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Original Research Article

Comparison of calcareous replacement hemiarthroplasty and proximal femoral nail in elderly ıntertrochanteric femur fractures

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ABSTRACT

Background: In this study, a retrospective evaluation was made of patients aged 70 years and over who were applied with proximal-femoral nail (PFN) or calcareous replacement cemented hemiarthroplasty in respect of early and late-stage morbidity and mortality and functional personal independence.
Methods: The study included a total of 77 patients aged over 70 years with an AO type 31-A1 or 31-A2 fracture. The patients were separated into two groups as those applied with proximal femoral nailing and those applied with calcar replacement hemiarthroplasty. Statistical comparison was made of the groups in respect of preoperative age, comorbidities, type of anaesthesia, ASA score, and fracture type, and postoperative amount of blood loss, albumin decrease, wound complications, other complications, Harris hip functional scores, Barthel daily living activity index, mortality rates.
Results: The two groups were found to be similar in respect of age, gender, comorbidities, AO fracture type and type of anaesthesia. The operating time was shorter in the proximal femoral nailing group. The Harris hip scores and the Barthel daily living activity ındex values were similar in both groups. Rates of wound infection were higher in the hemiarthroplasty group. Mortality rates at one month, six months and one year were similar in both groups.
Conclusions: Proximal femoral nailing can be one of the primary treatment options for intertrochanteric hip fractures in the elderly. Furthermore, although functional results and mortality rates are similar, as cemented calcar replacement hemiarthroplasty has serious life-threatening complications, it should not be the first choice of treatment method.

Keywords: Intertrochanteric fracture, Cemented hemiartroplasty, PFN

INTRODUCTION

Rate of hospitalization due to hip fracture has significantly increased in the last 20 years and intertrochanteric fractures and its surgery and the troubles afterwards are still major public health issues.[1-3] The implant to be used in the treatment of intertrochanteric fractures is still a matter of debate due to low bone mass, co-existing diseases and the reason that there are many implants to establish these fractures.[4] It has been reported by some studies that intramedullary nail devices, proximal-femoral nail (PFN) are suitable devices for intertrochanteric fractures, as shown by biomechanical studies.[5-7] However, implant insufficiency and screw stripping in severe osteoporotic fractures bring out partial hip prosthesis as an alternative method of treatment and it has satisfying results in literatures.[8,9]

In this study, we have retrospectively evaluated patients older than 70 years old that have fixed with PFN and partial prosthesis with cemented calcar replacement in our clinic and researched whether prosthesis with cemented calcar replacement could be an alternative to PFN for these patients by comparing their early and late mortality and morbidities, degrees of achieving functional personal independence.

METHODS

85 patients older than 70 years old, which received treatment November 2008 and December 2009 due to Arbeitsgemeinscaft fur Osteosyntesefragen (AO) type 31-A1 and 31-A2 intertrochanteric hip fracture in Ankara Numune Education and Research Hospital, were examined retrospectively. Eigth patients, those who had pathological fractures, ipsilateral or contralateral amputation were excluded from the study. Sixteen of theremaining 77 patients have lost their lives. Case details of those patient who lost their lives were used in our study for statistical purposes.

Ourpatients were divided into two groups, PFN group and hemiarthroplasty group. Fracture sides, intraoperative and postoperative amounts of bleeding, anesthesia types and ASA scores, fracture types according to AO, average hemoglobin decline amounts, blood transfusion amounts, average albumin decline amounts, operation durations, time from injury to surgery, hospitalization duration and total follow-up time of two different surgical techniques were evaluated and a comparison was made between the groups.

Modified Harris hip score criteria were observed by taking into consideration the pain, walking capacity and physical examination symptoms of the patients clinically and criteria of modified Barthel activities of daily living ındex (MBI) that assesses the degree of dependency of the patients on ful filling their daily life activities, personal care and needs were applied and their condition in the first year was evaluated.

The patients were radiologically evaluated for complications that could be observed in postoperative follow-up such as implant failure, screws cut-out, mechanical failure and secondary varus malalignment, shortness, acetabular penetration, acetabular protrusion, dislocation, fracture around the implant and prosthesis loosening. The two different techniques were evaluated in terms of wound infection, fat necrosis, decubitus ulcer, severe local pain, symptomatic deep vein thrombosis, pulmonary thromboembolism complications and compared. First month, sixth month, first year and total mortalities of the two groups were compared.

