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RESEARCH

COMPARISON OF CLINICAL RESULTS OF BIPOLAR HEMIARTHROPLASTY FOR EXTRACAPSULAR AND INTRACAPSULAR HIP FRACTURES

ABSTRACT

Introduction: In this study, patients aged 65 years and over who were undergoing cemented bipolar hemiarthroplasty following hip fracture were divided into two groups:those with intracapsular and extracapsular hip fractures. We retrospectively compared the early-stage functionality and radiological results, perioperative complications, surgical durations and the length of preoperative and postoperative hospitalisation.

Materials and Method: The study enrolled 127 consecutive patients (aged 65 years or older) who were admitted to the Ankara Ataturk Training and Research Hospital between January 2008 and October 2011 because of intracapsular (Group 1) or extracapsular (Group 2) hip fracture and were treated by cemented bipolar partial hip replacement and followed up for at least 6 months. Modified Harris Hip score and Barthel Index of Activities of Daily Living were used to evaluate the functionality results. The success of hemiarthroplasty was evaluated using Kwok criteria.

Results: Average Harris Hip scores, postoperative Barthel Indices of the Activities of Daily Life scores, surgery durations, blood transfusion requirement and results based on Kwok criteria for the two groups were statistically significantly different ($p<0.05$). No statistically significant differences were found between the durations of preoperative and postoperative hospitalisations and the number of complications in the two groups.

Conclusion: The results demonstrate that bipolar hip replacement had better functional outcomes for intracapsular hip fractures than for extracapsular hip fractures.

Key Words: Hip Fractures; Femoral Neck; Intertrochanteric; Hemiarthroplasty.

ARAŞTIRMA

BİPOLAR HEMİARTROPLASTİ UYGULANAN İNTRAKAPSÜLER VE EKSTRAKAPSÜLER KALÇA KIRIKLARININ KLİNİK SONUÇLARININ KARŞILAŞTIRILMASI

ÖZ

Giriş: Bu çalışmada kalça kırığı sonrası çimentolu bipolar hemiartroplasti uygulanan 65 yaş ve üstü olan hastaları intrakapsüler ve ekstrakapsüler kalça kırıkları olarak iki ayrı grupta ele alındı. Retrospektif olarak erken dönem fonksiyonel ve radyolojik sonuçlar, perioperatif komplikasyonlar, operasyon süreleri, preoperatif ve postoperatif yatış süreleri karşılaştırıldı.

Gereç ve Yöntem: 2008 Ocak-2011 Ekim tarihleri arasında, 65 yaş ve üzeri intrakapsüler (Grup 1) ve ekstrakapsüler (Grup 2) kalça kırığı ile Ankara Atatürk Eğitim ve Araştırma Hastanesi'ne başvuran ve çimentolu bipolar parsiyel kalça protezi ile tedavi edilen en az 6 ay takipli toplam 127 ardışık hasta değerlendirmeye alındı. Fonksiyonel sonuçlar ise Modifiye Harris Kalça skoru ve Barthel günlük yaşam indeksi ile değerlendirildi. Hemiartroplasti uygulama tekniğinin başarısı ise Kwok kriterleri ile değerlendirildi.

Bulgular: Ortalama Harris kalça skoru, postoperatif Barthel günlük yaşam aktivite indeksi, operasyon süreleri, kan transfüzyon ihtiyaçları, Kwok kriterine göre sonuçlarda iki grup arasında istatistiksel olarak anlamlı fark bulundu ($p<0.05$). Preoperatif ve postoperatif yatış süreleri ve komplikasyonlar açısından her iki grup arasında istatistiksel açıdan anlamlı fark bulunamadı.

Sonuç: Çalışmada elde ettiğimiz bulgular ışığında bipolar hemiartroplasti; intrakapsüler kalça kırıklarında ekstrakapsüler kalça kırıklarına göre daha iyi fonksiyonel sonuçlara sahiptir.

Anahtar Sözcükler: Kalça Kırığı; Femur boynu; İntertrokanterik; Hemiartroplasti

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Introduction

Hip fractures are a major public health problem in many countries. The number of hip fractures per year is estimated to reach 2.6 million by 2025 and 4.5 million by 2050 worldwide (1). Proximal femoral fractures (PFF) are radiologically classified into two groups intracapsular (femoral neck fractures) and extracapsular (intertrochanteric and subtrochanteric) (2). As the elderly population increases, the incidence of hip fractures increases (3). Old age and a decrease in bone density, oncological or neurological diseases, visual impairments, nutrition disorders and a decrease in physical activity result in PFF. Simple falls cause 90% of femoral neck fractures in the elderly population. In women, the hormonal changes secondary to menopause shift the balance between bone construction and destruction towards the latter process. Thus, PFF occurs in women three times more frequently than in men (4).

