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ORIGINAL ARTICLE

The Safety of Outpatient Stoma Closure: on the Verge of a Paradigm Shift?

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Abstract

Background An area of contention among colorectal surgeons is when it is safe to discharge patients who have undergone closure of diverting ostomies. This study aimed to review the trends in outpatient stoma closure (OSC), to assess the safety of this practice, and to identify appropriate surgical candidates for the outpatient procedure.

Methods Patients were queried from the ACS National Surgical Quality Improvement Program database (2005–2016). Main outcomes included Clavien-Dindo (C-D) III–V class surgical complications, and readmission. Outpatient stay was defined as a hospital stay of less than or equal to 1 day. Multivariable logistic regression analysis was used to identify risk factors for C-D III–V complications and readmission.

Results Of 24,393 patients, 668 (2.74%) underwent an OSC. OSC has increased over the last decade (3.16% 2005–2006, 4.14% 2016, $p < 0.001$). Outpatients had significantly lower ASA class and fewer comorbidities than inpatients. Outpatient complication rate was significantly lower than the inpatient rate (2.99% vs. 7.25%, $p < 0.001$). Readmissions were comparable (8.92% outpatient vs. 9.77% inpatient, $p = 0.54$). ASA > 2, smoking, COPD, dyspnea, steroid use, bleeding disorder, and partial/total dependency were associated with increased risk of complications and readmission. Patients without any risk factors had lower complication (4.75%) and readmission rates (8.09%) compared to those with ≥ 2 risk factors (11.50% complication and 13.07% readmission rate, $p < 0.001$).

Conclusions There is an increasing trend in the percentage of stoma closures being performed as outpatient procedures. Appropriate selection of patients preoperatively who are suitable candidates for OSC can be helpful in managing patient expectations and hospital resources.

Keywords Stoma · Ileostomy · Reversal · Elective

Introduction

A diverting loop ostomy, or stoma, is a procedure routinely performed by colorectal and general surgeons to divert enteric contents away from a distal surgical bowel anastomosis in an effort to encourage tissue healing and to reduce the chance of anastomotic leaks or fistula formation.[1] Reversal, or closure, of these stomas is usually undertaken after an interval of 6–12 weeks,[2,3] with patients often remaining in the hospital after the procedure for several days. Early discharge is feared due to the concern of readmission, and its associated penalties, or the development of a postoperative complication such as prolonged ileus.[4] Indeed, a systematic review of 48 studies examining reversal of loop ileostomies determined a mean length of stay (LOS) of 5.1 days, with a wide range from 3 to 10 days.[5]

Enhanced recovery pathways (ERPs) after colorectal surgery have dramatically reduced hospital stay without increasing postoperative complications or compromising patient safety. However, these outcomes have not been observed with

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stoma closure.[6,7] Published literature from the UK and the USA suggests that stoma reversal could in fact be conducted on an outpatient or ambulatory basis, with associated reductions in cost and no increases in complications, morbidities, or readmission rates.[8–11] Despite this evidence, surgeons and hospitals in the USA remain hesitant to adopt the mantra of day-case stoma closure.

This study aims to elucidate the trends in stoma closure practice in the USA, as well as to identify the factors that place patients at increased risk of postoperative complications and readmission. Through these endeavors, the hope is to develop a system whereby appropriate surgical candidates for outpatient stoma closure (OSC) can be recognized, and patients can be presented with their individual risk score.

Materials and Methods

Data Source

This was a retrospective analysis using the 2005–2016 ACS-NSQIP database, which comprises patients undergoing major surgical procedures at participating hospitals.[12,13] This database was designed for the purpose of developing outcome-based initiatives to improve surgical quality of care. Certified surgical clinical reviewers collect data on over 150 variables, including preoperative risk factors, intraoperative variables, and 30-day postoperative mortality and morbidity.[14] This study was reviewed and approved by the Institutional Review Board of the Johns Hopkins University School of Medicine.

Study Population

Adult patients who underwent an elective inpatient stoma closure (ISC) or OSC [Current Procedural Terminology (CPT) codes of 44620, 44625, and 44227] were included. Patients who underwent stoma closure as a secondary procedure, or a primary procedure in conjunction with another procedure, were excluded. Emergency cases and data missing for hospital LOS were also excluded.

