Obesity Surgery (2019) 29:15–22
https://doi.org/10.1007/s11695-018-3489-0

ORIGINAL CONTRIBUTIONS

A Nationwide Safety Analysis of Discharge on the First Postoperative Day After Bariatric Surgery in Selected Patients

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Published online: 17 September 2018

Abstract

Background Enhanced recovery after surgery has led to early recovery and shorter hospital stay after laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic sleeve gastrectomy (LSG). This study aims to assess feasibility and outcomes of postoperative day (POD) 1 discharge after LRYGB and LSG from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) 2015 dataset.

Methods Patients who underwent elective LRYGB and LSG and were discharged on POD 1 and 2 were extracted from the MBSAQIP dataset. A 1:1 propensity score matching was performed between cases with POD 1 vs POD 2 discharge, and the 30-day outcomes of the cohorts were compared.

Results A total of 80,464 patients met the study criteria: 8862 LRYGB and 31,370 LSG cases, which were discharged on POD 1, and matched 1:1 with those discharged on POD 2. Within the LRYGB cohort, patients discharged on POD 2 had higher all-cause morbidity (7.5% vs 6.1%; $p < 0.001$) and 30-day re-intervention (2.0% vs 1.5%; $p = 0.004$) in comparison with patients discharged on POD 1. There were no statistical differences with respect to serious morbidity (0.5% vs 0.4%; $p = 0.15$), 30-day readmission (4.9% vs 4.5%; $p = 0.2$), and 30-day reoperation (1.3% vs 1.2%; $p = 0.7$). Within the LSG cohort, patients discharged on POD 2 had higher all-cause morbidity (4.2% vs 3.4%; $p < 0.001$), serious morbidity (0.4% vs 0.3%; $p < 0.001$), 30-day re-intervention (1.0% vs 0.6%; $p < 0.001$), and 30-day readmission (2.9% vs 2.5%; $p = 0.002$) in comparison with patients discharged on POD 1.

Conclusions Early discharge on POD 1 may be safe in a selective group of bariatric patients without significant comorbidities.

Keywords Morbid obesity · Gastric bypass · Roux-en-Y · RYGB · Complication, enhanced recovery, readmission, sleeve gastrectomy, bariatric

Presented at the SAGES 2018 Annual Meeting (April 11–14, 2018, Seattle, Washington)

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Introduction

For the past two decades, a laparoscopic approach to sleeve gastrectomy (LSG) and Roux-en-Y gastric bypass (LRYGB) has become the standard of care in bariatric surgery [1]. Improvement of the perioperative care and safety of these procedures has been of significant interest for bariatric surgeons around the world, with more recent emphasis on the feasibility and efficiency of the enhanced recovery pathways [2–11].

Currently, the average length of hospital stay for the majority of patients undergoing stapling bariatric surgery is 2–3 days. With the goal of further optimizing the postoperative care of these patients, few studies have demonstrated the safety of even earlier discharge [2–6]. Accelerated recovery focuses on having shorter hospital stays without adversely affecting morbidity.

The aim of this study was to use the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database to evaluate the 30-day outcomes of hospital discharge on postoperative day (POD) 1 after the two most commonly performed stapling bariatric procedures (LRYGB and LSG), comparing them with outcomes from discharge on POD 2.

Methods

Data Source

The 2015 MBSAQIP participant use file (PUF) was utilized for the study. The MBSAQIP-PUF is one of the largest bariatric specific clinical dataset and includes 168,093 bariatric cases from 742 centers performed between January 1, 2015 and December 31, 2015. It contains approximately 200 variables relating to patient-level data (preoperative patient characteristics, procedure characteristics, 30-day outcomes, and details of 30-day reoperation, readmission, or interventions) and does not identify hospitals, health care providers, or patients. Prospectively collected data are based on previously standardized definitions for preoperative, intraoperative, and postoperative variables specific to bariatric surgery. Collection and audit of such data by dedicated trained reviewers maintains data integrity at each participating center.

