



## Original Research

## Anterior Versus Posterior Approach for Total Hip Arthroplasty in Femoral Neck Fractures

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## ABSTRACT

**Background:** The purpose of this study was to compare complication rates and clinical outcomes at 1 year or until death based on the surgical approach for total hip replacement in femoral neck fractures. **Methods:** This retrospective study was performed on 101 patients with displaced femoral neck fractures at our institution between 2005 and 2022. All surgeries were performed by fellowship-trained arthroplasty surgeons via either a posterior Kocher-Langenbeck approach, an abductor sparing anterolateral approach, or a direct anterior approach. Demographics were collected, as well as intraoperative characteristics, discharge information, and complications.

**Results:** Thirty-seven patients underwent a direct anterior approach, 42 underwent an abductor sparing anterolateral approach, and 22 underwent a posterior approach, with no significant difference in demographics between the groups. Of patients, 43.3% were able to be discharged home, while 55.4% of patients went to subacute rehab or other nursing home facility. There was a 30.6% complication rate, a 7% reoperation rate, and a 0.9% dislocation rate. The posterior group was more likely to be discharged to rehab instead of home (82.0% compared to 48.6%,  $P = .0054$ ) and had a significant increase in complication rate ( $P = .04$ ). There was a 36.3% rate of transfusion in the posterior group compared to a 5.0% rate in the anterior group ( $P < .0001$ ).

**Conclusions:** Anterior-based total hip arthroplasty for femoral neck fractures in our series demonstrated a significantly lower rate of postoperative complications, a lower rate of transfusion, and a significantly higher rate of being discharged home.

**Level of Evidence:** Level III.

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## Introduction

Femoral neck fractures (FNFs) in the elderly are common and morbid problems. The incidence is expected to rise to 2.26 million worldwide by 2050 [1]. They are a leading cause of hospitalization, as well as morbidity and mortality in the elderly. Up to 30% of patients will die within 1 year postoperatively [2]. As such, the importance of prompt diagnosis and treatment cannot be overstated.

Significant research has gone into the appropriate treatment for displaced geriatric FNF as it relates to hemiarthroplasty (HA). However, more recent studies have demonstrated that total hip arthroplasty (THA) is a safe procedure in this setting in independently ambulatory patients [3]. The HEALTH investigators [3] found that there was no difference in outcome for THA over HA in quality of life or function over 24 months. Additionally, Maceroli et al [4] found that THA at high-volume arthroplasty centers saw a lower mortality and 90-day mortality rate, with no difference in revision at 1 year.

Thus, as the popularity of THA for fracture increases, we sought to investigate how different surgical approaches would impact outcomes. This research has been done in the setting of hip HA, showing that the direct anterior approach (DAA) was not inferior to

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the posterior approach (PA) [5–7]. To our knowledge, however, this work has not been done for THA for FNF. This study identified patients treated with THA for FNF at our high-volume arthroplasty center. We hypothesized that patients who underwent an anterior-based approach (either DAA or anterior-based muscle-sparing [ABMS]) would have a shorter length of stay, be more likely to be discharged home, and see no increase in complications.

## Material and methods

### Patient cohort selection

This single-institution retrospective study was approved by our institutional review board (IRB-AAAU465). We reviewed patients who sustained displaced FNF and subsequently underwent THA at 3 sites within a single urban academic institution between January 2000 and February 2022. All patients underwent THA by one of 4 fellowship-trained arthroplasty surgeons.

Surgeries were performed by either a Kocher-Langenbeck PA, an anterior-based muscle-sparing approach (ABMS), or a Smith-Peterson DAA. Each patient had an approach selected in a personalized manner after a discussion with the surgeon and presentation of the risks and benefits, as well as the procedure with which the surgeon was most comfortable. Demographics were collected, as well as baseline ambulatory status, use of cement, length of stay in the hospital, time to ambulation with physical therapy in the hospital, and complications. Patient discharge location was determined using a standardized assessment by both physical therapy (PT) and occupational therapy postoperatively based on strength, endurance, and balance, which would allow them to determine if the patient could safely return home or would require rehab. All social work notes were also read to ensure there were no mitigating socioeconomic factors that may have led to a particular discharge location.