Baseline Characteristics

Outpatient stay, for the purpose of this study, was defined as hospital LOS (from procedure to discharge) of less than or equal to 1 day. Inpatient stay was consequently defined as LOS ≥ 2 days. NSQIP-defined patient demographic and clinical characteristics were compared between inpatient and outpatient procedures. Patient demographics included age (categorized as < 65 and ≥ 65 years), sex, and race (White, Black, other [American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, Asian], unknown, or not reported). Clinical characteristics included the American Society of Anesthesiologists (ASA) physical status classification (categorized as "I–II," no or mild disturbance; "III," severe disturbance; and "IV–V," life-threatening and moribund), obesity [body mass index (BMI) ≥ 30 kg/m^2], and preoperative comorbidities [current smoker, diabetes, history of chronic obstructive pulmonary disease (COPD), hypertension requiring medication, dyspnea, steroid use, bleeding disorder, and partial/total physical dependency].

Outcomes

The primary outcomes included Clavien-Dindo (C-D) III–V surgical complications and readmission.[15] The secondary outcomes included overall morbidity, mortality, reoperation, and prolonged operative time. Overall morbidity was defined as an occurrence of any of the following complications: wound infection, pneumonia, urinary tract infection (UTI), venous thromboembolic event (VTE), cardiac complication, shock/sepsis, unplanned intubation, bleeding requiring transfusion, renal complication, ventilator usage > 48 h, and organ/space surgical site infection (SSI). The C-D classification was applied to the NSQIP-defined complications in the following manner: II, wound infection, pneumonia, UTI, VTE, and bleeding requiring transfusion; III, cardiac and renal complications, organ space SSI, or reoperation; IV, shock/sepsis, unplanned intubation, or being on ventilator > 48 h; and V, mortality. Readmission is defined by NSQIP as 30-day postoperative admission to the same or another hospital for any reason, available from 2011 onward. Information on readmission timing and suspected reasons were also reported. Prolonged operative time was defined as operative time greater than the 75th percentile (CPT 44620 > 102 min, CPT 44625 > 102 min, and CPT 44227 > 180 min).

Statistical Analysis

Patient baseline demographics, clinical characteristics, and outcomes were compared between ISC and OSC using Pearson's X^2 test for categorical variables and Student's t test for continuous variables. Multivariable logistic regression analysis was used to identify risk factors associated with C-D III–V surgical complications and readmission, and it included variables with $p < 0.25$ in univariate analysis as recommended by Hosmer and Lemeshow.[16] Odds ratios (OR) and 95% confidence intervals (CI) were reported. Furthermore, two sets of three risk categories (one for each primary outcome) (0 risk factors, 1 risk factor, and ≥ 2 risk factors) were formed using the clinical risk factors only, and their associated relative and predicted risks of the primary outcomes were computed. All statistical analyses were performed using Stata/MP version 14.1 (StataCorp LP, College Station, TX).

Results

Study Population

A total of 43,083 stoma closures were identified initially. After applying the aforementioned inclusion and exclusion criteria, 24,393 patients were deemed appropriate for analysis. Of those, 688 (2.74%) were performed in an outpatient setting. There appeared to be a slow yet significantly increasing trend of OSC in the last decade (from 3.16% in 2005–2006 to 4.14% in 2016, $p < 0.001$) (Fig. 1). Compared to patients who underwent an inpatient procedure, patients who underwent an outpatient procedure tended to be younger, white, with lower ASA classification, and fewer comorbidities; however, sex, obesity, current smoking status, diabetes, and bleeding disorder were comparable between the two groups (Table 1).

Unadjusted Outcomes

In comparison to the ISC, the OSC had significantly lower rates of C-D III–V surgical complications (2.99% vs. 7.25%, $p < 0.001$) yet comparable rates of readmission (8.92% vs. 9.77%, $p = 0.54$) (Table 2). The rates of overall morbidity (5.69% vs. 12.86%, $p < 0.001$), reoperation (1.95% vs. 3.96%, $p = 0.008$), and prolonged operative time (9.13% vs. 24.95%, $p < 0.001$) were also lower for the outpatient procedures. Mortality rates were comparable between the two groups (0.15% vs. 0.46%, $p = 0.376$). Figure 2 presents relatively steady trends of outpatient and inpatient C-D III–V complication and readmission rates over the last decade, with the exception of inpatient readmission, which appeared to significantly decrease (11.16% in 2011 to 9.76% in 2016, $p = 0.03$). The median LOS for patients undergoing ISC procedures was 4 days (3–6 interquartile range).

