ED Visits Related to Bariatric Surgery: Review of Normal Post-Surgical Anatomy as Well as Complications

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Background

Obesity is a complex disorder associated with significant morbidity and mortality.

Bariatric surgical procedures such as laparoscopic Roux-en-Y gastric bypass, gastric banding, and sleeve gastrectomy are being routinely performed as treatment for morbid obesity. Among these, Roux-en-Y gastric bypass is the common done procedure.

Imaging has shown to play an important role in postoperative evaluation and to guide management of this patient population.

We present a pictorial exhibit of altered anatomy and imaging findings of common complications.
Roux-en-Y Gastric Bypass Surgery (RYGB)

• In this surgical procedure, a **small gastric pouch** of about 10-30 ml is created by dividing the stomach near the cardia with the large remainder of the stomach referred to as the **excluded stomach.**

• The jejunum is transected at about 30 cm distal to ligament of Treitz and anastomosed with the gastric pouch. This anastomosis is called the **Roux /alimentary/efferent limb.**

• The duodenum and proximal cut segment of the jejunum is called the **Bilio-pancreatic limb/afferent limb** and is anastomosed with rest of the jejunum at about 150 cm to form **Jejuno-Jejunal anastomosis (JJ).**
Normal Post Surgical CT Anatomy Of RYGB

• The proximal gastric pouch is smaller in capacity and is seen anastomosed with the alimentary tract which may be anterocolic or retrocolic (in relation to the transverse colon).
• The excluded stomach is seen to the left of the small gastric pouch and is usually un-distended.
• The jejuno-jejunal anastomosis is seen on the left side of the mid-abdomen.
Normal Post Surgical Anatomy Of RYGB

The images demonstrate normal CT appearance of post Roux-en-Y GBS.

Image A, oral contrast is present in the gastric pouch and the excluded stomach (yellow arrow) contains only a small amount of fluid but no oral contrast and no air.

Image B, the white arrow demonstrate the gastro-jejunostomy site and the alimentary tract.

Image C, the JJ anastomosis (blue arrow) is to the left of midline at the L2-3 level, as expected.
Complications of RYGB

A review of various surgical and non-surgical weight loss options was performed by Colquitt et al., in 2014. They found that RYGB was associated with higher sustained weight loss compared to LABG. Complication rates in the surgery group (including RYGB and sleeve gastrectomy) varied from 0-37% compared to 0-25% in the non surgical group.

- Anastomotic leak
- Gastro-jejunal anastomotic stricture
- Jejuno-jejunal anastomotic stricture
- Gastric staple line disruption
- Internal hernia
- Intussusception
- Haemorrhage
- Gastro-gastric Fistula
- Bowel obstruction and ischemia

Some of these complications are displayed in following images
Axial images demonstrates stenosis at the J-J anastomosis (blue arrow), proximal small bowel dilatation (white arrow) and dilatation of the excluded stomach (yellow arrow) with fluid seen refluxing into the bilio-pancreatic limb.
Ulcer Formation In The Proximal Gastric Pouch

In the images, the yellow arrow demonstrates ulcer crater along the lesser curvature of proximal gastric pouch and the blue arrow demonstrate excluded stomach.
The coronal and axial images with oral and IV contrast demonstrates defect in the medial wall of the excluded stomach with adjacent free extra luminal air suggesting gastric wall perforation from staple line dehiscence.
RYGB – Intraluminal Haemorrhage

The axial and coronal images demonstrate high density luminal content within the small bowel consistent with haemorrhage.
RYGB – Closed Loop Obstruction With Early Ischemia

In the images, the blue arrow suggest contrast opacified alimentary tract proximal to obstruction. The white arrow indicate obstructed bowel with early ischemic change and swirling of the vessels (yellow arrows).
Internal Hernia

- A retrospective review of causes of small bowel obstruction (SBO) post RYBG in 2009, revealed that internal hernias are the most common cause.
- In order to more to less common causes of SBO, adhesions, ventral hernias, and jejunojejunal anastomotic strictures were other identified causes which occur after the acute perioperative period.

Image A, blue arrow indicates misplaced J-J anastomosis within the right quadrant.
Image B, yellow arrow indicate swirling of the mesentery and mild congestions
Image C, white arrow indicate mild congestion of mesentery and stretching of vessels.
Petersen hernia

- Petersen’s space is a potential space between roux limb and the transverse mesocolon.
- After moderate weight loss this space often becomes patulous and bowel is able to herniate through the defect in mesentery posterior to roux limb, inferior to transverse mesocolon.
- Bowel may herniate right to left or left to right (as in this example)

*Lockhart et al. AJR 2007; 188: 745-750*  
*Images drawn by Dr. J. Robbins*
Comparing Types of Post RYGB Internal Hernias

Jejuno-jejunostomy hernia

- Occurs at the entero-enteric anastomosis (black arrowheads)
- Jejuno-jejunostomy anastomosis hernias tend to occur earlier than other types of internal hernias
- The swirled appearance of vessels in the mesenteric fat is a helpful sign to identify this hernia as well as migration of the JJ anastomosis either to the right side of the abdomen or too anteriorly in the left upper quadrant.

