



Fighting the obesity pandemic during the COVID-19 pandemic

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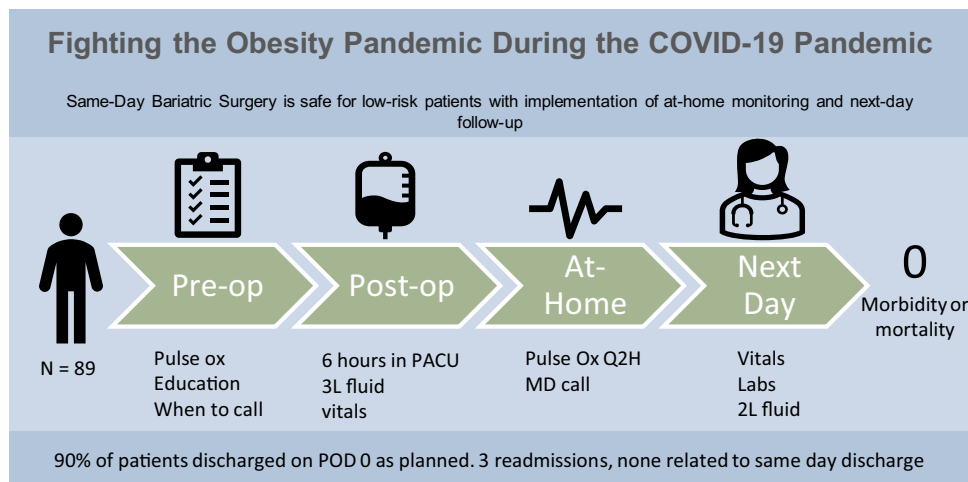
Abstract

Background The COVID-19 pandemic created delays in surgical care. The population with obesity has a high risk of death from COVID-19. Prior literature shows the most effective way to combat obesity is by weight loss surgery. At different times throughout the COVID-19 pandemic, elective inpatient surgeries have been halted due to bed availability. Recognizing that major complications following bariatric surgery are extremely low (bleeding 0–4%, anastomotic leaks 0.8%), we felt outpatient bariatric surgery would be safe for low-risk patients. Complications such as DVT, PE, infection, and anastomotic leaks typically present after 7 days postoperatively, well outside the usual length of stay. Bleeding events, severe postoperative nausea, and dehydration typically occur in the first few days postoperatively. We designed a pathway focused on detecting and preventing these early post-op complications to allow safe outpatient bariatric surgery.

Methods We used a preoperative evaluation tool to risk stratify bariatric patients. During a 16-month period, 89 patients were identified as low risk for outpatient surgery. We designed a postoperative protocol that included IV hydration and PO intake goals to meet a safe discharge. We sent patients home with a pulse oximeter and had them self-monitor their pulse and oxygen saturation. We called all patients at 10 pm for a postoperative assessment and report of their vitals. Patients returned to clinic the following day and were seen by a provider, received IV hydration, and labs were drawn. **RESULTS:** 80 of 89 patients (89.8%) were successfully discharged on POD 0. 3 patients were readmitted within 30 days. We had zero deaths in our study cohort and no morbidity that would have been prevented with postoperative admission.

Conclusion We demonstrate that by identifying low-risk patients for outpatient bariatric surgery and by implementing remote monitoring of vitals early outpatient follow-up, we were able to safely perform outpatient bariatric surgery.

Graphical abstract



Keywords Bariatric surgery · Outpatient · Same-day discharge · Sleeve · Bypass · Monitoring

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Weight loss surgery continues to be supported by medical literature as the most effective way of reducing comorbidities associated with obesity [1, 2]. The COVID-19 pandemic identified a new risk associated with obesity as obese patients were more likely to die as a result of contracting COVID-19 [3, 4]. COVID-19 continues to plague our world with new variants continuing to develop resulting in ongoing effects on hospitals, including bed shortages. At varying points during the pandemic, this has led to a freeze on elective inpatient surgeries for patients who required an overnight hospital stay [4]. The population with obesity experienced delays in their surgical care as a result [5]. In the previous decade, average length of stay after bariatric surgery was two days, but with adoption of ERAS protocols and an increasing rate of early discharge, average length of stay is decreasing to within one day [6, 7]. Advances in weight loss surgery have continued to decrease the morbidity and mortality associated with weight loss surgery [8]. Enhanced recovery pathways (ERAS) have been studied in bariatric surgery over the past 10 years and are showing earlier discharges are safe [9]. Our group had already implemented an ERAS protocol that was allowing the majority of our patients to safely go home on postoperative day (POD) 1–2. Immediately life-threatening complications like bleeding typically present within hours of surgery [7, 10], while leaks typically present on day 7 [10]. We felt that same-day discharge after an observation period of at least 6 h, with the addition of at-home monitoring of pulse and oxygen saturation, would capture any bleeding events prior to discharge, and capture any early signs of leak in time for appropriate intervention. To prevent further delay in surgical care of the obese patients during COVID-19, our group implemented an outpatient bariatric surgery protocol allowing laparoscopic Roux-en-Y gastric bypasses (LRYGB) and laparoscopic sleeve gastrectomy (LSG) patients to be safely discharged on POD 0. Our study is unique in that our group used at-home monitoring to allow for early rescue and readmission if a patient did show signs of distress.