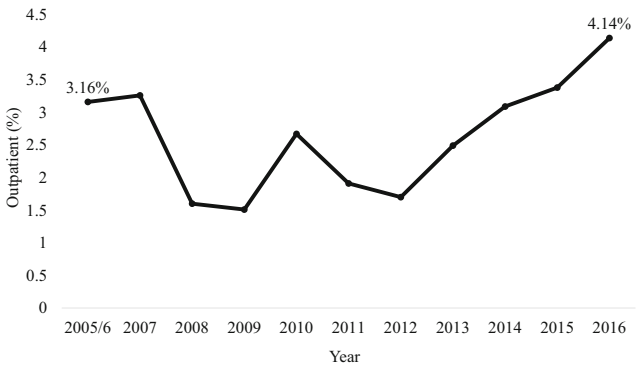

Fig. 1 Proportion of stoma closures performed on outpatient basis in the last decade

Risk Factors

Multivariable logistic regression analyses identified factors associated with significantly increased odds of complications and readmission. Significant risk factors for the C-D III–V complications included (1) black race (OR 1.36, 95% CI 1.16–1.59, $p < 0.001$), (2) ASA classes III and IV–V (OR 1.53, 95% CI 1.37–1.71, $p < 0.001$ and OR 2.74, 95% CI 2.10–3.57, $p < 0.001$; respectively), (3) current smoking status (OR 1.17, 95% CI 1.03–1.32, $p = 0.01$), (4) history of COPD (OR 1.46, 95% CI 1.17–1.81, $p = 0.001$), (5) dyspnea (OR 1.31, 95% CI 1.08–1.59, $p = 0.005$), (6) steroid use (OR 1.71, 95% CI 1.44–2.02, $p < 0.001$), (7) bleeding disorder (OR 1.41, 95% CI 1.13–1.76, $p = 0.002$), and (8) partial/total dependency (OR 1.85, 95% CI 1.45–2.35, $p < 0.001$) (Table 3). Significant risk factors for readmission included (1) ASA classes III and IV–V (OR 1.22, 95% CI 1.09–1.37, $p = 0.001$ and OR 1.50, 95% CI 1.08–2.10, $p = 0.02$; respectively), (2) history of COPD (OR 1.47, 95% CI 1.14–1.90, $p = 0.003$), (3) steroid use (OR 1.60, 95% CI 1.33–1.92, $p < 0.001$), (4) bleeding disorder (OR 1.81, 95% CI 1.43–2.29, $p < 0.001$), and (5) partial/total dependency (OR 1.45, 95% CI 1.06–1.99, $p = 0.02$). Moreover, stoma closures performed in an outpatient setting had significantly decreased odds of C-D III–V surgical complications (OR 0.43, 95% CI 0.28–0.68, $p < 0.001$).Note, the C-D III–V complications and readmission outcomes shared five of the seven clinical risk factors (Table 4).

Risk Categories

Two sets of three risk categories were created using only clinical risk factors, one for C-D III–V complications (ASA > II, smoking, COPD, dyspnea, steroid use, bleeding disorder, and partial/total dependency), and the other for readmission (ASA > II, COPD, steroid use, bleeding disorder, and partial/total dependency): 0 risk factors, 1 risk factor, and ≥ 2 risk factors. There were 42.56% of patients with 0 risk factors, 38.48% with 1 risk factor, and 18.96% with ≥ 2 risk factors (Table 5). These proportions were observed similarly for the readmission group, despite readmission data being available from years 2011–2016 and including slightly different risk factors. The risk of C-D III–V complications and readmission increased with the increasing number of risk factors: 0 risk factors, 4.75% and 8.09%; 1 risk factor, 7.63% and 9.79%; ≥ 2 risk factors, 11.50% and 13.07%, respectively. Predicted risk effectively mirrored these results.

