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Does Surgical Approach to the Hip Play a Role in Same-Day Discharge Outcomes?

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ABSTRACT

Background: Different approaches for total hip arthroplasty (THA) may offer advantages in regard to achieving same-day-discharge (SDD) success.**Methods:** We retrospectively identified patients aged ≥ 18 years who underwent elective primary THA from 2015 to 2020 who were formally enrolled in a single institution's SDD program. A total of 1,127 and 207 patients underwent THA via direct anterior approach and posterior approach, respectively, were included. Cohorts were assigned based on approach. The primary outcome was failure-to-launch, defined as hospital stay extending past 1 midnight. Secondary outcomes included Forgotten Joint Score-12, Hip Disability and Osteoarthritis Outcome Score for Joint Replacement, 90-day readmission and revision rate, and surgical time. Patient-reported outcomes were collected at 3 and 12 months.**Results:** After controlling for demographic differences, posterior approach patients had higher rates of failure-to-launch (12.1% versus 5.9%, $P = .002$) and longer surgical times (99 versus 80 minutes; $P < .001$) compared to direct anterior approach patients. The cohorts had similar readmission (1.7% versus 1.4%; $P = .64$) and revision rates (1% versus 1%; $P = .88$). The magnitude of improvement in Hip Disability and Osteoarthritis Outcome Score for Joint Replacement scores from preoperative to 12 months was similar between cohorts (35.3 versus 34.5; $P = .42$). The differences in outcome scores between cohorts at each time point were not considered clinically significant.**Conclusion:** Our analysis suggests that patient selection and surgical approach may be important for achieving SDD. Surgical approach did not significantly impact readmission or revision rates nor did it have a meaningful impact on patient-reported outcomes in the first year after surgery.

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Good outcomes and low complication rates [1] have been demonstrated with various total hip arthroplasty (THA) surgical approaches, but the advantages of each approach remain controversial [2–5]. The posterior approach [6] (PA) has been used in THA for decades. A common criticism of the PA is higher risks of instability; however, these concerns have been mitigated with modern techniques, advances in technology, and newer implant designs

[7–9]. Alternatively, the direct anterior approach (DAA) [10,11] has steadily gained popularity over the past few decades [12]. The DAA is touted for its quicker recovery, reduced postoperative pain, and lower dislocation risk; however, long-term studies fail to demonstrate superiority of 1 approach over another [12–14].

The exclusion of THA from the Center for Medicare and Medicaid Services inpatient-only list along with pressure on institutions to provide value-based healthcare and cost mitigation has led to the establishment of same-day-discharge (SDD) programs at many institutions [15–17]. SDD for THA produces safe and reproducible patient outcomes; however, emphasis should be placed on rigorous patient selection, multidisciplinary care, multimodal analgesia, and patient education [18–20].

Early postoperative advantages have been demonstrated in DAA, including lower pain scores, reduced narcotic usage, greater

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steps-per-day, and faster time-to-discontinue gait aids [21,22]. The early advantages of DAA could play an important role on SDD THA. The purpose of this study was to compare successful SDD and early postoperative outcomes between the DAA and PA in a cohort of patients preoperatively enrolled in our institution's SDD program. Outcome measures including failure-to-launch, 90-day readmission and revision rates, and patient-reported outcome (PRO) scores at 3 months and 1 year were analyzed. We hypothesized that patients undergoing DAA would have improved early postoperative outcomes and more successful SDD after THA.

Methods

We performed a retrospective review of patients enrolled in a SDD program at a single urban institution, comprised of a tertiary orthopaedic specialty hospital and an academic medical center, using a prospectively collected total joint arthroplasty (TJA) database. After an institutional review board approval, the database was queried for patients aged ≥ 18 years who underwent primary elective THA between January 1, 2015 and October 31, 2020. Only patients who completed formal enrollment in our institution's SDD TJA program were included. Patients undergoing THA for nonelective indications were excluded and those not meeting criteria for the SDD program. All surgeries were performed in a hospital setting and not in an ambulatory surgery center.

