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Evaluation of risk factors and outcomes associated with mortality after hip fracture surgery in eldery patients

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ABSTRACT

Objective: In this retrospective study, it was aimed to compare mortality related risk factors and outcomes in patients who underwent proximal femoral nail and partial hip prosthesis for hip fracture.

Material and Method: In our study, a total of 618 patient files who underwent hip fracture operations, including partial hip replacement (n=350) and proximal femoral nail (n=268) were retrospectively analyzed. Age, gender, fracture side, cause, type of fracture, type of operation, blood transfusion, hospital stay, anesthesia type and one-year survival times of the patients were examined.

Results: Gender, age, side, mechanism, anesthesia, comorbid diseases, cause of mortality, one-year mortality and survival time differences between patient groups were not statistically significant ($p>0.05$). However, fracture type, blood transfusion and hospital stay differences between groups were statistically significant ($p<0.05$). According to the correlation analysis results, there was a statistically significant relationship between the type of operation and the type of fracture, blood transfusion and hospital stay ($p<0.05$). The difference between level of fracture type and blood transfusion level was statistically significant ($p<0.05$). The difference in length of hospital stay was not significant at the multivariate level ($p> 0.05$). The mean survival time of the hip prosthesis group (144.97±9.83) was greater than the survival time of the proximal femoral nail group (129.72±12.31), but this difference was not statistically significant ($p> 0.05$).

Conclusion: According to the results of the research, both partial hip replacement and proximal femoral nail methods have similar results and mortality level. Therefore, methods including less invasive procedures should be preferred for the benefit of the patient in the selection of methods in hip fracture treatment.

Keywords: Hip fracture, mortality, hip replacement, risk factors

INTRODUCTION

Most hip fracture injuries occur in older people as a result of factors including falls and accidents (1-6). The proximal femaral nail (PFN) approach and partial hip replacement are two of the most popular surgical choices, despite the fact that surgical applications vary slightly based on the patient's condition, the type of injury, or other aspects of the surgical intervention (7-9).

While hip fracture is 34 per hundred thousand in men, it is 63 per hundred thousand in women. Generally, 90% of hip fractures are seen over the age of 60 (10). Although the PFN method and partial prosthesis are two common methods, there has been an increase in recent years that the PFN method involves less invasive procedures and therefore has a lower fracture risk (1). On the other hand, no study has been found that compares the two methods sufficiently. In a study conducted in 2021, which is one of the limited studies on this subject, a lower rate of fracture was observed in patients after PFN (11).

Due to the occurrence of hip fractures in older ages and health conditions that develop due to age, the management of the surgical intervention to be applied for the disease is difficult and increases the mortality of the disease. In the literature, in-hospital mortality rates after hip fracture surgery vary between %2.7 and %15, while one-year mortality rates vary between %11.5 and %58.3 (12). Although risk factors are the subject of many studies due to high mortality rates, there are not enough clinical studies comparing surgical methods. Therefore, in this study, it was aimed to compare risk factors and outcomes associated with mortality in patients treated with PFN and partial hip replacement.

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MATERIAL AND METHOD

The study was carried out with the permission of Hitit University Faculty of Medicine Clinical Research Ethics Committee (Date: 10.03.2021, Decision No: 2021/426). All procedures were carried out in accordance with the ethical rules and the principles of the declaration of Helsinki.

Study Design and Settings

Following the approval of the local ethics committee the files of 618 patients over the age of 65 who applied to our hospital with a hip fracture and were treated surgically with partial fracture side, cause of fracture, fracture type, presence of comorbid disease, operation type, blood transfusion, length of stay and anesthesia type, and one-year survival time were recorded. In the study, given hypothesis was tested: H0: There is not a statistically significant difference between proximal femoral nail and partial hip prosthesis for hip fracture.

Since fracture type is a prognostic and intercorrelated factor, its effect was evaluated in the binary logistic regression analysis as multivariate analysis metehod (12). Cemented arthroplasty was applied. Since both fracture type and surgical method differ, a multivariate analysis was performed to evaluate the effect of all of them together and the results were compared with univariate.