The aim of intracapsular and extracapsular hip fracture treatment is to recover the pre-fracture functions without causing any additional morbidity. The choice of treatment method depends on the age of the patient and the type of the fracture. Partial hemiarthroplasty is a common treatment method; it allows the early weight bearing, surgery does not last long and risk of repeated surgery is low (5,6).

However, the functional outcome after partial hemiarthroplasty for hip fractures may depend on various clinical factors, including sex, age at surgery, ambulatory status, comorbidities, type of fracture, duration of fracture, haemoglobin state and albumin level (7). Apart from these factors, very limited attention has been given to the relationship between the fracture location (intracapsular or extracapsular) and functional outcome of partial hemiarthroplasty in previous researches.

Therefore, this study evaluates the relationships between the location of intracapsular and extracapsular hip fractures and functional outcomes and radiological results of cemented bipolar hemiarthroplasty.

Materials and Method

This was a retrospective comparative study of functional outcomes and radiological results of partial hemiarthroplasty for intracapsular or extracapsular hip fractures. The effects of the following independent variables were studied: sex, age, side of fracture, anaesthesia type, additional diseases, pre- and postoperative hospital stays, surgical durations, transfusion requirements, complications, postoperative Barthel Index score and postoperative Harris Hip and Kwok scores. No dependent variables were selected as comparative criteria. We enrolled 194 consecutive patients aged ≥65 years who were admitted to the Ankara Ataturk Training and Research Hospital between January 2008 and October 2011 with a diagnosis of PFF and had undergone cemented bipolar partial hip replacement. Ethical approval was obtained from the Ankara Atatürk Education and Research Hospital Ethics Committee for Clinical Researchers (approval number: 2011/11/108). The patients were categorized with respect to the type of hip fracture, and the levels of functionality, radiological results, surgery duration, blood transfusion requirement and complications were analysed. We excluded 67 patients of whom 22, who were invited via phone calls, had a history of pre-fracture cerebrovascular events and Alzheimer's disease, and 45 patients died during the postoperative period. Among the remaining 127 cases (87 females and 40 males) included in the study, 57 had an intracapsular fracture (Group 1), whereas 70 had an extracapsular fracture (Group 2). The patients were administered low-molecular weight heparin as the thromboembolism prophylaxis in the preoperative period, and this therapy continued for 15 days after the operation. Cemented bipolar hemiarthroplasty using a posterolateral approach was performed in all patients in the lateral decubitus position. Omnifit straight femoral stems were used in all patients in Group 1 and in the patients with no disruption of the calcar femorale in Group 2. Head–neck straight femoral stems with calcar support were used in patients with disrupted calcar femorale in Group 2. In nine patients (7%), whose medical condition was accompanied by a dissected trochanter major fracture, the abductor mechanism was repaired using tension bands or trochanteric grip plates. The external rotators were sutured to the trochanter major in all patients.

On postoperative day 1, after the drains and urinary catheters were removed, all patients in both the groups were mobilized using walkers with a full load, and they were assigned to the same exercise program.

The patients were followed up for at least 6 months. Garden and Orthopaedic Trauma Association (OTA) classifications were applied for types of neck and intertrochanteric fractures, respectively (4). The postoperative Barthel Index, which is a 0–20 scoring system, was used to assess the activities of daily living for the patient's current level of ability for bowel movements, bladder emptying, grooming, toilet use, transfer, mobility, dressing, stairs and bathing. The Harris Hip score, which is a 0–100 scale, was used to assess the pa-

rameters of pain, limp, support, distance walked, sitting, entering public transportation, ability to climb stairs, ability to put on shoes and socks, range of motion and absence of deformity (8,9). In addition, perioperative complications and blood transfusion requirements were considered in the study. Finally, the prosthesis fixation quality was assessed on the basis of Kwok criteria, which comprises femoral head-, neck- and stem-shaft angles and calcar replacements in X-ray graphs, as excellent, good, fair and poor (10).

Statistical analyses were performed using SPSS version 17.0 software. In comparison, the Kolmogorov–Smirnov test was performed to determine the distribution of all variable groups. Parametric and non-parametric tests were applied to the variables. In the parametric tests, Student's t-test (independent sample t-test) was used to analyse the variables with normal distribution, whereas in the non-parametric tests, the Mann–Whitney U test was used in the analyses of the variables with skewed distributions. Cross-tabulation statistics (Chi-square and Fisher) were used for comparison of categorical variables. A value of $p<0.05$ was considered to indicate statistical significance. In the correlation analyses, Spearman's correlation analysis was used.

