



Laparoscopic adjustable gastric banding: Understanding the technique and common complications

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Learning objectives

To propose a description of the techniques and systems used in laparoscopic gastric banding. It will be reviewed the imaging postoperative findings, with main interest in the altered gastric anatomy and in the presentation of the most common early and later complications.

Background

Obesity is a serious and multifactorial chronic illness affecting patients of all ages, that has become a disease of epidemic proportions around the world, recognized by the World Health Organization. The latest data reports that more than 1,9 billion adults were overweight and 600 million were obese.

The most practical means of classifying obesity is the body mass index (BMI). Obesity is defined as a BMI of 30 Kg/m² or greater and morbid obesity is defined as a BMI of more than 40 Kg/m². This disease is frequently followed by secondary health problems, namely arterial hypertension, diabetes mellitus, heart and lung disease, sleep apnea, orthopedic complications, cancer and psychosocial stress.

Bariatric surgery techniques have been developed to reduce body weight in patients who have failed more conservative weight reduction alternatives such as diet, exercise and behavioral modification and medication. Bariatric surgery has several different types of bariatric procedures being performed today, but all of them fall into one of three categories: restrictive, malabsorptive or a combination of both.

The restrictive procedure induces a creation of a small stomach pouch that limits the food intake. The smaller stomach pouch fills quickly, which helps an early satiety with less food. Laparoscopic adjustable gastric banding has become an increasingly popular form of restrictive surgery for morbid obesity and one of the most least invasive surgical treatments. Although gastric band is a minimally invasive surgical procedure, it is associated with some important early and delayed complications.

Findings and procedure details

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The adjustable gastric banding system is composed for three parts: a radiopaque silicone band with an inflatable inner surface, the access port and the connector tube.

In laparoscopic adjustable gastric banding surgery, an adjustable silicone band gastric is placed around the proximal stomach, approximately 2 cm below the gastroesophageal junction, creating a small gastric pouch and an adjustable stoma. The band is sutured to the adjacent wall of the stomach and connected by means of a catheter to a subcutaneously implanted port accessible for percutaneous puncture in the anterior abdominal wall. The diameter of the band and hence the diameter of the gastric stoma can be adjusted through aspiration or injection of saline fluid into the port (can contain a maximum of 4 mL).

The laparoscopic adjustable gastric banding surgery must accomplish some criteria to obtain a maximum efficiency, such as:

- The gastric pouch should have a concentric and relatively symmetric shape and measure approximately 4 cm in maximum dimension after adequate filling with oral contrast or solid meal, corresponding to a volume of 15-20 mL;

- The stoma should measure approximately 3-4mm in diameter and should causing adequate emptying of the pouch within 15 to 20 minutes;

- The band must have an oblique orientation and this parameter is evaluated by the phi angle, that correspond to the angle between the spinal column and the gastric band. Phi angle should be between 4° and 58°.

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Fig. 1: Phi angle (4-58°). *References:* Radiology Department, Coimbra University Hospital - Coimbra/PT

The fluoroscopy is fundamental in the postoperative evaluation of these patients to adjust the stoma and diagnose and assist in the treatment of postoperative complications. The first evaluation may be performed one day after the surgery, to confirm the location of the band in relation to the stomach, assess the caliber of the lumen through the band and the size of the gastric pouch and evaluate for postoperative leaks. About long-term complications, an annual follow-up esophagography must be performed. Patients are also referred to the radiologist if weight loss is not satisfactory or if symptoms develop.

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Several complications can occur following the surgery. Some of the most common complications are developed below:

- Stomal stenosis and pouch dilatation
- Gastric band slippage
- Intraluminal band erosion
- Tube disconnection and leakage
- Port-site and intra-abdominal infections
- Gastric perforation

STOMAL STENOSIS AND POUCH DILATATION

The most common complication after gastric banding. In acute stomal stenosis, the affected individuals usually present with nausea and vomiting, regurgitation, dysphagia or upper abdominal pain.

Smaller diameter stomas in the immediate postoperative period are often due to overfilling at surgery, inappropriate positioning, or mucosal edema that it resolves spontaneously. Chronic stomal stenosis occurs when the band is too tight, causing an excessive luminal narrowing and a concentric dilatation of the proximal stomach, gastroesophageal reflux and slow emptying of the gastric pouch through the band into the remaining stomach. In this case, the band should be deflated to allow widening of the stoma and improve emptying. A chronic pouch dilation may also develop in the presence of a normal stomal diameter and is usually caused by pouch overfilling by patients that do not change their nutritional habits.



Fig. 2: Upper gastrointestinal tract barium study demonstrates concentric pouch dilatation secondary to a narrow stoma. *References:* Radiology Department, Coimbra University Hospital - Coimbra/PT

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Fig. 3: Upper gastrointestinal tract barium study demonstrates pouch dilatation due to inverted gastric band (slippage).

References: Radiology Department, Coimbra University Hospital - Coimbra/PT

GASTRIC BAND SLIPPAGE

This is a common complication that can occur for recurrent vomiting, overinflation of the band or faulty surgical technique. The patient usually presents with dysphagia, vomiting, regurgitation and food intolerance.

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Band slip can be posterior or anterior, depending on whether the anterior or posterior region of the stomach herniates through the band. The posterior slippage is associated with upward herniation of the posterior stomach superiorly through the band and results in stenosis and lateral eccentric gastric pouch enlargement, a phi angle greater than 58° and possible obstruction. The anterior slippage is associated with downward displacement of the band over the anterior aspect of the stomach, that results in stenosis with medial eccentric gastric pouch enlargement and a phi angle less than 4°.