The primary choice for pertochanteric fractures was PFN, and subgroups of all patients were grouped according to PFN appropriate indications by stratified sampling method and multivariate analysis was performed. Inclusion and exclusion criteria were as follows:

a. No lack of information in the patient file
b. Hip fracture surgery patients
c. No presence of a medical condition or drug use that would interfere with research results
d. Having similar rehabilitation and mobilization conditions
e. Over 70 ages

Statistical Analysis

In the study, frequency analysis was used to define nominal and ordinal data, and mean and standard deviation values were used to define measurement parameters. Chi-Square and Chi-Square Similarity Ratios were used in the difference analysis of ordinal and nominal data. Before the analysis of the measurement data, Kolmogorov Smirnov Test was performed for normality distribution analysis. Nonparametric tests were used as all parameters did not conform to normal distribution as a result of the test. Mann Whitney U was used for pairwise group differences and Spearman's rho correlation analysis was used for relational analysis. Binary Logistic Regression analysis was performed for analysis at multivariate level. Kaplan Meier and Log Rank (Mantel-Cox) tests were used for the difference between cumulative survival levels. All analyzes were performed at %95 confidence interval and 0.05 significance level using SPSS 17.0 for Windows program.

RESULTS

The differences of sex, age, side, mechanism, anesthesia, comorbid diseases, cause of mortality, one-year mortality and survival time between the two groups were not statistically significant ($p>0.05$). On the other hand, the differences between the groups in terms of fracture type, blood transfusion and hospital stay were statistically significant ($p<0.05$). While femoral neck fracture was seen in the majority of the hip prosthesis group (%65.4), the majority of the PFN group had a trochanteric fracture (%56.3). Hospital stay and mean blood transfusion were higher in the hip replacement group ($p<0.05$) (**Table 1**).

According to correlation analysis results, there was a statistically significant relationship between operation type and fracture type, blood transfusion and hospital stay ($p<0.05$). These relationships are positive between fracture type and operation type; and negative between the type of operation and blood transfusion and hospital stay. In the operation type coding, 1=hip prosthesis and 2=PFN; and fracture types were coded as 1=neck fracture, 2=Trochanteric and 3=Subtrochanteric. Therefore, when the type of operation was heavily PFN, the length of stay and blood transfusion decreased. PFN was found to be the more preferred type of operation in the neck fracture in trochanteric and subtrochanteric transition (**Table 2**).

Table 2. Spearman's rho correlation analysis results between significant parameters of patient groups

	R	P
Fracture type	0.291**	0.000
Blood transfusion	-0.124**	0.002
Hospital stay	-0.095*	0.018

*p<0.05 **p<0.01

Binary logistic regression analysis results showed that the difference between the groups in multivariate level of fracture type and blood transfusion level was statistically significant ($p<0.05$). On the other hand, although the difference in length of hospital stay was significant at the univariate level, it was not significant at the multivariate level ($p>0.05$) (**Table 3**).

Table 1. Demographic and clinical characteristics of patient groups

	Hip Replacement (n=350)	PFN (n=268)	Total (n=618)	p value
Gender, n (%)				
Male	153 (43.7)	125 (46.6)	278 (45.0)	0.468[a]
Female	197 (56.3)	143 (53.4)	340 (55.0)	
Age, mean±SD	85.65±6.25	84.69±5.81	85.24±6.08	0.065[b]
Side, n (%)				
Right	175 (50.0)	134 (50.0)	309 (50.0)	>0.05[a]
Left	175 (50.0)	134 (50.0)	309 (50.0)	
Mechanism, n (%)				
Fall	307 (87.7)	229 (85.4)	536 (86.7)	0.410[a]
Traffic accident	43 (12.3)	39 (14.6)	82 (13.3)	
Fracture type, n (%)				
Femoral neck fracture	229 (65.4)	91 (34.0)	320 (51.8)	
Trochanteric	97 (27.7)	151 (56.3)	248 (40.1)	0.000[a]
Subtrochanteric	24 (6.9)	26 (9.7)	50 (8.1)	
Anesthesia, n (%)				
GA	119 (34.0)	93 (34.7)	212 (34.3)	0.856[a]
SA	231 (66.0)	175 (65.3)	406 (65.7)	
Blood transfusion, mean±SD	2.22±1.34	1.97±1.33	2.11±1.34	0.002[b]
Hospital stay, mean±SD	11.27±5.86	10.35±5.97	10.87±5.92	0.018[b]
DM, n (%)	65 (18.6)	47 (17.5)	112 (18.1)	0.741[a]
HT, n (%)	112 (32.0)	73 (27.2)	185 (29.9)	0.200[a]
CAD, n (%)	31 (8.9)	19 (7.1)	50 (8.1)	0.425[a]
CVE, n (%)	13 (3.7)	11 (4.1)	24 (3.9)	0.804[a]
CRF, n (%)				
Mortality cause, n (%)				
Cardiac arrest	4 (3.3)	5 (6.2)	9 (4.5)	
Respiratory failure	2 (1.7)	2 (2.5)	4 (2.0)	
Sepsis	1 (0.8)	1 (1.2)	2 (1.0)	0.705c
PTE	1 (0.8)	-	1 (0.5)	
Other	112 (93.3)	73 (90.1)	185 (92.0)	
One-year mortality, n (%)	120 (34.3)	81 (30.2)	201 (32.5)	0.285[a]
Survival, days, mean±SD	144.97±107.71	129.72±110.83	138.82±108.96	0.223[b]

