Acute Care Surgery Problems in the Post-Bariatric Surgery Patient

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Objectives: At the completion of this module, fellows will be able to:
1) Identify the key anatomy and emergent problems following common bariatric procedures
2) Discuss the evaluation and imaging for emergencies in this patient population
3) Understand the important operative steps and interventions for successful treatment

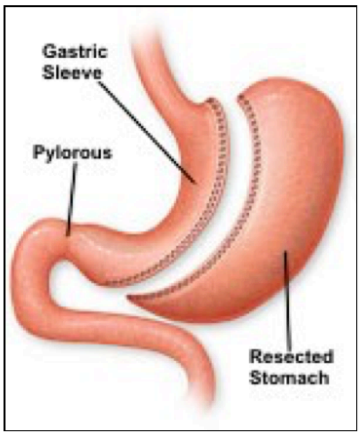
Background

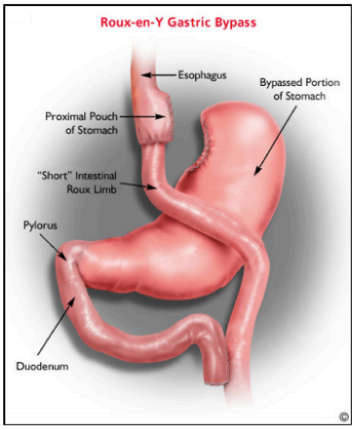
- Bariatric surgery is among the most rapidly increasing surgical procedures worldwide.
- Bariatric procedures have well defined general and procedure-specific complication profiles.
- All practicing acute care surgeons should be familiar with the common bariatric procedures, complication profiles, and basic management strategies.
- The simplest classification is whether the operation is purely restrictive or whether it is a combined restrictive/malabsorptive procedure. Restrictive means that only the stomach has been manipulated and there is no anastomosis or small bowel manipulation to worry about. Combined operations involve both the stomach and small bowel and have at least 2 anastomoses.
    - Problems can involve the stomach, the small bowel, or both.
    - Common bariatric procedures are summarized in **Table 1** and depicted in **Figure 1**.

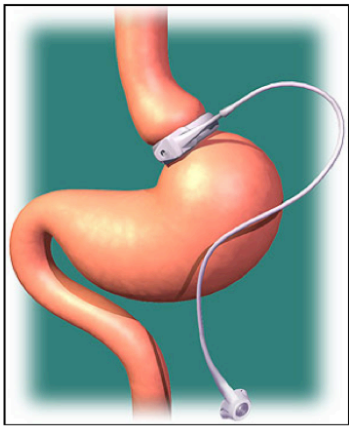
Table 1: Review of Common Current Bariatric Procedures and Terminology

	Restrictive	**Restrictive + Malabsorptive**
Current	adjustable gastric band	gastric bypass (aka "Roux-Y" bypass)
	sleeve gastrectomy	biliopancreatic diversion+duodenal switch
Historic/Uncommon	gastric plication	biliopancreatic diversion
	vertical banded gastroplasty (VBG)	jejuno-ileal bypass
	horizontal gastroplasty	mini or single loop gastric bypass

Figure 1. Anatomy of 3 most common bariatric procedures







Sleeve Gastrectomy	Gastric Bypass (Roux-en-Y)	Adjustable Gastric Band (“Lap Band”)

- Anatomic terms for gastric bypass (**Figure 1)** include the gastric pouch, gastric remnant, biliopancreatic (BP) limb, Roux (a.k.a. alimentary) limb, and common channel.
- The sleeve gastrectomy and gastric bypass are the two most commonly performed procedures. The adjustable gastric band (or "lap band") was previously the fastest growing procedure, but now is being widely abandoned due to both ineffective long-term weight loss, and a relatively high incidence of side effects and serious complications such as erosion and fundal herniation.
- The sleeve gastrectomy is the fastest growing bariatric procedure now being performed. Although touted as a "safer and less invasive" option as compared to the gastric bypass, the leak rate is similar (or higher).
- A summary of common complications as a function of time since surgery is provided in **Table 2.** In general, in the early postop period (1-4 weeks) any patient presenting with significant abdominal complaints or organ dysfunction (e.g., acute renal insufficiency) should be **assumed to have a leak until proven otherwise**.