Patients were stratified into 2 cohorts based on surgical approach. Most surgeons performed either exclusively DAA or PA; however, few used both. Surgeons who performed both approaches chose each patient's approach individually based on patient risk factors and joint decision-making. No patients underwent variants of lateral or antero-lateral surgical approaches. Intraoperative fluoroscopy and a specialized surgical table were used for the DAA cohort [23].

Demographic information and baseline factors including body mass index (BMI), smoking status, American Society of Anesthesiologists (ASA) classification, and Charleston comorbidity index [24] (CCI) were collected. The primary outcome measure was failure of SDD, or failure-to-launch, defined as hospital stay extending past 1 midnight or longer. Secondary outcomes were Forgotten Joint Score-12 (FJS-12), Hip Disability and Osteoarthritis Outcome Score for Joint Replacement (HOOS, JR), surgical time, 90-day readmission, and 90-day revision.

The FJS-12 is a 12-question survey, measuring patient satisfaction and was collected at 3 and 12 months, postoperatively. The HOOS, JR evaluates pain, function, and activities of daily living. Responses are converted to a 100-point scale with higher satisfaction and better outcomes indicated by higher scores. The HOOS, JR was collected preoperatively and at 3 and 12 months postoperatively. Surgical time was measured in minutes from incision start to wound closure.

Patient Demographics

A total of 1,334 patients were enrolled in the SDD TJA program and underwent THA during the study period. One thousand one hundred twenty seven (84%) underwent THA via DAA approach and 207 (16%) via PA. The DAA and PA operations were performed by 5 and 13 surgeons, respectively, with 2 surgeons using both approaches. Patients in the DAA group were older (mean 58 versus 55 years; $P < .001$) and more likely to be Caucasian (86.8% versus 66.2%; $P < .001$). The DAA cohort had a higher proportion of ASA Class II patients, whereas the PA group had a higher proportion of ASA Class III patients ($P = .001$, Table 1). There were no significant differences between groups regarding sex, smoking status, CCI, or BMI.

Table 1
Patient Demographics (n = 1,334).

Patient Characteristic	DAA (n = 1,127) (%)	PA (n = 207) (%)	P Value
Mean age in years (range)	58 (24–85)	55 (25–83)	<.001
Sex			.112
Women	566 (50.2)	91 (44.0)	
Men	561 (49.8)	116 (56.0)	
Smoking Status			.217
Never Smoker	728 (64.6)	128 (61.8)	
Former Smoker	332 (29.5)	60 (29.0)	
Current Smoker	67 (5.9)	19 (9.2)	
Race			<.001
Caucasian	978 (86.8)	137 (66.2)	
African American	58 (5.1)	27 (13.0)	
Asian	13 (1.2)	6 (2.9)	
Other	78 (6.9)	37 (17.9)	
ASA Class			.001
I	198 (17.6)	37 (17.9)	
II	890 (79.0)	151 (72.9)	
III	39 (3.5)	19 (9.2)	
CCI ($\pm$ SD)	2.8 $\pm$ 1.7	2.6 $\pm$ 1.8	.218
Mean BMI (kg/m ²) (range)	27.2 (18.3–44.2)	27.7 (19.5–41.2)	.236

Bold text denotes statistical significance ($P < .05$).

DAA, direct anterior approach; PA, posterior approach; ASA Class, American Society of Anesthesiologists Classification; CCI, charlson comorbidity index; BMI, body mass index; kg, kilogram; m, meter; SD, standard deviation.

Formal Same-Day-Discharge Program Protocol and Perioperative Criteria

The SDD TJA program exists within the infrastructure of our institution's well-established TJA integrated pathway. Patients are electively enrolled in the SDD program via joint decision-making between patient and provider. Subsequently, patients are preoperatively risk-stratified and medically optimized. To qualify, patients must have the ability to ambulate independently, hemoglobin ≥ 12 g/dL, BMI ≤ 40 kg/m², and no history of coronary artery disease, arrhythmias, chronic use of anticoagulation medication, or untreated obstructive sleep apnea.

