

## Choice of Approach in Hemiarthroplasty For Intertrochanteric Femur Fractures: Anterolateral or Posterolateral?

### İntertrokanterik Femur Kırıkları Tedavisinde Hemiartroplastide Yaklaşım Seçimi: Anterolateral ya da Posterolateral?

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#### ÖZ

**Amaç:** Kalça kırıklarında hemiarthroplasti uygulanırken hem anterolateral hem de posterolateral sık tercih edilen yaklaşımlardandır. Bu yaklaşımların birbirlerine üstünlükleri tam olarak anlaşılabilmiş değildir. Bu çalışmada intertrokanterik femur kırığı olan hastalara hemiarthroplasti uygulamasında anterolateral ve posterolateral yaklaşımları karşılaştırmayı amaçladık.

**Araçlar ve Yöntem:** AO tip 31-A1, A2 ve A3 proksimal femur kırığı olan 79 hasta iki gruba ayrıldı. Grup 1'deki 38 hastaya anterolateral yaklaşım ile, grup 2'deki 41 hastaya posterolateral yaklaşım ile hemiarthroplasti uygulandı. Demografik bulgular, ameliyat sırasındaki kan kaybı miktarı, ameliyat süresi, hastanede yatış süresi, ameliyat sonrası kan replasman miktarı, ameliyat sırası ve sonrası komplikasyonlar, ameliyat sonrası mobilizasyon süresi, ameliyat öncesi ve sonrası serum hemogloblin değerleri, Harris kalça skoru (HKS) ve Likert ağrı skoru değerlendirildi.

**Bulgular:** Yaş, cinsiyet, vücut kitle indeksi ve kırık tiplerinde grupları arası anlamlı fark saptanmadı ( $p=0.356$ ,  $p=0.981$ ,  $p=0.343$ ,  $p=0.631$ ). Ortalama ameliyat sırasında kan kaybı 1. grupta 413.15 ml iken 2. grupta 475.60 ml idi ( $p=0.012$ ). Benzer şekilde ameliyat sonrası ortalama kan transfüzyon miktarı 1. grupta 0.94 ünite iken, 2. grupta 1.95 üniteydi ( $p<0.001$ ). HKS ve likert ağrı skorları son kontrolde her iki grupta benzerdi ( $p=0.567$ ,  $p=0.388$ ).

**Sonuç:** İntertrokanterik kalça kırıklarında anterolateral ve posterolateral yaklaşım benzer ve kabul edilebilir klinik skorlara sahip yaklaşımlardır. Daha az ameliyat sırası kan kaybı ve ameliyat sonrası transfüzyon miktarı açısından anterolateral yaklaşım daha avantajlı görünmektedir.

**Anahtar Kelimeler:** anterolateral; artroplasti; cerrahi yaklaşım; kalça eklemi; posterolateral

#### ABSTRACT

**Purpose:** Both anterolateral and posterolateral approaches are commonly chosen for hemiarthroplasty in hip fractures. The superiority of these approaches to each other is not well understood. In this study, we aimed to compare the outcomes of posterolateral and anterolateral approaches in hip hemiarthroplasty for intertrochanteric hip fractures.

**Materials and Methods:** 79 patients who had AO type 31-A1, 31-A2 and 31-A3 fractures were divided into two groups: 38 patients in group I underwent anterolateral approach, and 41 patients in group II underwent posterolateral approach. Demographic findings, intraoperative blood loss, operation duration, hospital stay duration, blood transfusion amount, intraoperative and postoperative complications, postoperative mobilization time, preoperative and postoperative serum hemoglobin values, Harris Hip Score, and Likert pain scales were all assessed.

