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Ambulatory total hip arthroplasty: Causes for failure to launch and associated risk factors

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Aims

The volume of ambulatory total hip arthroplasty (THA) procedures is increasing due to the emphasis on value-based care. The purpose of the study is to identify the causes for failed same-day discharge (SDD) and perioperative factors leading to failed SDD.

Methods

This retrospective cohort study followed pre-selected patients for SDD THA from 1 August 2018 to 31 December 2020. Inclusion criteria were patients undergoing unilateral THA with appropriate social support, age 18 to 75 years, and BMI < 37 kg/m². Patients with opioid dependence, coronary artery disease, and valvular heart disease were excluded. Demographics, comorbidities, and perioperative data were collected from the electronic medical records. Possible risk factors for failed SDD were identified using multivariate logistic regression.

Results

In all, 278 patients were identified with a mean age of 57.1 years (SD 8.1) and a mean BMI of 27.3 kg/m² (SD 4.5). A total of 96 patients failed SDD, with the most common reasons being failure to clear physical therapy (26%), dizziness (22%), and postoperative nausea and vomiting (11%). Risk factors associated with failed SDD included smokers (odds ratio (OR) 6.24; $p = 0.009$), a maximum postoperative pain score > 8 (OR 4.76; $p = 0.004$), and procedures starting after 11 am (OR 2.28; $p = 0.015$). A higher postoperative tolerable pain goal (numerical rating scale 4 to 10) was found to be associated with successful SDD (OR 2.7; $p = 0.001$). Age, BMI, surgical approach, American Society of Anesthesiologists grade, and anaesthesia type were not associated with failed SDD.

Conclusion

SDD is a safe and viable option for pre-selected patients interested in rapid recovery THA. The most common causes for failure to launch were failing to clear physical therapy and patient symptomatology. Risk factors associated with failed SDD highlight the importance of preoperative counselling regarding smoking cessation and postoperative pain to set reasonable expectations. Future interventions should aim to improve patient postoperative mobilization, pain control, and decrease symptomatology.

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Introduction

Over the past 20 years, the average length of stay for total hip arthroplasty (THA) has decreased from seven days to approximately two days.¹⁻⁵ Innovations in patient education, perioperative care pathways, surgical and anesthetic techniques, blood conservation,

multimodal pain management, and accelerated recovery pathways were all instrumental in this paradigm shift.⁵⁻¹⁰ These efforts have led to the rise of ambulatory arthroplasty, allowing carefully selected patients to be safely discharged the day of surgery.^{8,11-17} In addition, the impetus of reducing healthcare costs has

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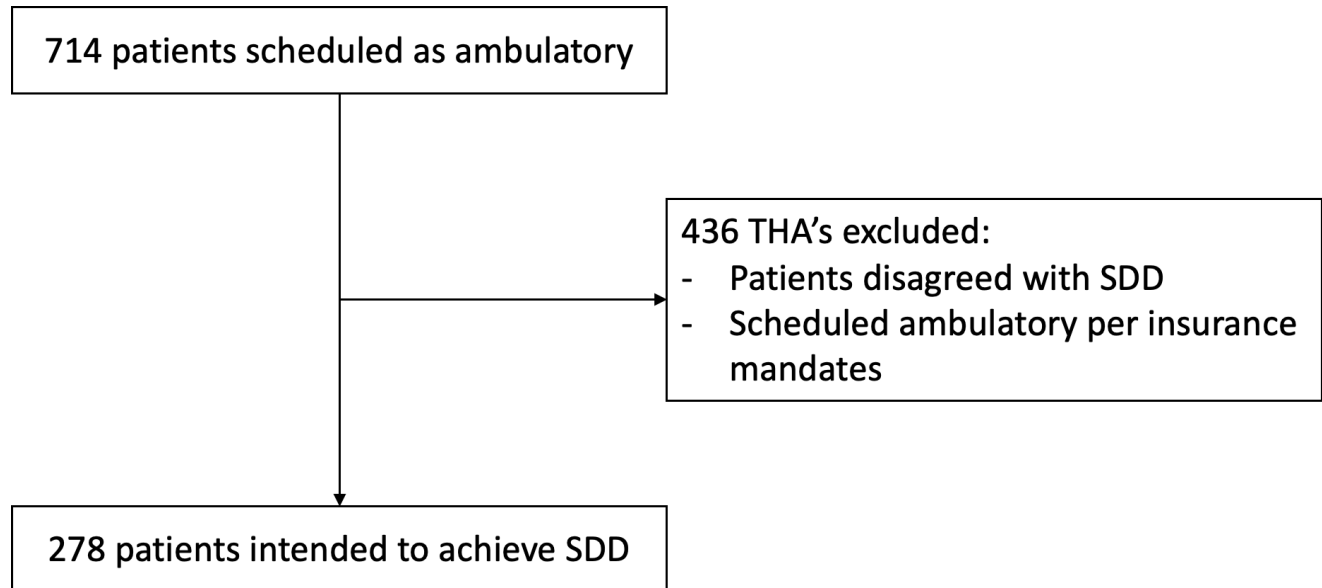