Our SDD TJA program involves preoperative education of the patient and their support system. All participants have a designated support person committed to immediate postoperative assistance. There are one-on-one encounters with clinical care coordinators, physical, and occupational therapists prior to date of surgery to review expected recovery, anticipated pain management needs, physical therapy exercises, and manage expectations. All postoperative medications are discussed and prescribed in advance. At any point preceding the day of surgery, patients may withdraw from program if they fail to meet program requirements or if they no longer desire SDD.

The standardized anesthesia protocol includes spinal anesthesia using 0.5% ropivacaine or bupivacaine, with intravenous fentanyl, propofol, midazolam, and dexamethasone. Postoperatively, patient-controlled intravenous analgesia and oral opioid medication is discouraged except for breakthrough pain. Patients are seen by physical therapists to assist with early ambulation to ensure a safe discharge. Patients must achieve an ambulation distance of 100 feet with minimal assistance and the ability to ascend stairs if necessary for home discharge. A universal hip precaution protocol for all patients includes instructions on avoiding extreme range of motion positions and avoiding low seating positions.

Data Analyses

Descriptive data are represented as means $\pm$ standard deviation (SD). Statistical differences in numeric and continuous variables were detected using independent-sample 2-sided *t*-tests. *Chi-*

Table 2
Outcomes.

Discharge & Short-Term Outcomes	DAA (n = 1,127) (%)	PA (n = 207) (%)	Effect of DAA (95% CI)	P Value
Surgical Time (min ± SD)	79.5 ± 21.0	98.6 ± 24.4	17.4 min decrease (14.2 to 20.6)	<.001
Failure to Launch	66 (5.9)	25 (12.1)	OR: 0.46 (0.28 to 0.76)	.002
90-d Readmission	19 (1.7)	3 (1.4)	OR: 1.35 (0.39 to 4.70)	.636
90-d Revision	11 (1.0)	2 (1.0)	OR: 1.13 (0.24 to 5.30)	.875

Bold text denotes statistical significance ($P < .05$).

DAA, direct anterior approach; PA, posterior approach; SD, standard deviation; CI, confidence interval; min, minutes; OR, odds ratio.

squared tests were used for categorical variables. Multivariate linear regressions were used to compare FJS-12 and HOOS, JR scores at each set time point between approach types. Multivariate logistic and linear regressions were used to account for significant differences in demographic data and baseline characteristics. An additional subanalysis was generated using propensity score matching to limit the effect of potential confounding demographic differences between cohorts, including age, sex, race, smoking status, marital status, ASA classification, CCI, and BMI [25]. A P value of $\leq .05$ was considered significant. All statistical analyses were performed using SPSS, version-25 (IBM Corporation, Armonk, New York).

Results

After controlling for baseline differences between cohorts, PA patients had higher rates of failure-to-launch compared to DAA counterparts (12.1% versus 5.9%; $P = .002$, Table 2). Patients undergoing THA via DAA were less than half as likely to fail-to-launch (Odds ratio: 0.46, 95% confidence interval 0.28–0.76). Surgical time for DAA was a mean 17 minutes faster than PA (80 [range, 42 to 271] versus 99 [range, 51 to 190]; $P < .001$). Readmission rate within 90-days was similar between cohorts ($P = .64$). Also, 90-day revision rate was 1% for both groups ($P = .88$).

Outcomes generally favored DAA over PA at most time points. FJS-12 favored DAA at 3 months (61.7 versus 47.6; $P < .001$, Table 3) but not at 12 months (72.7 versus 64.9; $P = .095$). Preoperative HOOS, JR scores favored the DAA cohort (53.0 versus 49.4; $P = .045$). HOOS, JR scores were not significant between groups at 3 months (82.0 versus 78.1; $P = .07$); however, they were significantly different at 1 year in favor of DAA (88.3 versus 83.9; $P = .047$). The magnitude of improvement in HOOS, JR scores from preoperative to 12 months was similar between cohorts (35.3 versus 34.5; $P = .42$). The magnitude of improvement in FJS-12 scores between 3 months and 1 year was statistically significant favoring the PA cohort (11.0 versus 17.3; $P = .007$). The minimally clinically important difference (MCID) for FJS-12 was exceeded at 3 months but not at 1 year [26]. MCID was not exceeded at any time point for HOOS, JR [27].