**Results:** There was no significant difference between the groups in terms of age, gender, BMI and AO fracture types, respectively ( $p=0.356$ ,  $p=0.981$ ,  $p=0.343$ ,  $p=0.631$ ). The mean intraoperative blood loss amount in Group I and II were 413.15 ml ( $SD\pm 96.34$ ) and 475.60 ml ( $SD\pm 117.32$ ), respectively ( $p=0.012$ ). Compatible with this result, the mean postoperative blood transfusion unit in Group I and II were 0.94 units ( $SD\pm 0.86$ ) and 1.95 unit ( $SD\pm 1.02$ ), respectively ( $p<0.001$ ). HHS and Likert scores following both techniques were statistically similar between both groups ( $p=0.567$ ,  $p=0.388$ , respectively).

**Conclusion:** Our results show that hemiarthroplasty with both anterolateral and posterolateral approaches are viable treatments for intertrochanteric femur fractures, yielding similar clinical outcomes and complication rates. Less intraoperative blood loss and postoperative transfusion rates make the anterolateral approach more favorable compared to the posterolateral approach.

**Keywords:** anterolateral; arthroplasty; hip joint; posterolateral; surgical approach

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## INTRODUCTION

Many various surgical approaches for hip arthroplasty, such as hemiarthroplasty, have been described in the literature.<sup>1,2</sup> Direct anterior, anterolateral, direct lateral and posterolateral approaches were identified. There is often confusion in naming these approaches. The two most commonly used approaches are the anterolateral (modified Watson-Jones) and the posterolateral (Moore, Gibson, or posterior).<sup>3,4</sup> Ganz and Weber reported that the anterolateral approach was first described by von Sprengel and Bardenheuer.<sup>5</sup> Bauer et al., Watson-Jones, Harris, Muller and Chamley all modified this approach.<sup>1,4,6-8</sup> Intermuscular planes between the tensor fascia lata and gluteus medius are used by this approach. Superior gluteal nerve innervates these muscles. Relaxing of the abductor mechanism and adequate acetabular exposure can be achieved by either a trochanteric osteotomy or a partial detachment of the gluteus medius and minimus off the greater trochanter.<sup>8</sup> The posterior approach was first described by Von Langenbeck and then Kocher according to Mehlman et al.<sup>9</sup> Gluteus maximus is passed split at posterior to the gluteus medius and minimus without cutting them.<sup>10</sup> After that, detaching the short external rotators (piriformis, superior and inferior genelli, and obturator internus) from trochanter major and dividing the posterior hip capsule is performed. The direct anterior approach uses interval between tensor fascia lata and sartorius, and a decreased dislocation rate is obtained when compared to the posterior approach. Direct lateral approach splits gluteus medius and vastus lateralis, and violation of abductor mechanism is a disadvantage. However, this approach allows access to both anterior and posterior hip joints without osteotomy.

Which surgical approach is superior for hemiarthroplasty after hip fracture is still subject to debate. Both approaches have merits and limitations. A previous study reported that there were no differences in Oxford hip score and dislocation or revision rates between the two approaches.<sup>2</sup> Yue et al. reported faster recovery with anterior approach compared to posterolateral approach.<sup>11</sup> There are limited studies comparing posterolateral and anterolateral approaches in hip hemiarthroplasty for intertrochanteric hip fractures. In this study, we aimed to compare the

outcomes of posterolateral and anterolateral approaches in hip hemiarthroplasty for intertrochanteric hip fractures.

## MATERIALS and METHODS

After Kırşehir Ahi Evran University ethics committee approval (Approval date, number: 18/05/2021, 2021-09/106), the medical records of 175 patients who underwent hemiarthroplasty between June 2018 and January 2020 with hip fractures were evaluated retrospectively. Of these, 76 patients were excluded because they either had an intracapsular femur fracture or subtrochanteric fracture. Also, 20 patients with pathological fractures, previous contralateral hip fractures, and reverse oblique fractures were excluded from the study. Finally, 79 patients who had AO type 31-A1 and 31-A2 fractures were included in the study. Patients were divided into two groups: 38 patients in group I underwent hemiarthroplasty with anterolateral approach, and in group II, 41 patients underwent hemiarthroplasty with posterolateral approach. The 1964 Declaration of Helsinki and its later updates were followed while performing this study.