Patient Identification

The Institutional Review Board approved this study under exempt status, as the data were publically available in a de-identified manner. Patients undergoing primary LRYGB and LSG were identified within MBSAQIP 2015 Participant User File using the Current Procedural Terminology (CPT) codes 43664, 43665, and 43775. To reflect a typical patient population, inclusion was restricted to patients with a body mass index (BMI) of 35–65 kg/m ^{2}. Exclusion criteria comprised of (1) patients who were discharged on the same day of surgery and after POD 2, (2) patients who underwent bariatric surgery via other approaches (hand assisted, open, single incision, and natural orifice transluminal endoscopic surgery), (3) revision surgeries, and (4) non-stapling procedures or emergency procedures. We also excluded patients who were greater than 65 years old, with a partially or totally dependent functional status, with chronic oxygen dependence, therapeutic anticoagulation, or renal insufficiency, as well as those requiring dialysis preoperatively, and American Society of Anesthesiology (ASA) class 4 and higher (moribund).

Propensity Matching

A 1:1 (POD 1:POD 2) propensity score-matched analysis was performed. Patients were matched based on factors that have been previously shown to be associated with early discharge and increased risk of perioperative morbidity and mortality following bariatric surgery [2–6]. These factors included age, gender, race, BMI, history of diabetes mellitus (DM), hypertension requiring medications (HTN), history of myocardial infarction (MI), chronic obstructive pulmonary disease (COPD), sleep apnea, use of a mobility device, chronic corticosteroid therapy, history of venous thromboembolism (VTE) (composite of previous history of deep venous thrombosis and pulmonary embolism), ASA class, operative time, and procedure performed. The propensity scores were estimated using a logistic regression model involving these predictors, resulting in a score on the scale of the linear predictor. Balance was assessed using absolute standardized mean differences, which are the absolute value of the difference in means between groups, expressed as a percentage of the standard deviation within treated patients.

Primary and Secondary Outcomes of Interest

Two primary composite outcomes of interest included 30-day all-cause morbidity outcome and a serious morbidity outcome.

All-cause morbidity comprised 30-day unplanned admission to the intensive care unit (ICU), readmission, reoperation, re-intervention, surgical site infection (SSI) (composite of superficial and deep SSI), organ/space SSI, wound disruption, deep vein thrombosis (vein thrombosis requiring therapy), pulmonary embolism, postoperative pneumonia, ventilator use for > 48 h, intraoperative or postoperative myocardial infarction, intraoperative or postoperative cardiac arrest requiring cardiopulmonary resuscitation (CPR), stroke or cerebrovascular event (CVA), coma lasting more than 24 h, unplanned intubation, acute renal failure, progressive renal insufficiency, postoperative urinary tract infection (UTI), intraoperative or postoperative transfusion performed within 72 h of surgery, peripheral nerve injury, postoperative sepsis, postoperative septic shock, incisional hernia, and mortality.

A composite of serious morbidity outcome was dictated by the Clavien-Dindo type IV and V complications [12, 13]. Class IV complications were defined as organ dysfunction requiring admission to the ICU and included acute renal failure, stroke, cardiac arrest, myocardial infarction, ventilator use > 48 h, unplanned re-intubation, pulmonary embolism, and septic shock within 30 days. Class V complications included 30-day mortality.

Secondary outcomes of interest included operative time, length of hospital stay (LOS), 30-day rates of readmission, reoperation, intervention, and individual complications.

Statistical Analysis

Continuous variables were summarized by medians and interquartile ranges (IQR) or mean and standard deviation, while categorical variables were summarized by counts and percentages. The matched POD 1 and POD 2 cohorts for individual procedures were compared with respect to baseline characteristics, intraoperative factors, and 30-day outcomes using two sample *t* tests for continuous variables and chi-square analysis or Fisher's exact test for categorical variables. All statistical analyses were two-tailed and performed using R (R Project, version 3.2.3, 2015-12-10) at significance level of $p \leq 0.05$.

Results

Patient Demographics

In total, 80,464 patients met inclusion criteria, and included 8862 LRYGB (11%) and 31,370 LSG (39%) cases, which were discharged on POD 1. These patients were matched with the same number of patients per group that were discharged on POD 2. Standardized differences for propensity-matched populations were all ≤ 0.1 and diagnostics of propensity score distributions revealed excellent overlap.