Propensity score–matched subanalysis generated cohorts (Table 4) demonstrated similar results. Ninety-day readmission and

revision rates were similar between cohorts. The DAA cohort had lower rates of failure-to-launch (1.5% versus 11.3%, $P < .001$) and faster operative times (76 versus 98 minutes, $P < .001$). FJS-12 favored DAA at 3 months; however, all PROs were ultimately equivalent at 1 year (Table 5).

Discussion

Although there is a great debate surrounding surgical approach for THA as it relates to patient outcomes [2,5,28,29], our analysis suggests that the DAA may have benefits over the PA for achieving SDD. As a larger proportion of arthroplasty procedures shift toward rapid recovery, institutions must optimize both operative and perioperative factors to meet these demands. Therefore, our urban academic institution sought to determine key factors that may impact a patient's ability to achieve SDD. Our analysis of 1,334 patients who participated in our SDD TJA program suggests that those who undergo THA via PA are twice as likely to fail-to-launch compared to those who undergo THA via DAA, although achieving the same postsurgical outcomes.

Not all patients are candidates for the SDD program. Those who qualify and remain committed to the program achieve high rates of SDD regardless of surgical approach: 94.1% for DAA and 87.9% for PA. Nevertheless, each patient requiring hospital stay incurs increased costs to the institution and healthcare system [30]. Our primary finding was a significant decrease in proportion of failure-to-launch in the DAA group compared to the PA group (5.9% versus 12.1%; $P = .002$). This difference persisted within the propensity score–matched analysis. There could be many reasons for this. Postoperative magnetic resonance imaging studies have demonstrated different muscular damage during the PA compared to the DAA [31]. Intramuscular dissection is classically reduced in the DAA, although some surgeons may require additional releases during DAA if femoral exposure proves difficult [32]. It is feasible that independent of surgical approach increased muscular dissection leads to worse immediate postoperative pain control and difficulty ambulating; however, we did not assess the reasons for failure of SDD in our cohort.

There are many factors which have been found to influence failure-to-launch in SDD arthroplasty. Fraser et al identified most

Table 3
Patient-Reported Outcomes.

Patient-Reported Outcome Measures	DAA	PA	Effect of DAA (95% CI)	P Value
FJS-12				
3 mo	61.7 ± 27.6 (n = 295)	47.6 ± 28.0 (n = 68)	13.1-point increase (5.8 to 20.4)	<.001
1 y	72.7 ± 26.3 (n = 316)	64.9 ± 25.6 (n = 43)	7.3-point increase (−1.3 to 15.8)	.095
HOOS, JR				
Preoperative	53.0 ± 13.7 (n = 561)	49.6 ± 11.9 (n = 95)	3.0-point increase (0.1 to 6.0)	.045
3 mo	82.0 ± 14.9 (n = 505)	78.1 ± 14.1 (n = 82)	3.3-point increase (−0.2 to 6.8)	.068
1 y	88.3 ± 14.7 (n = 411)	83.9 ± 14.3 (n = 53)	4.3-point increase (0.1 to 8.6)	.047

Bold text denotes statistical significance ($P < .05$).

FJS, forgotten joint score; HOOS, JR, Hip Disability and Osteoarthritis Outcome Score, Joint Replacement; DAA, direct anterior approach; PA, posterior approach; CI, confidence interval; mo, months; y, years.

Table 4
Matched Demographic Data.

Patient Characteristic	Matched Cohort Comparison		
	DAA (n = 204) (%)	PA (n = 204) (%)	P Value
Mean age in years (range)	54 (25–76)	55 (25–83)	.367
Sex			.691
Female	95 (46.6)	90 (44.1)	
Male	109 (53.4)	114 (55.9)	
Smoking Status			.952
Never Smoker	130 (63.7)	127 (62.3)	
Former Smoker	57 (27.9)	59 (28.9)	
Current Smoker	17 (8.4)	18 (8.8)	
Race			<.001
Caucasian	175 (85.8)	137 (67.2)	
African American	9 (4.4)	26 (12.7)	
Asian	4 (2.0)	6 (2.9)	
Other	16 (7.8)	35 (17.2)	
ASA Class			.167
I	27 (13.2)	37 (18.1)	
II	165 (80.9)	149 (73.0)	
III	12 (5.9)	18 (8.9)	
CCI ($\pm$ SD)	2.38 $\pm$ 1.56	2.58 $\pm$ 1.78	.226
Mean BMI (kg/m ²) (range)	27.0 (39.8)	27.7 (41.2)	.092

Bold text denotes statistical significance ($P < .05$).