Materials and methods

We previously designed a preoperative evaluation tool that identified bariatric patients as low risk, moderate risk, and high risk of having a morbidity associated with bariatric surgery (Table 1). Our evaluation tool used the Obesity Surgery Mortality Risk score in addition to assessment of comorbidities and functional status. While our evaluation tool goes in-depth with regard to behavioral and psychosocial readiness for surgery, for this study, we primarily used assessment of comorbidities and Obesity Surgery Mortality Risk score to identify low-risk patients. The Obesity Surgery Mortality Risk Score is a validated assessment that predicts mortality of patients

undergoing bariatric surgery (Table 2) [11, 12]. Patients with a score of 0–1 were generally placed in our low-risk group. To undergo outpatient bariatric surgery, patients had to have well-controlled comorbidities. Lastly, we assessed their functional status and their ability to make lifestyle changes as patients needed to have a good functional status and psychosocial support. We excluded patients who were moderate and high risk. During a 16-month period, 89 patients were identified as being an acceptable risk for outpatient surgery. We implemented a postoperative protocol (Fig. 1) that included IV hydration, nausea control, pain control, incentive spirometry use, vitals assessment, and ability to tolerate PO intake to meet a safe discharge. Additionally, patients had to be assessed by a physician prior to discharge. Patients were sent home with a pulse oximeter and self-monitored their heart rate and oxygen saturation. Patients were also sent home with an incentive spirometer. All patients were contacted at approximately 10 h postoperatively to assess vital signs and symptoms. Patients were also instructed to call their surgeon directly if they developed a heart rate greater than 100 or a pulse oxygen saturation less than 90%. Patients returned to the clinic on postoperative day 1 and were seen by a provider, received IV hydration, and labs were obtained. Of note, all patients received total intravenous anesthesia (TIVA), as well as “triple treatment” for nausea prior to emergence from anesthesia with promethazine (6.25 mg IV), ondansetron (4 mg IV), and dexamethasone (4 mg IV), to help control postoperative nausea. For postoperative pain control, we injected an admixture of 20 ml of liposomal bupivacaine, 30 ml of 0.25% bupivacaine, and 70 ml of normal saline in a laparoscopic transversus abdominis plane block and infiltrated around incision sites (Fig. 1). We then performed a retrospective review of patients who were selected for same-day discharge to see if there was increased mortality or morbidity defined as readmission or reoperation. This retrospective observational study was approved by our Institutional Review Board. Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at University of Tennessee Medical Center [13]. Descriptive and frequency statistics were used to describe continuous and categorical variables. SPSS Version 28 (Armonk, NY: IBM Corp.) was used to perform the analyses. Independent samples T tests were performed to look for significant differences in the means of continuous variables. Fisher's exact tests were used to look for association between patient comorbidities and length of stay greater than one day.

Results

We identified 89 patients as being candidates for having outpatient bariatric surgery from December 2020 through April 2022. Patient characteristics are detailed in Table 3. Our selection criteria for outpatient surgery were limited

Table 1 Preoperative evaluation tool for risk stratification of patients undergoing bariatric surgery

