Laparoscopic Adjustable Gastric Banding as a Type of Weight Loss

Abstract

Obesity has become a global health crisis. Traditional treatments try to modify behavior in regard to diet and exercise. Laparoscopic adjustable gastric banding (LAGB) has become the second most frequently performed bariatric procedure. Bariatric surgical options have different levels of effectiveness and complications.

Introduction

In developed countries, one half of the adult population is overweight and 16% are obese. BMI (Body mass index) is an estimate of body fat and a gauge of risk for diseases that can occur with more body fat. As BMI increases health risks also increase. Heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers, may accompany obesity. As body mass indices rise the need for bariatric surgery is also on the rise. Low et al. states, “bariatric surgery has become the most rapidly growing form of treatment for obesity and is the only current therapy that has been shown to achieve major and durable weight loss.” Accordingly, laparoscopic adjustable gastric banding has become the most common restrictive surgery.

A laparoscopic adjustable gastric band, commonly called a lap-band, or LAGB, is an elective procedure intended to restrict the size of the stomach. Through laparoscopic incisions, surgeons place an adjustable ring of silicon around the top of the stomach, creating a small gastric pouch about the size of a golf ball (see Figure 1). The ring has a balloon-like inner surface that can be adjusted by injection or withdrawal of saline solution into a small access port placed just under the skin on the abdominal wall. The new upper gastric pouch, which is
about 15 to 30 mL in volume, fills with food quickly and creates the sensation of satiety. Feeling full faster and for extended periods of time slows the consumption of food and the amount of calories consumed, thus leading to weight loss.\textsuperscript{4}

**Bariatric procedure considerations and comparisons**

Surgical options to weight loss have become the most rapidly growing form of management for obesity in recent years.\textsuperscript{6} The three most commonly performed bariatric procedures are Roux-en-Y gastric bypass (RYGB), vertical sleeve gastrectomy (VSG), and laparoscopic adjustable gastric banding (LAGB).\textsuperscript{5} RYGB was deemed the gold standard of bariatric surgeries.\textsuperscript{7} It has demonstrated effective results in significant weight loss, but due to complications rates it continues to be modified and revised.

**Roux-en-Y gastric bypass**

RYGB is considered a malabsorptive technique, in which weight loss is achieved mainly by redirecting food and bypassing most of the small intestine where calorie and nutrient absorption occurs (see Figure 2).\textsuperscript{1,6} In most studies, weight loss after gastric bypass surgery is often impressive, resulting in greater weight loss than AGB.\textsuperscript{5} Typically, patients lose 60% of their excess weight. In other words, a 350-pound person who is 200 pounds overweight would lose around 120 pounds.\textsuperscript{4}

Gastric bypass has a complication rate of about 10 percent.\textsuperscript{5} Complications may include nutrient and vitamin deficiencies, infections, digestive problems, bleeding, or more life-threatening complications like pulmonary embolism, heart attack or anastomatic leakage
appearing at the surgical junctions.\textsuperscript{4,5} The mortality rate after the RYGB procedure averages at about 0.3\% or less than one in 200 people.\textsuperscript{5}

**Vertical sleeve gastrectomy**

Vertical Sleeve Gastrectomy (VSG) is making a relatively new appearance as a bariatric surgical option that offers rapid and satisfactory weight loss. This procedure is a restrictive technique that is performed laparoscopically through a single-incision.\textsuperscript{1,7} About 85\% of the volume of the stomach is removed as staples are placed in a line parallel to the lesser curve of the stomach (see Figure 3).\textsuperscript{1} A gastric tube about the size of the duodenum is what remain of the stomach.\textsuperscript{8} The reduction in volume of the stomach restricts food requirements for satiety. With the removal of 85\% of stomach, 85\% of the cells that secrete the hormone ghrelin, is also removed. Ghrelin is secreted when the stomach is empty and stimulates appetite, which may lead to weight gain. Without this hormone hunger pains are not triggered.\textsuperscript{8} SG has been associated with shorter hospital stay, no malabsorption problems, no vitamin deficiencies, and rapid weight loss comparable to RYGB.\textsuperscript{7} Long term data has not been collected as this is still an emerging procedure.

