6 Laparoscopic Adjustable Gastric Band Complications

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Perioperative Challenges

Perioperative challenges include all the challenges associated with gastrointestinal surgery, laparoscopy, and anesthesia. Specific challenges in morbidly obese patients include the following.

Body Habitus A thick abdominal wall, which is more often encountered in obese females or extensive visceral fat more often found in obese males, contributes to technical challenges during bariatric procedures [1]. The anthropometric distribution of adipose cells varies tremendously between individuals. In the authors' opinion, the ability to readily palpate the patient's rib cage is a good indicator of the difficulty accessing the abdominal cavity with a laparoscopic approach. A fatty or cirrhotic liver makes appropriate anatomical exposure difficult, with the risk of potential fracture and bleeding from the liver. Some authors have used preoperative ultrasound to help identify the size of the liver and for perioperative planning. The thickness of abdominal, subcutaneous fat is also a consideration in gastric band port placement and needle access.

Respiration and Airway Management Laparoscopic bariatric procedures require a high-pressure pneumoperitoneum which may result in increased intrathoracic pressures, decreased functional capacity, pneumothorax, extraperitoneal insufflation, gas embolism, and surgical emphysema [2, 3]. Restricted mouth opening, limited flexion/extension of the cervical spine, and redundant oral tissue also contribute to the airway management difficulties. Presence of an illuminated portable video laryngoscope may be useful in these difficult airway patients. Postoperative oxygenation and monitoring is important as this patient population has significant risk for obstructive sleep apnea.

Drug Pharmacokinetics Morbid obesity alters the pharmacokinetics of lipophilic anesthetics. Having an anesthesia team that has experience with this patient population is important.

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Morbidity

Overall morbidity rates after LAGB range from 0% up to 68%. Relatively few studies reported rates above 20%; overall median morbidity rate is of approximately 11.3%∗ [4]. Matched-pair study with 442 cases, with 6-year follow-up in patients with BMI less than 50, reported early overall morbidity rate of 5.4% (vs. 17.2% RYGB). However, the overall long-term morbidity rate was significantly higher at 41.6% (vs. 19% RYGB) and more revisions, that is, 26.7% (vs. 12.7% RYBG), were reported [5]. A 30-day morbidity study from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database analyzed 4756 bariatric patients (1176 LAGB vs. 3580 RYGB). The study reported a lower rate of major complications (1.0% vs. 3.3%), overall morbidity (2.6% vs. 6.7%), and reoperation rate (0.94% vs. 3.6%) [6]. This considerable difference in complication rates between studies suggests a multifactorial nature of morbidity in bariatric patients (presence of comorbidities, body habitus, operative technique, experienced vs. inexperienced surgeon, volume of procedures performed, institutional resources, hardware differences, study design); therefore, morbidity rates should be treated with caution.

Iatrogenic Complications

Iatrogenic complications include both anesthesia and surgical events. Laparoscopic access to the peritoneal cavity may result in major blood vessel injury, intestinal perforation/injury, liver injury (resulting bile leak and biloma), spleen injury (requiring a splenorraphy or splenectomy), and injury to pleura (resulting in a pneumothorax). After access to the peritoneal cavity, positioning of a large friable or cirrhotic liver may cause fracture of the liver and necrosis or bleeding. Pars flaccida technique, during which a tunnel is created in the posterior gastric fatty tissue at the level of the gastroesophageal junction, has potential for injury to both the esophagus and posterior stomach in the lesser sac.

Table 6.1 Adverse intraoperative events by Chapman et al. [4]

Adverse intraoperative events		
	LAGB (n = 8504)	
Complication	n	Percent
Gastric perforation/injury	68	0.80
Liver injury/bile leak	4	0.05
Band positioned incorrectly	3	0.04
Spleen injury/splenectomy	1	00,1
Insufficient pneumoperitoneum	1	0.01
Injury to pleura	1	0.01
Esophageal tear	0	0

Other complications are band-related and can result in disruption of the integrity of the band or tubing and/or disconnection of the tubing from the port. Band aneurysm and fat embolus into the tubing after needle access are other iatrogenic complications.

