İstanbul Med J 2026; 27(2): 122-8
DOI: 10.4274/imj.galenos.2026.48347

Is a Calcar-Replacement Femoral Stem as Effective as a Diaphyseal-Fixation Modular Stem in Hemiarthroplasty for Unstable Intertrochanteric Fractures?

Bekir Karagöz[1], Mustafa Erdem[2], Ali Geçer[3], Hünkar Çağdaş Bayrak[4], Alican Barış[5], İsmail Ağır[6]

[1]University of Health Sciences Türkiye, Eskişehir City Hospital, Clinic of Orthopedics and Traumatology, Eskişehir, Türkiye
[2]Afyonkarahisar State Hospital, Clinic of Orthopedics and Traumatology, Afyon, Türkiye
[3]University of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Türkiye
[4]Çekirge State Hospital, Clinic of Orthopedics and Traumatology, Bursa, Türkiye
[5]University of Health Sciences Türkiye, Physical Therapy and Rehabilitation Training and Research Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Türkiye
[6]Adıyaman Training And Research Hospital, Clinic of Orthopedics and Traumatology, Adıyaman, Türkiye

ABSTRACT

Introduction: This study aims to compare the clinical and radiographic outcomes of cementless calcar replacement stems (CRSs) and distally fixed modular stems (DFMSs) in elderly patients undergoing hemiarthroplasty for unstable intertrochanteric femur fractures.

Methods: A retrospective cohort study was conducted on 138 patients who underwent cementless hip hemiarthroplasty for unstable intertrochanteric fractures at two tertiary university hospitals between 2017 and 2023. Patients aged 65 years or older with Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association type A2.2, A2.3, or A3 fractures were included. Based on the type of implant, patients were divided into two groups: CRS (n=67) and DFMS (n=71). The groups were compared in terms of demographic data, operative time, intraoperative blood loss, transfusion requirements, complications, Harris Hip Score (HHS), and Parker Mobility Score (PMS). Minimal Clinically Important Difference (MCID) analyses were performed for functional outcomes.

Results: Hospital stay, operative time, intraoperative bleeding, and transfusion needs were significantly lower in the DFMS group than in the CRS group (p=0.002; p=0.004; p=0.024; p=0.003, respectively). The incidence of dislocation was higher in the CRS group (p=0.039), while no significant differences were observed in other complications. HHS and PMS scores at 6 and 12 months postoperatively did not differ significantly between groups, and none of the differences exceeded the MCID thresholds.

Conclusion: Although functional outcomes were comparable between the two stem types, DFMSs demonstrated statistically significant advantages in terms of surgical duration, blood loss, transfusion requirements, and complication rates.

Keywords: Intertrochanteric fracture, hemiarthroplasty, calcar replacement stem, modular stem, elderly patient, hip fracture

Introduction

Unstable intertrochanteric femur fractures are common in elderly individuals and are associated with significant morbidity and mortality (1). In such patients, the primary treatment goal is to minimize surgical complications and enable early mobilization (2,3). Currently, two main surgical options are employed: osteosynthesis and hip arthroplasty (4). Although osteosynthesis is generally effective in stable fractures, its limitations in elderly and osteoporotic patients, such as implant failure and restricted weight-bearing capacity, have led to increasing interest in arthroplasty as an alternative treatment option, particularly in unstable fracture patterns (5).

Femoral stems used in hip arthroplasty are available in various designs, including proximal (metaphyseal) or distal (diaphyseal) fixation, short or long length, and cemented or cementless fixation (2,6,7). While proximally fixed stems are typically favored in primary cases, there has been a growing trend toward the use of distally fixed modular stems (DFMSs) in elderly patients with unstable intertrochanteric fractures (8,9). These modular stems offer increased intraoperative flexibility, particularly in adjusting limb length and femoral anteversion (9,10). However, the optimal implant choice in cases of calcar deficiency remains controversial. Reconstruction of the calcar in such fractures is technically demanding and has been linked to increased complication rates, thus it is recommended by only a few authors (10). Some studies report that

Address for Correspondence: Bekir Karagöz, University of Health Sciences Türkiye, Eskişehir City Hospital, Clinic of Orthopedics and Traumatology, Eskişehir, Türkiye
E-mail: drbkr71@gmail.com **ORCID ID:** orcid.org/0000-0002-7447-452X

Cite this article as: Karagöz B, Erdem M, Geçer A, Bayrak HÇ, Barış A, Ağır İ. Is a calcar-replacement femoral stem as effective as a diaphyseal-fixation modular stem in hemiarthroplasty for unstable intertrochanteric fractures? İstanbul Med J. 2026; 27(2): 122-8

Received: 13.02.2026
Accepted: 30.03.2026
Publication Date: 12.05.2026

calcar replacement stems (CRSs) provide effective stabilization, while others suggest that d DFMSs are associated with lower complication rates (9-12).

The present study compares the clinical and radiographic outcomes of the cementless CRS and the DFMS in patients undergoing hemiarthroplasty for unstable intertrochanteric fractures. We hypothesize that the type of femoral stem used may have a significant impact on clinical, surgical, and radiographic outcomes in this population.