Bariatric preoperative evaluation			
Low risk/Green	Moderate risk/ Yellow	High risk/ Red	Score
0 Age < 65		3 Age > 65	
0 OSMRS A (0–1)	2 OSMRS B (2–3)	3 OSMRS C (4–5)	
0 Co morbidities are stable and controlled	3 Needs medical Clearance from specialists	5 Needs to be roundtable	
0 Demonstrating lifestyle changes	2 Has started making some lifestyle changes	3 Has not started practicing lifestyle changes	
0 Keeping a detailed food journal	2 Intermittently keeping a food journal	3 Not currently keeping a detailed food journal	
0 Eating nutrient dense foods such as lean proteins, fruits, and vegetables	2 Significantly improved diet, still struggling with protein intake	3 Currently eating high sugar, high fat foods often	
0 Avoiding fast foods and frequent dining out		3 Dining out frequently	
0 Practicing meal preparation at home	2 Struggling with meal planning and preparations	3 Has not started meal planning	
0 Started exercising regularly	2 Increasing daily physical activity	3 No deliberate exercise to note	
0 Practicing chewing and sipping	2 Intermittent practicing chewing and sipping	3 Not practicing chewing and sipping	
0 Separating fluids and solids by 30 min	2 Intermittently separating fluids and solids	3 Currently eating and drinking together	
0 Abstaining from alcohol	3 Significant decreased alcohol intake	5 Currently drinking alcohol	
0 Abstaining from tobacco	6 Significantly cut back on tobacco use	10 Currently smoking	
0 Currently taking a daily multivitamin	2 Intermittently taking a multivitamin	3 Has not started a daily multivitamin	
0 Has an active support system	3 We currently are concerned about their support system	5 Currently struggling with social support and family dysfunction	
	2 Voices financial objections	5 Current opioid use	
		3 Prior weight loss surgery	
Notes:			Total

Table 2 Obesity mortality risk score and the risk stratification [11, 12]

Risk factor	Points	
Arterial Hypertension	1	
Age > 45	1	
Male gender	1	
Body mass index > 50 kg/m ²	1	
Risk factors for pulmonary embolism	1	
Risk group	Score	Post-Op mortality
A (low risk)	0–1	0.2
B (moderate risk)	2–3	1.2
C (high risk)	4–5	2.4

to only OSMR class A or B; however, in our data analysis, we identified a patient who was OSMR class C risk but was approved for outpatient (Male, Age 46, HTN, BMI 50.2). After discussion with his advanced practice provider, we determined he was approved for outpatient surgery because of his excellent functional status and his predicted

preoperative weight loss after the 14-day liquid diet would put him at BMI < 50 and OSMR B. Eighty-four percent (n 75) of the patients were females and 16% (n 14) were males. The average BMI of our patients was 44.3 kg/m². Thirty-one patients (34.8%) underwent a LSG and 58 patients (65.2%) underwent a LRYGB. There were also 6 patients who

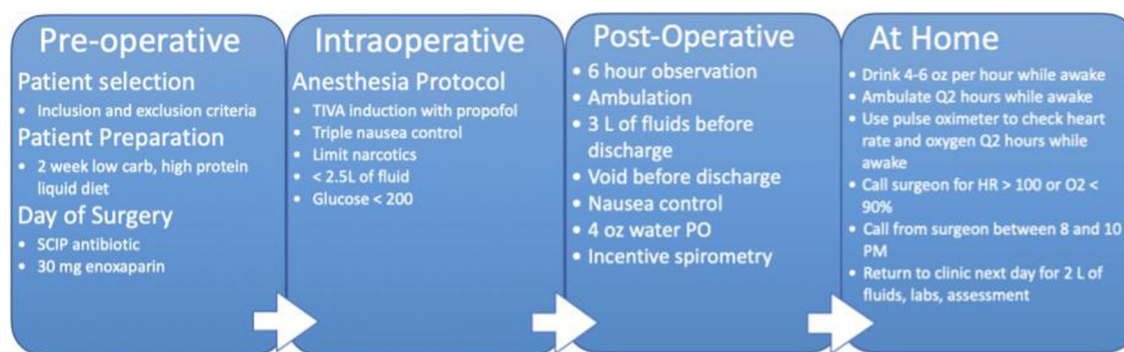


Fig. 1 Outpatient bariatric surgery protocol, including preoperative, intraoperative, postoperative, and at-home phases

Table 3 Characteristics of patients selected to undergo outpatient bariatric surgery

Characteristics	Outpatient Bariatric Patients (n = 89)
Age (years)	42
BMI (kg/m ²)	44
Female	75 (84%)
Male	14 (15.8%)
Sleeve gastrectomy	31 (35%)
RYGB	52 (58%)
Conversion	6 (7%)
Comorbidities	
Hypertension	44.9%
Type II Diabetes	34.8%
Sleep apnea	27%
OSMR score	1.22
Length of stay (days)	0.58
Overnight hospitalizations	9 (10.1%)

underwent a conversion procedure: two patients had a band removal and bypass in the same procedure, one patient had a history of band removal during a previous operation and underwent a bypass, and three patients had conversion of a sleeve to bypass. Ninety percent of patients were successfully discharged on POD 0 (80/89) with the average length of stay being 0.48 days (Table 3).