Longitudinal Assessment of Bariatric Surgery (LABS) database that included 1608 patients estimates the adverse intraoperative events rate (AIE) at 3.0% for LAGB procedures. Specific AIEs rates (for combined LAGB and RYGB) were reported as follows: anesthesia events 1.0%, instrument/equipment failure 0.8%, bowel injury 0.8%, hepatic injury 0.4%, splenic injury 0.2%, major blood vessel injury 0.1% [2]. Specific AIEs rates exclusively for LAGB reported by Chapman A, Kiroff G, Game P, et al., who evaluated 8504 LAGB patients, can be found in Table 6.1 [4].

Early Complications

Early complications include acute gastric obstruction, port/band infection, gastric perforation, hemorrhage, respiratory complications, delayed gastric emptying, and venous thromboembolism.

Late complications include pouch or esophageal dilatation from prolonged distal obstruction, band slippage, gastric prolapse, port or tubing malfunction, leakage at the port site tubing or band, band erosion, esophagitis and reflux. Fat embolus and obstruction of port tubing and extensive, gastric necrosis after band slippage are other complications.

Acute Gastric Obstruction Gastric obstruction may occur in up to 14% of LAGB patients [7, 8]. It is usually caused by implantation of a band of insufficient diameter, the inclusion of excess perigastric fat, or significant postoperative tissue edema. Presenting symptoms usually include persistent nausea, vomiting, and inability to tolerate secretions or oral intake. The diagnostic modality of choice is an upper gastrointestinal series demonstrating no passage of contrast beyond the band.

Stomal obstruction can be initially managed conservatively with NPO and nasogastric tube decompression until the edema subsides; however, one must be cautious due to the risk of stomach ischemia and aspiration pneumonia [9]. If obstruction persists, surgical revision or removal of the band is indicated. The use of larger diameter band may reduce the incidence of postoperative obstruction. Meticulous dissection of excess perigastric fat during band placement may help prevent this complication [10]. IV Solumedrol and Lasix have anecdotally helped relieve acute, postoperative obstruction status post band placement .

Port or Band Infection The incidence of the port site or band infection ranges between 0.3% and 9% [4, 11, 12]. Patients present with abdominal pain, fever, nausea, vomiting, and erythema/induration with or without purulent discharge from the port site. The diagnosis is made upon clinical and/or endoscopic finding.

Infection of the hardware is managed with surgical removal, especially if band erosion is present. An isolated port infection might be managed with the infected port removal alone and a new port reimplantation once the infection clears. Often times, an infected port site is a harbinger of a band erosion, so a thorough workup including radiologic imaging and an upper endoscopy can be diagnostic.

Respiratory Complications It was reported that 0.6% of patients treated with any bariatric surgical procedure developed postoperative pneumonia (PP). Additional 0.6% developed postoperative respiratory failure (PRF). PP risk factors include congestive heart failure, stroke, and smoking. Previous percutaneous coronary intervention, dyspnea at rest, diabetes mellitus, and prolonged anesthesia time are the factors most strongly associated with PRF. Bleeding disorder, age, COPD, and type of surgery were risk factors for both [13].

Venous Thromboembolism Study based on data from Bariatric Outcomes Longitudinal Database (BOLD) evaluating 73,921 bariatric patients reported venous thromboembolism (VTE) rate (including deep vein thrombosis and pulmonary embolism) of approximately 0.14% [36]. Risk factors for VTEs include: BMI >50 kg/m^2, a history of a VTE, a history of a hypercoagulable disorders, pulmonary hypertension, venous stasis disease, poor functional status, open or revision surgery, and operative time >3 hours [14, 15].

Infection Other infections including sepsis are fairly uncommon in LAGB patients with incidence rate of approximately 0.19% [4]. Most common cause of sepsis in these patients would be due to gastrointestinal viscus injury, which may occur during lysis of adhesions from previous operations.

Late Complications

Esophageal and Pouch Dilatation Dilatation of the distal esophagus, also called "pseudoachalasia syndrome," has been observed in up to 10% of patients [16]. The primary cause of this complication is linked to excessive band inflation or excessive food intake. Pouch dilatation has been reported in patients with a history of binge eating behavior pattern (Fig. 6.1). Patients often present with food and saliva intolerance, vomiting, nausea, halitosis, reflux, and epigastric pain. Upper gastrointestinal series can be diagnostic, demonstrating bird beak sign or pouch dilation. The initial treatment involves deflation of the band and behavioral diet modifications, which commonly results in reversing of esophageal