a. Chi-Square Test, b. Mann Whitney U Test, c. Chi-Square Likelihood Ratio, GA: General Anesthesia, SA: Spinal Anesthesia, DM: Diabetes Mellitus, HT: Hypertension, CAD: Chronic artery Disease, CVE: Cerebro Vascular Event, CRF: Chronic Renal Failure, SD: Standard Deviation, PTE: PulmonerTromboemboli,

Table 3. Binary logistic regression analysis results for significant parameters of patient groups

	B	S.E.	Wald	p	OR	95% C.I.for OR	
						Lower	Upper
Fracture type			57.583	.000			
Fracture type (1)	-.999	.311	10.342	.001	.368	.200	.677
Fracture type (2)	.360	.313	1.322	.250	1.433	.776	2.649
Blood transfusion	-.153	.066	5.369	.020	.858	.754	.977
Hospital stay	-.020	.016	1.567	.211	.980	.950	1.011
Constant	.614	.356	2.970	.085	1.847		

Cox & Snell R2: 0.107; Nagelkerke R2: 0.144, [1]: Femoral neck fracture, [2]: Torocontractic fracture

Both the mean and the range of blood transfusion levels were higher in the hip replacement group. Blood transfusion needs of the patients in the PFN group were closer to each other (**Figure 1**).

Although there was a statistically significant difference between hip prosthesis and PFN group in terms of operation preference, this difference was mostly valid in hip fractures due to falls. In traffic accident-related fractures, there was no significant difference between operation preferences in cases with the same fracture type (p>0.05) (**Figure 2**).

Although the mean survival time of the hip prosthesis group (144.97±9.83) was longer than the survival time of the PFN group (129.72±12.31), the results of the Log Rank (Mantel-Cox) test showed that this difference was not statistically significant (p>0.05) (**Figure 3**).

One-year mortality was %32.5 in all patients, %34.3 in the hip prosthesis group and %30.2 in the PFN group, and the differences between the groups were not statistically significant (p>0.05) (**Figure 4**). The mean age of the patients who died in the PFN group was 85.60±6.57, while it was 87.35±6.74 in the hip replacement group.

