Chapter 38
Bariatric Surgery

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BACKGROUND

Bariatric surgery is an effective long-term treatment for weight reduction [1–7], improving obesity-related comorbidities [1–7], and decreasing mortality [8, 9]. The National Institutes of Health (NIH) has developed consensus guidelines on appropriate candidates for bariatric surgery: body mass index (BMI) >40 or BMI between 35 and 40 with a serious obesity-related health problems including hypertension, diabetes mellitus (DM), hyperlipidemia, obstructive sleep apnea (OSA), obesity-hypoventilation syndrome (OHS), gastroesophageal reflux disease (GERD), and debilitating arthritis; acceptable operative risk; and ability to make necessary lifestyle changes and participate in long-term follow-up [10]. There is increasing support and evidence that bariatric surgery should be an option for patients with BMI between 30 and 35 with comorbidities [11].

The most common bariatric surgeries performed are the Roux-en-Y gastric bypass (RYGB) (open and laparoscopic), laparoscopic adjustable gastric band (LAGB), and the laparoscopic sleeve gastrectomy (LSG). A description of the most common surgeries is shown in Table 38.1. The 30-day mortality rate is approximately 0.1 % for each of these bariatric surgeries [1, 3, 5–7].

PREOPERATIVE EVALUATION

- The purpose of the preoperative evaluation for bariatric surgery is to assess the risk of complications, to identify and optimize medical conditions that increase a patient's risk, and to

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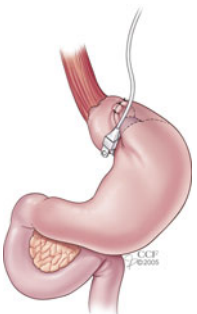
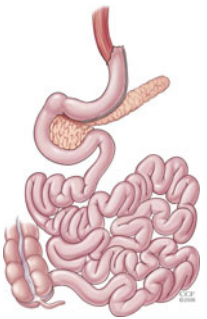
TABLE 38.1 DIFFERENCES BETWEEN ROUX-EN-Y GASTRIC BYPASS, LAPAROSCOPIC ADJUSTABLE GASTRIC BAND, AND LAPAROSCOPIC SLEEVE GASTRECTOMY

Surgery	Roux-en-Y gastric bypass (RYGB)	Laparoscopic adjustable gastric band (LAGB)	Laparoscopic sleeve gastrectomy (LSG)
Description	Involves making a small pouch of the stomach, just below the esophagus, that empties into a loop of jejunum. Surgery can be performed both open and laparoscopically	A device is placed around the uppermost portion of the stomach and can be adjusted to allow tailoring of the stoma outlet	The stomach is reduced in size by removal of a large portion of the stomach following the major curvature of the stomach
Images			
% Excess weight loss [7][a]			
1 year	63.31 %	34.26 %	51.49 %
5 years	64.92 %	57.23 %	-

[a] % excess weight loss = (weight loss/excess weight) × 100, excess weight = preoperative weight-ideal weight

TABLE 38.2 OBESITY SURGERY MORTALITY RISK SCORE (OS-MRS) PRIOR TO BARIATRIC SURGERY [13]

Class based on OS-MRS (points)	Mortality (90-day) (%)
A (0–1)	0.2
B (2–3)	1.2
C (4–5)	2.4

A point is given for BMI ≥50 kg/m², male gender, hypertension, known risk factors for PE (previous thromboembolism, IVC filter, hypoventilation, pulmonary hypertension), age ≥45

confirm that the patient meets the recommended criteria for bariatric surgery [12].

- A validated 90-day mortality risk assessment tool for patients undergoing bariatric surgery is shown in Table 38.2 [13], but the data remains mixed [14]. A risk scoring system for serious complications is also available [15].
- Cardiac risk assessment and optimization is similar in obese patient as other patients undergoing noncardiac surgery (see Chap. 6), but can be challenging due to limitations of the cardiac evaluation and cardiac testing due to weight limits of myocardial perfusion scans and cardiac catheterization tables, technical limitations of echocardiogram, and poor functional capacity for exercise stress testing. A cardiologist should be consulted if there are questions in regard to appropriate noninvasive testing.
- Obesity-related comorbidities that influence preoperative cardiac assessment and management of obese patients include coronary artery disease (CAD), congestive heart failure (CHF), DM, chronic renal insufficiency, cerebrovascular disease, hypertension, and poor exercise capacity [16].
- Pulmonary risk assessment prior to bariatric surgery is important. Obese patients have increased demand for ventilation, increased work of breathing, respiratory muscle inefficiency, and decreased lung volumes. These conditions are made worse when the patient is supine, under anesthesia, and with insufflation during laparoscopy.
- Pulmonary conditions associated with obesity to explore in the preoperative period include OSA and OHS (see Chap. 29), pulmonary hypertension (see Chap. 30), cor pulmonale, and history of venous thromboembolic disease (see Chap. 31).