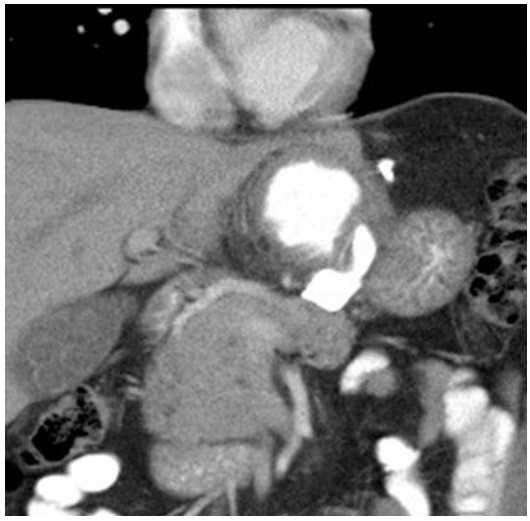

Fig. 6.1 Gastric pouch dilatation. (Photo credit Dr. Richard Ruchman, Monmouth Medical Center Division of Radiology)

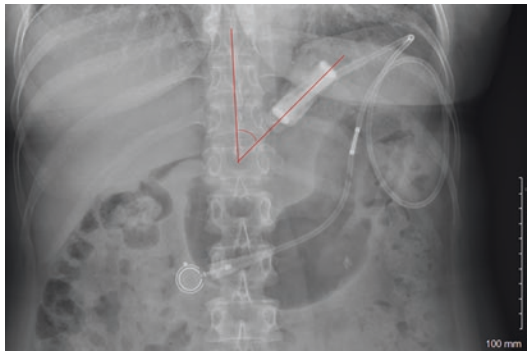

Fig. 6.2 Appropriate band orientation. (Photo credit Dr. Jeff Landers, Overlake Medical Center)

dilatation. If dilatation persists, replacement of the band in a new location on the stomach or conversion to RYGB, where indicated, is required.

Band Slippage and Gastric Prolapse Band slippage may occur in 2% to 14% of LAGB patients [4, 17, 18]. It implicates prolapse of part of the stomach through the band, with varying degrees of gastric obstruction (Figs. 6.2 and 6.3). Although this is listed under late complications, excessive nausea and vomiting in the immediate postoperative period may cause early band slippage. Band slippage can be categorized anatomically; posterior gastric prolapse occurs when the

Fig. 6.3 Band slippage & gastric prolapse. (Photo credit Dr. Christine Ren Fielding, Professor of Surgery, NYU School of Medicine)

band migrates caudally and creates a new enlarged pouch. Anterior prolapse involves migration of the band cephalad, which in turn results in gastric obstruction due to the creation of an acute angle between the band, stomach pouch, and esophagus. Leading symptoms include food intolerance, epigastric pain, and acid reflux. Diagnosis is confirmed with an upper gastrointestinal series demonstrating either displacement of the band or dilatation and prolapse of the gastric pouch. A simple abdominal X-ray positioned to capture an image from the nipples to the umbilicus will also delineate the position of the band. An "O"-shaped configuration of the gastric band on X-ray indicates potential slippage (47). The band in a proper orientation would appear as rectangular because we would see it from a side profile. The rectangular position of a properly placed band is from 2 o'clock to 7 o'clock in an AP X-ray. Placement of the band through pars flaccida without exposure of the stomach wall has decreased this complication

dramatically [19–21]. Anterior band fixation with gastro-gastric sutures proved to reduce band slippage rate down to 4% [22]. Depending on the presentation, surgery is required urgently or emergently. On rare instances, reduction of the prolapse can be accomplished by repositioning the band. However, the vast majority of slipped bands need to be replaced or removed, especially if significant edema and inflammation are present [23, 24].

Port Malfunction Tubing disconnection, leakage within the system, or subcutaneous port flip are possible causes of port malfunction. Reported incidence of port malfunction ranges from 0.4% to 7.0% [4, 17, 25]. Presenting symptoms are a loss of restriction, weight regain, and inability to access port. The incidence of port dislocation and slippage can be reduced by attaching the port to a polypropylene mesh before anchoring to the rectus fascia [26]. Port malfunction requires surgical repair or exchange of the hardware in order to regain band adjustability and reestablish restriction.