Additional Information About Readmission

The overall readmission rate was 9.75% (9.77% ISC vs. 8.92% OSC, $p = 0.54$). Patients were readmitted at a median

Table 1 Demographic and clinical characteristics for patients undergoing stoma closure

Characteristic, *n* (%)	Total 24,393	Inpatient 23,725 (97.26)	Outpatient 668 (2.74)	*p*
Age group, years				< 0.001
< 65	17,495 (71.72)	16,957 (71.47)	538 (80.54)	
≥ 65	6898 (28.28)	6768 (28.53)	130 (19.46)	
Male	13,365 (54.83)	12,986 (54.78)	379 (56.74)	0.32
Race				< 0.001
White	19,070 (78.18)	18,506 (78.00)	564 (84.43)	
Black	2101 (8.61)	2062 (8.69)	39 (5.84)	
Other[a]/unknown	3222 (13.21)	3157 (13.31)	65 (9.73)	
ASA classification				0.009
I–II	14,251 (58.47)	13,828 (58.33)	423 (63.42)	
III	9649 (39.59)	9411 (39.70)	238 (35.68)	
IV–V	472 (1.94)	466 (1.97)	6 (0.90)	
BMI ≥ 30 kg/m^2	5852 (24.01)	5689 (24.13)	163 (24.66)	0.75
Current smoker	4862 (19.93)	4719 (19.89)	143 (21.41)	0.33
Diabetes	2643 (10.84)	2585 (10.90)	58 (8.68)	0.07
History of COPD	857 (3.51)	845 (3.56)	12 (1.80)	0.02
Hypertension	8471 (34.73)	8273 (34.87)	198 (29.64)	0.005
Dyspnea	1231 (5.05)	1216 (5.13)	15 (2.25)	0.001
Steroid use	1482 (6.08)	1461 (6.16)	21 (3.14)	0.001
Bleeding disorder	826 (3.39)	811 (3.42)	15 (2.25)	0.01
Partial/total dependency	568 (2.33)	562 (2.38)	6 (0.90)	0.01

ASA, American Society of Anesthesiology; *BMI*, body mass index; *COPD*, chronic obstructive pulmonary disease

ASA: I–II (no/mild disturb), III (severe disturb), IV–V (life threat/moribund)

[a] Asian, Native Hawaiian/Pacific Islander, or American Indian/Alaska Native

Missing data: sex *n* = 24,374; BMI and ASA *n* = 24,372; functional status *n* = 24,329

of 5 days from discharge (5 days after inpatient discharge, 6 days after outpatient discharge, and 6 days for those who developed C-D III–V complication). Out of all readmitted patients, 9.29% and 16.67% were readmitted within 2 days following inpatient and outpatient discharge, respectively. The top six reasons for all readmissions were (1) intestinal obstruction without hernia (25.37%), (2) complications of surgical procedure or medical care (16.94%), (3) organ/space SSI

Table 2 Observed unadjusted rates of 30-day postoperative outcomes

Outcome, *n* (%)	Total 24,393	Inpatient 23,725 (97.26)	Outpatient 668 (2.74)	*p*
Overall morbidity[a]	3088 (12.66)	3050 (12.86)	38 (5.69)	< 0.001
Clavien-Dindo III–V[b]	1741 (7.14)	1721 (7.25)	20 (2.99)	< 0.001
Readmission (2011–2016)	1560/16008 (9.75)	1518/15537 (9.77)	42/471 (8.92)	0.54
Mortality	109 (0.45)	108 (0.46)	1 (0.15)	0.38
Reoperation	953 (3.91)	940 (3.96)	13 (1.95)	0.008
Prolonged operative time[c]	5980 (24.52)	5919 (24.95)	61 (9.13)	< 0.001

[a] Wound infection, pneumonia, urinary tract infection, VTE, cardiac complication, shock/sepsis, unplanned intubation, bleeding requiring transfusion, renal complications, on ventilator > 48 h, or organ space SSI

[b] III, cardiac complication, renal complication, organ space surgical site infection, reoperation; IV, shock/sepsis, unplanned intubation, on ventilator > 48 h; V, mortality

[c] Defined as operative time greater than 75th percentile for each CPT code (44,620 > 102 min; 44,625 > 102 min; 44,227 > 180 min)