	Gastric Bypass	**Sleeve Gastrectomy**	**Adjustable Gastric Band**
Early (1-4 weeks)*	anastomotic leak	staple line leak	dysphagia/GERD
	GI bleeding (staples)	GI bleeding	band slippage
	intraluminal clot	gastric outlet obstruction	balloon or tubing fracture
	early stricture	early stricture	edema/stenosis at band site
	surgical site infection+	surgical site infection+	surgical site infection+
	early postop SBO	early postop SBO	iatrogenic gastroesophageal injury
Late (>30 days)	internal hernia	leak or fistula	band slippage or erosion
	stricture	stricture	band over-inflation
	marginal ulcer	gastric outlet obstruction	port malposition
	gastro-gastric fistula	portal/SMV vein thrombosis	band/tubing fracture
	gallstones	gallstones	gallstones
	intussusception (at J-J)	severe GERD	intolerance to band inflation

Table 2: Bariatric-Specific Complications in the Early and Late Postoperative Periods

* additional iatrogenic complications of surgery such as a missed enterotomy should be considered as with any early postoperative patient; + an intra-abdominal abscess should be assumed to be due to a contained leak

History, physical examination, and laboratory testing

- Bariatric patients still develop appendicitis, gallstones and other common general surgical complaints. For patients who present with abdominal pain, routine evaluation should include these diagnoses in the differential.
- A thorough history is imperative! Many times all bariatric operations will be lumped together as "prior gastric bypass." If possible, contact the original bariatric surgeon or obtain prior operative reports as they can provide critical information or advice.
- The three most important predictors of an acute bariatric complication are 1) sustained tachycardia with heart rate (HR) > 110, 2) sense of impending doom reported by the patient,

and 3) refractory vomiting. Persistent emesis after any bariatric surgery is highly abnormal, and should raise a red flag of concern for an acute surgical emergency.

- History and physical exam for bowel obstruction after gastric bypass differs in many important ways.
    - Classic findings of tenderness and guarding may be absent due to body habitus.
    - Isolated obstruction of the biliopancreatic limb will not necessarily result in emesis or obstipation
    - BP limb has no outlet for decompression, ischemia & perforation can be rapid.
- A low threshold for imaging with a CT scan is necessary.
- Patients with adjustable gastric band slippage will usually present with acute intolerance to oral intake, persistent emesis, acute onset reflux, and even difficulty with oral secretions.

Radiographic imaging

- CT with PO and IV contrast is usually the most informative modality. CT is superior to fluoroscopy for detecting leaks, and provides much more anatomic information than fluoroscopy.
- A leak and a pulmonary embolus can present in a similar fashion. A PE-protocol chest CT can easily be added to the abdominal portion of the imaging.
- Due to the restrictive components of the operation, a reduced volume of oral contrast should be employed (e.g., 50 mL over 30 minutes) and an abbreviated prep time of 30-60 minutes can be used.
- Radiologists not familiar with bariatric imaging may have problems sorting out the anatomy. Face to face discussion and review of the studies is critical.
- Although there are a number of signs on CT scan suggestive of an internal hernia, none are highly sensitive or specific. A "normal" CT does not rule out internal hernia.
    - A mesenteric "swirl sign" indicating vascular torsion is the most reliable finding.
    - Clustered loops of bowel in the left upper quadrant, small bowel loop behind the SMA, and J-J anastomosis to the right of midline are other signs suggestive of an internal hernia.
- Air and/or contrast in the gastric remnant is unusual after the first post-operative week and suggests either gasto-gastric (GG) fistula or obstruction of the common channel, with reflux of air back into the remnant.
- A plain radiograph of the abdomen can be useful in assessing for band slippage following adjustable gastric band (AGB).
        - The angle formed by a straight line through the long axis of the band and a vertical line through the spinal column is known as the "phi angle". Normal position is approximately 45 degrees, and anything > 58 degrees indicates slippage.
        - In addition, an AGB in normal position should look like a hockey-puck viewed from the side, and not like a circle. This is known as the "O sign" and should prompt immediate evaluation.