**Laparoscopic adjustable gastric banding**

The acceptance of LAGB is largely due to the numerous attractive features. Gastric banding is minimally invasive; only a few small abdominal incisions allows the surgeon to perform the operation, instead of one large cut.\textsuperscript{3} No part of the stomach is stapled or removed, and the patient's intestines are not re-routed; he or she can continue to absorb nutrients from food
The digestive system is manipulated by introducing the biocompatible materials that are well tolerated. The band may be adjusted without additional surgeries and, if the need arises, it may be removed, at which time the stomach usually returns to its normal pre-banded size.\textsuperscript{6} LAGB usually only requires an overnight hospital stay when compared to 3-4 days with the gastric bypass procedure. Gastric banding has a low mortality rate of only 1 in 1000 versus 1 in 250 for gastric bypass.\textsuperscript{6} LAGB poses fewer short-term complications, but some studies reveal an increase of band related complications after the three year mark.\textsuperscript{3}

**Effectiveness of laparoscopic adjustable banding**

In most studies, one year after the procedure, RYGB and VSG results in greater weight loss of 60\% of excess body weight, while gastric banding has shown a average weight loss of 40\%.\textsuperscript{6} With quality post-operative care and consultation, LAGB weight loss is comparable to RYGB.\textsuperscript{5} LAGB may not result in faster weight loss, but encourage better eating habits and produce long term weight stability and reduce obesity-related comorbidities.\textsuperscript{9}

Bariatric surgery is considered safe and effective when compared to the alternative of doing nothing. The risk of bariatric surgery may far outweigh the risks of comorbidities that go along with obesity, but with every procedure the complications must be considered.\textsuperscript{3} The most frequent LAGB surgical complications include pouch dilatations, band migration, band erosion, infection of the port, and stomal obstruction.\textsuperscript{3} The following case reports highlight a few of these complications associated with laparoscopic adjustable gastric banding. The purposes of these reports are to demonstrate what may be observed with the different imaging modalities and different complications.
Imaging to diagnose complications

Serious medical conditions are related to obesity. In response, a variety of bariatric surgeries are available to assist patients attain their desired weight loss. Low et al\textsuperscript{3} stated that “it is important for the radiologist to be familiar with the normal anatomical appearance of the more common bariatric operations and to be able to recognize their potential complications on imaging.”\textsuperscript{3(p.433)}

When a band has been suspected of slipping, the position of the band may quickly be viewed through a plain chest and abdominal x-ray. The optimal position of the device is located just below the gastroesophageal junction. On a frontal radiograph the lumen of the band should not be visible and it should be angled 5 to 60 degrees clockwise from the vertical.\textsuperscript{3} Figure 4 demonstrates a normal band placement. Next, a barium swallow examination should be conducted to visualize the flow of contrast and demonstrating function of the UGI. If there is a concern of a perforation, water-soluble contrast agents should be used, such as gastrografin or ultravist.\textsuperscript{3} Contrast should flow unobstructed and no surplus stomach should be visualized above the band.

Case report of band slippage

A 48-year-old woman presents with symptoms of vomiting, dysphagia and intolerance to solids.\textsuperscript{3} 2 years prior she had undergone laparoscopic adjustable gastric banding with successful weight loss. A plain abdominal film demonstrates the position of the device (see Figure 5). It appeared to be displaced, revealing more of a horizontal orientation. A barium swallow validated that the gastric body had prolapsed superiorly through the band. The proximal pouch,
which measured 11cm in diameter displayed debris present above the band and retains contrast upon esophageal peristalsis. The band was removed and patient made a successful recovery.

The usual symptoms of dysphagia or vomiting should lead to radiographic protocol of plain chest and abdominal films, and also the preferred examination of a barium swallow. When a section of the stomach underneath the band travels up through the band, it is called band slippage. Band slippage can be identified on a plain abdominal film when the angle of the band exceeds 90 degrees. Perforation occurs as a result of continuous pressure of the band against the stomach leading to erosion of the device through the gastric wall. Computed Tomography (CT) is the best method to diagnose gastric perforation. Barium swallow is the best way to determine if the esophagus has been injured. This exam will show the anatomy as well as the function of the esophagus.

**Case Reports of Stomal Obstruction**

A 34-year-old man presents 5 months after undergoing a laparoscopic adjustable gastric banding. He recalls swallowing a piece of unchewed garlic before his symptoms of dysphagia and vomiting began. Endoscopy was performed on that same day and the piece of garlic could be visualized obstructing the stomal orifice. The garlic was removed endoscopically with satisfactory results.

