5).

This study aimed to compare mortality rates and functional outcomes in patients who underwent proximal femoral nail and bipolar hemiarthroplasty for intertrochanteric femur fracture in a secondary hospital.

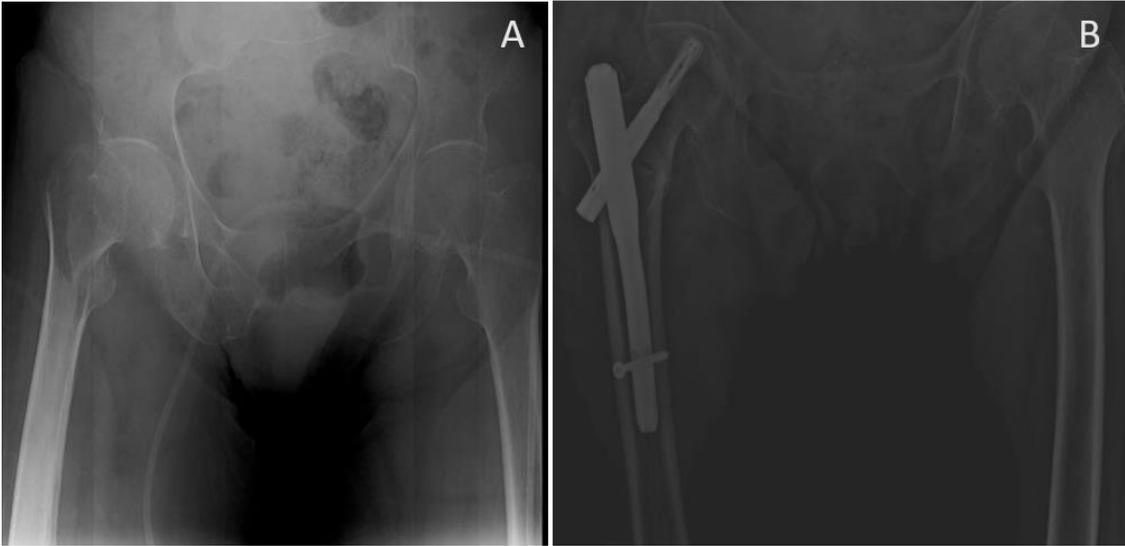


Figure 1: Preoperative intertrochanteric femur fracture(A) and postoperative imaging after fixation with proximal femoral nail (B)

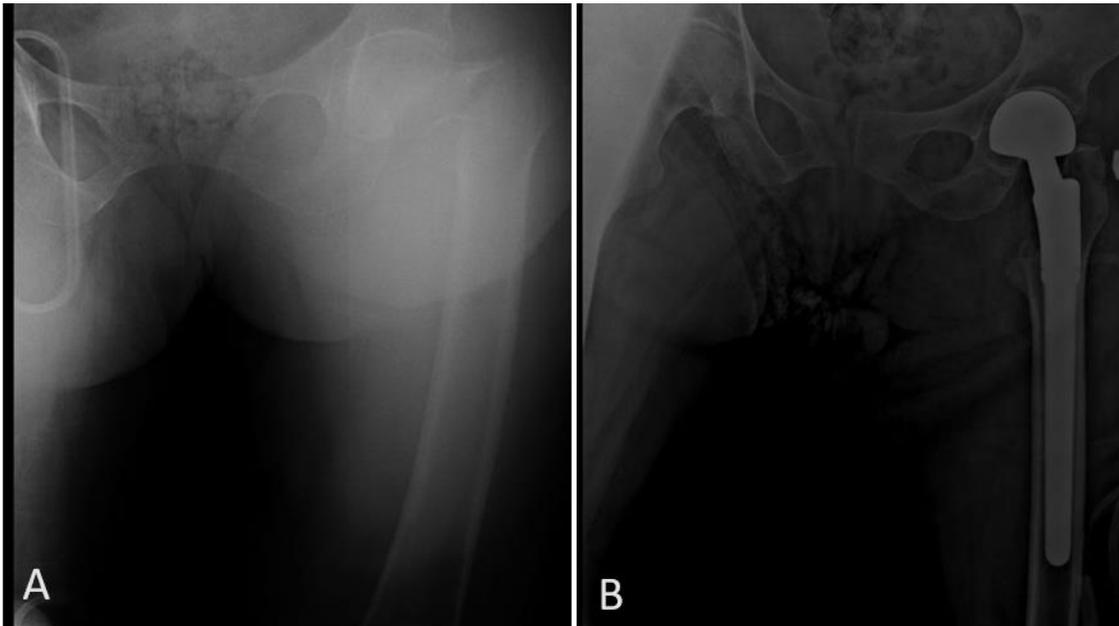


Figure 2: Preoperative intertrochanteric femur fracture(A) and postoperative imaging after bipolar hemiarthroplasty (B)

METHODS

This retrospective and non-interventional cohort study were conducted in patients undergoing BHA and PFNA for intertrochanteric femur fracture in a secondary hospital between January 2017 and December 2020.