- Any testing by the preoperative medical consultant should be determined by the history and physical exam (e.g., consideration of echocardiogram in the setting of CHF, pulmonary hypertension, or poor exercise capacity suspected to be due to a cardiopulmonary cause).
- Bariatric surgeons often have their own protocols for preoperative testing. Depending on which type of bariatric surgery is planned, the preoperative evaluation may include ultrasound of the gallbladder, endoscopy, upper GI series, fasting blood work (CBC, CMP, lipid panel, HbA1c, TSH, vitamin D 25-OH, vitamin B12, iron studies, ferritin), ECG, CXR, PFTs (ABG, full spirometry, and lung volumes), or sleep study [12].
- Medications should be reviewed carefully in the preoperative setting to anticipate any necessary changes or possible complications following surgery. For those patients who are taking numerous medications, controlled or extended-release medications, or medications with narrow therapeutic indices, an evaluation by a pharmacist with experience in bariatric surgery patients should be considered.
- A dietician should meet with the patient to optimize the patient's nutrition prior to surgery and to prepare them for post-bariatric surgery diet. Many patients are placed on a very-low-calorie diet (1,000 cal per day for approximately 3 weeks) before surgery to significantly reduce liver volume and improve operative exposure of the stomach.
- Another important component to the preoperative evaluation is a psychosocial evaluation for substance abuse, psychiatric disease, or social circumstances that may hinder the patient's ability to make the necessary long-term lifestyle changes.

PERIOPERATIVE MANAGEMENT

NUTRITION

- Proper hydration and adequate nutrition are particularly important following bariatric surgery.
- Postoperative bariatric diets vary according to institution but most follow a similar progression. Patients are usually able to start a clear liquid diet within the first 24 h after surgery and advance to a full liquid or soft and pureed diet prior to discharge under the direction of an experienced dietician.

- Patients should be reminded to eat more slowly and to eat more frequent but smaller meals, to stop eating when they are full, and to separate food from fluids by at least 30 min.
- The dietary changes following bariatric surgery are typically better tolerated for patients undergoing LAGB as opposed to RYGB or LSG since the band is not tightened when it is placed initially.
- Bariatric patients are at risk for nutrient deficiencies. Following RYGB and LSG, patients are started on a multivitamin with minerals and iron per day, calcium 1,200–1,500 mg per day (calcium citrate is preferred as it does not require an acid environment for absorption), and vitamin D3 (cholecalciferol) 800–1,200 IU per day. Patients may require vitamin B12 supplementation following surgery.
- Following LAGB, patients are not at the same increased risk of nutrient deficiency as those who undergo RYGB or LSG, but these patients are typically given the same supplementation.

MEDICATION MANAGEMENT

- In the early postoperative period, most medications are crushed or given as a liquid. Controlled or extended-release medications cannot be crushed or changed into a liquid formulation, so they must be changed after surgery to immediate-release medications with more frequent dosing.
- Bariatric surgery changes the pharmacokinetics of many drugs. The increase in gastric pH and the decrease in intestinal surface area available for absorption can decrease the bioavailability of a medication. This is particularly important for medications with narrow therapeutic indices such as psychiatric, antiepileptic, or transplant medications. Drug levels can be checked for most of these medications and should be followed postoperatively.

Management of Diabetic Medications

- Diabetic patients are at risk for hypoglycemia postoperatively. Patients who undergo RYGB and LSG are at the greatest risk of hypoglycemia. In addition to decreased caloric intake and rapid weight loss after surgery, the anatomic changes following RYGB and LSG affect hormone signaling and glucose metabolism. These patients may have dramatic decreases in the amount of insulin that they require starting on the first day or two after surgery. Patients who undergo LAGB have comparatively slower improvements in glucose control.