Patients were included if they had at least 1 year of follow-up or died within the first year following surgery. We identified 78 patients who were ultimately excluded as they were either lost to follow-up immediately postdischarge or within the first year after surgery.

### Kocher-Langenbeck posterior approach

Patients who underwent the PA approach were placed in the lateral decubitus position using either a peg board positioner or hip bumps. A curvilinear incision was then carried out on the lateral aspect of the hip down to fascia. The gluteus maximus was then split, at which point the short external rotators were detached and tagged for repair. At this point, capsulotomy was performed.

### Anterior-based muscle sparing approach

Patients who underwent the AMBS approach were placed supine on an operating room (OR) table, and an incision was centered on the anterolateral aspect of the hip from the anterior superior iliac spine to the greater trochanter and taken down to fascia. The fascia was then opened in line with the incision, and the interval between gluteus medius and tensor fascia lata was identified and bluntly spread to allow for retractors to be placed around the femoral neck. At this point, capsulotomy was performed.

### Smith-Peterson direct anterior approach

Patients who underwent the DAA approach were also placed supine on an OR table. An incision was made approximately 2 cm lateral to anterior superior iliac spine and carried distally. Tensor fascia lata was incised, and tensor was retracted laterally. Ascending branches of the lateral femoral cutaneous artery were identified and coagulated, and rectus tendon was identified and protected, allowing for exposure of the anterior capsule. At this point, capsulotomy could be performed.

### Statistical analysis

Patients were split into 2 groups: those who underwent an anterior-based approach in the supine position (DAA and ABMS) and those who underwent a posterior approach in the lateral decubitus position (PA). Collected data was analyzed using a Student's *t*-test to identify differences between the 2 study groups' demographics and complications. Mann-Whitney test was used for scale variables within groups. A Fisher's exact test was utilized to compare dichotomous outcomes. All analyses were performed using SPSS Version 23 (IBM, Armonk, NY) and Microsoft Excel 2016 (Microsoft, Redmond, WA). Statistical significance was set a priori at  $P < .05$ .

## Results

### Demographics

A total of 101 patients were identified retrospectively for study inclusion. Of these patients, 69.3% were women, and 63.3% of patients were community ambulators without assistive devices preoperatively. Mean age was  $76.2 \pm 10.8$  years with an average follow-up of  $25.7 \pm 24.3$  months. Regarding approach, 37 patients (37%) underwent a DAA approach, 42 (41%) underwent an AMBS approach, and 22 (22%) underwent a PA approach. There was no difference in age, time to OR, or Charlson comorbidity index between the groups (Table 1). Information regarding hospital admission is listed in Table 2. Of patients, 18% died within 1 year of

**Table 1**  
Patient demographics.

Demographic	Total (n = 101)	Anterior-based approach (n = 79)	Posterior-based approach (n = 22)
Age (y)	76.2	77.1	73.2
Females (%)	68.3%	69.6	63.6
Body mass index (kg/m <sup>2</sup> )	24.5	24.5	24.6
Follow-up time (mo)	25.7	20.9	42.9
Charlson comorbidity index	4.6	4.6	4.8
Preinjury ambulatory status (%)			
Independent, community ambulator	63.4%	65.8%	59.1%
Community ambulator with assistive device	31.7%	29.1%	40.9%
Household ambulator	4.9%	5.1%	0%

**Table 2**  
Hospital data.

Variable	Total	Anterior-based approach	Posterior-based approach	P-value
Time from presentation to operating room (OR) (d)	1.5	1.5	1.5	1.00
Estimated blood loss (cc)	256.4	242.2	306.8	.095
Cemented (%)	38.6%	49.4%	0%	.36
Postoperative day ambulating with physical therapy (d)	1.6	1.6	1.8	.08
Length of stay (d)	4.9	4.8	5.4	.26
Discharge location				
Home	43.6%	51.9%	18.2%	.0069
Nursing home or subacute rehabilitation	55.4%	48.1%	81.8%	.0054

surgery, and 43.3% of patients were able to be discharged home, while 55.4% of patients went to subacute rehab or other nursing home facility (Table 3). One patient died during initial hospitalization. Overall, there was a 30.6% complication rate, a 7% reoperation rate, and a 0.9% dislocation rate. There was no change in service protocol for transfusion (ie, hemoglobin <7.0 g/dL) during the study period. We did not find a significant difference in discharges to nursing home, patients requiring transfusion, or average femoral head diameter when evaluating cases over 5-year periods (Table 4).

