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Cemented versus cementless hemiarthroplasty for intertrochanteric femur fractures in the elderly

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Abstract

To compare the outcomes of the treatment of unstable intertrochanteric fractures in elderly patients who underwent cemented and cementless bipolar hemiarthroplasty. 65 patients who had AO type 31-A1 and 31-A2 fractures were divided into two groups; group 1 included 30 patients who underwent cemented hemiarthroplasty, and group 2 included 35 patients who underwent cementless hemiarthroplasty. Demographic findings, intraoperative blood loss, operation duration, hospital stay duration, blood transfusion amount, intraoperative and postoperative complications, preoperative and postoperative serum hemoglobin values, and new mobilization scores (NMS), Harris Hip Score (HHS), Likert pain scales were all assessed. Mean age of 39 (40%) female and 26 (60%) male patients was 80.86 years. The mean operation duration was 69.66 (SD 7.53) minutes for group 1 and 60.00 (SD 8.04) for group 2 and statistically different ($p<0.001$). HHS and Likert scores following both techniques were statistically similar between both groups ($p=0.195$, $p=0.380$, respectively). Blood loss, blood transfusion amounts, radiologic and clinical complication rates, hospital stay durations were all similar between both groups. The results show that cemented and cementless hemiarthroplasty are both viable treatments for intertrochanteric femur fractures, yielding similar clinical outcomes and complication rates. In need of revision, cemented prosthesis revisions may be more complicated, and complications may be more frequently seen.

Keywords: Cement, hemiarthroplasty, intertrochanteric femur fracture

Introduction

The incidence of hip fractures is expected to increase worldwide from 1.66 million per year in 1990 to 6.26 million per year in 2050 as the mean age of the population increase [1]. These fractures are reported as a common source of morbidity and mortality among these elderly populations worldwide and constitute a major public health problem [2].

Intertrochanteric fractures account for 45% to 50% of all hip fractures in elderly patients and reported as one of the most common types of this region [3, 4]. Of these fractures, 35% to 60% are reported as unstable [4]. Osteoporosis is one of the most important handicaps which prevents secure fixation after surgical treatment of these type of hip fractures. Nevertheless, decreased mobility following surgery usually causes complications such as pulmonary complications and bedsores [5].

Failure rates of unstable intertrochanteric fracture treatment have been decreasing with new types of osteosynthesis implants such as proximal nails and surgical techniques [6, 7]. Because of impaired bone quality, although still there is no consensus, arthroplasty may be considered as a treatment modality for these unstable intertrochanteric fractures [5, 8].

Many studies comparing cemented and cementless hemiarthroplasty for femoral neck fractures in elderly patients report that inferior short-term clinical results due to increased pain and decreased early mobilization, and fixation problems were reported with uncemented hemiarthroplasty [9, 10]. Earlier and better implant stabilization and fewer intraoperative periprosthetic fractures were reported with cemented hemiarthroplasty [11]. In patients with comorbidities, cement implantation syndrome is a challenging problem and cementation may lead to fat embolization [12, 13].

Accordingly, this study aimed to compare the outcomes of the treatment of unstable intertrochanteric fractures in elderly patients

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who underwent cemented and cementless bipolar hemiarthroplasty. This study hypothesizes that cemented and cementless options have similar short-term results for the treatment of intertrochanteric femur fractures.

Material and Methods

After obtaining Kırşehir Ahi Evran University Faculty of Medicine institutional ethics committee approval (Approval date, number: 20/10/2020, 2020-15/112) the medical records of 186 patients who underwent hemiarthroplasty between March 2017 and February 2020 with hip fractures were retrospectively evaluated. Of these, 101 patients were excluded because they had either an intracapsular femur fracture, inadequate medical data, or died during follow-up. Also, 20 patients with pathological fractures and reverse oblique fractures were excluded. Finally, 65 patients who had AO type 31-A1 and 31-A2 fractures were divided into two groups; 30 patients in group I underwent cemented hemiarthroplasty [Figure 1], and in group II 35 patients underwent cementless hemiarthroplasty [Figure 2]. This study has been performed by the 1964 Declaration of Helsinki and its later updates.