Methods

Study Design and Participants

This retrospective cohort study was approved by the Non-Interventional Clinical Research Ethics Committee of Adıyaman University (approval number: 2022/5-8, date: 24.05.2022) and conducted in accordance with the Declaration of Helsinki. The requirement for informed consent was waived by the ethics committee due to the retrospective design of the study. Patients who underwent cementless hip hemiarthroplasty for unstable intertrochanteric femur fractures between January 2017 and November 2023 at two tertiary referral centers (Adıyaman University Training and Research Hospital and Univeristy of Health Sciences Türkiye, Haydarpaşa Numune Training and Research Hospital) were included. Inclusion criteria were: age ≥65 years, diagnosis of an unstable intertrochanteric femur fracture classified as type A2.2, A2.3, or A3 according to the Arbeitsgemeinschaft für Osteosynthesefragen/ Orthopaedic Trauma Association (AO/OTA) classification, and treatment with either a cementless CRS or a DFMS. Exclusion criteria included age <65 years (n=15), history of hip fracture (n=11), pathological fractures (n=5), fractures resulting from high-energy trauma (n=8), multiple trauma (n=4), and use of any implant other than a CRS or DFMS (n=31). After excluding 74 patients based on these criteria, 138 patients met the inclusion criteria and were enrolled in the study (Figure 1). Among the included patients, 65 (47.1%) were male and 73 (52.9%) were female, with a mean age of 81.49±7.53 years. Based on the type of femoral stem used, 67 patients were assigned to the CRS group and 71 to the DFMS group.

Surgical Technique

A single surgical team experienced in hip arthroplasty performed all surgical procedures andworked collaboratively at both centers for an extended period. All patients received low-molecular-weight heparin for antithrombotic prophylaxis and 2 grams of intravenous cefazolin approximately 30 minutes before surgery for antibiotic prophylaxis. Surgeries were carried out under either spinal or general anesthesia. In all cases, the hip joint was accessed using a posterolateral approach with the patient positioned in the lateral decubitus position (13). After removal of the femoral head and neck fragments, the femoral canal was sequentially broached and rasped to prepare for implant insertion. Patients in the CRS group underwent cementless bipolar hemiarthroplasty with a CRS (TST SAN, İstanbul, Türkiye), while those in the DFMS group underwent a cementless long-stem modular bipolar hemiarthroplasty (Tıpmed, İstanbul, Türkiye) (Figures 2 and 3). Implant selection was based on predefined intraoperative considerations, including the presence of a significant calcar defect, degree of medial cortical comminution, extension of the fracture into the subtrochanteric region, bone quality, and femoral canal morphology. CRSs were generally preferred in cases with substantial calcar deficiency, severe medial cortical comminution, or inadequate proximal femoral support that could compromise metaphyseal fixation. In contrast, DFMSs were favored for cases with sufficient diaphyseal bone stock, particularly for fractures extending into the subtrochanteric region, where stable distal fixation could be achieved. Final implant positioning was confirmed intraoperatively via fluoroscopy. After hip reduction, joint stability and soft tissue tension were assessed manually, and adjustments to stem anteversion and leg length were made if necessary. A hemovac drain was placed in the surgical site, and the joint capsule was primarily closed. In cases of a detached greater trochanter fragment, the fragment was reduced and fixed with non-absorbable sutures or cerclage wire.

Postoperative Management and Rehabilitation

All patients followed a standardized postoperative rehabilitation protocol, harmonized across both centers and including both passive and active exercises. Hemovac drains placed at the surgical site were removed on the first postoperative day prior to mobilization. On the same day, patients began quadriceps-strengthening exercises and were allowed to bear partial weight on the operated limb with the aid of a walker, as tolerated. Intravenous cefazolin was administered for 24 hours postoperatively. For thromboembolism prophylaxis, low-molecular-weight heparin was continued until the sixth postoperative week. Anteroposterior radiographs of the hip were obtained shortly after surgery to assess early implant positioning. Patients without early complications were discharged between postoperative days 4 and 6, depending on their mobility. Routine clinical and radiographic follow-ups were scheduled at postoperative week 2 and at months 1, 3, 6, and 12, followed by annual outpatient visits.