Fig. 1

Flowchart of patient selection. THA, total hip arthroplasty.

been a catalyst for the shift towards ambulatory arthroplasty.¹⁸⁻²⁶ High patient satisfaction has been reported both in the hospital outpatient department (HOPD) and ambulatory surgery centre (ASC).²⁷⁻²⁹

When patients are not cleared to leave on the day of surgery, they lose the ability to recover in the comfort of their own home and the hospital incurs increased cost. Therefore, the main goal of this study was to elucidate the causes for failed same-day discharge (SDD) or “failure to launch” in preselected patients undergoing ambulatory THA. A secondary goal was to determine risk factors associated with failed SDD at the HOPD.

Methods

Institutional board approval was obtained prior to initiation of the study. A retrospective review of all ambulatory THAs performed between 1 August 2018 and 31 December 2020 at a tertiary orthopaedic speciality hospital (Hospital for Special Surgery, New York, USA) was performed. Ambulatory THA was defined as undergoing surgery and being discharged home on the same calendar day. Patients were deemed candidates for ambulatory THA according to comorbidities, social support, and patient preference (Table I). Patients who did not agree to be discharged the same day during the clinic visit and whose insurance company denied an inpatient stay, and therefore were scheduled as ambulatory, were excluded (Figure 1).

In all, 278 patients with a mean age of 57.1 years (standard deviation (SD) 8.1) and a mean BMI of 27.3 kg/m² (SD 4.5), of whom 45% were female, underwent THA with intention to be discharged on the same day (Table II). The majority of patient received neuraxial anaesthesia (98%),

Table I. Relative total hip arthroplasty outpatient candidacy criteria.

Inclusion criteria

Procedures: unilateral primary total knee arthroplasty or simple revisions
 Age 18 to 75 years
 BMI 18.5 to 37.0 kg/m²
 Not currently using warfarin or enoxaparin
 Appropriate social support: patient agrees and has a responsible adult to spend the night on the day of discharge
 Case scheduled before 12 pm

Exclusion criteria

History of active ischaemia
 Significant valvular disease or arrhythmia
 Uncontrolled or undiagnosed obstructive sleep apnoea
 Opioid dependence or addiction
 Glomerular filtration rate < 60 ml/min

were American Society of Anesthesiologists (ASA) grade II (89%), and were never smokers (67%). Surgical approach breakdown, posterior compared to anterior, was almost an even split (51% vs 49%, respectively).

Perioperative care protocols. Every patient underwent preoperative education regarding ambulatory discharge during the clinic visit to set appropriate expectations. Additionally, patients underwent a preoperative multidisciplinary pathway consisting of an educational webinar, virtual preoperative physical therapy (PT) assessment, and discharge planning with a case manager. Preoperatively, patients underwent risk assessment and medical optimization by an in-house specialist who routinely assess hip and knee arthroplasty patients.