Results

According to the Garden classification, in Group 1, five patients (8.6%) had Type I fracture; 11 (19%), Type II fracture; 25 (43.1%), Type III fracture and 16 (29.3%), Type IV fracture (Table 1). According to OTA classification, in Group 2, 13 patients (18.3%) had Type A1 fracture; 48 (69%), Type A2 fracture and nine (12.7%), Type A3 fracture (Table 2). Mean follow-up period was 13.5±2.4 months in Group 1 and 14.5±1.7 months in Group 2. There was no statistically significant difference between the sociodemographic features of patients in the two groups ($p>0.05$). In Group 1, 70% patients were female and in Group 2, 67%. Mean age was 77.30±5.58 years in Group 1 and 78.56±6.42 years in Group 2. Approximately 58% patients in both the groups had a fracture on their right side. In Group 2, the surgery lasted significantly longer than in Group 1. Mean surgery duration was 66.68±9.70 min in Group 1 and 88.28±14.77 min in Group 2. It was longer in Group 2 because in Type A2 and A3 fractures, we had to repair the abductor mechanism using the tension band or trochanteric grip and make a larger incision for exploration. Postoperative Harris Hip Score was 85.79±8.18 in Group 1 and 76.14±10.48 in Group 2. Therefore, Harris Hip Score was significantly lower in Group 2 than in Group 1 ($p<0.001$). Postoperative Barthel Index Score was significantly higher in Group 1 (17.04±1.68) than in Group 2 (15.93±2.3) (Table 3).We performed radiological evaluation for both the groups using Kwok criteria. On the basis of Kwok criteria, we demonstrated that the result in Group 2 were significantly poorer than that in Group 1 ($p=0.039$). The results were poor-to-fair for only two patients in Group 1 and for 10 patients in Group 2.

In Group 1, 15 (26.3%) patients developed complications and in Group 2, the number of complications was 23 (32.9%). However, the difference was not statistically significant ($p=0.423$). The most common complication in both the groups was deep vein thrombosis.

There was no statistically significant difference between the lengths of preoperative and postoperative hospitalisation in the two groups ($p>0.05$).

While mean blood transfusion requirement was 1.49 (range 0–5) units in Group 1, it was 2.39 (range 0–5) units in Group 2. Thus, the amount of blood transfused inpatients in Group 2 was significantly higher than in Group 1 ($p<0.001$).

Table 1— Distribution of the Intracapsular Fracture Types (Garden classification)

Garden Type	Number of cases (n)	Percentage (%)
1	5	8.6
2	11	19.0
3	25	43.1
4	16	29.3
Total	**57**	**100.0**

Table 2— Distribution of Extracapsular Fracture Types (Orthopaedic Trauma Association Classification)

OTA Type	Number of Cases (n)	Percentage (%)
A1	13	18.3
A2	48	69.0
A3	9	12.7
Total	**70**	**100.0**

Discussion

As the average life expectancy increases worldwide, there is an increase in the incidence of hip fractures in the elderly population. The treatment methods depend on the age of pa-

Table 3— The General Data and Results for the Two Groups.

	Group 1	Group 2	p	t/z
Gender: Male/Female	17/40 (29.8/70.2)%	23/47 (32.4/67.6)%	0.714*	
Age (Years)	77.30±5.58	78.56±6.42	0.247‡	0,027
Side: Right/Left	34/24 (57.9/42.1)%	41/29 (58.6/41.4)%	0.939*	
Anaesthesia Type: General/Spinal	17/40	19/50	0.637*	
Additional Diseases: No/Yes	9/48	12/58	0.838*	
Preoperative Hospital Stay (Day)	3 (0–7)	3 (1–6)	0.348†	0.9398
Postoperative Hospital Stay (Day)	3.5 (2–17)	4 (2–10)	0.674†	0.4207
Surgery Duration (Min)	66.68 (±9.7)	88.28 (±14.77)	<0.001‡	11,935
Transfusion Requirement (Unit)	1.49 (0–5)	2.39 (0–5)	<0.01†	12281
Complication: Yes/No	15/42	23/47	0.423*	
Postoperative Barthel Index Score (0 to 20)	17.04 (±1.68)	15.93 (±2.33)	0.004‡	3,135
Postoperative Harris Hip Score (0 to 100)	85.79 (±8.28)	76.24 (±10.48)	<0.001‡	4,615
Kwok Score (Poor-To-Fair/Good-To-Excellent)	2/55	10/60	0.039§	

*Chi-Square Test: Gender, Side, Anaesthesia Type, Additional Diseases ,Complication. †Mann–Whitney U Test: Pre-, Post-operative Hospital Stays, Transfusion Requirement. ‡Student's t-test: Age, Surgery Duration, Postoperative Barthel Index Score, Postoperative Harris Hip Score. §Fisher Exact Test: Kwok Score. Group1: intracapsular hip fractures, Group 2: extracapsular hip fractures.

tients and the type of fracture. In any method, the aim is to minimize both short- and long-term mortality and recover the pre-fracture functions as soon as possible. There is no consensus on the choice of surgical treatment methods for intracapsular and extracapsular hip fracture cases. The choice of surgical procedure varies depending on the type of fracture, preferences of the orthopaedist, severity of the injury, age of the patient and accompanying disorders, such as osteoporosis or joint osteoarthritis (11).