DAA, direct anterior approach; PA, posterior approach; ASA Class, American Society of Anesthesiologists Classification; CCI, charlson comorbidity index; BMI, body mass index; kg, kilogram; m, meter; SD, standard deviation.

common reasons for failed discharge were patient preference, dizziness/hypotension, failure to clear physical therapy, urinary retention, and pain management. Interestingly, authors noted patient preference was the top factor for failure, which may highlight the continued need for preoperative patient counseling and education. Risk factors for failure were multiple allergies, anxiety/depression, obstructive sleep apnea, and rheumatoid arthritis [33]. Similarly, Lieberman et al found hypotension, delayed resolution of spinal anesthesia, and nausea accounted for 60% of their SDD failures. Notable risk factors were age more than 70 years, more than 2 self-reported drug allergies, and preoperative narcotic use [34].

Multiple studies have demonstrated early benefits to the DAA. We assessed HOOS, JR and FJS-12 up to 1 year postoperatively. In our cohort, FJS-12 favored DAA at 3 months ($P < .001$); however, this benefit was no longer significant at 1 year. The MCID for FJS-12 was exceeded at 3 months but not at 1 year [26]. The magnitude of change from 3 months to 1 year was significant, in favor of the PA cohort; however, this is likely reflective the PA cohort's 3-month scores and the DAA having greater improvement prior to 3 months, as absolute scores were similar at 1 year. HOOS, JR was similar at 3 months and 1 year; however, this is confounded by a higher baseline in the DAA group. The magnitude of improvement in HOOS, JR scores from preoperative to 12 months was similar between cohorts. Furthermore, at no time point did differences exceed the MCID [27]. Previous literature examining PROs has demonstrated early benefits to DAA. However, these findings tend to equate quickly and there appears to be no difference in long-term outcomes [35,36]. A prospective randomized study by Parvizi et al compared the DAA to the lateral approach. The DAA group had better physical function at 2 weeks postoperatively. However, all functional outcome scores equalized by 4 to 6 weeks postoperatively [37]. Similarly, in a randomized controlled trial, Taunton et al compared 52 DAA THAs to 49 PA THAs. They demonstrated patients who received DAA THA performed better with early recovery metrics, including time-to-discontinue gait aids and steps-per-day at 2 weeks. However, differences equilibrated at less than 2 months [22]. Several meta-analyses have found early recovery advantages to DAA but nearly all studies reported equal recovery at long-term follow-up [13,21].

Table 5
Matched Patient-Reported Outcomes.

Patient-Reported Outcome Measure	Matched Cohort Comparison		
	DAA	PA	P Value
FJS-12			
3 mo	79.2 $\pm$ 27.8 (n = 5)	48.1 $\pm$ 27.9 (n = 67)	.019
1 y	79.6 $\pm$ 30.7 (n = 9)	64.9 $\pm$ 25.6 (n = 43)	.134
HOOS, JR			
Preoperative	53.1 $\pm$ 16.9 (n = 17)	49.3 $\pm$ 12.0 (n = 94)	.264
3 mo	83.3 $\pm$ 12.2 (n = 16)	78.4 $\pm$ 14.0 (n = 81)	.195
1 y	89.4 $\pm$ 17.6 (n = 15)	83.9 $\pm$ 14.3 (n = 53)	.213

Bold text denotes statistical significance ($P < .05$).

FJS, forgotten joint score; HOOS, JR, Hip Disability and Osteoarthritis Outcome Score, Joint Replacement; DAA, direct anterior approach; PA, posterior approach; CI, confidence interval; mo, months; y, years.