PTN (Pertrochanteric nail; BiometInc. Warsaw, IN, USA) system was performed to the patients in the PFN group. In this system which has length options of extra short, short and tall; we performed the short length option for our patients. A single lag screw could be placed to the femoral head over the nail at an angle of 128 degrees and solid sliding lag screw was used in all our patients. There was an option of locking with single screw in distal. Prosthesis with cemented calcar replacement (BiometInc. Warsaw, IN, USA) that is designed for proximal femur was performed with lateral approach to all our patients who underwent hemiarthroplasty.

Infection prophylaxis and thromboembolism prophylaxis were performed all the patients. Those patients whose general condition were sufficient after the operation were put on full load on day one in the hospital of a doctor to the extent they could bear the pain. In the follow-up of our PFN patients, based on their physical examinations and the radiographies, after ensuring full union in an average of three months, they were put on full load. The patients were called to their post-operative follow-ups as; sixth week, third month, sixth month, 12th month. Quality of reduction according to radiographic evaluation during the follow-up of the patients was classified as anatomic (varus-valgus, anteversion- retroversion less than 5 degrees), reasonable (5°-10°), orbad (>10°). The position of the lag screw was qualified good in center/inferior-center position according to anterior-posterior radiography and in center position in lateral radiography; and qualified bad in other positions.

Analysis of the data was carried out on statistical package for the social sciences (SPSS) for Windows 15 package program. Descriptive statistics were shown as average±standard deviation or median (minimum-maximum) for continuous and intermittent numeric variables, while categorical variables were shown as number of cases and (%). Results were considered statistically significant for $p<0.05$.

Ethics committee approval was obtained for our study from the ethics committee of Ankara Numune Education and Research Hospital with protocol number 536-2013.

RESULTS

PFN group consisted of 36 patients while prosthesis group consisted of 41. Minimum age in the PFN group was 70 years old, maximum 98 years old, average 79 years old; minimum age in the prosthesis group was 74 years old, maximum 97 years old and average 83 years old. Considering the intra group gender distribution; while there were 19 (52.8%) women and 17 (47.2%) men in the PFN group, there were 27 (65.9%) women and 14 (34.1%) men in the prosthesis group. There was no significant difference in terms of median age and gender distribution between the prosthesis and PFN groups ($p=0.077$ versus $p=0.350$). There was no difference between the groups in terms of frequency and distribution of co-existing diseases and average number of co-existing diseases, fracture distribution according to AO-OTA classification and type of anesthesia. The fracture etiology in all our patients was due to low-energy trauma caused by a simple fall. As additional trauma, 7 of our patients had radius distal end

fracture (4 percutaneous pinning, 3 closed reduction and plaster treatment), 2 of our patients had humerus surgical neck fracture (one patient open reduction + internal fixation, other one percutaneous pinning), 1 of our patients had shoulder dislocation (closed reduction) (Table 1).

Figures 1 and 2 show the radiographs and functional results of patients in PFN group and arthroplasty group.

Considering the quality of fracture reduction of the patients in the PFN group, reduction qualities achieved in 16 (44.4%) patients was anatomic, in 17 (47.2%) patients was reasonable and in 3 (8.3%) patients was bad. Considering the implant position, initial position of the lag screw was evaluated as good in 30 (83.3%) patients and bad in 6 (16.7%) patients. Cut-out occurred in the lag screws of our 4 patients during their follow-up. Upon bone union formation in 2 of our patients who had screw cut-out in the postoperative 2nd month, they underwent screw removing operation. Screw cut-out happened on the 3rd week for our 2 other patients. These patients were confined to bed. The patients and their relatives did not perfomed re-operation. Those 4 patients who had screw cut-out were in the group of patients with bad lag screw positions. There was no difference between the groups once the Harris hip score of the patients in PFN and prothesis groups were compared (Table 2).

Operation duration, average amount of bleeding, transfusion need, decrease in hemogram and albumin amounts of the patients were indicated in Tables 3 and 4. Results of modified Barthel index were indicated in Table 5.

Frequency of other complication sex, wound infection was found to be similar between the PFN and prosthesis groups. Wound infection was found to be significantly high in the prosthesis group compared to the PFN group (p=0.032) (Table 6).