Table 1 shows the preoperative characteristics between the two groups after matching for LSG and LRYGB, respectively. Following propensity score matching within the LSG cohort, there was no statistically significant difference between the two groups with respect to age, gender, HTN, MI, COPD, mobility device, chronic corticosteroid therapy, venous stasis, VTE, percutaneous coronary intervention (PCI), previous surgery, and ASA class. Despite matching, there were statistically significant differences with respect to distribution of race ($p \leq 0.001$), median BMI ($p \leq 0.001$), proportion of patients with DM ($p = 0.042$) and sleep apnea ($p \leq 0.001$), and median operative time ($p \leq 0.001$).

Within the LRYGB cohort, there were no statistical differences between the POD 1 and POD 2 cohorts for most of the preoperative characteristics; the only exception being the median BMI, which was statistically higher for the POD 2 cohort ($p = 0.007$). This small but statistically significant difference for some of the preoperative characteristics despite matching could be attributed to the inadequate controls available for matching.

Surgical Outcomes

Table 2 details the 30-day comparative outcomes (POD 1 vs POD 2) for the LSG and LRYGB cohorts. Within the LSG cohort, patients discharged on POD 2 had higher all-cause morbidity (composite of 26 adverse events, 4.2% vs 3.4%; $p < 0.001$) and serious morbidity (defined as class IV or V Clavien-Dindo complication, 0.4% vs 0.3%; $p < 0.001$). With respect to the other secondary outcomes, patients within the POD 2 cohort experienced higher incidence of 30-day re-interventions (1.0% vs 0.6%; $p < 0.001$), 30-day readmission (2.9% vs 2.5%; $p = 0.002$), unplanned readmission within 30 days (0.3% vs 0.1%; $p \leq 0.001$), organ space SSI (0.14% vs 0.07%; $p = 0.006$), and perioperative transfusion (0.1% vs 0.03%; $p \leq 0.001$) in comparison with patients discharged on POD 1 (Table 3). There were no statistical differences with respect to 30-day reoperation (0.5% vs 0.6%; $p = 0.17$).

Within the LRYGB cohort, patients discharged on POD 2 had higher all-cause morbidity (7.5% vs 6.1%; $p < 0.001$). However, there was no statistical difference with respect to serious morbidity (0.5% vs 0.4%; $p = 0.15$). In terms of secondary outcomes for the LRYGB cohort, patients discharged on POD 2 experienced a higher incidence of 30-day re-intervention (2.1% vs 1.5%; $p = 0.004$), perioperative transfusion (0.2% vs 0.1%; $p = 0.014$), and postoperative UTI (0.4% vs 0.2%; $p = 0.034$) in comparison with patients discharged on POD 1 (Table 3). There were no statistically significant differences with respect to 30-day readmission (4.9% vs 4.5%; $p = 0.2$) and 30-day reoperation (1.3% vs 1.2%; $p = 0.7$).

Discussion

This work represents one of the few studies derived from the national databases that shows the safety and feasibility of POD 1 discharge in comparison with propensity-matched POD 2 discharges following elective bariatric surgery. The data for this study was extracted from the bariatric specific MBSAQIP database which offers advantages over other general surgery national databases. Participating centers in MBSAQIP registry are accredited bariatric surgery centers, at which minimum standards are met regarding staffing, support, and perioperative care protocols of bariatric patients. In addition, the MBSAQIP-PUF includes all the bariatric

Table 1 Baseline characteristics of the LSG and LRYGB cohort groups after propensity matching