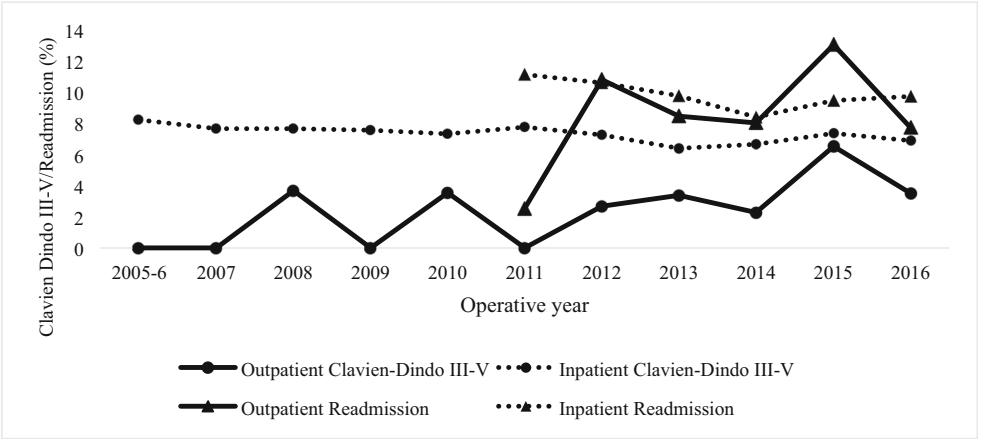

Fig. 2 Proportion of Clavien-Dindo III–V surgical complications and readmissions over the last decade (outpatient Clavien-Dindo III–V, $p = 0.46$; outpatient readmission, $p = 0.47$; inpatient Clavien-Dindo III–V, $p = 0.61$; inpatient readmission, $p = 0.03$)

(11.24%), (4) other (10.45%), (5) other gastrointestinal disorder (8.87%), and (6) and superficial/deep incisional SSI (8.52%). Identical reasons for readmission were obtained for inpatients with the following proportions (and in the same order): (1) 25.41%, (2) 16.61%, (3) 11.34%, (4) 10.34%, (5) 8.98%, and (6) 8.71%; however, reasons for readmission

Table 3 Multivariable logistic regression analysis. Risk factors for Clavien-Dindo III–V surgical complications and readmission

	Clavien-Dindo III–V[a]		Readmission	
Factors	OR (95% CI)	*p*	OR (95% CI)	*p*
Setting				
Inpatient	Reference			
Outpatient	0.43 (0.28–0.68)	< 0.001		
Age group, years				
< 65	Reference		Reference	
≥ 65	0.98 (0.87–1.10)	0.74	0.90 (0.79–1.02)	0.10
Male	–		–	
Race				
White	Reference		Reference	
Black	1.36 (1.16–1.59)	< 0.001	1.13 (0.94–1.35)	0.31
Other[b]/unknown	1.03 (0.88–1.20)	0.73	0.96 (0.82–1.13)	0.68
ASA classification				
I–II	Reference		Reference	
III	1.53 (1.37–1.71)	< 0.001	1.22 (1.09–1.37)	0.001
IV–V	2.74 (2.10–3.57)	< 0.001	1.50 (1.08–2.10)	0.02
BMI ≥30 kg/m^2			0.90 (0.79–1.02)	0.10
Current smoker	1.17 (1.03–1.32)	0.01	1.00 (0.88–1.15)	0.95
Diabetes	0.90 (0.77–1.05)	0.19	0.94 (0.79–1.11)	0.49
History of COPD	1.46 (1.17–1.81)	0.001	1.47 (1.14–1.90)	0.003
Hypertension	1.10 (0.99–1.24)	0.07	1.07 (0.95–1.21)	0.26
Dyspnea	1.31 (1.08–1.59)	0.005	0.94 (0.73–1.21)	0.62
Steroid use	1.71 (1.44–2.02)	< 0.001	1.60 (1.33–1.92)	< 0.001
Bleeding disorder	1.41 (1.13–1.76)	0.002	1.81 (1.43–2.29)	< 0.001
Partial/total dependency	1.85 (1.45–2.35)	< 0.001	1.45 (1.06–1.99)	0.02