#### Anterior-based vs posterior-based approaches

All patients discharged to a rehab facility were evaluated by physical therapy and occupational therapy based on strength, endurance, and balance. Two patients required additional support and other psychosocial factors that precluded them from going home, in addition to PT and occupational therapy recommendations (1 direct anterior patient and 1 ABMS patient). When evaluating anterior-based vs posterior-based approaches, the posterior group was more likely to be discharged to rehab instead of home (82.0% compared to 48.6%,  $P = .0054$ ). Additionally, the posterior group had a significantly higher complication rate (45.5% compared to 26.5.5%,  $P = .04$ ). Specifically, there was a 36.3% rate of transfusion in the posterior group compared to a 5.0% rate in the anterior group ( $P < .0001$ ). The overall dislocation rate was 1%, with no significant difference between the groups and the single dislocation occurring in the anterior (AMBS approach) group on postoperative day 7.

The mean length of stay for the group was 4.2 + 3.4 days, with 5.4 + 3.4 days on average for the anterior-based group and 4.2 + 3.3 days for the posterior-based group ( $P = .26$ ). Additionally, there was no difference between the average time to being able to ambulate with physical therapy (postoperative day 1.8 + 0.98 for the anterior group and postoperative day 1.3 + 0.83 for the posterior group,  $P = .08$ ). There was no significant difference in reoperation rate (7.6% in the anterior group, 9.1% in the posterior,  $P = .18$ ).

Six patients in the anterior group required revision surgery. Two patients underwent open reduction internal fixation (ORIF) for periprosthetic femur fractures, with revision of components. One patient underwent explant and placement of wound vac for

periprosthetic joint infection, eventually requiring a two-stage revision. One patient required a revision of components on postoperative day 7 for dislocation. One patient required revision THA for cement mantle fracture. The final patient developed a periprosthetic joint infection requiring revision and an eventual Girdlestone procedure. Two patients in the posterior group required reoperation. One patient underwent revision of all components for trunionosis and periprosthetic femur fracture. The second patient required revision of all components and open reduction internal fixation for a Vancouver B2 periprosthetic femur fracture.

#### Discussion

Femoral neck fractures are a leading cause of hospitalization, as well as morbidity and mortality in the elderly, with up to 30% of geriatric patients dying within 1 year postoperatively [1,2]. A significant amount of research has focused on hip HA for the treatment of displaced geriatric femoral neck fractures, especially in those with significant comorbidities. However, more recent studies have demonstrated that outcomes following THA may compare favorably [3,4]. To our knowledge, this is the first study to investigate the impact of surgical approach on outcomes following THA for geriatric femoral neck fractures. In our cohort, when compared to posterior-based THA, anterior-based approaches demonstrated a significantly lower rate of complications and a significantly higher rate of being discharged home following a displaced femoral neck fracture. A post hoc power analysis revealed a high power for both discharge to rehabilitation or nursing home (84.7%) and postoperative transfusion (85.7%).

Much of the research focus on the impact of surgical approaches for femoral neck fractures has been on HA, despite the growing popularity of THA to treat these injuries. A recent meta-analysis on HA found a majority of studies showed superior early functional outcomes in anterior-based approaches; however, there were no significant long-term functional outcome differences compared to posterior approaches [6]. For example, Nogler et al [8] evaluated the effect of surgical approach in HA and found that anterior-based approaches resulted in less postoperative pain, blood loss, and reduced length of stay. Moreover, Auffarth et al [5] found no differences between the DAA and lateral Hardinge approach in HA. In another recent meta-analysis, Wang et al [9] also found superior postoperative pain and early hip function scores following the DAA approach for primary THA. However, none of these studies have analyzed how surgical approach affects outcomes for femoral neck fractures treated with THA.