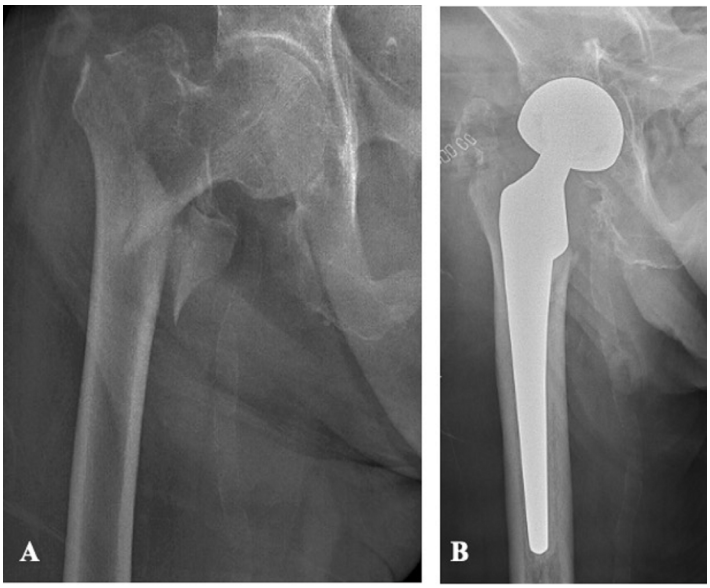

Figure 1. X-ray images of a patient in group 1. A-preoperative, B-postoperative

As the routine practice of our clinic, hemiarthroplasty is performed on patients with proximal femur fractures who are older than 75 years old, have low postoperative activity demand and/or presence of multiple comorbidities. For patients with high-grade acetabular osteoarthritis, total hip arthroplasty is performed. For patients with intertrochanteric femur fracture especially for stable fractures, the first option is internal fixation, however for patients who have severe osteoporosis, there can be a problem of stable implant fixation and early immobilization after the operation, so hemiarthroplasty is chosen for these patients.

Over 70 years of age, patients who underwent hemiarthroplasty for intertrochanteric femur fracture with either cemented or cementless and a minimum 12 months follow-up were the inclusion criteria of this study.

Exclusion criteria were patients with pathologic fractures, presence of previous ipsilateral and/or contralateral hip surgery, follow-up period less than 12 months, and presence of ipsilateral neurological deficits.

The decision of cemented or cementless hemiarthroplasty was performed due to the surgeon's preference. Cemented hemiarthroplasty is performed on patients with severe osteoporosis and need of strong fixation.

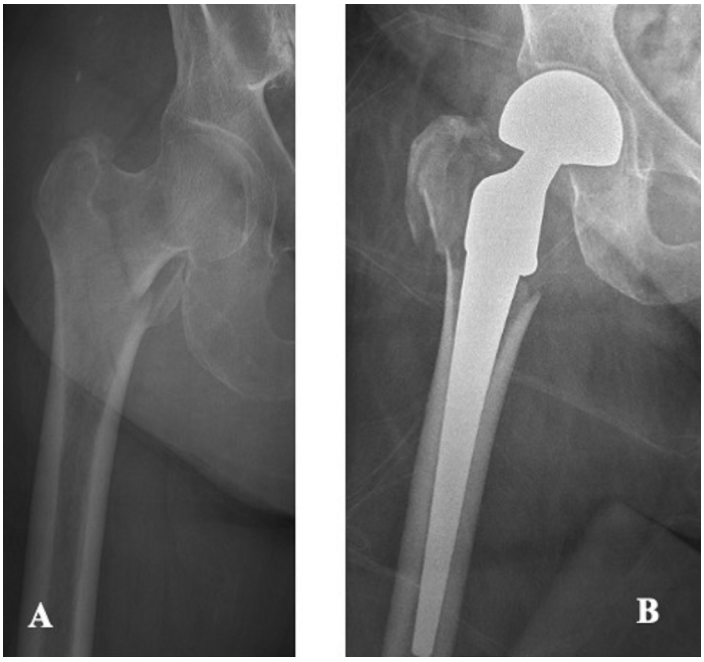

Figure 2. X-ray images of a patient in group 2. A-preoperative, B-postoperative

Before the surgical intervention, the American Society of Anesthesiologists (ASA) criteria were used to evaluate the comorbidity scores of the patients. One surgeon performed all operations with the same surgical technique except cementing at lateral decubitus position. Cemented calcar replacement femoral stems (Biomet Inc. Warsaw, IN, USA) were used in group I and cementless femoral stems of the same company (Biomet Inc. Warsaw, IN, USA) were used in group II.

All patients were courageous to walk to full weight bearing on the first postoperative day. Patients were instructed to avoid flexion beyond 90°, adduction, and internal rotation of the affected hip following the operation.

Age, gender, body mass index, fracture classification according to AO classification, comorbidities, intraoperative blood loss, operation duration, hospital stay duration, blood transfusion amount, intraoperative and postoperative complications, preoperative and postoperative mobilization scores according to new mobility score (NMS) [14], preoperative and postoperative serum hemoglobin difference and follow-up time were all assessed. The blood collected in the suction system intraoperatively was measured for the intraoperative blood loss.

NMS measures the ability of a patient to perform indoor walking, outdoor walking, and shopping before fracturing the hip. A score between zero and three is provided for each function (item) (zero = not at all, one = with help from another person, two = with an aid, three = no difficulty, no aid). The total score ranges from zero to nine and a score of zero indicates that the patient has no walking ability at all and a score of nine indicates full independence.