In practice, open reduction and internal fixation are usually preferred for non-displaced fractures, whereas hemiarthroplasty or total hip replacement is preferred for displaced fractures (12). As it allows early mobilization, arthroplasty has some advantages, such as reduction of the risk of pressure ulcers, heart and lung problems and thromboembolic events and an improvement in the quality of life.

Because of the characteristics of blood flow to the affected area in intracapsular fractures, the bones frequently do not knit back together and avascular necrosis occurs. The incidence of intracapsular hip fractures in elderly patients is increasing. There is no consensus on the use of internal fixation or partial replacement as the treatment procedure (13).

Unlike in femoral neck fractures, in extracapsular fractures, the blood flow is not disrupted, and the healing potential is higher. Stabile intertrochanteric fractures are successfully treated using dynamic hip screws and proximal femoral nails (14,15). With the development of locked intramedullary systems (16), the internal fixation has recently become more commonly used in unstable fractures. However, some complications, such as high level of reduction loss, lack of knitting, external rotation and shortening, were reported following internal fixation with dynamic hip screws and first generation proximal femoral nails, particularly in unstable intertrochanteric fractures (17,18). Moreover, there is a view supporting hemiarthroplasty because it is associated with less postoperative pain and lower complication ratios than internal fixation in the treatment of intertrochanteric fractures (19,20). There are also studies reporting improved early mobilization and functionality following hemiarthroplasty (4,17,21,22). In this study, better positive effects on both early mobilization and functionality were observed for cemented bipolar hemiarthroplasty than for internal fixation in the treatment of intertrochanteric fractures.

The female-to-male ratio and mean age of patients were similar to those in the previously published studies (4,23,24). Moreover, there were no statistically significant differences among the ages, genders, sides, additional diseases and length of postoperative hospitalisation in the two groups. There was no statistically significant difference between the numbers of complications in the groups, and the most common complication in both the groups was deep vein thrombosis. Moreover, deep vein thrombosis has been reported as the most common complication in the study of Kılıçarslan et al. (4).

Surgery duration and perioperative transfusion requirements were significantly higher in the extracapsular fracture group. We believe that this difference arose because extracap-

sular fractures are more complex and require larger dissection for the repair of abductor mechanism.

The hemiarthroplasty replacement performance was evaluated using Kwok criteria. Poor-to-fair results were significantly more frequent in the treatment of intertrochanteric fractures. This was probably because of the impairment of posteromedial support in unstable intertrochanteric fractures negatively affecting the position and stability of the femoral stem. Moshein et al. revealed no correlation between the quality of prosthesis fixation and postoperative functionality results (25). However, in our study, functionality scores in the extracapsular fracture group having a higher proportion of poor-to-fair results based on Kwok criteria were worse compared with those in the intracapsular fracture group.

Barthel Index of the Activities of Daily Living and Harris Hip Score were used for the evaluation of functionality results. In the intracapsular fracture group, postoperative Barthel Index was significantly lower than in the femoral neck fracture group. Average Harris Hip Scores six months after bipolar arthroplasty were fair-to-good in both the groups and in accordance with the previously published results (4,17,23,26). However, the average Harris Hip Scores (6 months after bipolar arthroplasty) were significantly higher in the intracapsular fracture group than in the extracapsular fracture group. We believe that this difference between the functionality results in the two groups was because of the abductor mechanism injury accompanying extracapsular fracture. Additionally, we believe that the higher number of poor radiological results in extracapsular fracture group plays a role in this as well.

Moreover, we detected a correlation between postoperative Harris Hip Score and Barthel Index, independent of the fracture type (r=0,887 and p<0,001). Among patients after partial hemiarthroplasty, individuals with higher postoperative hip scores had higher postoperative activity indices.

Therefore, the bipolar hip replacement is a preferable surgical method for the treatment of intracapsular fractures. Bipolar hip replacement is also effective in extracapsular fractures because it provides a stable, painless and satisfactory joint mobility. However, as the functionality and radiological results were inferior in the extracapsular fracture group, more extensive and randomized prospective studies comparing intramedullary surgical treatment and hemiarthroplasty, particularly in unstable osteoporotic extracapsular fractures, are required.

Conflict of Interest

The authors declare no conflict of interest.

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