

# Complication Rates for Direct Anterior Total Hip Arthroplasty After Fellowship Compared with Switching Approaches Midcareer: A Multicenter Study of the First 100 Cases

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*The rate of complications and case complexity were evaluated in the first 100 total hip arthroplasty (THA) procedures in early-career direct anterior approach (DAA)-trained adult-reconstruction surgeons and midcareer surgeons who switched to DAA from a different approach. The study is a multicenter, retrospective analysis that collected data on 500 DAA THAs performed by three early-career surgeons and two midcareer surgeons. The patients of early-career surgeons were older (66.4 vs. 64.1), had a higher body mass index (29.9 vs. 28.4), and increased Charlson Comorbidity Index (2.21 vs. 1.52) compared with midcareer surgeons ( $p < 0.05$ ). There were no differences in intraoperative complications or 90-day postoperative adverse events (odds ratio 0.45, 95% confidence interval 0.17 – 1.09,  $p = 0.87$ ). Operative time was significantly greater for the early-career cohort relative to midcareer surgeons (98.1 min vs. 73.8 min, respectively,  $p < 0.001$ ). Early-career fellowship-trained arthroplasty surgeons have similar complication rates to experienced surgeons switching from a different approach, with higher complexity patients. (Journal of Surgical Orthopaedic Advances 34(3):138-141, 2025)*

Key words: direct anterior approach (DAA), total hip arthroplasty, learning curve, arthroplasty fellowship

The direct anterior approach (DAA) for total hip arthroplasty (THA) has increased in popularity over the past 2 decades,<sup>1,2</sup> largely based on studies reporting quicker recovery times and superior early postoperative outcomes.<sup>3</sup> Contemporary literature shows that DAA may be associated with improved early functional outcome scores, earlier return to work, and ambulation without the use of assistive devices.<sup>4-6</sup> Compared with the posterior or lateral approach, DAA is associated with lower pain scores in the immediate postoperative period, with reduced opioid analgesia requirements and earlier hospital discharge.<sup>7,8</sup>

A common drawback of DAA is the learning curve associated with the procedure. Higher revision rates are reported in early practice, with approximately 10 – 50 cases required for revision rates to equalize to those of an experienced DAA surgeon.<sup>9-11</sup> Although multiple large cohorts report higher complication rates when a surgeon first introduces the DAA into practice,<sup>10,12</sup> no study has compared the learning curve associated with the DAA for younger surgeons learning the approach during fellowship with those midcareer surgeons who have adopted the DAA. In addition, data are lacking on the case complexity between early- and midcareer surgeons utilizing this approach. Case complexity includes patient characteristics, such as body mass index and comorbidities,<sup>13-15</sup> and surgical indications.<sup>16</sup> The purpose of this study

is to evaluate the rate of intraoperative complications and 90-day postoperative adverse events resulting in readmission in the first 100 THA procedures in early-career DAA-trained adult-reconstruction surgeons and midcareer surgeons who switched to DAA from a different approach.

## Materials and methods

This study received Institutional Review Board approval at all three participating institutions.

### Study Setting

A retrospective analysis of prospectively collected data was conducted from the first 100 DAA procedures performed by five surgeons from three East Coast institutions. Procedures took place between June 2018 and March 2021 at a combination of tertiary care hospitals, community hospitals, and an orthopaedic specialty hospital. The included surgeons were divided into two cohorts: early career and midcareer. The early-career group included three surgeons starting practice immediately following adult reconstruction fellowship. The two midcareer surgeons were adult reconstruction fellowship-trained surgeons with 15 and 21 years of experience primarily performing the direct lateral approach. The midcareer surgeons later learned the DAA by a combination of observation and courses and had varying levels of integration of the procedure into clinical practice.

Inclusion criteria incorporated the first 100 DAA primary THA procedures completed by each surgeon. All surgeons utilized a standard operating table without the use of intraoperative fluoroscopy.

### Outcomes

The primary outcomes were the rate of intraoperative complications and 90-day postoperative adverse events re-

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**TABLE 1. Patient characteristics**

Variables	Early Career n = 300	Midcareer n = 200	p-Value
Age (yr), mean (SD)	66.4 (10.9)	64.1 (10.1)	0.017
Sex, n (%)			0.523
Male	143 (47.4)	102 (51.0)	
Female	157 (52.3)	98 (49.0)	
BMI, mean (SD)	29.9 (5.75)	28.4 (5.44)	0.005
CCI, mean (SD)	2.21 (2.26)	1.52 (1.59)	< 0.001
Laterality, n (%)			0.887
Left	146 (48.7)	96 (48.0)	
Right	146 (48.7)	100 (50.0)	
Bilateral	8 (2.67)	4 (2.00)	
Diagnosis n, (%)			< 0.001
OA	258 (86.0)	198 (99.0)	
Fracture	31 (10.3)	0 (0.00)	
Osteonecrosis	11 (3.67)	2 (1.00)	
OR time (minutes), mean (SD)	98.1 (29.8)	73.8 (20.1)	< 0.001
Length of stay (nights), mean (SD)	0.72 (0.81)	1.13 (0.85)	< 0.001
Cemented procedure, (yes) n (%)	39 (13.0)	7 (3.50)	< 0.001
Intraoperative complications, (yes) n (%)	11 (3.67)	5 (2.50)	0.641
90-day postoperative adverse events resulting in readmission, (yes) n (%)	27 (9.00)	7 (3.50)	0.027

SD, standard deviation; BMI, body mass index; CCI, Charlson Comorbidity Index (age adjusted); OA, osteoarthritis; OR, operating room

sulting in readmission. Postoperative adverse events were defined by the Hip Society.<sup>17</sup> Case complexity, defined by patient characteristics,<sup>13-15</sup> and surgical indications<sup>16</sup> were also compared between the surgeon cohorts.