At last follow-up, for the functional evaluation of patients, Harris Hip Score (HHS) [15] was used. Nevertheless, pain severity was measured with a 4-point Likert scale (0=none, 1=mild, 2=moderate, or 3=severe) [16].

Statistical analysis: The mean and standard deviation were used in the presentation of descriptive statistics. The Shapiro-Wilk test was used for the evaluation of the distribution of variables. The Chi-Square test and Student test were used in the comparison between groups. A p-value < 0.05 was considered statistically significant. All statistical analysis was performed using IBM SPSS for Windows, version 24 (SPSS Inc, Chicago IL, USA).

Results

Table 1 presents the general patient demographics and disease-specific characteristics of the 65 patients included in this study. The mean follow-up period in Group 1 and 2 were 36.67 months (SD 21.59) and 31.22 months (SD 24.45), respectively (p=601). There was no significant difference between the groups in ASA scores and AO fracture types, respectively (p=0.288, p=0.327).

Table 1 Demographic and clinical data of the patients

Variable	Entire Study Population	Group 1	Group 2	p
Patient number, n (%)	65 (100)	30 (46.2)	35 (53.8)	0.434
Patient number, n (%)	65 (100)	30 (46.2)	35 (53.8)	0.434
Age, year, SD	80.86±7.43	80.30±8.06	81.34±6.94	0.577
Gender, n (%)				
Female	39 (40.0)	18 (60)	21 (60)	0.601
Male	26 (60.0)	12 (40)	14 (40)	
BMI, kg/m2, SD	26.71±4.40	27.02±3.97	26.45±4.78	0.606
ASA (1-2/3-4), n (%)				
1-2	29 (44.6)	15 (50)	14 (40)	0.288
3-4	36 (55.4)	15 (50)	21 (60)	
Comorbidities, n (%)				
Dementia	31 (48.2)	20 (64.5)	11 (35.5)	
Ulcer disease	23 (35.1)	12 (52.1)	11 (47.9)	
Congestive heart failure	14 (21.4)	9 (64.2)	5 (35.8)	
Pulmonary disease	14 (21.4)	8 (57.1)	6 (42.9)	
Diabetes mellitus	13 (20)	5 (38.4)	8 (61.6)	
Cerebrovascular disease	9 (13.8)	4 (44.4)	5 (55.6)	
Myocardial infarction	8 (12,3)	5 (62.5)	3 (37.5)	
Renal disease	7 (10,7)	4 (57.1)	3 (42.9)	
Liver disease	3 (4,6)	2 (66.6)	1 (33.4)	
AO fracture classification, n (%)				
A2-1	30 (46.2)	11 (36.7)	19 (54.3)	
A2-2	19 (29.2)	11 (36.7)	8 (22.9)	0.327
A2-3	16 (24.6)	8 (26.7)	8 (22.9)	
Surgery duration, minutes, SD	64.46±9.16	69.66±7.53	60.00±8.04	<0.001
Postoperative hospital stay, days, SD	7.84±4.96	6.60±4.37	8.94±5.24	0.057
Intraoperative blood loss, cc, SD	446.92±114.18	450.00±118.90	444.28±111.65	0.842
Follow-up time, months, SD	1.4±1.07	1.46±1.10	1.45±1.06	0.972
Postoperative blood transfusion, unit, SD	33.09±22.63	36.67±21.59	31.22±24.45	0.601

Abbreviations: SD standart deviation, BMI body mass index, ASA American Society of Anesthesiologists score, AO Arbeitsgemeinschaft für Osteosynthesefragen, p<0.05 was defined as significant and defined bold

The mean operation duration was 69.66 (SD 7.53) minutes for group 1 and 60.00 (SD 8.04) for group 2 and statistically different (p<0.001). Mean postoperative hospital stay time, the mean amount of intraoperative blood loss, and mean postoperative blood transfusion amounts were not founded as statistically different between groups (p=0.057, p=0.842, p=0.972) (Table 1).

Intraoperative complications were assessed and one patient (3.3%) had a trochanter major fracture in group 1. In group 2, one (2.9%) patient had a periprosthetic fracture, and one (2.9%) patient had a trochanter major fracture. Intraoperative complication rates were not statistically different between groups (p=0.644). One patient (3.3%) in group 1 and 2 patients (5.7%) in group 2 had a superficial infection and treated with intravenous antibiotics. Radiologic assessments during follow up were done and complications were reported in Table 2. After operation 2 patients (6.7%) in group 1 and 6 patients (17.1%) in group 2 were followed at the intensive care unit. No significant difference between groups was detected in terms of intensive care need (p=0.185).

Harris hip score, Likert pain score, preoperative and postoperative mobilization scores, preoperative and postoperative serum hemoglobin differences were reported in Table 3.