- Regardless of the type of bariatric surgery, all patients with diabetes should have their blood glucose monitored frequently after surgery.
- Oral sulfonylureas (glipizide, glyburide, and glimepiride) and meglitinides (repaglinide, nateglinide) should be discontinued after bariatric surgery.
- Metformin should be held postoperatively but lower doses can safely be resumed once acceptable renal function is confirmed.
- Patients taking insulin preoperatively are initially managed postoperatively with an insulin infusion protocol while NPO (see Chap. 13). When transitioning to SC insulin, basal insulin requirements are usually significantly reduced. Basal insulin dosing following bariatric surgery varies from patient to patient, but a rough starting point is half of the patient's basal insulin dose prior to surgery, the same dose as if a patient were not eating.
- Due to the substantial decrease in calories during the postoperative period, patients must be careful with prandial and correctional insulin. Both prandial and correctional insulin are typically not recommended upon discharge. Further adjustments are made in the outpatient setting.

Management of Antihypertensive Medications

- Patients who are taking antihypertensives are at risk for hypotension, electrolyte abnormalities, and dehydration postoperatively.
- Antihypertensive medications should be resumed carefully after bariatric surgery. Although most patients will still require antihypertensive medications at discharge, they may be able to achieve adequate blood pressure control with reduced doses or fewer medications.
- Patients receiving preoperative beta-blockers for cardiovascular indications should have these continued postoperatively (see Chap. 8).
- Diuretic agents are typically discontinued after bariatric surgery but may need to be continued or decreased in patients with CHF.

EARLY POSTOPERATIVE COMPLICATIONS

Anastomotic Leaks

- Leaks are potentially fatal and are important to recognize. The rate of anastomotic leak for RYGB has been reported to be 0.6–0.8 %, and the rate for LSG has been reported to be 0.7–0.9 % [5, 6].

- Signs and symptoms include new or worsening abdominal complaints, sustained tachycardia, or respiratory distress. Anastomotic leaks can be evaluated with an upper gastrointestinal (UGI) study or by CT.
- If there is a high suspicion for a leak, exploratory surgery is indicated despite negative studies.

Venous Thromboembolism

- Pulmonary embolism (PE) is one of the most common causes of mortality following bariatric surgery. The rates of pulmonary embolism (PE) for RYGB, LSG, and LAGB have recently been reported as 0.2 %, 0.3 %, and 0.02 %, respectively [5].
- The presenting symptoms of PE can be similar to anastomotic leaks and both should be considered in the appropriate clinical context.
- Anticoagulation is indicated when there is a high suspicion for PE. Anticoagulation can usually be started safely within 24–48 h after surgery, but this must be discussed with the surgeon.
- There is no consensus about prophylactic VTE regimens, but patients should receive sequential compression devices in addition to heparin or low-molecular-weight heparin. Extended prophylaxis after discharge is commonly employed as the time period of increased risk of VTE extends beyond discharge [17]. The duration of extended prophylaxis varies from institution to institution from 10 days to 4 weeks. Patients should also be encouraged to ambulate early.

Respiratory Failure

- Respiratory failure is a significant cause of morbidity following bariatric surgery. The rates of respiratory failure for RYGB, LSG, and LAGB have recently been described to be 1.3 %, 0.8 %, and 0.3 %, respectively [6].
- The prevention and treatment of respiratory failure include aggressive pulmonary toilet, incentive spirometry, oxygen supplementation, and early use of continuous positive pressure ventilation (CPAP) or bi-level positive airway pressure (BPAP) postoperatively when indicated. Medications that result in respiratory depression should be avoided or minimized.

Cardiac Complications

- The rate of myocardial infarction or cardiac arrest is approximately 0.1 % [5, 6].

- The prevention and management of cardiac complications following bariatric surgery are the same as for other surgeries and include close monitoring in high-risk patients, perioperative beta-blockade if indicated (see Chap. 8), and blood pressure control.

Bleeding

- Bleeding occurs at a higher rate (1 %) in RYGB compared with LSG (0.6 %) and LAGB (0.05 %) [5]. Indications to transfuse blood products are the same as for other surgical procedures (see Chap. 22). Patients may require an operative intervention if bleeding is persistent or severe.

Wound Complications

- Wound complications range in severity and include superficial and deep infections and wound dehiscence. Definitions vary by study along with the rates of wound complication. Wound complications are more common in open RYGB than any other procedure [5]. Wound complications are primarily managed by the surgical team.

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