AAST Acute Care Surgery Didactic Curriculum

Complications Following Bariatric Surgery

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Objectives

- Identify the key anatomy and emergent problems associated with common bariatric procedures.
- Discuss the work-up for emergent complications in this patient population.
- Understand the important operative steps and interventions for successful treatment.

Background

- Obesity affects roughly one third of the U.S population and continues to rise. Despite introduction of new medications targeting weight loss, bariatric surgery remains the most effective long-term treatment.
- Given the prevalence of these surgical techniques, acute care surgeons should be familiar with the most common bariatric surgeries, anatomy, associated complications, and approaches for patient.

Anatomy

- Broadly, bariatric surgery can be categorized into either purely restrictive mechanisms or a combination of malabsorptive and restrictive mechanisms.
- The most common procedures performed today are the sleeve gastrectomy and the gastric bypass. However, additional malabsorptive/restrictive procedures as listed below are being performed with more regularity. Additionally, endoscopic weight loss management has become more common and has particular challenges when managing acute complications. Understanding of the anatomy and potential complications associated with each procedure are crucial.
- Restrictive mechanisms
    - Adjustable gastric banding (AGB)
    - Vertical sleeve gastrectomy (VSG)
    - Endoscopic sleeve gastroplasty (ESG)

Postsurgical anatomy following restrictive mechanisms

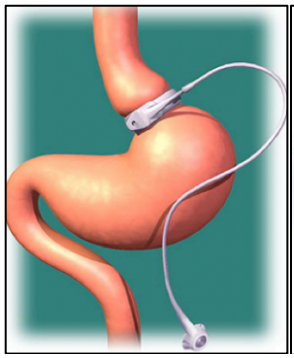

Figure 1. AGB

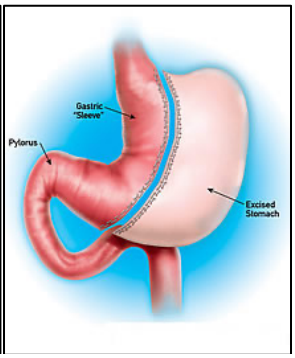

Figure 2. VSG

- Malabsorptive/restrictive mechanisms
  - Roux-en-Y gastric bypass (RYGB)
  - Biliopancreatic diversion with duodenal switch (BPD/DS)
  - Single anastomosis duodeno-ileostomy with sleeve gastrectomy (SADI-S)
  - One anastomosis gastric bypass (OAGB)