Table 2 Complications stratified between groups

n, (%)	Entire Study Population	Group 1	Group 2	P value
Loosening	9 (13.8)	3 (10)	6 (17.1)	0.131
Trochanter major fracture	2 (3.1%)	1 (3.3%)	1 (2.9%)	0.756
Protrusion	1 (1.5%)	0 (0%)	1 (2.9%)	0.621
Dislocation	1 (1.5%)	0 (0%)	1 (2.9%)	0.665

Abbreviations: n number, p<0.05 was defined as significant and defined bold

Table 3 Clinical score, mobilization time and hemoglobin difference outcomes

	Entire Study Population	Group 1	Group 2	P value
Harris Hip Score, SD	76.52±12.55	78.72±12.05	74.53±12.84	0.195
Likert Pain Score, SD	1.81±0.64	1.89±0.61	1.75±0.67	0.380
NMS, SD				
Preoperative	7.89±1.34	6.99±2.04	8.01±1.69	0.876
Postoperative	6.71±1.34	6.12±1.71	7.18±1.91	0.318
Hgb difference, mg/dL, SD	1.30±1.03	1.25±0.88	1.35±1.16	0.713

Abbreviations: SD standart deviation, hgb hemoglobin, NMS new mobility score, p<0.05 was defined as significant and defined bold

Discussion

Clinical scores and complication rates were not significantly different in patients undergoing cemented or cementless hemiarthroplasty for intertrochanteric femur fractures. Only one parameter between both techniques was statistically different; surgery duration was higher in a cemented group compared with the cementless group.

Hip fractures are seen more frequently in elderly individuals worldwide [7, 17]. These fractures are expected to become a public health problem in the future [18, 19]. Intertrochanteric fractures constitute 40% to 50% of hip region fractures and more than half of intertrochanteric fractures are known to be unstable [6, 20]. Unstable patterns of these fractures are comminution of the posteromedial side of the intertrochanteric area, an extra lesser trochanteric fragment, or a subtrochanteric fracture extension [6]. Because of the unstable fracture pattern, stable fracture fixation may be difficult and early ambulation is very important to decrease morbidity and mortality and for early ambulation, stable fracture fixation is mandatory. For these reasons' best treatment approach for intertrochanteric fractures is still debatable [5]. Internal fixation is the generally accepted treatment option for intertrochanteric hip fractures [21]. Some studies reported high failure rates with internal fixation such as screw cut out, malunion, coxa vara, delayed union, or nonunion in intertrochanteric fractures [22, 23]. In light of these findings, hip arthroplasty may shorten the mobilization time, reduce the complications of implants and increase functional outcomes instead of internal fixation [24, 25]. The choice of hip arthroplasty with cemented or cementless methods for the treatment of unstable intertrochanteric fractures is still not clear. Cemented arthroplasty in elderly patients has been reported to be technically complicated and maybe cause cardiopulmonary complications [26]. However, fixation of arthroplasty was thought to be better for osteoporotic bone in elderly patients. Many studies reported no significant difference between cemented and cementless partial hip arthroplasty in terms of morbidity, mortality, or length of hospital stay for femoral neck fractures in the long-term, however functional outcomes after cementless arthroplasty was worse than those with a cemented technique [11, 27, 28]. Yoo JI et al. reported the results of a systematic review and meta-analysis that both cemented and cementless hemiarthroplasty for unstable intertrochanteric fracture showed similar rates of mortality and complications in elderly individuals [5]. Our results showed that functional and clinical results were statistically similar between the two groups, only surgery duration was longer in the cemented group. There were only a few reports about the healing of the fracture.

The effect of stem implantation with cement on mortality, caused by increasing the intramedullary pressure which may lead to fat embolization [13, 29]. Elmaraghy et al. [30] reported that cementation does not affect the creation of fat emboli, nevertheless, Christie et al showed that cemented arthroplasty was associated with greater and more prolonged embolic processes than uncemented arthroplasty [12]. Karakaplan et al. [31] reported sciatic nerve entrapment after heterotopic ossification of hip fracture treatment. Our findings showed no significant difference between groups in terms of radiologic and clinical complications, bleeding amounts, transfusion rates.

There are some limitations of this study, firstly patients were not randomized and chosen cemented or cementless application of prosthesis after consulting the senior author, which may cause selection bias. Follow-up time is relatively short and longer follow-up may give more reliable results. The sample size may be larger for more reliable results too.

Conclusion

The results show that cemented and cementless hemiarthroplasty are both viable treatments for intertrochanteric femur fractures, yielding similar clinical outcomes and complication rates.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
Kırşehir Ahi Evran University Faculty of Medicine Ethics Committee (date: 20/10/2020, and number: 2020-15/112).

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