Inclusion criteria of this study were patients who were older than 18 years old, had a proximal femur fracture of AO type 31-A1 and A2, underwent primary hemiarthroplasty, and had a minimum 12 months follow-up.

Excluded patients were patients with pathologic fractures, presence of previous ipsilateral and/or contralateral hip surgery, patients under 18 years old, follow-up period less than 12 months, who underwent revision arthroplasty, patients with multiple fractures and presence of ipsilateral neurological deficit.

All operations were performed by one experienced surgeon with the same surgical technique except the choice of surgical approach under general or regional anaesthesia. In Group 1, anterolateral hip approach was applied. At the center of the trochanter major, an approximately 14-15 cm incision was made. After passing fascia lata, the adhesion point of the gluteus medius to the anterior trochanter major was partially separated. After exposure of the capsule, the hip joint was reached with a T-shaped opening. The

femoral head was dislocated to the anterior side. In group 2, posterolateral hip approach was applied. With this approach, a curved incision was made behind the trochanter through the skin and fascia. The gluteus maximus was bluntly dissected alongside the fibers. The short external rotators were released, and the joint capsule was identified. A capsulectomy was performed, and the joint was assessed. The prosthesis was implanted, and the posterior structures were resutured. After implantation, joint capsules were sutured with absorbable sutures at both approaches. For displaced trochanters, according to displacement amount and bone quality, trochanters were secured by one or more cables. Preoperative and postoperative x-ray views of a patient are shown in Figure 1.



**Figure 1.** Preoperative and postoperative x-ray images of a patient. A: preoperative, B: postoperative

Under the supervision of a physiotherapist, full weight-bearing mobilization on the first postoperative day was performed on all patients. Flexion beyond 90 degrees, adduction and internal rotation of the operated hip were avoided following operation at least 6 weeks. After the postoperative 1st day, hip, knee, ankle joint range of motion exercises were started. The same rehabilitation protocol was applied to all patients.

Age, gender, body mass index, fracture classification according to AO,<sup>12</sup> intraoperative blood loss (measured the amount of blood which is collected at the container of aspirator), operation duration, hospital stay duration, blood transfusion amount (blood transfusion was performed to patients who had serum hemoglobin value less than 10 g/dL), intraoperative and postoperative complications,

intensive care requirement, postoperative mobilization time, preoperative and postoperative serum hemoglobin values and follow-up time were all assessed.

At the last follow-up, for the functional evaluation of patients, Harris Hip Score (HHS)<sup>13</sup> was used. A 4-point Likert scale was used for pain measurement. (0=none, 1=mild, 2=moderate, or 3=severe).<sup>14</sup>

### Statistical Analysis

The mean  $\pm$  Standard Deviation (SD) was 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 t-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, disease-specific characteristics and some of the outcomes of the 79 patients included in this study (Table 1).