Characteristic	Laparoscopic sleeve gastrectomy cohort (*n* = 62,740)			Laparoscopic Roux-en-Y gastric bypass cohort (*n* = 17,724)		
	Discharge day 1 (*n* = 31,370)	Discharge day 2 (*n* = 31,370)	*p* value	Discharge day 1 (*n* = 8862)	Discharge day 2 (*n* = 8862)	*p* value
Age (year), median (IQR)	43 (34–51)	43 (34–51)	0.47	43 (35–51)	43 (35–52)	0.42
Sex			0.83			0.99
Female, % (*n*)	81.1 (25,428)	80.9 (25,406)		78.4 (6943)	78.3 (6941)	
Male, % (*n*)	18.9 (5942)	19.0 (5964)		21.7 (1919)	21.7 (1921)	
Race			< 0.001			0.22
White, % (*n*)	73.9 (23,428)	71.8 (22,525)		79.9 (7076)	80.6 (7145)	
Black, % (*n*)	17.9 (5621)	18.6 (5833)		12.5 (1103)	12.3 (1093)	
Other, % (*n*)	8.3 (2595)	9.6 (3012)		7.7 (683)	7.1 (624)	
BMI (kg/m^2), median (IQR)	43.5 (39.98–48.42)	43.7 (40.08–48.74)	< 0.001	44.5 (40.5–49.6)	44.8 (40.74–50.02)	0.007
Comorbidities						
Diabetes, % (*n*)	20.4(6403)	21.1 (6611)	0.042	30.0 (2662)	29.6 (26,323)	0.53
Hypertension, % (*n*)	43.6 (13,674)	43.9 (13,779)	0.40	47.5 (4213)	47.1 (4177)	0.6
Sleep apnea, % (*n*)	32.6 (10,239)	34.3 (10,751)	< 0.001	35.9 (3179)	35.6 (3155)	0.72
COPD, % (*n*)	1.1 (335)	1.1 (346)	0.7	1.2 (105)	1.1 (95)	0.52
History of myocardial infarction, % (*n*)	0.7 (222)	0.8 (239)	0.45	0.9 (83)	0.9 (84)	> 0.99
Previous PCI, % (*n*)	1.1 (344)	1.2 (361)	0.54	1.4 (122)	1.5 (134)	0.49
History of venous thromboembolism, % (*n*)	1.2 (366)	1.2 (390)	0.4	1.3 (114)	1.3 (114)	0.99
Preoperative venous stasis, % (*n*)	0.7 (205)	0.7 (218)	0.56	1.1 (96)	0.9 (80)	0.26
Chronic steroid use, % (*n*)	1.4 (425)	1.4 (439)	0.66	0.9 (86)	0.9 (87)	> 0.99
Patient's ambulation limited, % (*n*)	1.0 (316)	1.0 (327)	0.69	1.5 (253)	1.4 (120)	0.45
Smokers, % (*n*)	9.2 (2899)	9.4 (2942)	0.56	8.6 (757)	9.4 (830)	0.058
ASA class, % (*n*)			0.46			0.55
I, II	28.3 (8870)	28 (8785)		18.6 (1646)	18.2 (1614)	
III	71.7 (22,500)	72 (22,585)		81.4 (7216)	81.8 (7248)	

BMI body mass index, *COPD* chronic obstructive pulmonary disease, *PCI* percutaneous coronary intervention, *ASA class* American Society of Anesthesiologist classification of Physical Health, % percentage, *n* count of patients

operations performed nationally at the bariatric centers in comparison with sampled protocols included in other general surgery national datasets. Therefore, MBSAQIP provides a more comprehensive representation of bariatric surgery data in real life.

The study was designed to assess the safety of POD 1 discharge in comparison with POD 2 discharge according to the type of bariatric procedure performed. LRYGB and LSG, being the most commonly performed bariatric procedures [1], were considered for analysis. Patients who underwent other bariatric procedures, such as adjustable gastric banding, and duodenal switch, or via uncommon approaches such as open and single incision were excluded because these procedures did not represent current national bariatric practices [1]. Although being increasingly adopted, discharge on day 1 following bariatric surgery may be considered for selected group of healthier patients. In order to represent the same, patients with higher preoperative risk (age greater than 65 years, partially or totally dependent functional status, with chronic oxygen dependence, therapeutic anticoagulation, renal insufficiency, those requiring dialysis preoperatively, ASA class 4 and higher, revision surgeries, and emergent procedures) were excluded from the analysis. Patients discharged on day 0 (1.8%) were excluded from the analysis as it does not represent common practice. Assuming that patients who were discharged early were part of either enhanced recovery protocols or fast track pathway, we excluded patients with postoperative length of stay greater than 2 days (26.4%) in order to assess the feasibility of discharge on POD 1 [14]. Additionally, the latter group may represent patients being managed for high-risk comorbidities or postoperative complications (medical or surgical). Thus, with the aforementioned criterion, the study cohort included patients with average preoperative risk and they were anticipated to experience an uncomplicated postoperative course.