Data Collection and Assessment Tools

Demographic and clinical data for all included patients were reviewed retrospectively from the hospital's electronic medical records. Collected variables included age, sex, fracture side, length of hospital stay, comorbidities, American Society of Anesthesiologists (ASA) score, type of anesthesia, and need for postoperative intensive care unit admission (14). Fracture types were classified preoperatively using the AO/OTA system (15). Classifications were independently performed by two orthopedic surgeons who were blinded to treatment allocation. In case of disagreement, the final classification was determined by consensus. Surgical data included operative time, intraoperative blood loss, and the number of transfused red blood cell units. Operative time was defined as the duration from skin incision to final skin closure. Blood loss was calculated as the sum of the volume in the suction container and the difference in weight between dry and used surgical gauze. The same type of gauze and the same measurement method were used across all cases. The transfusion requirement was recorded as the total number of red blood cell units administered to each patient. Functional outcomes were assessed using the Harris Hip Score (HHS) and the Parker Mobility Score (PMS) (16,17). Both scores were recorded preoperatively and at 6 and 12 months postoperatively. Preoperative scores were recorded based on the patients' premorbid functional status, as documented in medical records or obtained from patient and/or caregiver reports

at admission. HHS is a 100-point scale that evaluates pain, function, deformity, and range of motion; higher scores indicate better hip function (16). PMS evaluates a patient's mobility level and has been validated as a predictor of postoperative mortality (17). All perioperative surgical and medical complications were recorded. These included prosthesis dislocation, periprosthetic fracture, infection, deep vein thrombosis (DVT), osteolysis, and heterotopic ossification. Osteolysis was assessed on standard anteroposterior hip radiographs taken at or after the 12-month follow-up using the Gruen zone method (18). Heterotopic ossification was graded according to the Brooker classification (19). All HHS and PMS evaluations, as well as osteolysis and Brooker assessments, were performed by two independent orthopedic surgeons who were blinded to implant type. In cases of disagreement, a third reviewer was consulted to reach consensus.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as means, standard deviations, frequencies, and percentages. The distribution of continuous variables was assessed using the Shapiro–Wilk test, which indicated that the data were not normally distributed. Between-group comparisons of independent continuous variables were conducted using the Mann–Whitney U test, while paired data were analyzed with the Wilcoxon signed-rank test. Categorical variables were compared using Fisher's exact test for variables with two levels and the chi-square test for variables with more than two levels. A p value <0.05 was considered statistically significant for all tests. To assess the effect size of statistically significant findings, Cohen's d was calculated. The mean effect size was found to be 0.93. Based on this value, a post-hoc

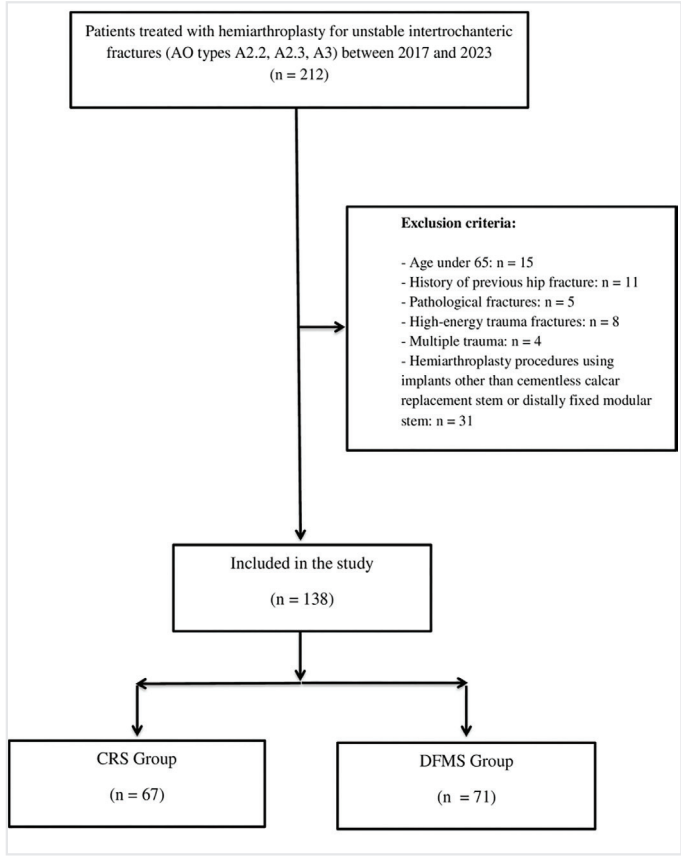

Figure 1. Flowchart of patient selection. AO: Arbeitsgemeinschaft für Osteosynthesefragen, CRS: Calcar replacement stem, DFMS: Distally fixed modular stem