Management/Indications for Operative Intervention

- A lower threshold for both imaging and operative exploration is indicated because of the relatively subtle symptoms of life threatening emergencies in this patient population. See the summary algorithm at the end of this module.
- The unstable, septic bariatric patient belongs in the operating room. The manifestations of abdominal sepsis may involve pulmonary, renal, and cardiac dysfunction.
- Bariatric patients who fail to improve with "conservative" therapy (NPO, hydration, anti-emetics) should undergo diagnostic laparoscopy at a minimum.
- The most common surgical emergencies encountered by acute care surgeons in the bariatric patient will be perforations or obstructions.
    - Acute perforations are typically from anastomotic or resectional staple lines.
    - Leaks following gastric bypass are most common at the gastrojejunostomy, followed by the jejunojejunostomy and then the gastric remnant staple line.
    - In the late period after gastric bypass, perforation is most common from a marginal ulcer at the gastrojejunostomy. They are usually small, anterior, and easily repaired.
    - Leaks following sleeve gastrectomy are usually near the angle of His/gastroesophageal junction. These are difficult problems! Control sepsis and leakage, and refer to an expert.
- In the bariatric patient who is not acutely decompensating, there is an increasing role for non-operative management of leaks. These strategies require a stable patient with a contained leak and the local expertise of proceduralists, including therapeutic gastro-enterology and interventional radiology.
- For sleeve leaks, attempts at primary repair in the acute phase usually fail. The goal is to achieve adequate drainage/control of leak. Endoscopic stenting is much more difficult and should be referred to a very experienced endoscopic surgeon or gastroenterologist.
- GI bleeding following bariatric surgery is almost always from a staple line. Hematemasis is common, however, a distended Roux limb can hold up to 2 liters of blood prior to emesis, and a distended BP limb may not result in hematemesis at all.
    - Staple line bleeding will usually stop spontaneously. If not, urgent endoscopy should be considered
    - Operative over-sewing of the bleeding staple line may be required.
    - Bleeding at the distal anastomosis (JJ) can cause an obstructive clot. This is a surgical emergency! Immediate operation and clot evacuation should be performed.
- Small bowel obstructions (SBO) are managed differently in the patient who has undergone a prior gastric bypass (or other procedure with a small bowel anastomosis). SBO in a prior sleeve gastrectomy patient are managed similar to any other patient.
    - SBO is an internal hernia until proven otherwise. Delay to operative exploration can result in devastating small bowel necrosis and loss
    - The excluded stomach cannot be decompressed with an NG tube – do NOT treat these like routine SBOs. Immediate laparoscopic or open exploration is usually the right answer.
- Any procedure that involved a prosthetic device (gastric band, VBG) has the potential for the band/tubing to slip out of position or to erode into surrounding structures.
    - Slippage can cause acute gastric necrosis if left untreated.
    - Many acute abdominal complaints with the adjustable gastric band can be relieved by complete band deflation (can be done at bedside).

    - The ultimate treatment is removal of the band, but in many cases deflating the band by accessing the subcutaneous port and aspirating all fluid will relieve the symptoms and obviate the need for emergent surgery.
- Less urgent, late conditions that may result in surgical consultation include fluid and electrolyte-related symptoms, anastomotic stricture, and marginal ulceration.

Operative Techniques

- Many bariatric emergencies can be managed laparoscopically in experienced hands. However, there should be no hesitation to convert to open as needed.
- Somewhat counter-intuitively, the entire relevant anatomy can usually be accessed through a 15 cm upper midline laparotomy if an open procedure is chosen.
- A flexible endoscope should be in the operating room. Intra-operative endoscopy can be useful to identify the anatomy or the site of perforation, or to do leak testing after repair.
- Leaks within 72 hours are almost always technical and can usually be addressed with primary repair using interrupted, absorbable sutures.
    - Always look for distal obstruction as a cause of a proximal leak.
    - Inspect for any internal hernias or mesenteric defects.
    - Drain widely!! Assume your repair might break down.
- When exploring for SBO, there are 3 potential spaces for an internal hernia. All three should be inspected, and the defects should be closed even if there are no incarcerated contents.
    - mesenteric defect at the jejunojejunostomy
    - mesenteric defect in the transverse colon mesentery (if a retrocolic roux limb was performed)
    - final defect area is between the roux limb and transverse colon – Petersen's space
- It is easier to run the bowel retrograde from the ileocecal valve towards the jejunojejunostomy, as opposed to beginning at the gastrojejunostomy and moving distally. This will often reduce the hernia and return the jejunojejunostomy to a normal position.
- Perforated marginal ulcers can usually be managed by omental patch, similar to perforated duodenal ulcers. Resection and revision of the gastrojejunostomy should be considered for large perforations, refractory perforations, and perforations associated with a gastro-gastric fistula.
- For any gastric bypass patient, if there is expected prolonged recovery, intolerance to oral nutrition, or healing of the gastrojejunostomy, consider placing a remnant gastrostomy tube.
- Removal of a gastric band is required if deflation does not resolve symptoms. Dissection should always begin on the lesser curve side of the band, and avoid dissecting in the greater curve area (as the stomach is usually plicated over the band in this location).
    - divide adhesions and omentum to expose the band and buckle on the lesser curve.
    - the tubing can be used as a "handle" to retract and manipulate the band.
    - unbuckling is often difficult – the band can be divided with scissors and then easily pulled out of the retrogastric tunnel and removed.
- The management of choledocholithiasis in the gastric bypass patient can be challenging, due to lack of easy access to the biliary tree via endoscopy. Retrograde ductal decompression is possible via rendezvous procedure or laparoscopic-assisted endoscopic retrograde cholangiopancreatography (ERCP).