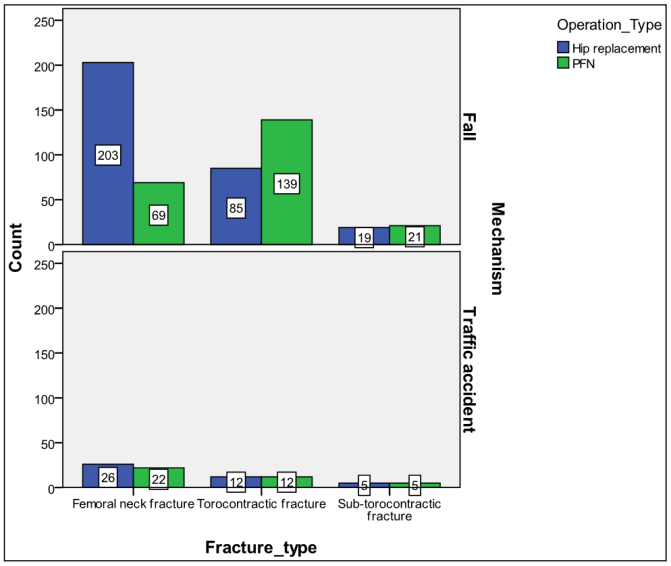

Figure 1. Distribution of blood transfusion values of patients

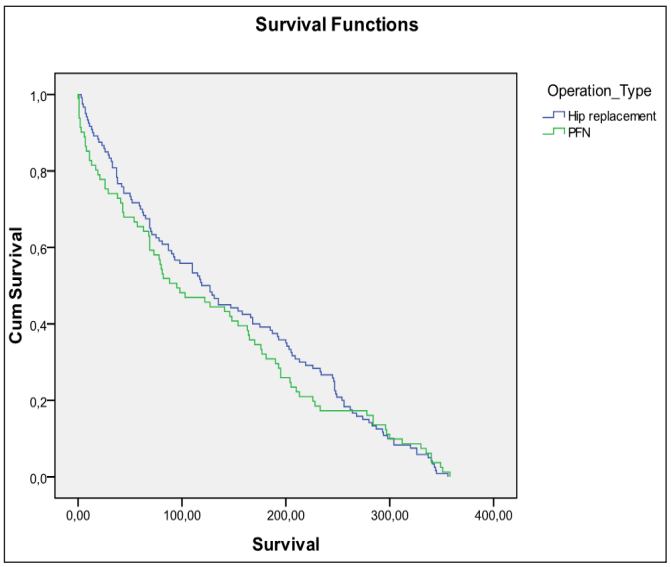

Figure 2. Distribution of fracture type and mechanism parameters of patients

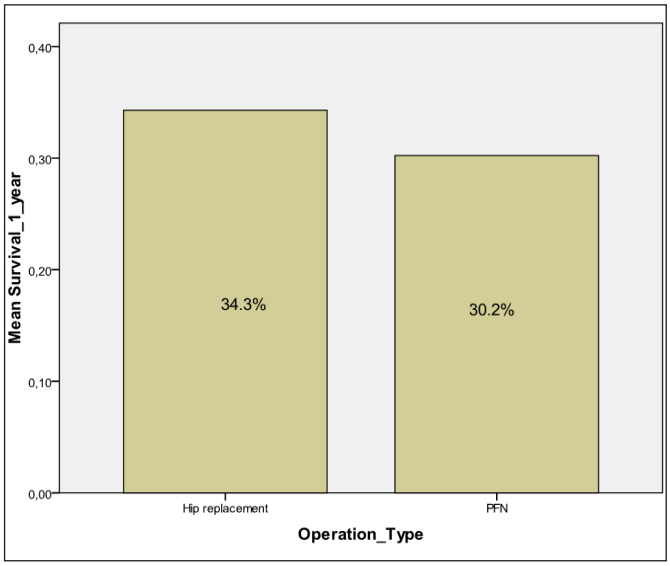

Figure 3. One-year survival and cumulative survival distribution of patients

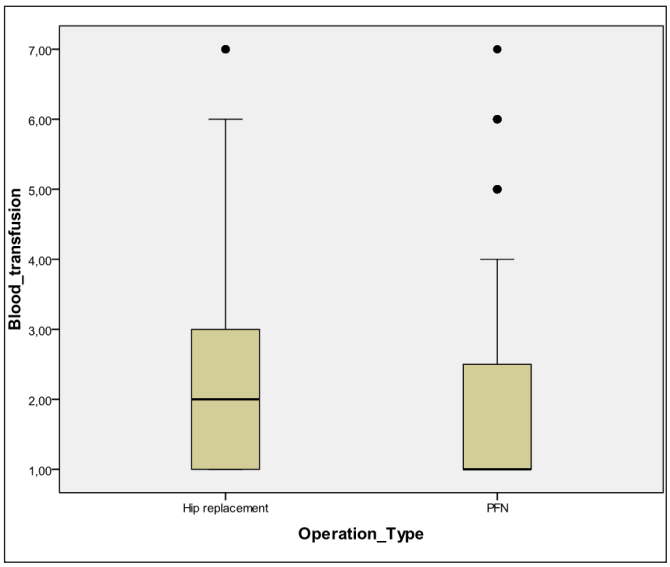

Figure 4. One-year mortality rates by operation groups

DISCUSSION

In this study, the outputs and mortality rates of hip prosthesis and PFN methods were compared in hip fracture cases, which are important guests of the orthopedic field and have high mortality rates.

Studies in the literature on hip fractures have reported that it is more common in older age and women (13-17). In our study, women were in the majority compared to men in cases treated with both methods, and %55 of all cases were women. Their average age was over 85, and the majority (%86.7) had hip fracture surgery due to a fall.