The day of surgery, all patients were allowed to consume clear fluids up to three hours prior to surgery according to institutional guidelines. In the preoperative

Table II. Patient demographics and factors associated with successful same-day discharge.

Variable	Overall (n = 278)	Successful SDD (n = 182)	Failed SDD (n = 96)	p-value
Age, yrs (SD)	57.1 (8.1)	56.8 (7.8)	57.8 (8.7)	0.293*
< 50, n (%)	45 (16)	30 (16)	15 (16)	
50 to 64, n (%)	192 (69)	127 (70)	65 (68)	
65 to 79, n (%)	41 (15)	25 (14)	16 (17)	
Sex, n (%)				0.100†
Female	126 (45)	76 (42)	50 (52)	
Male	152 (55)	106 (58)	46 (48)	
BMI, kg/m² (SD)	27.3 (4.5)	27.3 (4.3)	27.2 (4.9)	0.872*
Non-obese, BMI < 30 kg/m ² , n (%)	202 (73)	133 (73)	69 (72)	
Obese (BMI ≥ 30 kg/m ² , n (%)	76 (27)	49 (27)	27 (28)	
ASA grade, n (%)				0.116†
I	25 (9)	17 (9)	8 (8)	
II	248 (89)	164 (90)	84 (88)	
III	5 (2)	1 (1)	4 (4)	
Smoking status, n (%)				0.005†
Current	13 (5)	4 (2)	9 (9)	
Former	80 (29)	47 (26)	33 (34)	
Never	185 (67)	131 (72)	54 (56)	
Laterality, n (%)				0.138†
Left	127 (46)	89 (49)	38 (40)	
Right	151 (54)	93 (51)	58 (60)	
Anaesthesia, n (%)				0.419†
Regional	272 (98)	179 (98)	93 (97)	
General	6 (2)	3 (2)	3 (3)	
Surgical approach, n (%)				0.156†
Direct anterior	135 (49)	94 (52)	41 (43)	
Posterior	143 (51)	88 (48)	55 (57)	
Procedure start time, n (%)				0.006†
Before 11 am	217 (78)	151 (83)	66 (69)	
On or after 11 am	56 (20)	28 (15)	28 (29)	
Procedure length, min, n (SD)	82.4 (8.0)	82.5 (6.9)	82.2 (20.2)	0.921
Estimated blood loss, ml, n (SD)	149.5 (40.5)	148.6 (40.7)	151.0 (40.2)	0.640
Intraoperative IV fluid intake, ml, n (%)	1,364 (371)	1,380 (386)	1,330 (339)	0.327
Highest postoperative pain score, n (%)				0.007†
0 to 3	32 (12)	26 (14)	6 (6)	
4 to 7	156 (56)	108 (59)	48 (50)	
8 to 10	86 (31)	46 (25)	40 (42)	
Pain goal for discharge, n (%)				0.006†
Minimal pain, 0 to 3	167 (60)	99 (54)	68 (71)	
Moderate to severe pain, 4 to 10	107 (38)	81 (45)	26 (27)	
Number of PT attempts on DOS, n (%)				< 0.001†
1	165 (59)	156 (86)	9 (9)	
> 1	113 (41)	26 (14)	87 (91)	

*Independent-samples *t*-test.

†Pearson's chi-squared test.

ASA, American Society of Anesthesiologists; DOS, day of surgery; PT, physical therapy; SD, standard deviation; SDD, same-day discharge.

holding area, the patients set their tolerable pain goal. Blood conservation strategies consisted of a two-dose tranexamic acid (TXA) protocol, 1 gm IV prior to incision and 1 gm IV in the post-anaesthesia care unit (PACU). Intraoperative multimodal anaesthesia protocols consisted of neuraxial anaesthesia, ketamine (up to 50 mg), ketorolac 15 mg IV, acetaminophen 1 gm IV,

and a surgeon-administered periarticular injection (PAI). Neuraxial anaesthesia (spinal, epidural, or combined spinal epidural) drug and dose vary according to anaesthesiologist preferences. Nausea and vomiting prophylaxis consisted of ondansetron 4 mg IV administered once intraoperatively. A single high dose of glucocorticoids (dexamethasone 4 mg IV) is administered to decrease the

surgical stress response.³⁰ Postoperative pain management consisted of IV ketorolac 15 mg once, IV acetaminophen 1 gm once, oral administration of oxycodone 5 to 10 mg q at four to six hours PRN, acetaminophen 1 gm q at six hours, and meloxicam 15 mg daily.