Table 2 30-day outcomes of the LSG and LRYGB cohorts after propensity matching

30-day outcomes	Laparoscopic sleeve gastrectomy cohort ($n = 62{,}740$)			Laparoscopic Roux-en-Y gastric bypass cohort ($n = 17{,}724$)		
	Discharge day 1 ($n = 31{,}370$)	Discharge day 2 ($n = 31{,}370$)	*p* value	Discharge day 1 ($n = 8862$)	Discharge day 2 ($n = 8862$)	*p* value
Follow-up, % (*n*)	95.5 (29,945)	96.1 (30,136)	< 0.001	96.3 (8536)	96.2 (8524)	0.66
Composite morbidity, % (*n*)	3.4 (1050)	4.2 (1302)	< 0.001	6.1 (544)	7.5 (667)	< 0.001
Serious morbidity, % (*n*)	0.3 (78)	0.4 (131)	< 0.001	0.4 (34)	0.5 (48)	0.15
Mortality, % (*n*)	0.03 (9)	0.05 (17)	0.17	0.07 (6)	0.09 (8)	0.79
Reoperation, % (*n*)	0.5 (150)	0.6 (176)	0.17	1.2 (105)	1.3 (1110)	0.73
Readmission, % (*n*)	2.5 (780)	2.9 (904)	0.002	4.5 (400)	4.9 (437)	0.20
Intervention, % (*n*)	0.6 (202)	1.0 (317)	< 0.001	1.5 (131)	2.1 (183)	0.004
Unplanned readmission to ICU, % (*n*)	0.1 (40)	0.3 (92)	< 0.001	0.3 (22)	0.3 (29)	0.40
Days to postoperative assessment, median (IQR)	13 (8–18)	14 (9–20)	< 0.001	14 (9, 21)	14 (9, 21.5)	0.87
Discharge disposition			0.28			0.17
Expired, % (*n*)	0.01 (2)	0.01 (2)		0.01 (1)	0	
Facility which was home, % (*n*)	0.11 (33)	0.1 (32)		0.03 (3)	0.08 (7)	
Home, % (*n*)	99.7 (31,273)	99.7 (31,274)		99.8 (8844)	99.7 (8837)	
Rehabilitation, % (*n*)	0	0.01 (2)		0.01 (1)	0	
Separate acute care, % (*n*)	0.05 (17)	0.06 (18)		0.01 (1)	0.08 (7)	
Skilled care, not home, % (*n*)	0.01 (2)	0.03 (9)		0.01 (1)	0	
Unskilled facility, not home, % (*n*)	0.07 (23)	0.07 (21)		0.03 (3)	0.01 (1)	
Unknown, % (*n*)	0.06 (20)	0.04 (12)		0.09 (8)	0.1 (10)	

ICU intensive care unit, % percentage, *n* count of patients

Several studies have been published to suggest that early discharge after bariatric surgery can be safe in selected patients. Howell et al. [15] published a single-center study of 330 LRYGB cases completed in 2015, of which 36.7% were discharged on POD 1, and only 3.9% were readmitted. Mahmood et al. [16] similarly showed that 52.9% of 506 patients undergoing LSG and LRYGB in a single center were successfully discharged on POD 1, with no associated increase in readmission rates. They suggested that lower BMI (< 50) is associated with POD 1 discharge, and patients undergoing LSG are 3.3 times more likely to require more than 1 day in-hospital recovery after surgery. Thomas et al. [6] also demonstrated that early discharge within 23 h of LRYGB was feasible with only a 1.8% readmission rate. The literature supports early discharge as feasible and safe in certain patients; however, some surgeons remain hesitant about discharging these high-risk patients too early, missing early signs of complications, namely, leaks, or increasing readmission rates due to dehydration [17–20]. Our analysis found that 26% of LRYGB and 45% of LSG patients were discharged on POD 1, which is higher than our prior study (18% for LRYGB and 34% for LSG) [2]. By comparing the early postoperative outcomes between those discharged on POD 1 and those discharged on POD 2, we found that discharge on POD 1 after LSG or LRYGB did not increase morbidity or readmission rates. However, one should exercise caution when interpreting these findings. These data do not imply that every patient after LRYGB and LSG can be routinely discharged safely on POD 1. The findings indicate that POD 1 discharge may be a safe practice in the subset of patients, who are clinically ready to be discharged on POD 1.