In posterior band slippage, when the stomach herniates superiorly through a slipped gastric band, the weight of the herniated stomach sometimes causes the band to tilt along its horizontal axis, so the anterior and posterior sides of the band are no longer superimposed, producing an O-shaped configuration (also known as the "O sign"). After the diagnosis, all residual fluid must be removed from the band to decrease luminal narrowing and prevent obstruction.



Fig. 4: A - Upper gastrointestinal tract barium study demonstrates anterior slippage of the gastric band, with a phi angle greater than 58°; B - Upper gastrointestinal tract barium study demonstrates posterior slippage of the gastric band, with presence of the "O sign".

References: Radiology Department, Coimbra University Hospital - Coimbra/PT

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Fig. 5: Upper gastrointestinal tract barium study demonstrates pouch dilatation due to anterior slippage of the band.

References: Radiology Department, Coimbra University Hospital - Coimbra/PT

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Fig. 6: Upper gastrointestinal tract barium study demonstrates gastric band slippage with intrathoracic migration of the gastric pouch - hiatus hernia. *References:* Radiology Department, Coimbra University Hospital - Coimbra/PT

INTRALUMINAL BAND EROSION

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The intraluminal band erosion is a rare complication of gastric band that occurs in 1-3% of patients and represents a typical late complication. The patients may experience complaints related to erosion including loss of restriction, nonspecific epigastric pain, hematemesis, intra-abdominal abscesses or port-site infection.

Frequently occurs for a continuous and inappropriate pressure of the band against the gastric wall with necrosis of the adjacent gastric wall and subsequent erosion of the band into the lumen. Others reasons can be faulty surgical technique (trauma to the muscular layers), inflammatory reaction to foreign bodies and abuse of nonsteroidal antiinflammatory drugs. Usually is an incomplete erosion of the band into the stomach, but the entire band occasionally may erode into the lumen and causing a mechanical obstruction.



Fig. 7: Upper gastrointestinal tract barium study demonstrates intragastric band erosion.

References: Radiology Department, Coimbra University Hospital - Coimbra/PT

TUBE DISCONNECTION AND LEAKAGE

Port and band complications are reported in 0-7% of cases. System disconnections can occur at three different locations: between the proximal and distal parts of the connector

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tube, at the junction between the access port and the connector, and at the junction between the band and the connector. Disconnection can be caused by manipulation such as repositioning of the port due to patient discomfort or trauma.

Leakage is first suspected by an insufficient deflating volume of the banding system even when is filling combined with loss of eating restriction. The disconnection of the tube can be detected on abdominal radiographs or on fluoroscopy study with injection of nonionic contrast material into the band through the subcutaneous port, that can better demonstrate the site of leakage as well as asymmetric and non-uniform band inflation. Surgical treatment is mandatory.

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Fig. 8: Fluoroscopic-guided low osmolar contrast injection of a laparoscopic adjustable gastric band that demonstrates leakage of contrast material from the connection between the catheter and the band.

References: Radiology Department, Coimbra University Hospital - Coimbra/PT

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Fig. 9: Fluoroscopic-guided low osmolar contrast injection of a laparoscopic adjustable gastric band that demonstrates leakage of contrast material from the connection between the catheter and the port.

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Fig. 10: Upper gastrointestinal tract barium study demonstrates an elongated (hypotonic) stomach in the absence of the gastric band. Subsequent exploratory laparoscopy revealed gastric band placed around the lesser omentum. *References:* Radiology Department, Coimbra University Hospital - Coimbra/PT

PORT-SITE AND INTRA-ABDOMINAL INFECTIONS

Port-site infection occurs in less than 1% of the patients. Early infections will manifest with the cardinal signs of swelling, warmth, erythema, and fever and most likely represent

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surgical site infections. Late port site infections are often caused by delayed band erosion with ascending infection. Laparoscopic adjustable gastric band placement may predispose to an intra-abdominal infection or abscess, related to band as a foreign body. Infection increases the risk of perforation and fistulization.

GASTRIC PERFORATION

The perforation related to gastric band is a rare complication, being seen in less 0,1%-0,8% of patients. This is an early post-operative complication and usually results from trauma to the gastric wall at surgery. Patients with symptoms of suspected gastric perforation, like fever and abdominal pain or with less specific signs of sepsis, should be evaluated with computed tomography.

Images for this section:

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Fig. 1: Phi angle (4-58°).

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Fig. 3: Upper gastrointestinal tract barium study demonstrates pouch dilatation due to inverted gastric band (slippage).

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Fig. 9: Fluoroscopic-guided low osmolar contrast injection of a laparoscopic adjustable gastric band that demonstrates leakage of contrast material from the connection between the catheter and the port.

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Fig. 10: Upper gastrointestinal tract barium study demonstrates an elongated (hypotonic) stomach in the absence of the gastric band. Subsequent exploratory laparoscopy revealed gastric band placed around the lesser omentum.

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Conclusion

Imaging and clinical assessments of laparoscopic gastric banding are important for postoperative evaluation of patients as well as for the detection of potential complications. It is imperative that radiologists are familiar with the normal and abnormal imaging appearances of gastric bands and related complications.

Personal information

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