In our THA cohort, there were no differences in length of stay, time until ambulating with PT, or reoperation rate between the different surgical approach cohorts. However, 82% of the posterior group was discharged to rehab instead of home vs 49% of the anterior group, suggesting that the intermuscular anterior approach may lead to improved early performance with PT following THA. In addition to this often being a patient's preference,

**Table 3**  
Postoperative complications.

Variable	Total	Anterior-based approach	Posterior-based approach	P-value
Transfusion	12	4	8	<.0001
Complication required reoperation	8	6	2	.18
Reason for reoperation				
Fracture	5	3	2	.29
Infection	2	2	0	1.00
Recurrent dislocations	1	1	0	1.00

**Table 4**  
Perioperative factors and outcomes over time.

Variable	2005-2009	2010-2014	2015-2019	2020-2022	P-value	2005-2009
Discharges to rehabilitation or nursing home (%)	7 (70)	7 (70)	18 (47.4)	24 (55.8)	.099	7 (70)
Patient requiring transfusion (%)	1 (10)	2 (20)	4 (10.5)	5 (11.6)	.73	1 (10)
Average femoral head diameter (mm)	34.7	34.4	33.3	34.0	.31	34.7

multiple large studies have shown improved, cost-effective long-term outcomes in patients discharged home vs acute or subacute rehab following THA [10-12]. Geriatric FNFs often occur in older and frailer patients who are not ideal surgical candidates, making an efficient approach that minimizes operative time and inflicts minimal muscle trauma the ideal technique [8,13]. The Kocher-Langenbeck PA approach requires splitting of the gluteus and short external rotators prior to repair—and thus muscle and tendon healing to occur—which may explain why the muscle-sparing DAA approach has previously shown early functional improvements in primary THA [6,8,13]. Given that the primary goal of hip fracture surgery is to regain preinjury mobility, further studies investigating the effects of surgical approaches on early and late functional mobility outcomes for THA following femoral neck fractures are warranted.

In their meta-analysis, Khan et al [6] found a significantly lower total complication rate, dislocation rate, and improved short-term postoperative pain in the anterior group compared to the posterior group in HA. They found no difference in periprosthetic hip fracture, prosthetic joint infection, reoperation, transfusion, or mortality rates between the anterior and posterior approaches. Similar findings were also reported by Van der Sijp et al [14], who found an increased dislocation and reoperation rate in the posterior approach for HA compared to the DAA or lateral approach. Meneghini et al [15] found an increased risk of early femoral loosening with the DAA approach in primary THA.

In our THA cohort, there was a significantly lower total complication rate (26.5% vs 45.5%) and transfusion rate (5% vs 36.3%) in our anterior-based group. Following primary THA, Ponzio et al [16] also found a significantly lower rate of transfusion in the anterior group, with 9% of patients requiring transfusion compared to 23% in the posterior group. This finding was previously attributed to lower procedure and OR times when using the ddDAA approach [9,16,17], although we were unable to assess this. There were also no differences in dislocation, loosening, periprosthetic fracture, reoperation, or 1-year mortality rates between the 2 approaches in our study. Periprosthetic fracture or implant loosening is a theoretical risk of the DAA approach given the reduced exposure of the hip joint, especially given the often poor bone quality in these patients and the initial learning stages of the approach [6,18]. Multiple studies have shown the anterior approach to be associated with a lower risk of dislocation in primary THA and HA for hip fractures [6,19,20]. However, the only dislocation event in our cohort occurred in the ABMS group. Despite this, in geriatric patients with diminished mental status at baseline, the anterior approach to THA may be preferred, as this subset of patients may have difficulty adhering to posterior hip precautions.