A 34-year-old woman presents 14 months after undergoing a LAGB. After swallowing a piece of gum, she was experiencing epigastric pain and continuous vomiting. An Upper Gastric Intestinal (UGI) study was performed with barium sulfate which showed a complete hold-up of the contrast at the lower end of the esophagus at the level of the gastric band. The
gum had caused an obstruction of the stoma. The band was deflated and the patient was able to swallow normally. A week later she was still symptom free and the band was re-inflated.10

The consumption of unchewed foods in patients with a LAGB may cause impaction. Endoscopy and UGI studies are the exams of choice to determine cause of stomal obstruction due to a foreign body.10 Deflation of the band should be the first course of action to allow body to pass. If deflation does not resolve the obstruction and symptoms persist, removal with endoscope would be utilized.10

Case Report of stenosis

In October of 2006 a 41-year-old woman underwent a LAGB for morbid obesity. She weighed 230 lbs with a body mass index (BMI) of 39.4 kg/m² and also complained of sleep apnea.11 The band placement was uneventful, but immediately following the surgery symptoms presented of frequent vomiting, food intolerance and rapid weight loss. The symptoms continued after the band was completely deflated in June 2007.11 The patient was unwilling to have the band removed despite the severe digestive symptoms. In May 2009 the patient, weighing only 119 lbs, reluctantly sought medical aid. “Complaining of nausea, regurgitations, and vomiting after each meal, and frequent episodes of dysphagia, a barium swallow and esophageal manometry showed a dilated esophagus and pseudo-achalasia secondary to the LAGB.”11(p.401)

The band was surgically removed in June 2009, but the digestive symptoms continued and the patient had to be hospitalized in August 2009.11 She weighed 103 lbs at this time. An upper GI endoscopy showed a fibrotic stenosis at the site where the band had been, and confirmed the presence of a dilation of the esophagus and the gastric pouch. Laparoscopic
surgery was performed removing the band and the patient regained esophageal motility. Twelve months later, she was symptom free with a healthy BMI of 20 kg/m$^2$ (about 118 lbs).$^{11}$

**Conclusion**

As obesity continues to rise worldwide, bariatric surgery has become a popular treatment to control weight and weight related diseases. The acceptance and attractiveness of LAGB is greatly due to the fact that its minimally invasive, adjustable, reversible, effective and has few complications. With all procedures complications arise. As surgical techniques are developed it is important for the radiographic science community to be aware of the examinations that best demonstrate irregularities that often demonstrate certain complications.$^3$
References


Figures and Captions

**Figure 1.** AGB: Adjustable gastric band. Distal to the gastroesophageal junction a band with an inner inflatable silicone balloon is placed around the proximal stomach. The port is placed just under the skin on the abdominal wall and adjustments to the inner band diameter are made by injection or withdrawal of solution. Image courtesy of Stefater MA, Wilson-Perez HE, Chambers AP, et al. All bariatric surgeries are not created equal: insights from mechanistic comparisons, Endocrine Reviews. 2012;33(4):0000-0000.
Figure 2. RYGB: Roux-en-Y gastric bypass in which a small gastric pouch is formed and rerouted past most of the small intestine. The biliary limb, including the gastric remnant is reattached to the Roux Limb. Image courtesy of Stefater MA, Wilson-Perez HE, Chambers AP, et al. All bariatric surgeries are not created equal: insights from mechanistic comparisons, Endocrine Reviews. 2012;33(4):0000-0000
Figure 3. VSG: Vertical sleeve gastrectomy. 80% or more of the stomach is removed including the fundus and greater curvature. The new stomach is about the size of the small intestines. Images courtesy of Stefater MA, Wilson-Perez HE, Chambers AP, et al. All bariatric surgeries are not created equal: insights from mechanistic comparisons, Endocrine Reviews. 2012;33(4):0000-0000.
Figure 4. Appropriate placement of a gastric band. The band collar is sitting just under the left diaphragm and the lumen is not visible. The collar sets about 30 degrees from the vertical. Image courtesy of Low V, Tan J, Lu J. Complications of laparoscopic adjustable gastric banding: Our local experience. Journal Of Medical Imaging & Radiation Oncology. August 2012;56(4):432-441.