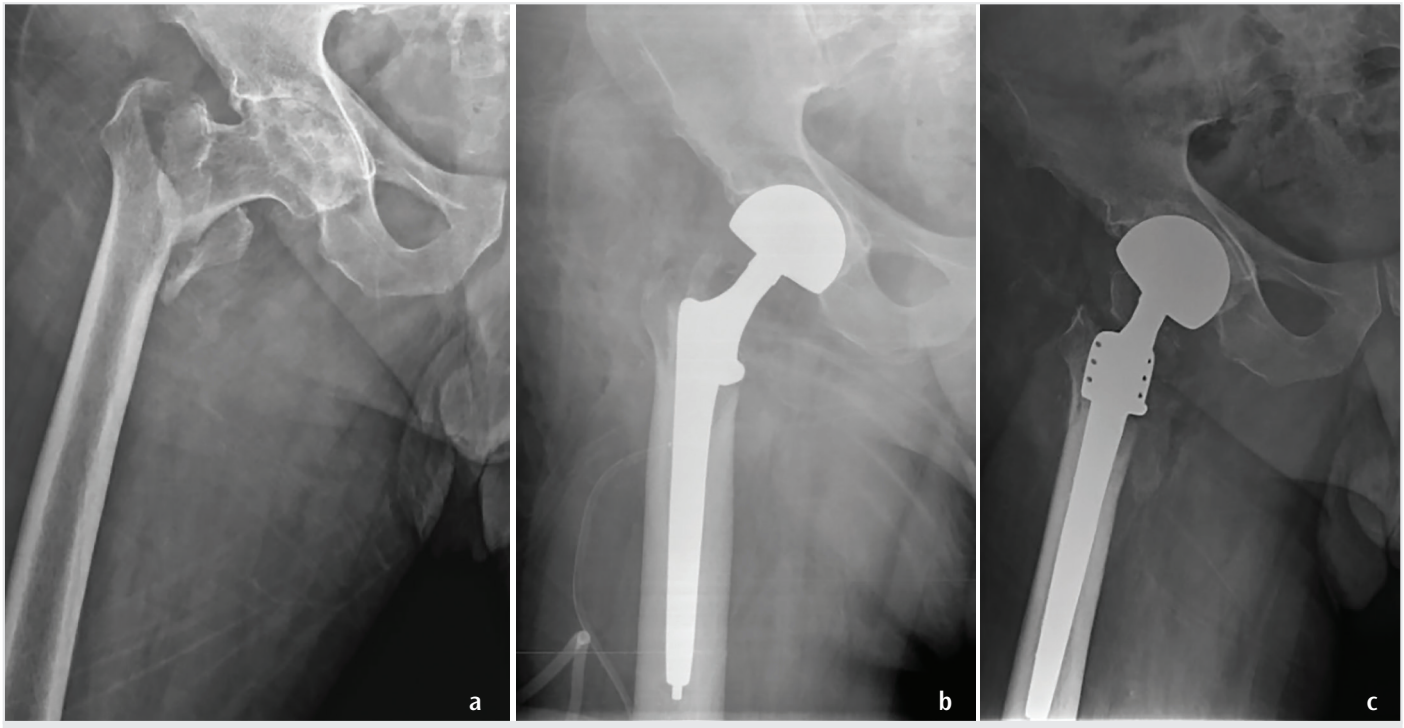

Figure 2. A 78-year-old male patient with an unstable intertrochanteric fracture of the right hip. Preoperative anteroposterior radiograph a) immediate postoperative radiograph following cementless hemiarthroplasty using a calcar replacement stem b), and radiograph at 1-year postoperative follow-up c). Consent of the patient is taken