The patients who were not discharged on POD 0 were admitted from PACU for the following reasons. Four of the nine patients who stayed overnight were admitted secondary for uncontrolled postoperative pain or uncontrolled postoperative nausea. Two patients were admitted for closer monitoring due to the difficulty of the case (mesenteric hematoma, revision with significant scar tissue). These patients were discharged on POD 1 without issue. One patient was admitted for postoperative hypertension. One patient was admitted for postoperative low-grade

tachycardia, which resolved without intervention. One patient was admitted due to impending inclement weather that might prevent safe return to the clinic the next morning. All our patients who were discharged on POD 0 had vitals within acceptable range when monitored at home. Zero of the 89 patients required reoperation related to initial surgery. We had two readmissions within thirty days in the patients who went home on POD 0. One patient was readmitted sixteen days after surgery for acute cholecystitis and underwent an uneventful laparoscopic cholecystectomy. The second readmission was on postoperative day 5 for acute onset epigastric pain with nausea and vomiting. CT abdomen showed mild dilation of the roux limb just proximal to the jejunojejunostomy. They were admitted for IV hydration and bowel rest and were discharged the next day tolerating oral intake without further issues. We also had one readmission among the 9 patients discharged on POD 1. This patient was diagnosed with a DVT and PE. They were doing well at their two-week postoperative clinic visit but subsequently fell ill and tested positive for influenza. They reported sleeping in a recliner for two days with minimal ambulation and then developed leg swelling. They were diagnosed with a DVT and pulmonary embolism. They were started on systemic anticoagulation without further issue. This patient had received a 30 mg dose of enoxaparin preoperatively, and then routine 40 mg doses every 12 h during their postoperative admission.

Independent samples T tests were performed to look for significant differences in the means of continuous variables. There were no significant differences in patient demographics between those who discharged on POD 0 and those who did not. Fisher's Exact tests were used to look for association between patient comorbidities and length of stay greater than one day. No patient comorbidities were associated with greater length of stay (Table 4).

There was a significant difference in readmission rates between the group who was discharged on POD 0 ($n = 2$, 2.5%) and those who were admitted postoperatively ($n = 1$,

11.1%) ($p=0.026$). We had no difference in mortality as this event did not occur in our patient population.

Discussion

Our data support that patients can undergo laparoscopic Roux-en-Y gastric bypass or laparoscopic sleeve gastrectomy and safely be discharged on POD 0. There are more studies detailing the safety of same-day discharge of LSG [14–19] than detailing LRYGB. These studies show no increase in mortality with same-day discharge of LSG with mixed results on increased morbidity with POD 0 discharge versus POD 1. To our knowledge, there are only four other studies that look at discharging LRYGB on POD 0 [20–23], and they report a mixed safety profile for same-day discharge of LRYGB. In 2014, Morton et al. [20] reviewed the Bariatric Outcomes Longitudinal Database to determine the safety of same-day discharge of LRYGB, and Inaba et al. [21] used the 2015 Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database to evaluate the safety of same-day discharge after LRYGB. Morton et al. examined 51,788 RYGB patients in the BOLD database and found a mortality rate of 0.1%, morbidity rate of 0.5%, and readmission rate of 3.8%. With LOS 2 days as the reference value, there was a significantly increased risk of mortality with a LOS of 0 days, and with a LOS of 1 day. There was a non-significant trend toward increased risk of serious complications with LOS of 0 days and 1 day, and no association between LOS and readmission [20]. The study by Inaba et al. was much smaller, included 9721 patients, of

which 319 were discharged on POD 0. They found a mortality rate of 0.95%, morbidity rate of 3.76%, but also no significant difference in readmission [21]. Both studies found same-day discharge to be associated with an increased risk of morbidity and mortality, but not readmission. Our study found a higher readmission rate among patients who were not discharged home on the same day. This is a different result from the prior studies mentioned which showed no significant difference in readmission rates. It is possible that our study was limited by our small sample size; we should compare the readmission rate of those discharged on POD 0 to the readmission rate of all our inpatient bariatric surgery patients from the same study period, as this group of 9 patients who failed to discharge on POD 0 is very small. Looking at total inpatient bariatric surgery patients, of which we had 255 during the study period, 13 were readmitted within 30 days, which gives us a readmission rate for inpatients of 5%, which is not significantly different from the outpatient readmission rate ($p=0.53$).