Our study assessed revision and readmission rates at 90 days without significant differences between groups. Hoskins et al analyzed the Australian Orthopaedic Association National Joint Replacement Registry for all patients who underwent primary THA for osteoarthritis over the course of 3 years. There were no differences in the overall rate of early all-cause revision among surgical approaches. The DAA was associated with a higher rate of early major revisions and femoral complications (revisions for periprosthetic fracture and femoral loosening) compared to the PA; however, the DAA had lower rates of revision for dislocation and infection [4].

Surgical time in our cohort was 17 minutes longer with the PA compared to the DAA ($P < .001$). It is difficult to assess the clinical relevance of this difference. While extended operative times have been associated with increased LOS in THA, few procedures in our cohort would have been considered extended operative times, as times were overall short [38]. Previous literature reporting operative times comparing approaches have tended to favor the PA or have not demonstrated significant differences [39–41]. Due to the retrospective nature of our study, it is difficult to identify the etiology of this finding. One possible explanation is that DAA surgeons were, on average, more efficient in the operating room than their PA colleagues. Since there were more surgeons in the PA group, one could reasonably assume there was a wider variance in operative times and surgical volume, although we did not directly assess this. Concordantly, operative time SDs were greater in the PA cohort, also implying the PA could have been more heavily influenced by outliers. DAA surgeons theoretically performed a higher average volume of procedures, which could be related to this finding. However, also we did not assess each surgeon's true volume which would include cases not formally enrolled in the SDD program. Also, the study was conducted in a teaching institution and surgeons worked with different level of trainees which can influence surgical time.

A confounding factor may be patient impressions prior to surgery. Trends in marketing have made patients increasingly aware of possible benefits to DAA THA [12]. Trousdale et al surveyed consecutive new hip osteoarthritis patients revealing pre-conceptions favoring DAA [42]. While much time is spent on patient education prior to SDD THA, patient perceptions may be a source of bias in favor of DAA. Notably, our DAA cohort was much larger than our PA cohort despite less surgeons using DAA. This discrepancy implies that surgeons performing the DAA enrolled many more patients into the SDD program than PA surgeons. With this, there is a degree of selection bias with respect to the surgeon, their preferred surgical approach, and their patient population enthusiasm towards an SDD program. Patients who seek a DAA

surgeon may be more inclined to seek SDD compared to the general population.

There are limitations to this study that should be considered. The retrospective study design is subject to selection bias. There were multiple operating surgeons with variability in experience and fellowship training. At our institution, surgeons with a preference towards the DAA also tended to strongly encourage SDD. This constellation of preferences likely represents a confounding factor in our analysis. While this may have introduced selection bias, we also believe our cohort to be representative of a realistic population of patients who providers perceived could achieve an SDD under the given circumstances. We attempted to mitigate the effect of selection bias by controlling for significant differences in baseline characteristics. A statistically significant difference in age and ASA score between study cohorts is a relevant confounder [43], although this was controlled for in our initial analysis through multivariate logistic and linear regressions and we performed a propensity-matched analysis to further mitigate these factors. Cases included in this study were performed at an urban orthopaedic specialty hospital; therefore, results may not be generalizable to surgeons performing THA at lower-volume centers. Cohorts were not homogenous regarding implants and surgical technique making it difficult to evaluate for additional confounding factors. Our DAA cohort had better preoperative HOOS, JR scores; however, this did not exceed the MCID [27]. We examined 90-day revision and complication rates and were therefore unable to see differences at longer follow-up. Also, as stated previously, the DAA has been advertised to patients for suspected recovery benefits [12,42]. Previous literature has demonstrated various factors, such as patient preconditioning, which can influence THA outcomes and could have played a role here [44].

Conclusion

Our study demonstrated patients undergoing SDD THA performed with PA compared to DAA were twice as likely to fail-to-launch. DAA was associated with faster operative times and improved early postoperative outcomes, with equivalent complication rates. These results may be confounded by patient selection and patient perceptions about the DAA. Further study should continue to investigate the optimal protocols for SDD THA and the healthcare costs of surgical approach as it relates to an SDD program.

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