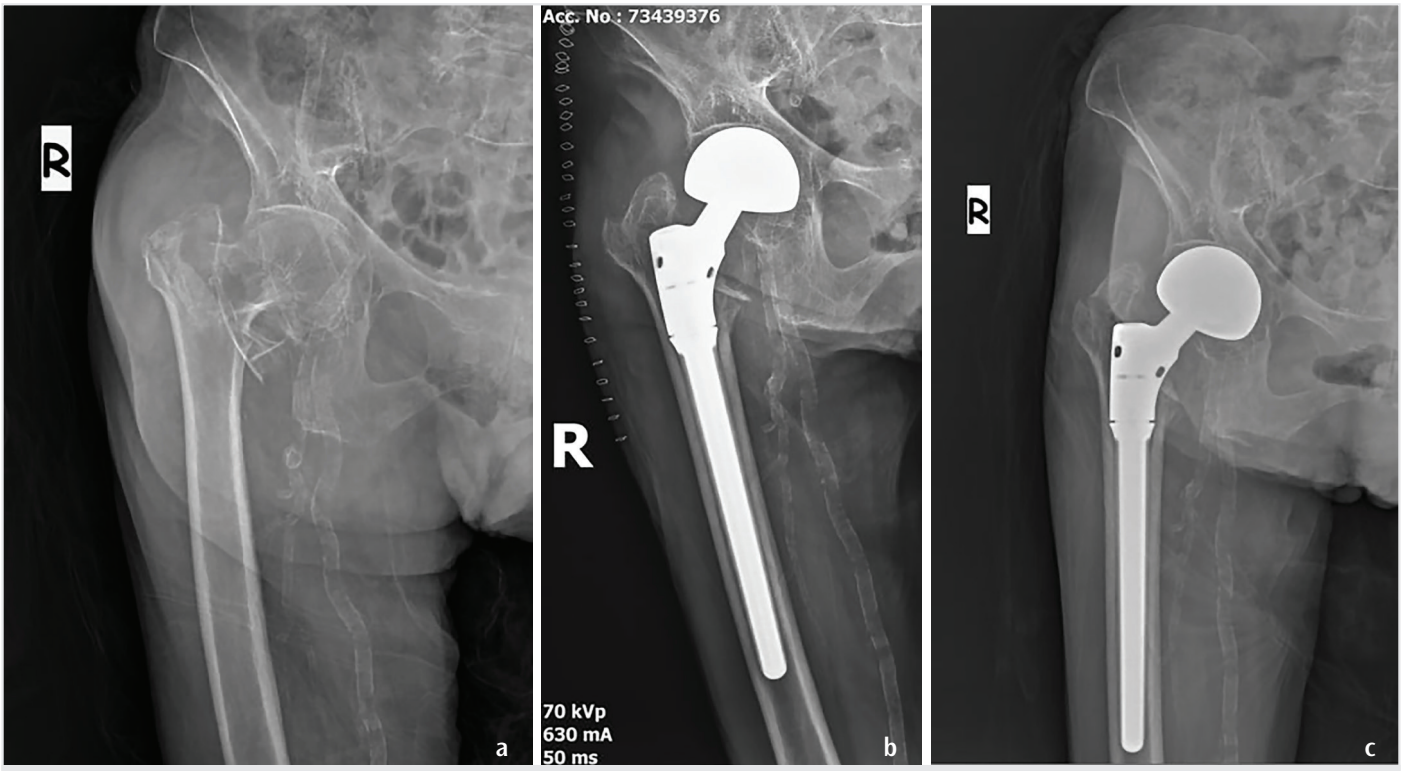

Figure 3. An 82-year-old female patient with an unstable intertrochanteric fracture of the right hip. Preoperative anteroposterior radiograph a), immediate postoperative radiograph following cementless hemiarthroplasty using a distally fixed modular stem b), and radiograph at 1-year postoperative follow-up). Consent of the patient is taken

power analysis indicated that the statistical power of the study exceeded 99% for the given sample size. To further evaluate changes in functional outcomes, minimal clinically important difference (MCID) values were calculated for the HHS and PMS. The MCID was determined using a distribution-based approach, defined as 50% of the pooled standard deviation of both groups (20).

Results

The demographic characteristics of the 138 patients included in the study are summarized in Table 1. Except for the length of hospital stay, no statistically significant differences were observed between the groups in terms of age, sex, side of fracture, AO/OTA classification, comorbidities, ASA score, type of anesthesia, or intensive care unit admission. The length of hospital stay was significantly shorter in the DFMS group than in the CRS group (p=0.002).

Significant differences were observed between the groups in mean operative time, intraoperative blood loss, and the number of transfused blood units (Table 2). The average operative time was significantly shorter in the DFMS group than in the CRS group (p=0.004).

Both intraoperative blood loss and transfusion volume were lower in the DFMS group than in the CRS group (p=0.001 and p=0.003, respectively). The proportion of patients requiring three or more units of blood transfusion was significantly higher in the CRS group (p=0.013).

Among all postoperative complications, the most frequently observed complication was prosthesis dislocation, with an overall incidence of 7.2%. This complication occurred significantly more often in the CRS group (p=0.039). No statistically significant differences were found between the groups for other complications (Table 2).

When functional outcomes were evaluated, no statistically significant differences were found between the CRS and DFMS groups in HHS or PMS at the preoperative, 6-month, or 12-month time points (Table 3). However, in both groups, postoperative HHS values were noticeably lower than preoperative scores. Despite these changes over time, the differences in mean scores between preoperative and postoperative assessments did not exceed the predefined MCID thresholds for either HHS or PMS and were therefore considered clinically insignificant.

Discussion

This study was conducted to compare the clinical and surgical outcomes of cementless hemiarthroplasty using CRS and DFMS in elderly patients with unstable intertrochanteric femoral fractures. The analysis showed that the length of hospital stay was significantly shorter in the DFMS group. Similarly, operative time, intraoperative blood loss, and transfusion requirements were significantly lower in the DFMS group. On the other hand, the incidence of prosthesis dislocation was significantly higher in the CRS group. However, no statistically significant differences were observed between the two groups with respect to functional outcomes as assessed by HHS and PMS scores at 6 and 12 months postoperatively.

One of the main challenges in the surgical treatment of unstable intertrochanteric fractures is managing defects in the femoral calcar region. In hemiarthroplasty, reconstruction of this area is important to prevent stem subsidence and reduce limb length discrepancies (7,11,21-