After surgery, patients were monitored in the PACU until discharge or admitted to the hospital for an overnight stay. Early mobilization was encouraged by PT after recovering full motor and sensory function approximately two hours postoperatively, discharge criteria include ambulating 150 feet, independent transfer from the supine and seated position to standing and negotiating stairs if needed. Additionally, patients should be able to independently perform a home exercise programme. Every patient who failed the first PT evaluation was seen a second time after a two- to three-hour period. Following the first postoperative void, one litre of normal saline solution is administered over one hour routinely. Transition to regular diet is encouraged two hours after surgery. Once all discharge criteria have been met both, patients and family members must verbalize their understanding of discharge instructions.

Statistical analysis. Patient demographics and perioperative data were reported using descriptive statistics. Continuous variables were reported as means and SD or median and interquartile range (IQR) for normally and non-normally distributed data, respectively. Comparisons between groups were investigated using independent-samples *t*-test or Mann-Whitney U test depending on data distribution. Categorical variables were presented as frequencies and percentages and compared using Pearson's chi-squared tests. Univariate and multivariate logistic regression were used to identify factors associated with SDD. All tests were two-tailed, and *p*-values < 0.05 were considered statistically significant. Statistical analyses were performed using Stata version 15.0 (StataCorp, USA).

Results

Overall, 182 patients (65.5%) were successfully discharged the day of surgery, while the remaining 96 patients (34.5%) failed SDD. Of these 96 patients, 72 (82.2%) were discharged the next day (next day discharge (NDD)). A greater proportion of patients who went home the same day were never smokers (72% vs 56%; *p* = 0.005), had a procedure start time before 11 am (83% vs 69%; *p* = 0.006), had a tolerable pain goal for discharge > four (45% vs 27%; *p* = 0.006), and were cleared by PT on the first attempt (86% vs 9%; *p* < 0.001). A higher percentage of patients who were current smokers failed SDD (2% vs 9%; *p* = 0.005). Age, sex, BMI, ASA grade, surgical approach, and procedure length were similar between patients who went home the same day and those who stayed at least one night.

The most common causes for failed SDD were failure to meet ambulation goals (26%), dizziness (22%), and

Table III. Reasons for failed same-day discharge (n = 96).

Reason	n (%)
Failure to meet ambulation goals	25 (26)
Dizziness	21 (22)
Nausea/vomiting	11 (11)
Uncontrolled pain	8 (8)
Urinary retention	7 (7)
Late case	6 (6)
Other	5 (5)
Hypotension	4 (4)
Patient preference	4 (4)
OSA monitoring	3 (3)
Bradycardia/tachycardia	2 (2)

OSA, obstructive sleep apnoea.

postoperative nausea and vomiting (PONV) (11%) (Table III). Interestingly, four patients (1.4% of the entire population) who had previously agreed to go home the day of surgery preferred to stay overnight, despite meeting criteria to be discharged on the same day.

According to multivariate analysis (Table IV), independent risk factors associated with failing same day discharge include being a current smoker (adjusted OR 6.24; *p* = 0.009), procedure start on or after 11 am (adjusted OR 2.28; *p* = 0.015), and having the highest in-house postoperative pain score ≥ 8 (adjusted OR 4.76; *p* = 0.004). A higher tolerable pain goal for discharge was a protective factor for being discharged the day of surgery (adjusted OR 0.37; *p* = 0.001).