Band Erosion It is estimated that gastric band erosion through the wall of the stomach occurs in up to 7% of LAGB patients (Figs. 6.4 and 6.5). The reported mean occurrence is 22-month placement. It is believed that gastric wall ischemia from an excessively tight band combined with the band buckle–linked mechanical trauma and thermal trauma from electrocautery use and inadvertently leads to band erosion [27, 28]. Introduction of new band hardware and placement technique may reduce the incidence of this complication. Rotating the band buckle medially and creating a gastric fundoplication laterally over the band where the buckle remains outside of this fundoplication may reduce the risk of erosion. Clinical signs of band erosion include nausea and vomiting, epigastric pain, failure to lose weight, and infection. Hematemesis and epigastric pain may signify the erosion of the band into the left gastric artery [29]. This complication often occurs when the lap-band erodes into the posterior part of the stomach in the near proximity of the cardio-esophageal junction. Careful placement of the gastric band without embracing the ascending branch of the left gastric artery may prevent torrential hemorrhage due to band erosion.

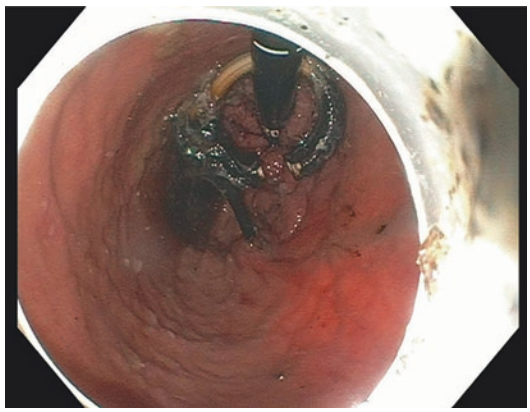

Fig. 6.4 Endoscopic view of a band erosion. (Photo credit Dr. Christine Ren Fielding, Professor of Surgery, NYU School of Medicine.)

Fig. 6.5 Fluoroscopic image of a band erosion. (Figure credit Dr. Christine Ren Fielding, Professor of Surgery, NYU School of Medicine)

Endoscopy is an effective diagnostic modality in patients with suspected band erosion. A gastrografin-fluoroscopic swallow study with a "double lumen" sign is also diagnostic of band erosion. Treatment involves removal of the band, either laparoscopically, endoscopically, or via a

combined approach if greater than 50% of the band has eroded through the stomach wall. It has been reported that even in cases of partial intragastric migration, successful endoscopic removal has been performed [29, 30]. Since the complication rate with immediate conversion to another bariatric procedure in the presence of an erosion is increased, it is generally recommended that conversion be postponed for at least 2–3 months after band removal. A laparoscopic Roux-en-Y gastric bypass (RYGB) is a commonly considered procedure after gastric band removal.

Vomiting and Food Intolerance The rate of vomiting and food intolerance in patients with LAGB varies from 0% up to 60%. Several of the LAGB studies reported a reduction of vomiting incidence with time elapsed since surgery. Early intolerance may be a result of gastric edema. Postoperative diet varies tremendously as does the progression from liquids to purees to solids. Early intolerance can be reduced or avoided by a slow progression back to a soft regular diet, allowing any surgical edema to subside. Since adjusting the volume of the band is an intrinsic part of the follow-up, reduction in the incidence of vomiting and food intolerance may possibly be attributed to the partial deflation of the band. One study, with 3-month follow-up, reported significantly lower rate of total dysphagia (defined as an inability to drink or eat without vomiting) with Swedish Adjustable Gastric Band (SAGB) when compared with the Lap-Band ™ (7.3% vs. 31%) [31]. Over time, manufacturers have increased the dimensions of the band and have allowed for a larger capacity of fluid within the band, to allow for more flexibility with adjustments. Vomiting and food intolerance are initially managed by deflation of the band. Appropriate studies should be performed if intolerance persists despite complete deflation of the band, as this may indicate a band slippage or erosion. In nonresponders, band removal and subsequent conversion to and alternate procedure should be considered where indicated.

Cholelithiasis and Choledocholithiasis High incidence of new onset cholelithiasis and choledocholithiasis following rapid weight loss after bariatric procedures has been widely reported. Despite extensive literature on the incidence of gallstones following RYGB and sleeve gastrectomy (SG), literature on gallstones secondary to LABG is lacking. The Australian Safety and Efficacy Register of New Interventional Procedures based on 5780 LAGB patients reported the incidence rate of cholelithiasis/cholecystectomy of 0.19%∗ [4]. This rate is considerably lower than that of general US population (6% for men and 9% for women) [32]. In our personal experience, those rates seem to overestimate the problem. Further studies are needed to estimate a factual rate of gallstones formation after LAGB.