While the mortality rates at 1st month, 6th month and 1st years of the prosthesis group were higher to the PFN group, there was no significant difference between the groups (p>0.05) (Table 7).

Table 1: Demographic and clinical characteristics of the cases according to prosthesis and PFN groups.

Characteristics	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
Age, (year)	83 (74-97)	79 (70-98)	0.077†
Gender			0.350‡
Male	14 (34.1)	17 (47.2)	
Female	27 (65.9)	19 (52.8)	
Alzheimer's	9 (22.0)	4 (11.1)	0.336‡
DM	9 (22.0)	14 (38.9)	0.170‡
HT	34 (82.9)	33 (91.7)	0.321¶
COPD	12 (29.3)	9 (25.0)	0.870‡
CAD	9 (22.0)	8 (22.2)	1.000‡
Parkinson's	4 (9.8)	3 (8.3)	1.000¶
Heart failure	5 (12.2)	2 (5.6)	0.438¶
Chronic kidney failure	1 (2.4)	0 (0.0)	1.000¶
Asthma	1 (2.4)	0 (0.0)	1.000¶
Number of co-morbid diseases	2 (1-4)	2 (1-4)	0.985†
Type of anesthesia			0.974‡
General	17 (41.5)	16 (44.4)	
Spinal	24 (58.5)	20 (55.6)	
ASA			0.151†
2	2 (4.9)	4 (11.1)	
3	22 (53.7)	22 (61.1)	
4	15 (36.6)	9 (25.0)	
5	2 (4.9)	1 (2.8)	

†Mann Whitney U test, ‡continuity corrected Chi-square test, ¶Fisher's exact test, $student's t test

Table 2: Findings regarding fracture characteristics of the cases according to prosthesis and PFN groups.

Characteristics	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
Fracture classification			
31 - A1.1	4 (9.8)	2 (5.6)	0.679†
31 - A1.2	4 (9.8)	2 (5.6)	0.679†
31 - A1.3	1 (2.4)	2 (5.6)	0.596†
31 - A2.1	8 (19.5)	13 (36.1)	0.169‡

Continued.

Characteristics	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
31 - A2.2	15 (36.6)	8 (22.2)	0.261‡
31 - A2.3	9 (22.0)	9 (25.0)	0.964‡
Harris score	77.8±10.2	77.0±11.0	0.786¶
Harris score			0.728$
Bad	6 (20.6)	6 (18.8)	
Moderate	10 (34.4)	14 (43.8)	
Good	8 (27.5)	7 (21.9)	
Excellent	5 (17.2)	5 (15.6)	
Quality of reduction			-
Bad	-	3 (8.3)	
Reasonable	-	17 (47.2)	
Anatomic	-	16 (44.4)	
Position of implant			-
Bad	-	6 (16.7)	
Good	-	30 (83.3)	

†Fisher's exact test, ‡continuity corrected Chi-square test, ¶student's t test, $Mann Whitney U test (Harris score calculated survive patients)

Table 3: Other clinical symptoms of the cases according to prosthesis and PFN groups.

Symptoms	Prosthesis (n=41)	PFN (n=36)	P value †
Duration of operation (mins.)	40 (35-55)	25 (20-35)	<0.001
Intra-op bleeding (cc)	400 (200-500)	150 (100-250)	<0.001
Blood transfusion (unit)	2 (0-5)	1 (0-2)	<0.001
Post-op drainage (cc)	400 (200-600)	100 (50-150)	<0.001
Follow-up period (month)	19 (15-26)	19 (14-25)	0.571

†Mann Whitney U test

Table 4: Preoperative and postoperative laboratory measurements of the cases according to prosthesis and PFN groups.

Parameters	Pre-op	Post-op	P value †	Change	P value ‡
Hemoglobin					<0.001¶¶
Prosthesis	11.5±1.2	8.7±0.9	<0.001¶	-2.8±1.1	
PFN	11.0±1.2	9.6±1.2	<0.001¶	-1.4±0.6	
Albumin					<0.001$$
Prosthesis	32 (21-41)	20 (13-28)	<0.001$	-13 (-20-4)	
PFN	35 (20-46)	28.5 (15-42)	<0.001$	-6 (-15-1)	

†Comparisons made between preoperative and postoperative with in the groups, ‡comparison made for the amount of change in the postoperative period compared to preoperative period with in the groups, ¶paired samples t-test, $Wilcoxon sign ranked test, ¶¶student's t test, $$Mann Whitney U test

Table 5: MBI distribution of the cases according to prosthesis and PFN groups.