We found that the readmission rate was no different on POD 1 vs POD 2 for LRYGB (4.5% POD 1 and 4.9% POD 2, $p = 0.2$) but it was significantly different for LSG, with a higher readmission rate for patients discharged on POD 2 (2.5% POD 1 and 2.9% POD 2, $p = 0.002$). Similar results were seen on the composite morbidity on both cohort groups (LSG: 3.4% POD 1 vs 4.2% POD 2, $p < 0.001$; LRYGB: 6.1% POD 1 vs 7.5% POD 2, $p < 0.001$). The observed differences may be likely attributable to the large sample size and to the fact that patients discharged on POD 2 might have more comorbidities that required them to return to the hospital. However, these differences are minimal and may not be clinically significant.

Since the introduction of enhanced recovery pathways, successful implementation of standardized pathways and multidisciplinary approaches have led to improved perioperative care and shorter postoperative recovery in various surgical fields [2, 21, 22]. Multiple strategies including detailed preoperative work-up, medical management of comorbidities,

Table 3 Individual complications of the LSG and LRYGB cohorts after propensity matching

Individual complications	Laparoscopic sleeve gastrectomy cohort ($n = 62{,}740$)			Laparoscopic Roux-en-Y gastric bypass cohort ($n = 17{,}724$)		
	Discharge day 1 ($n = 31{,}370$)	Discharge day 2 ($n = 31{,}370$)	p value	Discharge day 1 ($n = 8862$)	Discharge day 2 ($n = 8862$)	p value
Superficial SSI, % (n)	0.2 (67)	0.2 (66)	> 0.99	0.5 (45)	0.7 (64)	0.084
Deep SSI, % (n)	0.02 (5)	0.02 (6)	> 0.99	0.03 (3)	0.08 (7)	0.34
Organ space SSI, % (n)	0.07 (21)	0.1 (44)	0.006	0.1 (9)	0.2 (16)	0.23
Acute renal failure, % (n)	0.02 (5)	0.03 (9)	0.42	0.02 (2)	0 (0)	0.5
Progressive renal insufficiency, % (n)	0.03 (10)	0.02 (7)	0.63	0.07 (6)	0.01 (1)	0.12
Coma within 24 h, % (n)	0 (0)	0 (1)	> 0.99	0 (0)	0 (0)	
Stroke, % (n)	0 (1)	0 (1)	> 0.99	0 (0)	0 (0)	
Cardiac arrest requiring CPR, % (n)	0.01 (2)	0.02 (5)	0.45	0.02 (2)	0.02 (2)	> 0.99
Myocardial infarction, % (n)	0.01 (4)	0.02 (7)	0.55	0.02 (2)	0.02 (2)	> 0.99
Peripheral nerve injury, % (n)	0 (0)	0 (0)		0.01 (1)	0 (0)	> 0.99
Pneumonia, % (n)	0.06 (18)	0.06 (20)	0.87	0.1 (12)	0.2 (14)	0.84
Pulmonary embolism, % (n)	0.07 (22)	0.07 (21)	> 0.99	0.09 (8)	0.08 (7)	> 0.99
Vein thrombosis requiring therapy, % (n)	0.1 (40)	0.2 (60)	0.057	0.09 (8)	0.09 (8)	> 0.99
Sepsis, % (n)	0.04 (14)	0.04 (12)	0.84	0.02 (2)	0.09 (8)	0.11
Septic shock, % (n)	0.01 (3)	0.03 (8)	0.23	0.03 (3)	0.03 (3)	> 0.99
Transfusion within first 72 h, % (n)	0.03 (8)	0.1 (42)	< 0.001	0.08 (7)	0.2 (21)	0.014
Unplanned intubation, % (n)	0.03 (10)	0.05(15)	0.42	0.07 (6)	0.08 (7)	> 0.99
UTI, % (n)	0.2 (72)	0.3 (86)	0.30	0.2 (20)	0.4 (37)	0.034
Wound disruption, % (n)	0.02 (5)	0.02 (6)	> 0.99	0 (0)	0.06 (5)	0.062
Incisional hernia, % (n)	0.07 (22)	0.1 (32)	0.22	0.03 (3)	0.1 (10)	0.096