This study included 212 patients aged 54- 98 who underwent BHA or PFNA for intertrochanteric femur fracture. The patients had between one and three years of postoperative follow-up. Multiple trauma patients (n=7), both hips operated on by different methods (n=2), and those who died from COVID (n=3) were excluded. The study was continued with a total of 199 patients.

Patients were divided into two groups depending on the operation technique a proximal femoral nail (Xrbest®, Xinrong Medical, Yongxin Road, Jinfeng, Zhangjiagang, Jiangsu Province, China) and bipolar hemiarthroplasty (Tipmed®, Kemalpaşa District 7401/1 Street No:16 Bornova / İzmir, Turkey). Patients in both groups were operated on in the lateral decubitus position. Intravenous 1 gr cefazolin was administered to all patients as a prophylactic antibiotic. In addition, anti-embolic stockings were used for six weeks and subcutaneous enoxaparin at a dose-dependent weight for 4- weeks. All patients were started on the first postoperative day with quadriceps exercises and complete or partial weight-bearing according to the patient's tolerance, and they were mobilized.

Data acquisition

All clinical variables of the patients were obtained retrospectively from the hospital database. The operation method, age, gender, vitality, operation time, and hospital stay were recorded for each patient. In addition, the patients' time of death was recorded from a national database. There was no information about the place of death of the patients. In addition, the short form-36 (SF-36) questionnaire was applied to the surviving patients at their last visit, comparing the pre-fracture and postoperative quality of life. Sixty-four patients in PFNA and 67 patients in BHA had SF-36 records. The SF-36 records of 4 BHA patients did not include in the analysis because they were missing.

Statistical analysis

Statistical analysis was performed using SPSS version 25.0 for Windows 10(SPSS Inc.; Chicago, IL, USA) and the G power program. Continuous variables are presented as mean \pm SD for normally distributed data, minimum- maximum for non-normal data. The compliance of continuous variables to the normal distribution was evaluated using visual (histogram and probability graphics) and analytic methods (Kolmogorov - Smirnov/ Shapiro- Wilk tests). Categorical variables were reported as count and percentage, and differences in categorical variables were evaluated using the Chi-square test.

Data were applied to power analysis using the G power program. As a result of the comparison of the independent groups, the influence quantity was calculated as $p < 0.05$ and $1-\beta$ as 0.86. The value was expected to be more than 0.80. The p -value ≤ 0.05 was considered statistically significant. With these results, acquired findings were credible.

University Scientific Research's Ethics Committee approval for this study was obtained on 11 December 2020 (Protocol no. E.133145). Because of being an archival study, written informed consent was not required.

RESULTS

The relationship between PFNA-BHA and gender with age was demonstrated in table 1. The maximum follow-up time of both BHA and PFNA was 3-years. No significant difference had found for gender, age and follow-up time compared to operation methods ($p > 0.05$).

Compared to operation method and patient survival, there was a significant difference between deceased patients about methods ($p = 0.001$). The mortality rate of the BHA was higher than the rate of PFNA. No difference had found between surviving patients and the operation method ($p > 0.05$) (Table 2).

Table 1: The relationship of surgical methods with gender and age. PFNA: proximal femoral nail, BHA: bipolar hemiarthroplasty

Methods	Gender		Age	Follow- up Time (days)	Total
	Female	Male			
PFNA	40 (20.1%)	43 (21.6%)	80.1 \pm 8.9 (min-max: 54-96)	378.3 \pm 189 (min-max:3-1001)	83 (41.7%)
BHA	49 (24.6%)	67 (33.7%)	81.3 \pm 8.4 (min-max:58-98)	469.4 \pm 323.7 (min-max:0-1063)	116 (58.3%)
Total	89 (44.7%)	110 (55.3%)	80.8 \pm 8.6 (min-max: 54-98)	431.4 \pm 278.7 (min-max:0-1063)	199 (100%)

Table 2: The comparison of patient's survival and operative method. PFNA: proximal femoral nail, BHA: bipolar hemiarthroplasty

	PFNA	BHA	p
Alive (n=135)	64	71	>0.05
Deceased (n=64)	19	45	0.001
Toplam (n=199)	83	116	

The mean time of death of the deceased patients was 202.1 \pm 187.1 days (min-max: 2- 682 days). While the mean of the deceased patients' death time for PFNA was 257.2 \pm 194.0 days, BHA was 178.3 \pm 181.1 days. Compared to the time of death, no significant difference was found between operation methods ($p > 0.05$).