Parameters	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
MBI			0.077†
Slightly dependent	6 (20.6)	10 (31.3)	
Reasonably dependent	11 (37.9)	15 (46.9)	
Significantly dependent	12 (41.3)	7 (21.9)	

†Mann Whitney U test (MBI score calculated survive patients)

Table 6: Complication distribution of the cases according to prosthesis and PFN groups.

Parameters	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
Complication	20 (48.8)	15 (41.7)	0.692†
PTE	8 (19.5)	2 (5.6)	0.094‡
Wound infection	8 (19.5)	1 (2.8)	0.032‡

Continued.

Parameters	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
Development of shortness	2 (4.9)	5 (13.9)	0.242‡
Fat necrosis	4 (9.8)	2 (5.6)	0.679‡
Residual pain	1 (2.4)	4 (11.1)	0.179‡
Decubitus	3 (7.3)	1 (2.8)	0.618‡
UTI	1 (2.4)	1 (2.8)	1.000‡
DVT	2 (4.9)	0 (0.0)	0.496‡
Pneumonia	1 (2.4)	0 (0.0)	1.000‡

†Continuity corrected Chi-square test, ‡Fisher's exact test, DVT: deep vein trombosis, PTE: pulmonary tromboembolism, UTI: urinary tract infection

Table 7: Mortality rates according to the follow-up time of the cases according to the prosthesis and PFN groups.

Time	Prosthesis (n=41) (%)	PFN (n=36) (%)	P value
1 month	6 (14.6)	2 (5.6)	0.271†
6 months	9 (22.0)	4 (11.1)	0.336‡
12 months	12 (29.3)	4 (11.1)	0.093‡

†Fisher's exact test, ‡continuity corrected Chi-square test

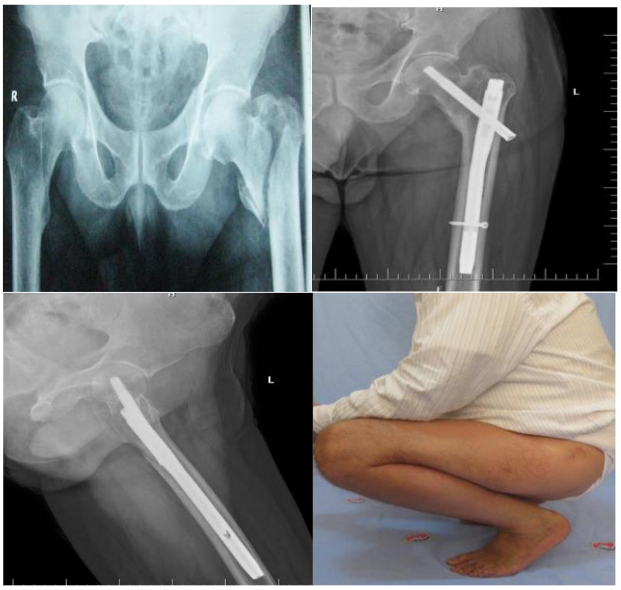

Figure 1: 68-year-old male patient with 31 A2-2 left interthoracanteric fracture after falling, radiographs and functional images in the first year follow up.

Figure 2: Postoperative radiographs and functional status of an 81-year-old male patient with AO 31-A2-2 fracture during the first year follow-up.

DISCUSSION

Despite technological advances, the treatment of hip fractures continues to be a controversial problem all over the world.[10-12] While there was an average of 1.7 million proximal femur fractures in the world during 1990, it is estimated that this number will reach 6.3 million in the year 2050. Independently of the surgery performed, mortality rate changes between 18% and 33% in the year after the trauma.[13] The most effective method of treatment for instable intertrochanteric femur fractures at the present time is fixation of the fracture and internal devices.[14,15] While it is expected that the implant to be used in order to perform this fixation is applicable via minimal invasive technique, enable full load after the operation and have low complication rates; a number of complications are observed in all of the implants that are used in the treatment of intertrochanteric fractures.[16,17] The implant that will provide all these conditions is appropriately not available today. Therefore, choice of the implant fort the treatment of the intertorachanteric hip fracture is still controversial. Nowadays, perthoracanteric nail, dynamic hip screw (DHS), plate screw osteosynthesis, hemiarthroplasty and total hip arthroplasty are among the methods used in the treatment of intertorchanteric femur fractures.[18]