Table 1. Baseline demographic and clinical characteristics of the study groups

Variable	CRS Group (n=67)	DFMS Group (n=71)	p value
Age, mean ± SD	81.10±7.83	81.84±7.27	0.664[1]
Gender, n (%)			
Female	35 (52.2%)	38 (53.5%)	0.508[2]
Male	32 (47.8%)	33 (46.5%)	
Side, n (%)			
Right	38 (56.7%)	38 (53.5%)	0.419[2]
Left	29 (43.3%)	33 (46.5%)	
AO classification, n (%)			
A22	31 (46.3%)	30 (42.3%)	0.893[3]
A23	21 (31.3%)	18 (25.4%)	
A33	15 (22.4%)	17 (23.9%)	
Length of hospital stay, days	8.99 ± 2.86	6.46 ± 2.10	0.002[1]
Comorbidities, n (%)			
Hypertension	44 (65.7%)	44 (62.0%)	0.392[2]
Diabetes mellitus	21 (31.3%)	22 (31.0%)	0.555[2]
Coronary artery disease	7 (10.4%)	11 (15.5%)	0.266[2]
Alzheimer's disease	12 (17.9%)	13 (18.3%)	0.542[2]
COPD	8 (11.9%)	9 (12.7%)	0.454[2]
Chronic kidney disease	8 (11.9%)	9 (12.7%)	0.905[2]
ASA score, n (%)			
2	7 (10.4%)	10 (14.1%)	0.799[3]
3	46 (68.7%)	48 (67.6%)	
4	14 (20.9%)	13 (18.3%)	
Type of anesthesia, n (%)			
General	14 (20.9%)	16 (22.5%)	0.515[2]
Spinal	53 (79.1%)	55 (77.5%)	
Postoperative intensive care unit stay, n (%)	13 (19.4%)	10 (14.1%)	0.206[2]

[1]Mann–Whitney U test, [2]Fisher's exact test, [3]chi-square test, AO: Arbeitsgemeinschaft für Osteosynthesefragen, COPD: Chronic obstructive pulmonary disease, ASA: American Society of Anesthesiologists physical status classification, CRS: Calcar replacement stem, DFMS: Distally fixed modular stem, SD: Standard deviation

Table 2. Surgical outcomes and complication rates in CRS and DFMS groups

Variable	CRS group (n=67)	DFMS group (n=71)	p value
Operative time (minute)	164.85±29.21	123.87±12.05	0.004[1]
Intraoperative blood loss (mL)	914.62±160.20	841.26±93.37	0.001[1]
Blood transfusion (units)	2.33±0.88	1.90±0.74	0.003[1]
Blood transfusion, n (%)			0.013[3]
1 unit	12 (17.9%)	21 (29.6%)	
2 units	27 (40.3%)	38 (53.5%)	
3 units	22 (32.8%)	10 (14.1%)	
4 units	6 (9.0%)	2 (2.8%)	
Complications, n (%)			
Dislocation	8 (11.9%)	2 (2.8%)	0.039[2]
Periprosthetic fracture	5 (7.5%)	2 (2.8%)	0.197[2]
DVT	3 (4.5%)	2 (2.8%)	0.472[2]
Infection	4 (6.0%)	3 (4.2%)	0.468[2]
Osteolysis	3 (4.5%)	2 (2.8%)	0.472[2]
Heterotopic ossification	1 (1.5%)	0	0.486[2]

[1]Mann–Whitney U test, [2]Fisher's exact test, [3]chi-square test, DVT: Deep vein thrombosis, CRS: Calcar replacement stem; DFMS: Distally fixed modular stem

Table 3. Comparison of functional outcomes between patients treated with CRS and DFMS

Variable	CRS group (n=67)	DFMS group (n=71)	p value
Harris Hip Score			
Preoperative	77.55±6.18	76.25±6.76	0.379
Postoperative 6th month	56.09±11.37	57.85±5.77	0.102
Postoperative 12th month	66.69±8.58	65.87±8.15	0.350
Parker Mobility Score			
Preoperative	7.12±0.86	6.97±1.09	0.186
Postoperative 6th month	4.60±1.06	4.80±1.15	0.432
Postoperative 12th month	6.01±1.83	6.24±1.01	0.449

CRS: Calcar replacement stem, DFMS: Distally fixed modular stem

23). However, calcar reconstruction often requires additional soft tissue dissection and supplementary implants, which may increase operative time and intraoperative blood loss (9,10). For this reason, CRSs have been recommended to provide medial support when reconstruction is not feasible (7,11,24). Nevertheless, achieving stable fixation with these stems can be challenging due to poor bone quality, trochanteric fragmentation, and insufficient stabilization (2), and the technique may involve a considerable learning curve with limited implant availability in some centers (6,11). As an alternative, DFMSs have gained attention in cases of insufficient calcar support. These implants achieve fixation in the distal femoral diaphysis, where cortical bone is typically stronger, and their modular design allows for more precise adjustment of femoral anteversion and limb length (8,10,25,26). These features may facilitate intraoperative management and improve technical control. In our study, DFMS demonstrated significant advantages over CRS in terms of operative time, intraoperative blood loss, and transfusion requirements.

All of these parameters were statistically significant, suggesting a potential clinical advantage. A shorter hospital stay in the DFMS group may be associated with several factors. Reduced operative time and lower intraoperative blood loss in this group may have contributed to faster postoperative recovery and earlier mobilization. In addition, more stable distal fixation may facilitate improved early weight-bearing capacity, which can further support earlier discharge. However, these associations should be interpreted cautiously, and further prospective studies are needed to better clarify the underlying mechanisms.