Hiatal Hernia It is estimated that 19.5% of patients undergoing LAGB have a coexisting but frequently unrecognized hiatal hernia (HH). Combining LAGB with hiatal hernia repair (HHR) significantly reduces reoperation rate for HHR alone, with band slippage, or gastric pouch dilatation; without an increase in blood transfusion incidence, length of hospital stay, or band-related complications. For this reason, diagnosis of HH and HHR with simple crural repair ± MESH during initial placement of gastric band should be performed [33]. In patients with GERD, an addition of HHR to LAGB had a negligible effect on postoperative improvement of reflux symptoms [34].

Esophagitis and Reflux Esophagitis and reflux are uncommon complications following LAGB [18]. In the majority of patients, deflation of the band and PPI therapy control the symptoms. If no response to the medical therapy is noted, band removal or conversion to RYGB, where indicated, may be necessary.

Failure to Lose Weight Due to relatively modest weight loss (EWL), coupled with rather high rates of revisions and weight recidivism, LAGB is no longer a commonly performed bariatric procedure. In 2011, LABG constituted 35.4% of all bariatric procedures, while in 2017 it declined to only 2.77% [35–37]. Patients may anticipate one-pound-per-week weight loss rate until a plateau is reached at approximately 2 years [38, 39]. Most patients initially lose weight, but some

Table 6.2 Specific complications across all studies reporting complications by Chapman et al. [4]

Specific complications		
	LAGB (n = 8504)	
Complication	n	Percent
Dilatation	338	3.97
Band slippage	138	1.62
Port rotation/movement	74	0.87
Catheter rupture/disconnection/leak	68	0.80
Erosion	50	0.59
Infection of band or reservoir	31	0.36
Respiratory complications	24	0,28
Wound infection	24	0.28
Infection (other, inc. sepsis)	16	0.19
Cholelithiasis/cholecystectomy	16	0.19
Pulmonary embolism	14	0.16
Incisional hernia	13	0.15
Seroma/hematoma	13	0.15
Occluded/kinked stoma	12	0.14
Oesophagitis	12	0.14
Painful port site	11	0.13
Stenosis	10	0.12
Defective/leaking/broken/damaged band	8	0.09
Psychological problems	5	0.06
Subphrenic abscess/abscess	4	0.05
Bleeding (inc. GI)	4	0.05
Bleeding/discharge/necrosis at incision	4	0.05
Urinary tract infection	4	0.05
Gastritis	1	0.01
DVT	1	0.01
Miscellaneous	35	0.41

[a]Since the data were derived from a multitude of varying quality and heterogeneous studies, considerable variation in long-term follow-up times, any results drawn from such a process should be treated with the utmost caution

fail to sustain their improvements. Cases of no significant weight loss at all have also been reported. Therefore, frequent follow-up appointments during the first 2 years after surgery are of critical importance in order to ascertain fundamental changes in eating habits and lifestyle and achieve long-term success in maintaining weight loss. A study of a total of 3227 LAGB patients with 15-year follow-up reported a durable 47% EWL [36]. In our personal clinical experience, LAGB is a valid mode of surgical treatment of obesity in highly compliant and young patients (Table 6.2).

Mortality

The Australian Safety and Efficacy Register of New Interventional Procedures based on 5780 LAGB patients reported a short-term mortality rate of 0.05%∗, long-term mortality rate of 0.17%∗, and overall mortality rate of 0.22%∗ [4]. Pulmonary embolism (PE) accounts for approximately 30% to 50% of mortality causes [40, 41]. Other causes of in-hospital mortality include sepsis, cardiac events, and respiratory failure. Most of these events are not surgically related, but rather are related to the general risks of a morbidly obese patient undergoing any form of surgery.

Conclusion Paragraph

LAGB is associated with a variable rate of morbidity and mortality as reported in the literature. However, overall, it is considered a safe procedure, especially when performed by experienced bariatric surgeons following appropriate patient selection. It is reversible and does not exclude patients from further surgical interventions when needed. It is a valuable asset in the bariatric surgeon's armamentarium, especially when chosen as part of an informed decision-making process.

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