There was a significant difference in gender between surviving patients (Female=54, Male=81) ($p < 0.05$). The deceased patients had no significant difference between genders ($p > 0.05$).

The mean of the operation time was in overall 87.8 \pm 31.1 minutes. While the mean operation time for PFNA was 73.5 \pm 26.1 minutes, BHA was 98.4 \pm 30.4 minutes. Compared to the operation time significant difference was between operation methods ($p < 0.01$).

The mean hospitalization length was 6.6 \pm 3.02 days (min-max: 2-22 days). While the mean length of hospitalization for PFNA was 5.8 \pm 2.92 days (min-max: 2-22 days), BHA was 7.1 \pm 2.98 days (min-max: 2-20 days). The length of significant hospitalization difference was between operation methods ($p < 0.05$).

SF-36 scores for both groups at preoperative and postoperative measurements were presented in table 3. There was no significant difference between groups except for social functioning scores ($p < 0.001$) at preoperative measurements ($p > 0.05$). At postoperative measurements, SF-36 physical functioning, energy/fatigue, emotional well-being, social functioning, pain, general health, and total scores were higher in the PFNA group ($p < 0.001$; respectively).

Table 3: SF-36 scores between groups at preoperative and postoperative measurements. PFNA: proximal femoral nail, BHA: bipolar hemiarthroplasty

		Group	Mean± Std. Deviation	p ^a
Preoperative	Physical Functioning	PFNA	77.14±24.30	0.132
		BHA	82.83±17.71	
	Role limitations due to physical health	PFNA	89.51±22.88	0.545
		BHA	91.79±19.65	
	Role limitations due to emotional problems	PFNA	93.65±24.58	0.365
		BHA	97.01±17.14	
	Energy/fatigue	PFNA	82.30±19.27	0.918
		BHA	82.01±10.87	
	Emotional well-being	PFNA	90.95±19.49	0.132
		BHA	94.86±6.14	
	Social functioning	PFNA	72.22±26.22	<0.001
		BHA	48.12±16.90	
	Pain	PFNA	84.52±19.45	0.977
		BHA	84.44±12.64	
General health	PFNA	79.92±26.23	0.057	
	BHA	87.31±15.98		
Health change	PFNA	52.22±19.06	0.146	
	BHA	56.34±12.57		
Total score(Sum of scores)	PFNA	721.03±163.23	0.876	
	BHA	724.74±97.75		
Postoperative	Physical Functioning	PFNA	71.98±27.49	0.002
		BHA	56.04±31.19	
	Role limitations due to physical health	PFNA	86.90±25.34	0.085
		BHA	77.61±34.57	
	Role limitations due to emotional problems	PFNA	93.65±24.58	0.113
		BHA	85.07±35.90	
	Energy/fatigue	PFNA	80.07±19.12	0.001
		BHA	70.00±14.67	
	Emotional well-being	PFNA	91.82±15.68	0.039
		BHA	86.53±13.22	
	Social functioning	PFNA	72.22±25.83	<0.001
		BHA	50.07±20.51	
	Pain	PFNA	82.02±19.57	<0.001
		BHA	67.27±14.24	
General health	PFNA	77.93±26.54	0.009	
	BHA	64.70±29.98		
Health change	PFNA	48.73±19.62	0.135	
	BHA	43.35±21.07		
Total score(Sum of scores)	PFNA	705.35±166.87	<0.001	
	BHA	596.50±177.59		

^aIndependent samples t-test

SF-36 total scores and preoperative/ postoperative group variables were shown in Tables 4 and 5. Both group variables and preoperative/ postoperative measurement variables were a significant effect on SF-36 total scores. SF-36 total scores were significantly higher in the PFNA group and preoperative measurements (for group variable $p=0.006$, $\eta^2=0.029$; preoperative/postoperative measurement $p<0.001$, $\eta^2=0.052$).

In addition, it was shown that group variable and preoperative/ postoperative measurement was a common and significant effect size on SF-36 total scores. In other words, the PFNA group difference between preoperative and postoperative measurements was statistically lower than in the BHA group ($p=0.004$, $\eta^2=0.033$).