The type of complications that may occur after hemiarthroplasty can vary depending on the design of the implant and the surgical technique used (6,24).While prosthesis dislocation and surgical site infection are among the most frequently encountered complications, others such as femoral shaft fracture, leg length discrepancy, nonunion of the greater trochanter, stem subsidence, osteolysis, and heterotopic ossification are observed less commonly (2,9). Several studies have explored the

relationship between stem design and postoperative complications. For example, Tsai et al. (27) reported lower complication rates with distally fixed stems, while Karaali and Çiloğlu. (2) found that proximally fixed short stems were associated with higher rates of dislocation and osteolysis compared to distally fixed long stems. However, this association has not been consistently confirmed across all studies, and some reports have shown similar outcomes with non-modular stems (28). In our study, postoperative complications following hemiarthroplasty were also analyzed in detail. Prosthesis dislocation emerged as the most common complication. Although dislocation was the most frequent complication in both groups, it occurred less frequently in the DFMS group. No significant differences were observed between the groups regarding other complications. The modular structure of DFMS, which allows more precise adjustment of anteversion during surgery, may have contributed to prosthesis stability. This technical advantage might partially explain the lower dislocation rate observed in the DFMS group.

Study Limitations

This study has several important limitations. First, due to its retrospective design, patient groups were not randomized, and implant selection was based on surgeon preference and clinical judgment rather than on a standardized protocol. Although predefined intraoperative considerations were used to guide implant selection, the final decision depended on intraoperative assessment and the surgeon's judgment. Therefore, the potential for selection bias cannot be excluded. This may have led to imperfect group homogeneity and the potential for selection bias. Although the follow-up period was acceptable compared with existing literature, the feasibility of long-term follow-up in elderly populations is inherently limited and may therefore restrict its overall impact on clinical outcomes. Finally, although the sample size was small, it was comparable to those of similar studies in the literature. Nevertheless, stronger evidence is needed from future studies with larger sample sizes, prospective designs, longer follow-up durations, and standardized surgical protocols to confirm and expand upon these findings.

Conclusion

This study provided a comparative evaluation of two hemiarthroplasty techniques for the treatment of unstable intertrochanteric fractures in elderly patients. The findings demonstrated that, while both techniques yielded comparable functional outcomes, DFMS offered statistically significant advantages in surgical parameters, such as operative time, intraoperative blood loss, transfusion requirements, and complication rates. These findings suggest potential advantages of modular stem designs in this patient population.

Ethics

Ethics Committee Approval: The approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Adıyaman University (approval number: 2022/5-8, date: 24.05.2022).

Informed Consent: The requirement for informed consent was waived by the ethics committee due to the retrospective design of the study.

Footnotes

Authorship Contributions:

Surgical and Medical Practices - B.K., A.G.; Concept - B.K., M.E., H.Ç.B., A.B., İ.A.; Design - B.K., M.E., A.G., A.B., İ.A.; Data Collection or Processing - M.E., A.G., H.Ç.B.; Analysis or Interpretation - B.K., A.G.; Literature Search - B.K., M.E., H.Ç.B.; Writing - B.K., H.Ç.B., A.B., İ.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Tseng FJ, Chia WT, Pan RY, Lin LC, Shen HC, et al. Comparison of arthroplasty vs. osteosynthesis for displaced femoral neck fractures: a meta-analysis. J Orthop Surg Res. 2017; 12: 131.
2. Karaali E, Çiloğlu O. Metaphyseal vs. diaphyseal fixed-stem hemiarthroplasty in treating unstable intertrochanteric fractures in elderly patients. Ulus Travma Acil Cerrahi Derg. 2021; 27: 104-8.
3. Luo X, He S, Zeng D, Lin L, Li Q. Proximal femoral nail antirotation versus hemiarthroplasty in the treatment of senile intertrochanteric fractures: case report. Int J Surg Case Rep. 2017; 38: 37-42.
4. Yu X, Wang H, Duan X, Liu M, Xiang Z. Intramedullary versus extramedullary internal fixation for unstable intertrochanteric fracture, a meta-analysis. Acta Orthop Traumatol Turc. 2018; 52: 299-307.
5. Socci AR, Casemyr NE, Leslie MP, Baumgaertner MR. Implant options for the treatment of intertrochanteric fractures of the hip: rationale, evidence, and recommendations. Bone Joint J. 2017; 99-B(1): 128-33.
6. Göçer H, Coşkun S, Karaismailoğlu N. Comparison of treatment of unstable intertrochanteric fracture with different arthroplasty methods. Niger Med J. 2016; 57: 81-5.
7. Cobden A, Camurcu Y, Duman S, Kocabiyik A, Kıs M, Saklavcı N. Mid-term survivals of cemented calcar-replacement bipolar hemiarthroplasty for unstable intertrochanteric fractures in elderly patients. Injury. 2019; 50: 2277-81.
8. Cohn MR, Tetreault MW, Li J, Kunze KN, Nahhas CR, Michalski JF, et al. Is there a benefit to modularity for femoral revisions when using a splined, tapered titanium stem? J Arthroplasty. 2020; 35: S278-83.
9. Çiloğlu O, Karaali E, Kuşvuran Özkan A, Ekiz T. Distally-fixed non-modular monoblock fluted long-stem hemiarthroplasty versus proximal femoral nailing for elderly patients with an osteoporotic intertrochanteric fracture: a retrospective comparative study. Hip Int. 2022; 32: 124-30.
10. Zha GC, Liu J, Wang Y, Feng S, Chen XY, Guo KJ, et al. Cementless distal fixation modular stem without reconstruction of femoral calcar for unstable intertrochanteric fracture in patients aged 75 years or more. Orthop Traumatol Surg Res. 2019; 105: 35-9.
11. Wada K, Mikami H, Oba K, Yonezu H, Sairyo K. Cementless calcar-replacement stem with integrated greater trochanter plate for unstable intertrochanteric fracture in very elderly patients. J Orthop Surg (Hong Kong). 2017; 25: 2309499016684749.
12. Khatri K, Banga RK, Malhotra N, Bansal D. Cemented calcar replacement versus long stem cemented hemiarthroplasty in unstable ıntertrochanteric fractures in octogenarians. Rev Bras Ortop (Sao Paulo). 2021; 57: 511-20.