Rodop et al in which they published results of a 54 patients that treated bipolar Leinbach hemiarthroplasty; it was stated that 80% of the patients received perfect and good results according to Harris hip score system and there was no compilication.[19] In another study by Huang et al, they treated total of 131 patients with interthoracanteric fracuters three different methods (PFNA, DHS, arthroplasty). They found out Harris scores at 12 weeks after operation in hemiarthroplasty was higher than that of DHS and PFNA, but there was no statistical difference between DHS and PFN They concluded that hemiarthorplasty is the best method for the who has a severe unstable osteoporotic multifragment fracture in

elderly patients.[20] In another study by Jolly et al, they evulated the Harris scores of a total of 100 patients treated with PFN (50 patients) and cemented hemiarthroplasty (50 patients). They found it higher in the arthroplasty group in the first 3 months, but higher in the PFN group in the 6th and 12th months. And mean mobility score was better in the pfn group at 6 months, but they did not detect any difference between the two groups at 12 months.[15] We used modified Harris hip score system (MHHS) in this study too.[21] When we evaluated the functional results of alive PFN and hemiarthroplasty patients with MHHS and made a comparison between the groups, we could not detect a significant difference at one year results. We evaluated independency of our patients regarding personal care duties according to modified Barthel index (MBI) in our study.[22] We have detected external dependence levels of PFN and prosthesis during postoperative term to be similar, however; a more accurate comparison can be done by evaluating the patients condition before the fracture in the assessment of independency in personal care duties.

Hemiartroplasty has a serious complications such as requiring a broad incision during the operation, amount of bleeding being high, hypotension and embolism developing due to the use of bone cement, dislocation of prosthesis after the operation, higher rates of deep and superficial infection.[23] On the other hand, superficial and deep infection, pulmonary complications and cut-out are important complications in patients who underwent PFN.[24] Complications of the patients who received prosthesis via PFN or other internal fixation methods have been compared in many studies. While some articles have found internal fixation methods to be better, some found functional results of hemiarthroplasty better. Generally, the mortality rates of the patients who done internal fixation were lower compared to the ones who treated by hemiarthroplasty.[25-27] In the prospective randomized study of Kim et al, reported that mortality rate of hemiarthroplasty group was 55% in the third year, it was 17% in the PFN group.[28] Mortality generally happens during the first six months following intertrochanteric fractures.[29] In our study in the PFN group, two patients lost their lives at the end of the first month and a total of four patients lost their lives at the end of the sixth month and no other patient lost their lives in the PFN group during our follow-up. In the prosthesis group, six patients lost their lives at the end of the 1st month and with the gradual increase in the number of patients who lost their lives during the follow-up; a total of 12 patients lost their lives. Although mortality rates of first month, sixth month and first year were higher in the prosthesis group, there was no significant difference between the groups. Even though it was not statistically significant, according to our study, cemented hemiarthroplasty application causes mortality in higher rates than PFN application in patients with intertrochanteric fractures. In our study when we compared PFN and prosthesis groups in terms of other complications; while the number and rates of patients with wound infection were higher in the prosthesis group, a significant difference could not be detected. We consider that the more invasive approach in the prosthesis patients make these patients more prone to wound complications. Although the difference between the groups is statistically not significant, were of the opinion that cemented hemiarthroplasty poses a risk in terms of vascular complications.

Limitations

Limitations of our study include: difficulty of standardization due to the number of patients in the groups being low compared to their studies in the literature, every patient's co-morbidities affecting each patient differently according to their biological condition, were other limitations of our study.

CONCLUSION

According to our knowledge hemiarthroplasty may be an alternative treatment method in these patients, but serious cardiac and vascular complications, high mortality rate, longer operation time, greater amount of bleeding and need for transfusion, and long-term loosening, prosthesis dislocation, acetabular protrusion and periprosthetic fracture may be encountered in these patients. Such serious complications limit theuse of hemiarthroplasty. According to our knowledge more objective results can be obtained by conducting prospective studies comparing PFN and uncemented hemiarthropasty.

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