- The rendezvous procedure involves endoscopic, ultrasound-guided, transgastric puncture of the left lobe of the liver (via the gastric pouch), with cannulation of a dilated bile duct. A guidewire is then passed antegrade through the biliary tree and into the duodenum so as to facilitate rendezvous endoscopic retrograde cholangiopancreatography.
- Laparoscopic-assisted ERCP involves making a gastrotomy in the excluded stomach, and passing the endoscope thru the abdominal wall and into the stomach. From there, the anatomy and procedure proceed as usual.

Evaluation & Management Algorithm

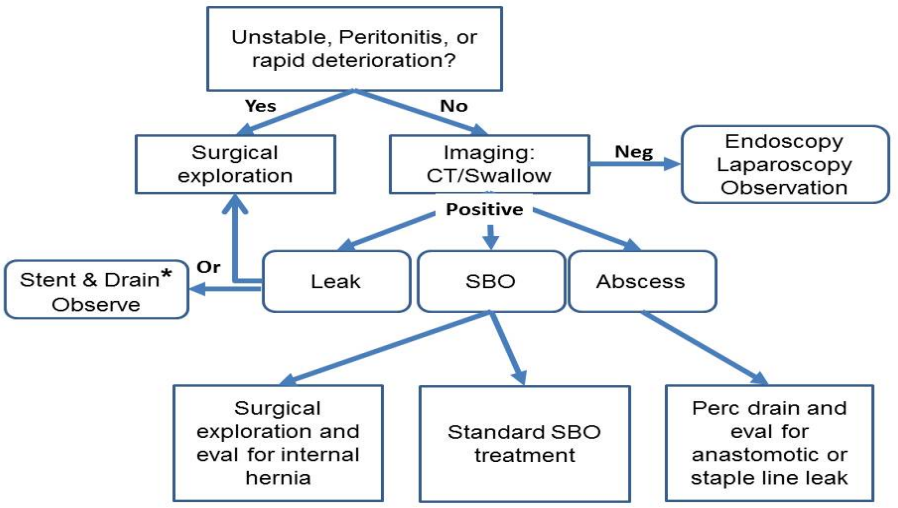


Fig 1. Simplified algorithm for acute abdominal complaints after bariatric surgery

Ask the Experts

1. Does every 'swirl sign' on CT imaging mandate exploration? If your index of suspicion is low and you cannot see well laparoscopically, would you open or quit and observe?

Recommended Readings

1. Chousleb E, Chousleb A. "Management of post-bariatric surgery emergencies." J Gastrointest Surg 2017;21(11):1946-53.

2. Lim R, Beekley A, Johnson DC etal. "Early and late complications of bariatric operation." Trauma Surg Acute CareOpen 2018;3(1):e000219.

3. Kassir R, Debs T, Blanc P etal. "Complications of bariatric surgery: Presentation and emergency management." Int J Surg 2016;27:77-81.

4. Wernick B, Jansen M, Noria S etal. "Essential bariatric emergencies for the acute care surgeon." Eur J Trauma Emerg Surg 2016;42(5):571-84.