Two recent studies published in 2019 and 2021 by Leepalao et al. [22] and Nijland et al. [23] show that there is no increase in morbidity with same-day discharge after LRYGB. Leepalao et al. examined 362 patients and found a readmission rate of 3.59%, and a complication rate of 0.24%, and had 0% mortality [22]. They did not use any remote monitoring. Nijland included only 50 patients and found no mortality, but a 4% readmission rate and 4% complication rate. The studies by Leepalao and Nijland have significantly smaller sample sizes and due to the low overall morbidity and mortality in bariatric surgery, may be underpowered to detect a difference in morbidity and mortality among same-day discharge patients. The studies by Morton and Inaba are both retrospective studies from national databases, consequently there is little information regarding selection criteria for same-day discharge after bariatric surgery or whether any form of remote monitoring or early follow-up were used. In contrast, our study and the studies by Leepalao and Nijland detail a strict selection criteria for outpatient bariatric surgery which may account for the lower morbidity and mortality rates. The Nijland et al. study is the only other study we found that used at-home monitoring to allow for early identification of patient distress after same-day discharge of LRYGB. They also report a mortality rate of zero. Inaba et al. identified failure to rescue as a possible reason for increased morbidity and mortality in their study. By implementing at-home monitoring, we were able to identify if patients were not meeting parameters that would help prevent morbidity and mortality. We recognize that our study was performed at a high-volume bariatric surgery center with morbidity and mortality rates below the national average and results may not be applicable to all weight loss surgery centers. We also recognize that our study only included 89 patients and which makes it subject to a sampling bias.

Table 4 Tests of association between patient demographics and comorbidities and length of stay

Characteristics	LOS > 1	LOS < 1	<i>p</i>
Age (years)	44.4	41.7	0.57
BMI (kg/m ²)	48.1	43.9	0.22
OSMR	1.67	1.16	0.09
Gender (M/F)	2/7	12/68	0.63
Comorbidities			
Hypertension	5 (55.6%)	35 (43.8%)	0.73
Obstructive Sleep Apnea	2 (22.2%)	22 (27.5%)	1
Diabetic	5 (55.6%)	26 (32.5%)	0.27
Conversion	1 (12.5%)	5 (7.4%)	0.499
Readmission	1 (11.1%)	2 (2.5%)	0.026*

We calculated independent samples *t* tests to look for significant differences in the means of continuous variables. We calculated Fisher's exact test to look for association between patient comorbidities and length of stay greater than one day. Data are presented as frequencies except Age, BMI, and OSMR which are averages

* $p < 0.05$

LOS length of stay, OSMR Obesity Surgery Mortality Risk

We wanted to estimate the cost savings to the hospital and patient that would be achieved with same-day discharge, but unfortunately were unable to get details of charges to patients or cost to the hospital. The only estimate we were provided was the charge for a room for one night, which was quoted at \$1130.50. Discharge on POD 0 rather than POD 2 should result in a cost savings of at least \$2261. The benefits to the hospital of having an open bed are probably significantly greater.

As bed shortages are becoming less frequent, and not resulting in cancelation of elective inpatient surgeries, we must consider if we will continue offering same-day discharge to our bariatric surgery patients. Same-day discharge has benefits beyond getting patients to surgery during a pandemic; it avoids the cost of an inpatient stay, and gets patients home where they are more comfortable, more active due to the absence of bed alarms and IV tubing, and not exposed to risk of medication errors and hospital-acquired infections. Same-day discharge is not appropriate for every patient due to comorbidities, and some may still be uncomfortable with the idea of going home after major surgery, but we will continue to do same-day discharge for patients who request it and are low risk, following the same at-home monitoring and next-day follow-up protocol.

Conclusion

We demonstrated that outpatient bariatric surgery can safely be performed in selected low-risk patients with remote monitoring of vital signs and close outpatient follow-up.

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Declarations

Disclosures Dr Matthew Mancini has relationships with Olympus and CareSyntax as a consultant, additionally he receives support for academic travel from University of Tennessee Medical Center Knoxville General Surgery Department. He is also the secretary of the UT Day Surgery Advisory board for which he receives additional compensation, this does not present a conflict of interest as all bariatric surgeries are performed in the Main OR. He owns stock in Apple, which is making strides into the healthcare field but is not relevant to this paper. Dr Gregory Mancini receives fees as a consultant for CareSyntax. Dr Kleppe has also received consulting fees from CareSyntax. Drs Grubbs, Daigle, Shepherd, and Heidel have no disclosures.

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