Although the posterolateral group had a higher rate of overall complications, the anterior group showed a slightly higher rate of requiring reoperation, though this difference was not statistically significant. The concern for increased reoperation rates after an anterior-based THA is amplified by the well-documented learning curve associated with the DAA [21]. Again, there were 6 reoperations within the anterior-based group, 3 of which were for fracture, 2 of which were for infection, and one of which was for recurrent dislocations. There were 2 reoperations within the posterior-based group, both of which were for fracture. Each approach has been

studied in the literature and its individual complications discussed. The anterior approach has been cited for increased risk of early femoral fracture and injury to the lateral femoral cutaneous nerve [22,23], while certain papers have reported the posterolateral approach to have higher rates of postoperative dislocation and a theoretical risk of injury to the sciatic nerve [22-24]. A comparative study by Bendich et al evaluated 2348 DAA THAs matched 1:1 with 2348 patients who underwent PA THA during the same period. Similar to the current study, they found that the majority of reoperations were due to periprosthetic fracture, infection, and dislocation. There was no significant difference in reoperation within 1 year between the 2 approaches, which suggested similar complication profiles [25]. As such, each surgeon should assess the risks and benefits of both approaches based on individual clinical judgment.

Our study has several limitations. First, it is a single-center retrospective study in a limited population that is difficult to follow-up with and thus subject to confounding and may not be generalizable to other institutions. All patients were operated on by fellowship-trained joint arthroplasty surgeons, which may influence outcomes and differ from other institutions. Our results are also subject to nonresponse bias given that patients who followed up at 1 year may be healthier or more health-literate at baseline, with postoperative rehabilitation an important part of the recovery process. However, there was no difference in age, time to OR, or Charlson comorbidity index between each cohort in our study. Overall, we believe this retrospective study should be followed by a prospective, multi-center study to determine if there are any differences in outcomes based on the surgical approach for displaced femoral neck fractures.

## Conclusions

Anterior-based THA for displaced FNFs demonstrated a significantly lower rate of complications and a significantly higher rate of being discharged home compared to posterior approaches. There were no differences in length of stay, time until ambulation, dislocation, loosening, fracture, reoperation, or 1-year mortality rates between the 2 approaches in our study. Future prospective studies are warranted to determine if there are any differences in outcomes based on surgical approach for displaced femoral neck fractures.

## Conflicts of interest

N. O. Sarpong is a paid consultant for Link Orthopaedics. R. P. Shah is a paid consultant for Link Orthopaedics, Monogram, and Zimmer; is an unpaid consultant for OnPoint; has stock options in Parvizi Surgical Innovations; and is a board/committee member of the American Association of Hip and Knee Surgeons and the US Food and Drug Administration. H. J. Cooper is a speaker of 3M; is a paid consultant for 3M, Canary, DePuy, Polaris, and Zimmer-Biomet; has stock options in Polaris; receives research support from Smith & Nephew; is an editorial/governing board member of *Journal of Bone and Joint Surgery-American*; and is a board/committee member of AAOS and Eastern Orthopaedic Association. J. A. Geller receives royalties from Smith & Nephew; is a speaker of

Smith & Nephew; is a paid consultant for Nimble Health and Smith & Nephew; has stock options in Zimmer; receives research support from Orthopaedic Scientific Research Foundation, OrthoSensor, and Smith & Nephew; and is an editorial/governing board member of Clinical Orthopaedics and Related Research, Journal of Arthroplasty, and Journal of Bone and Joint Surgery-British. All other authors declare no potential conflicts of interest.

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### CRedit authorship contribution statement

**Kyle L. McCormick:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Michael A. Mastroianni:** Writing – original draft, Investigation, Formal analysis, Data curation. **Carl H. Herndon:** Writing – review & editing, Supervision, Resources, Project administration. **Nana O. Sarpong:** Writing – review & editing, Supervision, Resources. **Roshan P. Shah:** Writing – review & editing, Supervision, Resources. **H. John Cooper:** Writing – review & editing, Supervision, Resources. **Alexander L. Neuwirth:** Writing – review & editing, Supervision, Resources. **Jeffrey A. Geller:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization.

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