13. Foran JRH, Della Valle CJ. Posterolateral approach to the hip. In: Nho SJ, Bedi A, Salata MJ, Mather RC III, Kelly BT, editors. Hip arthroscopy and hip joint preservation surgery. Cham: Springer; 2022.

14. Quach LH, Jayamaha S, Whitehouse SL, Crawford R, Pulle CR, Bell JJ. Comparison of the Charlson Comorbidity Index with the ASA score for predicting 12-month mortality in acute hip fracture. Injury. 2020; 51: 1004-10.

15. Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. Fracture and dislocation classification compendium-2018. J Orthop Trauma. 2018; 32 Suppl 1: S1-170.

16. Vishwanathan K, Akbari K, Patel AJ. Is the modified Harris hip score valid and responsive instrument for outcome assessment in the Indian population with pertrochanteric fractures? J Orthop. 2018; 15: 40-6.

17. Voeten SC, Nijmeijer WS, Vermeer M, Schipper IB, Hegeman JH; DHFA Taskforce study group. Validation of the Fracture Mobility Score against the Parker Mobility Score in hip fracture patients. Injury. 2020; 51: 395-9.

18. Molloy DO, Munir S, Jack CM, Cross MB, Walter WL, Walter WK Sr. Fretting and corrosion in modular-neck total hip arthroplasty femoral stems. J Bone Joint Surg Am. 2014; 96: 488-93.

19. Brooker AF, Bowerman JW, Robinson RA, Riley LH Jr. Ectopic ossification following total hip replacement. Incidence and a method of classification. J Bone Joint Surg Am. 1973; 55: 1629-32.

20. Revicki D, Hays RD, Cella D, Sloan J. Recommended methods for determining responsiveness and minimally important differences for patient-reported outcomes. J Clin Epidemiol. 2008; 61: 102-9.

21. Liu P, Jin D, Zhang C, Gao Y. Revision surgery due to failed internal fixation of intertrochanteric femoral fracture: current state-of-the-art. BMC Musculoskelet Disord. 2020; 21: 573.

22. Bonnevialle P, Saragaglia D, Ehlinger M, Tonetti J, Maisse N, Adam P, et al. Trochanteric locking nail versus arthroplasty in unstable intertrochanteric fracture in patients aged over 75 years. Orthop Traumatol Surg Res. 2011; 97: S95-100.

23. Abdelkhalek M, Ali AM, Abdelwahab M. Cemented bipolar hemiarthroplasty with a cerclage cable technique for unstable intertrochanteric hip fractures in elderly patients. Eur J Orthop Surg Traumatol. 2013; 23: 443-8.

24. Chammout G, Kelly-Pettersson P, Hedbeck CJ, Stark A, Mukka S, Sköldenberg O. HOPE-trial: hemiarthroplasty compared with total hip arthroplasty for displaced femoral neck fractures in octogenarians: a randomized controlled trial. JB JS Open Access. 2019; 4: e0059.

25. Perticarini L, Rossi SMP, Fioruzzi A, Jannelli E, Mosconi M, Benazzo F. Modular tapered conical revision stem in hip revision surgery: mid- term results. BMC Musculoskelet Disord. 2021; 22: 29.

26. Wiik AV, Aqil A, Al-Obaidi B, Brevadt M, Cobb JP. The impact of reducing the femoral stem length in total hip arthroplasty during gait. Arch Orthop Trauma Surg. 2021; 141: 1993-2000.

27. Tsai SW, Chen CF, Wu PK, Huang CK, Chen WM, Chang MC. Does implant selection impact postoperative complications following hip arthroplasty for failed intertrochanteric fractures? A retrospective comparative study. Artif Organs. 2016; 40: 798-804.

28. Regis D, Sandri A, Bartolozzi P. Stem modularity alone is not effective in reducing dislocation rate in hip revision surgery. J Orthop Traumatol. 2009; 10: 167-71.