**Variables**

Demographic and medical history was collected, including Charlson Comorbidity Index (CCI) (Table 1). Operative reports and postoperative radiographs were reviewed to identify complications. Operative times were defined as the cut-to-close times.

**Statistical analysis**

Continuous data are presented as mean (standard deviation), and categorical data are presented as cell count (percentage). Shapiro-Wilks tests were used to determine normality for continuous data. Mann-Whitney U tests were analyzed to compare continuous data, and chi-square or Fisher's exact tests were used for categorical data. Multivariate logistic regression models were used to examine factors influencing 90-day adverse events resulting in readmission. Multiple imputation procedures were employed to address missingness of operative time values utilizing the inclusion of gender and age as auxiliary variables.<sup>18</sup> Significance was determined at *p*-value < 0.05. All statistical analyses were done using R Studio (Version 4.1.2, Vienna, Austria).

**Results**

**Participants**

A total of 500 patients were included in the study, 300 for the early-career cohort and 200 for the midcareer cohort. There were no significant differences in patient gender or laterality (*p* > 0.05) between the groups. The patients of early-career surgeons were older (66.4 years vs. 64.1 years, *p* = 0.017), had slightly higher body mass index (BMI) (29.9 vs. 28.4, *p* = 0.005), and had an increased CCI (2.21 vs. 1.52, *p* < 0.001). Early-career surgeons performed a higher percentage of THAs for fracture or avascular necrosis (*p* < 0.001) (Table 1). Midcareer surgeons were more selective with approach—one completing the 100th DAA after the 210th THA, and the other completing the 100th DAA after the 130th consecutive THA (Table 2).

**TABLE 2. Number of days and cases utilized per surgeon to reach 100 direct anterior hips**

Surgeons	Days	Cases
Early Career		
1	99	100
2	427	100
3	422	100
Midcareer		
1	308	210
2	171	130

**Intraoperative Complications**

Intraoperative complications were similar between the groups (*p* = 0.641) (Table 3). There were two intraoperative femur fractures in the midcareer group and one in the early-career group. There were no episodes of bleeding requiring emergent intervention, neural deficits, vascular injury, adductor disruption, prosthetic joint infection, heterotopic ossification, bearing surface wear, osteolysis, implant loosening, cup-liner dislocation, or implant fracture. No mortalities occurred within 90 days of surgery.

**90-Day Postoperative Adverse Events Resulting in Readmission**

The rate of 90-day postoperative complications was 9% for the early-career group, and 3.5% for the midcareer group (*p* = 0.027) (Table 3). After adjusting for patient factors and operative time, surgeon experience was not a significant factor in postoperative complications (odds ratio [OR] 0.45, 95% confidence interval [CI] 0.17 – 1.09, *p* = 0.87) (Table 4). Dislocation was the most common complication in each group (Table 5). Each cohort had one revision THA.

**Surgical Time**

The average surgical time was 98 and 74 minutes for the early-career and midcareer cohorts, respectively (*p* < 0.001) (Table 1). Increased BMI and less surgeon experience were significant factors that increased surgical time (*p* < 0.001) (Table 6).

**Discussion**

Utilization of the DAA for THA continues to increase due to a combination of patient preference, surgeon market-

**TABLE 3. Breakdown of intraoperative complications**

Intraoperative complications, n (%)	
Calcar fracture <sup>^</sup>	1 (6)
Femur fracture <sup>*</sup>	2 (13)
Malignant hypertension	4 (25)
Conduction arrhythmia	1 (6)
Acute postoperative anemia	3 (19)
Heart failure	1 (6)
GI complications	2 (13)
Electrolyte imbalance	1 (6)
Bradycardia	1 (6)

<sup>^</sup> The one calcar fracture occurred in the early career cohort.

<sup>\*</sup> The two femur fractures occurred in the midcareer cohort.

GI, gastrointestinal

**TABLE 4. Logistic regression examining 90-day postoperative adverse events resulting in readmission**

Predictors	OR	95% CI	p-Value
Experienced attending	0.45	0.17 – 1.08	0.087
Age	1.02	0.98 – 1.06	0.355
BMI	1.04	0.98 – 1.11	0.208
CCI	1.01	0.85 – 1.20	0.875
Operating room time	1.003	0.99 – 1.02	0.612

Dependent outcome is 90-day postoperative adverse events.