OR, odds ratio; *CI*, confidence interval; *ASA*, American Society of Anesthesiology; *COPD*, chronic obstructive pulmonary disease

Models adjusted for variables with $p < 0.25$ from unadjusted analysis

[a] III: cardiac complication, renal complication, organ space surgical site infection, reoperation; IV: shock/sepsis, unplanned intubation, on ventilator > 48 h; V: mortality

[b] Asian, Native Hawaiian/Pacific Islander, or American Indian/Alaska Native

Table 4 Clinical characteristics of patients who are at a significant risk of Clavien-Dindo III–V complications and readmission

Clavien-Dindo III–V[a]	Readmission
ASA > II	ASA > II
Current smoking	
History of COPD	History of COPD
Dyspnea	
Steroid use	Steroid use
Bleeding disorder	Bleeding disorder
Partial/total dependency	Partial/total dependency

ASA, American Society of Anesthesiology; *COPD*, chronic obstructive pulmonary disease

[a] III: cardiac complication, renal complication, organ space surgical site infection, reoperation; IV: shock/sepsis, unplanned intubation, on ventilator > 48 h; V: mortality

following OSCs were somewhat different: (1) complications of surgical procedure or medical care (27.03%), (2) intestinal obstruction without hernia (24.32%), (3) other (13.51%), (4) organ/space SSI or abdominal pain (both 8.11%), (5) pulmonary embolism/DVT requiring therapy and other gastrointestinal disorders (both 5.41%), and (6) fluid and electrolyte disorders (2.7%).

Discussion

There is an increasing trend in the percentage of stoma closures being performed as outpatient procedures within the USA, which reflects the increasing bank of evidence of the safety of such practice. In 2016, 4.14% of all stoma closures reported to NSQIP were performed on an outpatient basis, up from 3.16% in 2005–2006. Though concerns of early discharge after OSC have been debated, our study is the first to demonstrate significantly less morbidity and no difference in readmission for patients undergoing OSC compared to ISC. We show that highly selective performance of OSC can be safe and acceptable and that identified risk factors can help predict readmission and complications.

The readmission rate of 8.92% for OSC is comparable and not statistically different from the ISC rate of 9.77%. These results are consistent with those of Kaladay et al., who identified a readmission rate of 10.7% for their ambulatory, or OSC, patients, compared to a 13.3% rate for their ISC cohort.[8] An interesting observation is the median time for readmission, which was 6 days for OSC versus 5 days for ISC, with only 16.67% of OSC cases being readmitted within 2 days. This suggests that OSC cases that required readmission initially do well at home before coming back to the hospital, implying that pain control and initial tolerance of a diet may not be the factors prompting readmission and that more than likely readmission may be linked to a diagnosis of ileus/partial small bowel obstruction, as has been previously reported.[11]

Significant differences were observed in the surgical complication rate, with an observed rate of 2.99% with OSC compared to 7.25% in ISC cases ($p < 0.001$). However, it is important to recognize that the OSC patients were significantly healthier than their ISC counterparts. This is evidenced by significantly lower ASA classification and lower rates of comorbidities among OSC patients, which is also observed in prior studies.[8–10,17]

Further analysis of comorbidities and patient clinical factors identified a specific subset associated with increased risk of C-D III–V complications and readmission after stoma reversal, namely ASA > II, current smoking status, COPD, hypertension, dyspnea, steroid use, bleeding disorder, and partial/total dependency. These factors have previously been shown to be associated with a higher risk of morbidity and mortality following stoma closure.[18,19] Upon examining patients regardless of their LOS, it became apparent that there was an observable positive correlation between readmission rates and complications and the number of risk factors. In fact, with no risk factors, readmission rate was 8.09% and complication rate was 4.75%, while with ≥ 2 risk factors, the rates increase to 13.07% and 11.50% respectively ($p < 0.001$). Combining this information with the knowledge that the

Table 5 Risk for Clavien-Dindo III–V complications and readmission after stoma closure