Richmond et al. (18) reported the rate of femoral neck fracture as %51.4 in their study.In our study, femoral neck fracture was found as %51.8 in total. While hip replacement was the most preferred method in this type of fracture, PFN was the most preferred surgical method in trochanteric fractures. Although the defects in the anatomical structure of the bone in femoral neck or trochanteric fractures are different, the use of both methods for each other (femoral neck fractures and trochanteric fractures) was also very high. In both methods, the use of spinal anesthesia was more common.

In our study, both blood transfusion and hospital stay were significantly higher in the hip replacement group compared to the PFN group. Thus, the PFN method seems to be a favorable method in terms of blood transfusion and hospital stay. As a matter of fact, the multivariate analysis results revealed that when all variables were considered together, there was no significant difference in the hospital stay between the two patient groups. When this finding is evaluated together, the difference between the two methods is

limited to the type of fracture and blood transfusion. The difference in blood transfusion is thought to be due to the fact that hip prosthesis application is a more major surgery than PFN.

Hypertension (HT), Diabetes Mellitus (DM), Chronic Artery Disease (CAD), and Chronic Renal Failure (CRF) are the leading comorbidities that can affect any surgical operation process. The presence of these diseases affects both the anesthesia process and the treatment process during and after the operation. Therefore, the surgical method to be applied in the presence of comorbid diseases may differ. In our study, the comorbid disease distributions of both groups were similar and the differences between the groups were not statistically significant. Therefore, it can be stated that comorbidity does not have a significant effect on the choice of surgical method in hip fractures, since the study was retrospective and it was not possible to have bias or bias in the selection of patient groups.

In the literature, different rates are given in studies on mortality after hip fracture. Pollmann et al. (6) the annual mortality as %22.8 in both groups treated as traditional method and fast track. Richmond et al. (18) in-hospital mortality as %2.7 and one-year mortality as %11.5. Leibson et al. (19) one-year mortality as %20 in patients who had hip fracture surgery, and %11 in the control group (20). Bentler et al. (21) that the one-year mortality after hip fracture was %26. Therefore, not only hip fracture mortality is included in the one-year mortality. Generally, most of clinical studies reported higher mortality in men (22-25). In another study, Wehren et al. (26) that the mortality was 31.4% in women and %23.3 in men, and %18.9 in all patients. In our study, one-year mortality was found as %32.5 in all patients, %34.3 in the hip prosthesis group and %30.2 in the PFN group, and the differences between the groups were not statistically significant. One-year mortality rate in patients treated with both methods was consistent with the literature. The mean survival time was 138.82 days in all patients, 144.97 in the hip replacement group and 129.72 in the PFN group, and the differences were not significant.

Our study showed that prosthesis application or PFN application alone did not affect mortality in patients with hip fractures. The fact that hip fracture cases generally occur in the advanced age group, therefore, the patient's anamnesis and comorbidities are not sufficiently recorded, there are difficulties in the follow-up of the data due to the fact that the cases are treated and followed up by different physicians in more than one service, and the functional status of the patients before the fracture is not known. The main limitations are that the information on what the preference is determined according to is not sufficiently included in the patient records and the study is single-centered. In addition, this issue could not be evaluated since sufficient data could not be reached for cost benefit analysis of the two methods. Similar limitations in the results obtained in the literature show that there is a need for well-planned multi-center studies that reveal cost analysis that evaluate possible risk factors including pre-fracture functional status of patients with multiple data analysis.

Correlation analysis resuts showed that hospital stay, fracture type and blood transfusion were effective on PFN or hip prosthesis. However, multivariate analysis results showed that only femoral neck fracture was a predictive factor for selection of surgical procedure. In literature, there is an accepted approach that PFN is a primary selection for subtrochanteric fractures. However, our results showed that its accepted for only femoral neck fractures. The fact that the study is conducted in a single center is the most important limitation of the study. Results may be extended to more general population with multi centered studies.

CONCLUSION

After hip fracture surgery, one-year mortality rates are significant and high, and studies should be conducted to reveal more risk factors. According to the results of the research, both hip replacement and PFN methods have similar results and mortality levels. Therefore, it is clear that in cases where both methods can be preferred in the treatment of hip fractures, it is necessary to choose a method that includes less invasive procedures for the benefit of the patient and is less costly in terms of public expenditures. For this, comprehensive studies including cost-benefit analysis are needed.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Hitit University Faculty of Medicine Clinical Research Ethics Committee (Date: 10.03.2021, Decision No: 2021/426).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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