Eckhauser A. Am Surg 2006;72(2):581-584

Images drawn by Dr. J. Robbins
Comparing Types of Post RYGB Internal Hernias

Transmesocolic hernia

- During the original surgery, a defect is made in transverse mesocolon
- The Roux/alimentary/efferent limb is pulled through the surgically-created defect in the transverse mesocolon (blue arrow)
- With rapid weight loss, this defect that can become lax and allow herniation of small bowel (arrowheads)
- Not a common type of hernia compared to the other two

Yu J. Radiology. 2004;231(3):753-60

Images drawn by Dr. J. Robbins
Internal Hernia With Intussusception

Axial and coronal images, yellow arrow indicate central mesenteric swirling suggestive of internal herniation and blue arrow demonstrates bowel with in bowel appearance suggesting intussusception.
The images demonstrating contrast opacification of the excluded stomach from the proximal gastric pouch suggesting suture dehiscence and fistulous communication.

The yellow arrow – Proximal Gastric Pouch, Blue arrow – Excluded stomach, White arrow arrow – Alimentary limb.
Laparoscopic Sleeve Gastrectomy

• In this surgical technique the stomach is divided along the long axis, with resection of the larger portion of stomach from the fundus to antral region along the greater curvature.
• The residual stomach along the lesser curvature has a small volume of about 100ml.
Sleeve Gastrectomy

Post sleeve gastrectomy with small capacity residual stomach. The white arrow indicates part of the vertical linear surgical staple lines along the lateral wall of the stomach.
Complications Post Sleeve Gastrectomy:

- Gastric leaks
- Stricture
- Gastric dilatation
- Reflux
Laparoscopic Adjustable Gastric Banding (LAGB)

- This procedure involves placing an inflatable silicone-lined band across the proximal stomach to create a small pouch.
- The band is connected through a tube to a port which is placed in the subcutaneous plane of the upper anterior abdominal wall.
- The stoma created by the band is adjustable, by injecting saline into the port.
- The type of procedure is not funded by certain provinces and is therefore less commonly seen at our institution.
- Nevertheless, patients may present with complications related to remote placement of LAGB.
Laparoscopic Adjustable Gastric Banding

The “Phi angle” is useful to assess for normal position of the band. It is a vertical line along the spine and through the long axis of the band. It has a normal range of 4-58 degrees and should be measured with the gastric band in profile (image C).

In the images, the blue arrow indicates gastric band, white arrow the connecting tubing and yellow arrow the port.
Banding Tube Normal Appearance

Axial CT images, the blue arrow indicates gastric band, white arrow the connecting tubing and yellow arrow the port.
Complications of LAGB

- Gastric pouch dilatation
- Band slippage (can be anterior or posterior and occurs in 4-15% of patients)
- Intraluminal band erosion
- Perforation (occurs in < 1% of and is usual iatrogenic near the time of the procedure)
- Gastric volvulus
- Port related complications

The following slides demonstrate some of these complications
Coronal images with oral and IV contrast demonstrate dilated proximal gastric pouch (white arrow) and esophagus secondary to tight banding (yellow arrow). The phi angle is normal, therefore this is not due to slippage. It was simply due to the band being set too tightly and can be adjusted percutaneously through the subcutaneous port.
Banding Tube Disconnection

Image A, yellow arrow indicates port in the soft tissue plane
Image B, white arrow indicates disconnected tubing at the port end.
Take Home Points:

- Knowledge of normal post-surgical anatomy is essential for identifying early and subtle signs of bariatric surgery related complications.
- Internal hernias are not always associated with full blown obstruction and can be the cause of recurrent abdominal pain in these individuals.
- While CT identifies most of the complications related to bariatric surgery, findings can be supplemented with fluoroscopic contrast studies in certain situations, especially when functional assessment is required (e.g. to look for low-grade strictures).
- Early diagnosis of bariatric surgery related complications help to prevent increased morbidity and in certain situations, mortality.
- Identification of indirect signs of internal hernia helps in early diagnosis of this condition, possibly preventing more serious complications such as bowel ischemia by allowing early intervention.
References