Discussion

SDD is possible as a result of optimizing patient factors and perioperative care pathways. Patient selection and optimization, advances in surgical and anaesthetic technique, and rehabilitation are all instrumental in achieving this goal. Therefore, it is crucial to understand the causes for failure to launch in order to further refine the optimization protocols for these highly efficient pathways.

While interpreting the results of this study, its strengths and limitations should be considered. The main strength of this study was the use of a standardized ambulatory THA pathway by high-volume surgeons at a tertiary orthopaedic hospital. Additionally, the study period incorporates the ambulatory THA pathway since its inception. Selection bias is inherently present in our study only including patients who are relatively healthy and motivated to go home the day of surgery. The limited numbers of patients in this study constraint the minimal difference detected between the groups. External validity is limited due to the heterogeneity in ambulatory pathways between institutions. Also, the HOPD has limitations in achieving SDD when compared to ASCs. The convenience of having the inpatient ward inhouse may increase the number of overnight stays.

Table IV. Multivariate analysis of patient and perioperative factors associated with failed same-day discharge.

Variable	Adjusted OR	95% CI	p-value*
Age, yrs	1.02	0.99 to 1.06	0.243
Female sex	1.63	0.90 to 2.95	0.109
BMI, kg/m ²	0.99	0.93 to 1.06	0.787
ASA score	2.04	0.78 to 5.28	0.144
Posterior approach	1.65	0.94 to 2.92	0.082
General anesthesia	1.27	0.20, to 7.91	0.799
Smoking status			
Never	Ref		
Prior	1.55	0.85 to 2.84	0.153
Current	6.24	1.59 to 24.54	0.009
Procedure start on or after 11 am	2.28	1.17 to 4.43	0.015
Highest postoperative pain score			
0 to 3	Ref		
4 to 7	1.93	0.71 to 5.24	0.199
8 to 10	4.76	1.64 to 13.78	0.004
Pain goal for discharge			
Minimal pain, 0 to 3	Ref		
Moderate to severe pain, 4 to 10	0.37	0.20 to 0.68	0.001

*Multivariate logistic regression.

ASA, American Society of Anesthesiologists; CI, confidence interval; OR, odds ratio.

In this retrospective cohort study of 278 pre-selected ambulatory THA patients, almost two thirds were safely discharged home the day of surgery from the HOPD. Prior studies assessing ambulatory THA performed at HOPD report failure to launch rates ranging from 0% to 72%.^{4,5,8,12,14,31-36} Notably, the investigation performed by Gromov et al⁸ was performed in an unselected population, leading to a 72% failure to launch rate. The study by Berger et al³⁶ reported a 100% SDD rate, but only included the first case of the day.

Patient selection is key, with 91.3% of patients being discharged by postoperative day one. Recently, insurance companies have taken unilateral determinations on admission status. Therefore, we excluded patients whose inpatient stay was denied by the insurer to minimize confounding. These patients arrived to our institution with the expectation to stay at least one night. Rodriguez et al²⁵ demonstrated that patients whose inpatient stay was denied and subsequently underwent outpatient surgery were twice as likely to be converted to an inpatient stay. The decision to undergo ambulatory arthroplasty should consider medical, psychological, social, and financial factors. An open dialogue between the surgeons and patients is crucial, highlighting the importance of shared decision-making principles.

At our institution, the most common causes for failure to launch as failing PT ambulation goals, patient symptomatology and preference, and cases starting after 11 am. Previous studies on this topic have also identified PONV, dizziness, pain control, and urinary retention as the main causes for failure to launch,^{4,5,8,12,14,34,37} all potentially avoidable to some

extent with improvements in pathways and patient management. Fraser et al⁴ reported patient preference as the main reason for overnight stay, highlighting one of the limitations faced at the HOPD when compared to ASCs. We found failing PT ambulation goals was the main cause for failure to launch (26%); our goal for patients to walk 150 feet may be too ambitious as prior ambulatory arthroplasty report goals ranging from 50 to 100 feet.^{4,6,14,38} The exception being the study by Gromov et al,⁸ who had an ambulation goal of 70 metres (230 feet), and also reported failing PT as the main reason for failing SDD.