SSI surgical site infection, *CPR* cardiopulmonary resuscitation, *UTI* urinary tract infection, % percentage, *n* count of patients

postoperative multimodal analgesic approach, early enteral nutrition, and patient ambulation are employed [2, 21, 22]. Blanchet et al. [21, 23] reported POD 1 discharge in 86% patients with implementation of enhanced recovery protocols with a complication rate of 2.9%. Over a period of 5 years of implementation of enhanced recovery pathway, their mean LOS decreased from 4 to 1 day. In a randomized control trial of 116 patients who received LSG, the median length of stay decreased to 1 day following implementation of enhanced recovery protocol in comparison with 2 days for the control groups and 3 days for a historical group. There were no differences in early readmission rates or postoperative complications [24].

Several other factors play an important role in facilitating early discharge. Preoperative patient education plays a pivotal role in addressing postoperative care and discharge instructions. A team of trained bariatric support staff can serve as quintessential parts of the multidisciplinary approach, providing emotional support, encouragement, and ongoing education for the patients and family members. A standardized discharge protocol assessing the discharge readiness is important. These may include clinical factors, for instance, transition of pain control to oral medications, ability to tolerate minimal clear fluids or liquid diet, absence of signs of anastomotic leak (tachycardia), or normal results for imaging studies assessing leak (if ordered). Early morning imaging studies are generally preferred as it may provide adequate time for interpretation of results before discharge. Additionally, close proximity of the discharge destination to the bariatric center, presence of a family member or an adult during discharge, and clear understanding of the alarming signs prompting return to the nearest emergency room or the bariatric center itself are also pertinent. Currently, the American Society for Metabolic and Bariatric Surgery (ASMBS) initiative for enhance recovery is being practiced in 36 US bariatric centers. Employing New Enhanced Recovery Goals to Bariatric Surgery (ENERGY) aims to decrease the variability of fast track pathways among bariatric centers, in order to improve patient outcomes, optimize pain control, faster return to normal activities, and reduce readmission rates [25].

This study has several limitations. Data were derived from a large multicenter database and do not provide long-term data or the metabolic outcomes. There are also potential for coding errors. Lack of data with respect to the participating hospital discharge policies is another most important limitation of the study. Postoperative protocols vary from center to center and can play a role in whether patients are discharged on POD 1, POD 2, or even later as a matter of routine. Additionally, discharge criteria used by each participating institution may not be uniform across different hospital systems because centers may have variable criteria based on surgeons' practice pattern, average metabolic disease burden of the referred patients, and local home health supports. This database also lacks some social variables that may affect readiness for discharge, including patient's cultural and socioeconomic status, distance from home to the hospital, and insurance coverage [2]. Despite the limitations, this study provides a large, nationwide sample of trends and outcomes of early discharge following LRYGB and LSG.

Conclusion

We present one of the few national studies, showing that early discharge on POD 1 after LSG and LRYGB in select patients is safe and feasible. The findings would also indicate that surgeons practicing in MBSAQIP accredited centers can effectively identify patients who were ready to be discharged on POD 1, since the patients discharged on POD 2 had higher 30-day composite and serious morbidity.

Compliance with Ethical Standards

The Institutional Review Board approved this study under exempt status, as the data were publically available in a de-identified manner.

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval Statement For this type of study formal consent is not required.

Informed Consent Statement This study does not require informed consent.

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