OR, odds ratio; CI, confidence interval; BMI, body mass index;

CCI, Charlson Comorbidity Index

**TABLE 5. Breakdown of 90-day postoperative adverse events resulting in readmissions**

90-day postoperative readmission diagnoses	n (%) Total	Breakdown	
		Early Career	Mid career
Wound dehiscence	2 (6)	1	1
Wound infection (superficial)	2 (6)	2	0
Prosthetic joint infection	1 (3)	1	0
Periprosthetic fracture	2 (6)	2	0
Dislocation	5 (15)	3	2
Congestive heart failure	4 (12)	3	1
COVID-19	1 (3)	1	0
Arrhythmia	2 (6)	1	0
Seizures	1 (3)	1	0
Sepsis	1 (3)	0	1
Pulmonary embolism	2 (6)	0	1
Gout	1 (3)	0	1
Cellulitis	1 (3)	1	0
Hyponatremia	1 (3)	1	0
Neutropenia	1 (3)	1	0
Pain	2 (6)	2	0
NSTEMI	1 (3)	1	0
Medication reaction	1 (3)	1	0
Subdural hematoma	1 (3)	1	0
Pyelonephritis	1 (3)	1	0
Fatigue	1 (3)	1	0

COVID-19, coronavirus disease 2019; NSTEMI, non-ST segment elevation myocardial infarction

**TABLE 6. Linear regression examining operative time**

Predictors	Estimate	95% CI	p-Value
Experienced attending	-22.7	-27.4 – 17.9	< 0.001
Age	-0.14	-0.37 – 0.09	0.244
BMI	1.04	0.64 – 1.45	< 0.001
CCI	0.48	-0.72 – 1.68	0.43

Dependent outcome is operative time.

CI, confidence interval; BMI, body mass index;

CCI, Charlson Comorbidity Index

ability, industry advocacy, and research demonstrating improved recovery.<sup>13</sup> There is an uprise in fellowship training to include this approach, and many midcareer surgeons are adopting this practice to compete in the changing market.<sup>19</sup> This study demonstrated early-career, fellowship-trained surgeons and midcareer surgeons had a similar rate of intraoperative complications and 90-day postoperative complications, but early-career, fellowship-trained surgeons pursued higher complexity cases.

As the DAA has increased in popularity, evaluating complication trends is critical to safely integrating the approach into practice.<sup>20,21</sup> The incidence of total intraoperative complications was 3% and postoperative complications was 7%, similar to other publications reporting approximately 9% surgical complications rates within the first 50 cases.<sup>22</sup> The study did not observe a difference in the rate of periprosthetic femur fractures, one of the major concerns with the DAA.<sup>23,24</sup> Wound complications were noted in only four patients, two for the early-career and two for the midcareer cohort, with one patient undergoing reoperation in the first 90 days, like other publications.<sup>22,25,26</sup> Overall, complications are similar for surgeons who adopt DAA midcareer compared with those who learn the approach during fellowship.

Surgeons who adopted the approach midcareer did so in a selective manner. It took the midcareer surgeons 210 and 130 total cases before reaching 100 DAA cases compared with the early-career surgeons who did all THAs using the DAA approach. In addition, the midcareer cases were mainly for osteoarthritis, whereas the early-career surgeons utilized the DAA for higher complexity cases, including fractures and avascular necrosis. Midcareer surgeons likely observed, studied, and practiced the new approach in a stepwise fashion with well-chosen patients to safely implement DAA into practice.<sup>5,27</sup> Future research efforts should be dedicated to determining how to best learn new approaches midcareer and how to appropriately select patients.

This study demonstrated a significantly greater surgical time for the early-career cohort relative to midcareer surgeons (98.1 min vs. 73.8 min, respectively,  $p < 0.001$ ). This trend is similar to previous publications showing the first 100 DAA cases for early-career surgeons average apx. 118 minutes,<sup>25</sup> whereas midcareer surgeons that transition from a different approach to a DAA have an average operative time of apx. 109 minutes over the first 50 DAA cases and apx. 89 minutes over the next 50 DAA cases.<sup>12</sup> These results suggest midcareer surgeons may be more comfortable and facile in a surgical setting relative to newer surgeons or that the newer surgeons are taking on more complex cases with the approach that the more senior surgeons were not.

Limitations of this study are derived from the retrospective design. Although relevant patient demographics and comorbidities were included, it is difficult to account for all confounders. Complications and readmissions were tracked prospectively at one institution (3/5 surgeons) by nurse navigators but only available via chart review and based on personal operative records kept by each surgeon at the other two institutions. All surgeons trained at the same fellowship and utilized a standard operating table for THA, thus limiting conclusions to surgeons utilizing similar techniques. Limiting sample size to the first 100 cases likely introduced the possibility for Type II error with rare complications. However, this case volume was deemed appropriate for comparison with previous literature regarding learning curve.

As the DAA has increased in popularity for THA, the learning curve has become a relevant concept when introducing the approach into practice. This study showed that early-career, fellowship-trained arthroplasty surgeons have similar complication rates to experienced surgeons switching from a

different approach, but early-career surgeons were more willing to utilize the DAA for higher complexity patients. Extensive experience during fellowship and self-directed learning during practice are both safe and effective methods for safely learning the approach.

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