Early mobilization is essential in achieving SDD; however, it is well recognized that some patients may experience dizziness, nausea, and syncope. When combined dizziness and PONV accounted for 33% of our failure to launch rate even with routine use of antiemetic prophylaxis and goal-directed fluid management. Prior studies have reported orthostatic intolerance may occur in 42% to 76% of patients following arthroplasty.^{39,40} Common symptoms of orthostatic intolerance include dizziness, nausea, or even syncope. Data from goal-directed fluid management studies have shown that orthostatic intolerance may not be a hypovolemic problem, but caused by an impaired sympathetic response complemented by an increased parasympathetic response.^{39,41} Preliminary data suggests using low doses of α_1 -drenoreceptor agonist may reduce orthostatic intolerance.^{42,43} In addition, reports from the anaesthesia and general surgery literature suggest the use of preoperative complex carbohydrate drinks reduces postoperative insulin resistance,

positively impacting lean body mass and muscle function, and decreasing incidence of PONV.⁴⁴⁻⁴⁸ However, there is lack of data suggesting the same benefits are translated to the arthroplasty population. One randomized controlled trial following type 2 diabetic patients undergoing total knee arthroplasty compared preoperative complex carbohydrate drinks to IV 10% dextrose reported no reduction in PONV.⁴⁹ The authors also found preoperative complex carbohydrate drinks did not increase hyperglycaemia, suggesting it may be safe in type 2 diabetics who do not use insulin. Future investigations are needed to elucidate the role of preoperative complex carbohydrate drinks and α_1 -adrenoreceptor agonist in the ambulatory arthroplasty population.

No definitive conclusions can be drawn regarding the role that the ASA grade may play in the risk of failure to launch as our cohort suffers from selection bias. Other investigators reported ASA grade III and female sex to be risk factors for unsuccessful SDD.^{8,35} Notably, only 2% of our study population was ASA grade III. The causation of sex disparities are not well defined. Studies assessing sex differences in the inpatient arthroplasty population cite females verbalize the need for assistance more therefore changing the course of rehabilitation and lower functional independent measure (FIM) scores.^{50,51} In concordance with prior reports, age (range 28 to 79 years) and BMI (range 16.7 to 40 kg/m²) within the ranges seen in our selected population were not significant risk factors for unsuccessful SDD.^{35,36} We identified patients who currently smoke had a six-fold increase in the odds for failing SDD. While no prior studies have focused on the effects of smoking in SDD THA, there is evidence of increased costs, complications (medical and orthopaedic), lengths of stay, and risk of revision surgery.⁵²⁻⁵⁵ Currently, we counsel patients to stop smoking at least one month prior to surgery, but do not test for nicotine levels.

Our results show patients who reported a maximum pain score ≥ 8 were four-times as likely to fail SDD. Conversely, a higher tolerable pain goal prior to discharge increased the odds (adjusted OR 2.70; $p = 0.001$) of being discharged the day of surgery. Pain control is essential in achieving SDD. Our findings support prior studies reporting uncontrolled pain as a hindrance to successful SDD. Keulen et al³⁵ demonstrated that patients who had a previous successful contralateral joint arthroplasty had higher a higher chance of achieving SDD; therefore, we believe there is room for improvement in setting appropriate expectations regarding postoperative pain in patients who are naïve to arthroplasty.

In conclusion, ambulatory THA is a safe and effective treatment for end-stage arthritis in pre-selected patients interested in going home the day of surgery. The most common causes for failure to launch were related to postoperative mobilization and symptomatology. Our results emphasize the importance of preoperative counselling

regarding smoking cessation and postoperative pain. Future research should be aimed at reducing dizziness and postoperative nausea and vomiting.



Take home message

- Our results emphasize the importance of preoperative counselling regarding smoking cessation and postoperative pain.

- Future research should be aimed at reducing dizziness and postoperative nausea and vomiting.

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