**Table 1.** Demographic and disease-specific characteristics of the patients

Variable	Entire Study Population	Group 1	Group 2	p
Patient number, n (%)	79 (100)	38 (48.1)	41 (51.9)	0.431
Age, year, SD	81.36 $\pm$ 7.25	80.57 $\pm$ 6.88	82.09 $\pm$ 7.59	0.356
Gender, n (%)				
Female	50 (63.3)	24 (63.2)	26 (63.4)	0.981
Male	29(36.7)	14 (36.8)	15 (36.6)	
BMI, kg/m <sup>2</sup> , SD	26.67 $\pm$ 4.44	26.18 $\pm$ 4.25	27.13 $\pm$ 4.62	0.343
AO fracture classification, n (%)				
A2-1	29 (36.7)	16 (42.1)	13 (31.7)	0.631
A2-2	23 (29.1)	10 (26.3)	13 (31.7)	
A2-3	27 (34.2)	12 (31.6)	15 (36.6)	
Surgery duration, minutes, SD	62.46 $\pm$ 9.73	63.81 $\pm$ 10.02	61.21 $\pm$ 9.40	0.239
Postoperative hospital stay, days, SD	8.31 $\pm$ 5.15	7.76 $\pm$ 3.80	8.82 $\pm$ 6.15	0.362
Intraoperative blood loss, ml, SD	445.56 $\pm$ 111.57	413.15 $\pm$	475.60 $\pm$	0.012
Postoperative blood transfusion, unit, SD	1.46 $\pm$ 1.07	0.94 $\pm$ 0.86	1.95 $\pm$ 1.02	<0.001
Follow-up time, months, SD	33.09 $\pm$ 12.63	29.42 $\pm$ 12.29	32.15 $\pm$ 12.26	0.590
Postoperative mobilization, day, SD	1.75 $\pm$ 0.85	1.78 $\pm$ 0.96	1.71 $\pm$ 0.73	0.689

Abbreviations: SD standard deviation, p<0.05 was defined as significant and defined in bold

The mean follow-up period in Group I and II were 29.42 months (SD 22.29) and 32.15 months (SD 22.26), respectively (p=590). There was no significant difference between the groups in terms of age, gender, BMI and AO fracture types, respectively (p=0.356, p=0.981, p=0.343, p=0.631). The mean intraoperative blood loss amount in Group I and II were 413.15 ml (SD 96.34) and 475.60 ml (SD 117.32), respectively (p=0.012). Compatible with this result, the mean postoperative blood transfusion units in Group I and II were 0.94 unit (SD 0.86) and 1.95 unit (SD 1.02), respectively (p<0.001).

Table 2 presents intraoperative and postoperative complications for both groups.

**Table 2.** Intraoperative and postoperative complications

Complications	Entire Study Population	Group 1	Group 2	
Intraoperative complications n, (%)	3	0	3	0.089
Trochanter major fracture	3 (3.8)	0 (0)	3 (7.3)	
Postoperative complications n, (%)	17	5	12	0.165
Infection	6 (7.6)	3 (7.9)	3 (7.3)	
Loosening	4 (5.1)	0 (0)	4 (9.8)	
Protrusion	1 (1.3)	1 (2.6)	0 (0)	
Dislocation	2 (2.5)	1 (2.6)	1 (2.4)	
Trochanter major fracture	2 (2.5)	0 (0)	2 (4.9)	
Pulmonary embolus	2 (2.5)	0 (0)	2 (4.9)	

Abbreviations: SD standard deviation, p<0.05 was defined as significant and defined in bold

All postoperative infections were superficial and treated with surgical debridement and intravenous antibiotics. No implant-related infection was seen. Complication rates were statistically similar between the two groups (Table 2).

Harris hip score, Likert pain score, mobilization time after the operation, and preoperative and postoperative serum hemoglobin differences were reported in Table 3. All clinical outcomes were statistically similar between groups (Table 3). 5 (13.2%) patients in group I and 7 (17.1%) patients in group II were followed at intensive care unit at postoperative term, and results were not statistically significant (p=0.628).

**Table 3.** Clinical score, mobilization time and hemoglobin difference outcomes

Clinical score	Entire Study Population	Group 1	Group 2	p
Harris Hip Score, SD	77.24± 11.80	76.45± 14.59	78.05± 8.14	0.567
Likert Pain Score, SD	1.79± 0.64	1.72± 0.69	1.86± 0.59	0.388
Hgb difference, mg/dL, SD	1.39± 1.12	1.22± 0.96	1.54± 1.25	0.209

Abbreviations: SD standard deviation, hgb hemoglobin, p<0.05 was defined as significant and defined in bold

## DISCUSSION

The most important finding of this study was that clinical scores and complication rates were not significantly different in patients undergoing hemiarthroplasty with anterolateral and posterolateral approaches for intertrochanteric femur fractures. Only intraoperative blood loss and postoperative blood transfusion rates were different between groups. Both parameters were significantly higher in patients with the posterolateral approach. There was no difference between the two groups regarding gender, BMI, age, fracture pattern according to AO, surgical duration, postoperative hospital stay, postoperative mobilization day. Trochanter major fracture occurred during operation at three patients in group 2, although none of the patients had this kind of fracture, and the difference was statistically insignificant. Likert pain scores and HHS values at the last follow-up were higher in group 2, but differences were insignificant.