Postsurgical anatomy following malabsorptive/restrictive mechanisms

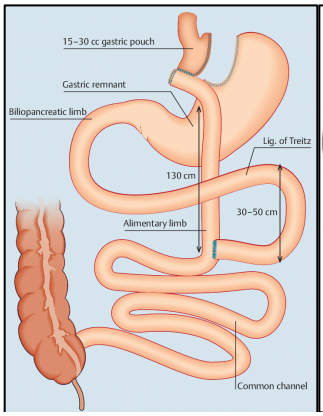

Figure 3. RYGB

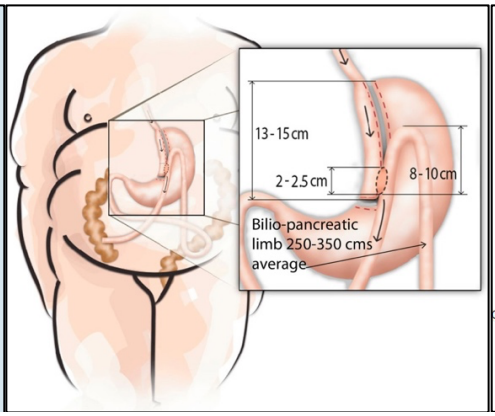

Figure 4. OAGB

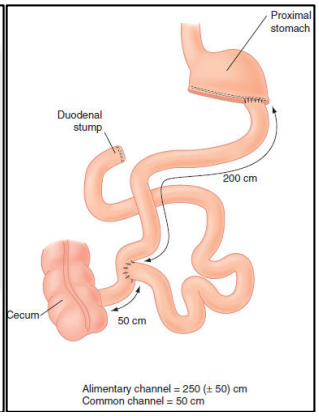

Figure 5. BPD

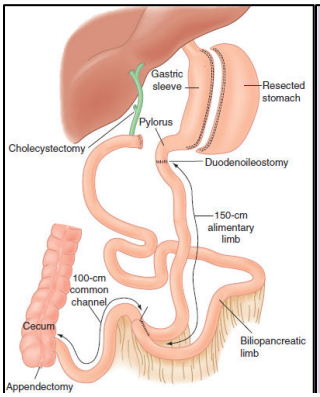

Figure 6. DS

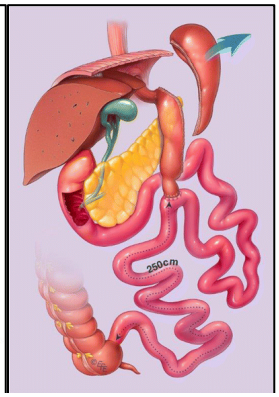

Figure 7. SADI-S

Potential Complications and Management

	RYGB	VSG	AGB
Early (1-4 weeks)*	Anastomotic leak GI bleeding Anastomotic obstruction Surgical site infection+ Early postop SBO Pulmonary embolus	Staple line leak GI bleeding Gastric outlet obstruction Surgical site infection+ Portal vein/SMV thrombosis Pulmonary embolus	Dysphagia Band slippage Balloon or tubing fracture Edema at band site Surgical site infection+ Iatrogenic gastroesophageal injury
Late (>30 days)	Internal hernia Anastomotic stricture Marginal ulcer Gastro-gastric fistula Jejunostomy intussusception	Fistula Gastric outlet obstruction Severe GERD	Band slippage Band erosion Over-inflation resulting in dysphagia/GERD Port malposition Band/tubing fracture

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

- Understanding of the patient's anatomy drives differential. Often these patients get lumped into a "prior bypass patient" diagnosis. Make sure to take a thorough history and obtain prior operative reports when possible.
- In the early postoperative period, a post bariatric surgery patient who presents in extremis should be considered to have an anastomotic or staple-line leak until proven otherwise. Have a low threshold to obtain CT imaging ideally with IV and PO contrast. Upper GI series is less helpful in the acute setting.
    - Pulmonary embolus can present similarly to intraabdominal catastrophe and the addition of a CT PE protocol to abdominal imaging is recommended.
        - While rare, also remember to consider SMV thrombosis on your differential. This is more common following sleeve gastrectomy due to manipulation of the gastroepiploic vein which can cause clot propagation. SMV thrombosis generally presents with non-specific abdominal complaints within the first two weeks following surgery. Prompt initiation of systemic heparin therapy improves outcomes.
    - Due to restrictive gastric anatomy, less oral contrast can be utilized (50mL over 30 minutes) and an abbreviated prep time of 30-60 minutes can be used due to quicker GI transit times.
    - Radiologists not familiar with bariatric imaging may have problems sorting out the anatomy. Face to face discussion and review of studies is critical.
- 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 high abnormal and should raise a red flag of concern for an acute surgical emergency.

- Body habitus can obscure usual physical exam signs consistent with acute abdomen. Rely on history, vital signs, and imaging.
- Bariatrics patients still develop appendicitis, biliary disease (occur at higher rates than the general population due to rapid weight loss following surgery), and other common general surgery complaints. Remember to include these in the differential.
- Many bariatric emergencies can be handled laparoscopically in experienced hands. However, there should be no hesitation to convert to open if needed. Even if the patient has bypass anatomy, the entirety of the relevant anatomy can be accessed through an upper midline laparotomy if an open procedure is chosen.
- Always have an endoscope available in the operating room. Intraoperative endoscopy can be useful in identifying anatomy, determining source of leak, or be used to do leak testing following repair.

RYGB

- In the gastric bypass patient, if there is any concern about prolonged recovery with inability to tolerate PO postoperatively, don't hesitate to place a gastrostomy tube in the remnant stomach.
- Anastomotic leak
    - In the bariatric patient who is not acutely decompensating, there is an increasing role for nonoperative management of leaks. These strategies require a stable patient with a contained leak and the local expertise of proceduralists, including therapeutic gastroenterology and interventional radiology.
    - These usually occur at the gastrojejunostomy, followed by the jejunojejunostomy, followed by the gastric remnant staple line.
    - Leaks in the early postoperative period (<72hrs) are almost always technical and can usually be addressed with primary repair using absorbable sutures.
        - Always look for distal obstruction as a cause of proximal leak.
        - Inspect for any internal hernias or mesenteric defects.
        - Drain widely. Assume your repair might break down.
- GI bleeding
    - GI bleeding following bariatric surgery is almost always from a staple line. It generally presents as acute anemia rather than hematemesis. A distended roux limb can hold up to 2 liters of blood prior to emesis and a distended BP limb may not results in hematemesis at all.
    - Staple line bleeding usually stops spontaneously; however, retained intraluminal clot can result in obstruction and intraabdominal bleeding can result in prolonged ileus and failure to thrive. If significant staple line bleeding is suspect, urgent endoscopy with or without diagnostic laparoscopy is recommended. Operative oversewing of the staple line may be required.
- Obstruction
    - Small bowel obstruction in a patient with a prior bypass is an internal hernia until proven otherwise. Delay to operative intervention can result in devastating small