				Predicted risk	
Risk categories	C-D III–V/readmission	C-D III–V[a] risk	Readmission risk	C-D III–V risk (95% CI)	Readmission risk (95% CI)
0 risk factors[b]	42.56%/50.41%	4.75%	8.09%	4.99% (4.62–5.34%)	8.28% (7.77–8.86%)
1 risk factor	38.48%/39.57%	7.63%	9.79%	7.28% (6.91–7.65%)	10.15% (9.52–10.78%)
≥ 2 risk factors	18.96%/10.02%	11.50%	13.07%	11.78% (10.95–12.60%)	15.82% (14.23–17.42%)

C-D, Clavien-Dindo

[a] III: cardiac complication, renal complication, organ space surgical site infection, reoperation; IV: shock/sepsis, unplanned intubation, on ventilator > 48 h; V: mortality

[b] Clinical risk factors from Table 4

safety of OSC mirrors that of ISC, it becomes apparent that low-risk patients should be offered the opportunity to have their stoma reversed on an outpatient basis.

Another interesting observation from this study is that the rate of prolonged operative time was significantly lower for OSC compared to ISC. Prolonged operative time is a good surrogate marker of difficulty surgery, and is well known to be associated with poorer outcomes and increased complications.[20,21] It is therefore not unexpected to find that the rate of prolonged operative time was lower for OSC cases, as significant surgical difficulty would likely deter the surgeon from sending the patient home within the first day.

The implications of this study are far reaching and could impact not only patients requiring stoma reversal, but also the hospital systems in which they are managed. There is an observable trend across many fields of surgery to shorten hospital stays, thus lowering health care costs, shortening waiting list, and providing patients with shorter absence from the work place and a lessened risk of hospital-borne infection.[22–24] Kaladay et al. highlight the financial benefit of OSC at a single institution, showing that even when taking into account the cost of readmissions, OSC was 23% less costly than ISC.[8]

This study highlights that selecting the appropriate patients for OSC is essential, as the risk of complication or readmission increases substantially as the number of clinical risk factors increases. Thus, in order to fully exploit the potential benefit of OSC, a rigorous selection process needs to be employed. Tools currently exist and are utilized to detect patients at high risk for ambulatory anesthesia,[25,26] and as such the development of a risk-scoring system is the next logical step to help guide the suitability of a patient for OSC or ISC.

Future prospective studies are required to evaluate the implications of performing a higher proportion of cases in an outpatient setting. It may be necessary to employ such measures as frequent postoperative phone calls, which have been shown to be effective and welcomed by patients,[27–29] or to develop a mobile app to monitor progression at home and highlight patients at risk of morbidity, allowing interventions aimed at preventing readmission.[30,31]

This study has several limitations, relating in part to its retrospective nature and the fact that the information is drawn from the NSQIP database that relies on accurate coding of Current Procedural Terminology codes. As a retrospective study, it suffers from confounding by indication, and therefore it is important to note that the patient populations differ vastly when comparing OSC to ISC, and must be taken into consideration when interpreting the results. In addition, there is no method by which to include the indication for the initial surgery, such as inflammatory bowel disease, trauma, or cancer, as this is not captured by NSQIP. Nevertheless, the NSQIP database has the strengths of large sample sizes, and capturing readmissions of patients to hospitals other than the primary site of surgery, thus enhancing readmission statistical accuracy.

Conclusion

An increasing trend is observed in the percentage of stoma closures being performed as outpatient procedures. Appropriate selection of patients preoperatively who are suitable candidates for OSC can be helpful in managing patient expectations and hospital resources. A randomized-controlled trial is needed to further assess the safety and feasibility of OSC; however, the prospect of an ERP for stoma closures and the benefits to both patient and hospital are there to be seen.

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Contribution James P. Taylor – Concept, design, interpretation, drafting work, writing manuscript
Miloslawa Stem – Concept, design, data analysis and interpretation, writing manuscript
Sophia Y. Chen – Design, interpretation, revising manuscript
David Yu – Design, interpretation, revising manuscript
Sandy H. Fang – Manuscript revision and interpretation
Susan L. Gearhart – Manuscript revision and interpretation
Bashar Safar – Manuscript revision and interpretation
Jonathan E. Efron – Concept, design, revising manuscript

Compliance with Ethical Standards

This study was reviewed and approved by the Institutional Review Board of the Johns Hopkins University School of Medicine.

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