Hardinge described the direct lateral approach to the hip in 1982.<sup>15</sup> Adequate exposure of hip joint is provided by this approach, and postoperative dislocation rates were reported as very low.<sup>16,17</sup> Moore popularized posterior/posterolateral approach to hip in 1950.<sup>3,4</sup> Popularity of posterolateral approach increased year by year. Adequate exposure to the hip region and protection of adductor muscles during exposure are obtained. Sciatic nerve has to be protected, and external rotator muscles and posterior capsule have to be repaired.<sup>17</sup>

It was reported by many previous studies that preserving posterior joint capsule and posterior soft tissue envelope with non-posterior approaches reduces hip dislocation rates. The main advantage of anterior approach is reported not to damage the posterior capsule and short external rotator muscles.<sup>17,18</sup> We found one dislocation in both

approach groups. We did not find similar rates to the literature. We think that meticulous capsular repair and transosseous fixation of short external rotator muscles might reduce dislocations, and similar dislocation rates were found in both groups in our study.

One of the most important risks of posterolateral approach is sciatic nerve injury, and it is reported as 0.6% to 3.7% in the literature<sup>19</sup>. However, due to the anterior retractor replacement, femoral nerve injury may occur with anterolateral approach. Also, superior gluteal nerve palsy can occur during the direct lateral approach to hip as it is about 5 cm proximal to the greater trochanter<sup>20</sup>. In our study, no nerve injury occurred in the two groups. Greater sample size may give more accurate results regarding complications related to nerve injuries.

It was reported that muscle sparing and less soft tissue literature properties of anterior approach lead to less blood loss and shorter hospital stay.<sup>17,21</sup> In modified Hardinge or anterolateral approach which we applied, this outcome was not seen as compared to posterior approach in the literature.<sup>18</sup> Our study did not confirm this finding. We found that intraoperative blood loss and postoperative blood transfusion rates were significantly higher in patients with posterolateral approach. A more extended approach and dissection of short external rotator muscles may lead to this result.

Likert pain scores and HHS values at the last follow-up were higher in group 2, but differences were insignificant. Our findings are similar to the literature about approaches for hemiarthroplasty;<sup>17,18</sup> however, there is no previous study that compares both approaches for intertrochanteric fractures.

Some limitations are present: patients were not randomized but rather applied hemiarthroplasty with anterolateral or posterolateral approaches after consulting with the senior author, which may have influenced our results due to selection bias. Randomization may give more reliable results. Follow-up time is relatively short, and this shortness may affect the results. The small sample size may also limit the reliability of results for a larger population. Another limitation is the retrospective nature

of the study. Randomized controlled prospective studies may be better.

Our results show that hemiarthroplasty with both anterolateral and posterolateral approaches are viable treatments for intertrochanteric femur fractures, yielding similar clinical outcomes and complication rates. Less intraoperative blood loss and postoperative transfusion rates make anterolateral approach more favorable compared with posterolateral approach.

### Conflict of Interest

The authors declare that there is not any conflict of interest regarding the publication of this manuscript.

### Authors' Contributions

Concept/Design: MY, GE, MÖ. Data Collection and/or Processing: MY, GE, MÖ. Data analysis and interpretation: MY, GE, MÖ. Literature Search: MY, GE. Drafting manuscript: GE, MÖ. Critical revision of manuscript: GE. Supervision: MY.

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