bowel and necrosis and loss. Immediate laparoscopic or open exploration is usually the right answer.
    - The use of nasogastric tube decompression in a patient with bypass anatomy is not recommended.
    - *Internal hernia*
        - The vast majority of bypasses are now done with an antecolic, retrogastric roux limb. These creates two potential spaces through which internal herniation may occur.
            - Mesenteric defect at the jejunojejunostomy
            - Mesenteric defect between the roux limb and the transverse colon (Peterson's defect)
            - If a retrocolic roux limb was performed, a third defect may occur in the transverse colon mesentery
        - A number of signs on CT scan can suggest internal hernia but none are highly sensitive or specific. A "normal" CT does not rule out an 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 behind the SMA, and the J-J anastomosis to the right of midline are all signs suggestive of internal hernia
    - Gastrojejunostomy (GJ) obstruction or stenosis
        - Obstruction of the GJ can present acutely with intolerance to liquids, non-bilious vomiting, intolerance of secretions
            - Keep patient NPO until symptoms resolved
            - If not resolved by POD#5, consider TPN or fluoroscopy guided GJ feeding tube placement
            - Rarely requires reoperation as usually secondary to postoperative edema
        - Stenosis presents as a late complication and manifests as a gradual intolerance to solids
            - Treatment usually starts with endoscopic dilation
            - If stenosis is associated with a marginal ulcer, medical therapy and surgical intervention may be indicated
    - Jejunojejunostomy (JJ) stenosis/intussusception
        - Manifests as late complication with nausea, vomiting, abdominal distention, abdominal discomfort
        - Treatment includes surgical re-exploration, possible JJ revision
        - Consider a gastrostomy tube in the remnant
        - Make sure to close mesenteric defect to prevent internal hernia
- Marginal ulcer
    - Most commonly occur as late complication presenting as epigastric pain. The vast majority of patients will present with a history of tobacco or NSAID abuse.

First line therapy is cessation of tobacco, NSAIDs, and initiation of proton pump inhibitor therapy. Most marginal ulcers will resolve with medical therapy.
        - Rule out H pylori especially if patient did not undergo H pylori screening prior to bariatric surgery
    - May present acutely perforated. Perforation site is usually small, anterior and easily repaired with an omental patch and wide drainage. Resection and revision of the gastrojejunostomy should be considered for large perforations, refractory perforations, and perforations associated with gastro-gastric fistula.
- Gastro-gastric (GG) fistula
    - Air and/or contrast in the gastric remnant is unusual after the first post-operative week and usually suggests GG fistula. This can be found on CT imaging or UGI and confirmed with endoscopy.
        - Obstruction of the BP limb or common channel can also cause reflux of air/contrast into the remnant so maintain this on your differential
    - Management involves takedown of the fistulous connection which can usually be achieved with stapling

VSG

- Staple-line leak
    - Attempts at primary repair in the acute phase usually fail. The goal is to achieve adequate drainage/control of leak. Endoscopic stenting is not generally utilized.
    - Leaks are most commonly located near the angle of His/gastroesophageal junction. These are difficult problems to manage. The goal in the acute setting should be to control the sepsis, control the leak (usually through wide drainage), and referral to an expert.
    - Make sure to evaluate for distal obstruction as potential cause of increased pressures resulting in proximal leak. May need sleeve revision if this is the case.

AGB

- Dysphagia/GERD
    - Many acute abdominal complaints with the adjustable gastric band can be relieved by complete band deflation. This is accomplished by accessing the subcutaneous port and removing all fluid. Ultimately band removal is the next step, by complete deflation can stabilize the patient and avoid an emergent operation.
    - To remove the band, dissection should always begin on the lesser curve side of the band.
        - 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, pulled out of the retrogastric tunnel and removed.

        - Takedown the gastro-gastric plication on the greater curve. This is accomplished by removing the interrupted sutures keeping the wrap in place.
- Band slippage
    - Presents with acute PO intolerance, refractory vomiting, reflux, difficulty with oral secretions
    - Thoracoabdominal KUB can be useful in assessing AGB positioning
        - 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.
        - 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.
    - Slippage can cause acute gastric necrosis if left untreated.
- Band erosion
    - Band erosion presents with nausea, vomiting, abdominal discomfort, and potentially intraabdominal free air and peritonitis
    - Surgical treatment involves band removal, primary closure of gastrotomy with omental buttress. Drain widely.
    - Used EGD to evaluate for more progressive intraluminal gastric necrosis which could necessitate further resection

ESG
- Perforation/leak
    - There can be up to 12 full thickness sutures placed during the index operation. Given the potential for multiple sites of perforation, full gastric mobilization may be necessary.
    - EGD is a useful adjunct to defect gastric defects and rule out distal stricture secondary to endoscopically placed sutures which may change operative management. In the presence of a distal obstruction, it is recommended to remove all gastroplasty sutures.
    - It is reasonable to attempt to remove these endoscopically, but if pulled tightly, they can be difficult to see. In this case, a laparoscopic approach may be warranted to remove them externally. Performing a gastrotomy may be necessary to extract all sutures.

Choledocholithiasis in the Bypassed Patient
- 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 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.