Table 4: Descriptive statistics of sf-36 scores. PFNA: proximal femoral nail, BHA: bipolar hemiarthroplasty

Group	Test	Mean	Std. Deviation	n
PFNA	Preoperative	721.03	163.23	63
	Postoperative	705.35	166.87	63
	Total	713.19	164.59	126
BHA	Preoperative	724.74	97.75	67
	Postoperative	596.50	177.59	67
	Total	660.62	156.64	134
Total	Preoperative	722.94	133.03	130
	Postoperative	649.25	180.28	130
	Total	686.09	162.37	260

Table 5: Analysis of the effect of group and preoperative/postoperative variables on SF-36 total scores

Source of variance	Type III Sum of Squares	df	Mean Square	F	Sig. ^a	Partial Eta Squared
Group	179467	1	179467	7.543	0.006	0.029
Preoperative/postoperative SF-36 scores	336268	1	336268	14.133	<0.001	0.052

DISCUSSION

This study observed that elderly patients who underwent PFNA for intertrochanteric femur fracture in a secondary hospital had lower mortality rates and higher SF-36 functional scores.

Although PFNA is the standard gold method in treating intertrochanteric femur fractures, it has been preferred by orthopedic surgeons in recent years due to improvements in BHA design, low risk of nonunion, and early weight-bearing (6, 7). In addition, BHA may be preferred in PFNA because of the risk of implant failure (8).

The literature had reported that mortality rates in the 1-year follow-up of BHA and PFNA applied for intertrochanteric femur fracture are similar (6, 9-11). In another study comparing PFNA and BHA, Görmeli et al. showed that after a 1-year follow-up, BHA had a significantly higher mortality rate (12). In a study comparing the mortality rates of PFNA and BHA at 3-year follow-up in intertrochanteric femur fractures, a mortality rate of 17% for PFNA and 55% for BHA was reported (13). Xie et al. reported that the mortality rates of PFNA and BHA were similar; however, they reported higher complication rates in BHA. The same study emphasized that BHA should not be the first-line treatment in elderly intertrochanteric femur fractures (6). In this study, the mortality rate was significantly increased in femoral intertrochanteric fractures treated with BHA at three years of follow-up.

Lu et al. found that PFNA had significantly higher SF-36 scores than DHS (14). Esen et al. evaluated the Harris hip score and function SF-36 between PFNA and BHA. Although the Harris hip score of PFNA was relatively better and the vitality/energy score was better in the PFNA group, it showed no significant difference between the Harris hip score and the SF-36 score of both groups (15). In the study by Esen et al., there was no comparison of the preoperative and postoperative SF-36 scores of the two groups. In this study, there was no significant difference between the two groups in the preoperative PFNA group, except for social functions ($p^a < 0.001$) (Table 3).

In the postoperative evaluation of SF-36, there was a difference between the two groups except for role limitations due to physical health and role limitations due to emotional problems. Other subgroups of SF-36 had higher scores for the PFNA. There were also higher differences in BHA in postoperative scores.

Some authors did not report a significant difference in operative time for PFNA and BHA (9, 15). In contrast, Hari Prasad et al. reported that the operative time of PFNA was significantly lower than that of BHA, similar to our study (16).

Although intertrochanteric fractures were more common in women (17, 18), there was no significant difference in this study. However, the male gender was relatively more frequent. The reason for this is that males take a more active role in work and daily life in the agricultural lifestyle in the region and are also more open to accidents and trauma. Some authors stated that female patients had a lower mortality rate as a result of the fact that female patients were primarily housewives, had a sedentary lifestyle, and had a reduced risk of fractures (19-22). In our study, however, there was no significant difference between the genders of the patients who died.

The main limitations of this study were the difficulty of communication, inability to learn the comorbidities due to a poor archiving system, unknown reasons for death, lack of information about blood loss, and inefficient follow-up due to some incompatible patients. Fortunately, these limitations did not affect the results because the study was a retrospective archival study focused on the mortality rates and functional scores. Another limitation was that more than one surgeon operated on the patients. However, physicians did not have a specific choice for PFNA or BHA, and the surgeon factor was not considered in the study.

In conclusion, compared to bipolar hemiarthroplasty in geriatric patients who underwent PFNA for intertrochanteric femur fracture, the duration of surgery and hospitalization after surgery is shorter. In addition, patients treated with PFNA had lower mortality rates and higher SF-36 functional scores. Therefore, the surgeon working in a secondary care hospital can safely prefer PFNA in elderly patients with intertrochanteric femur fractures.

Conflict of interest

No conflict of interest was declared by the authors.

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