Complications after bariatric surgery

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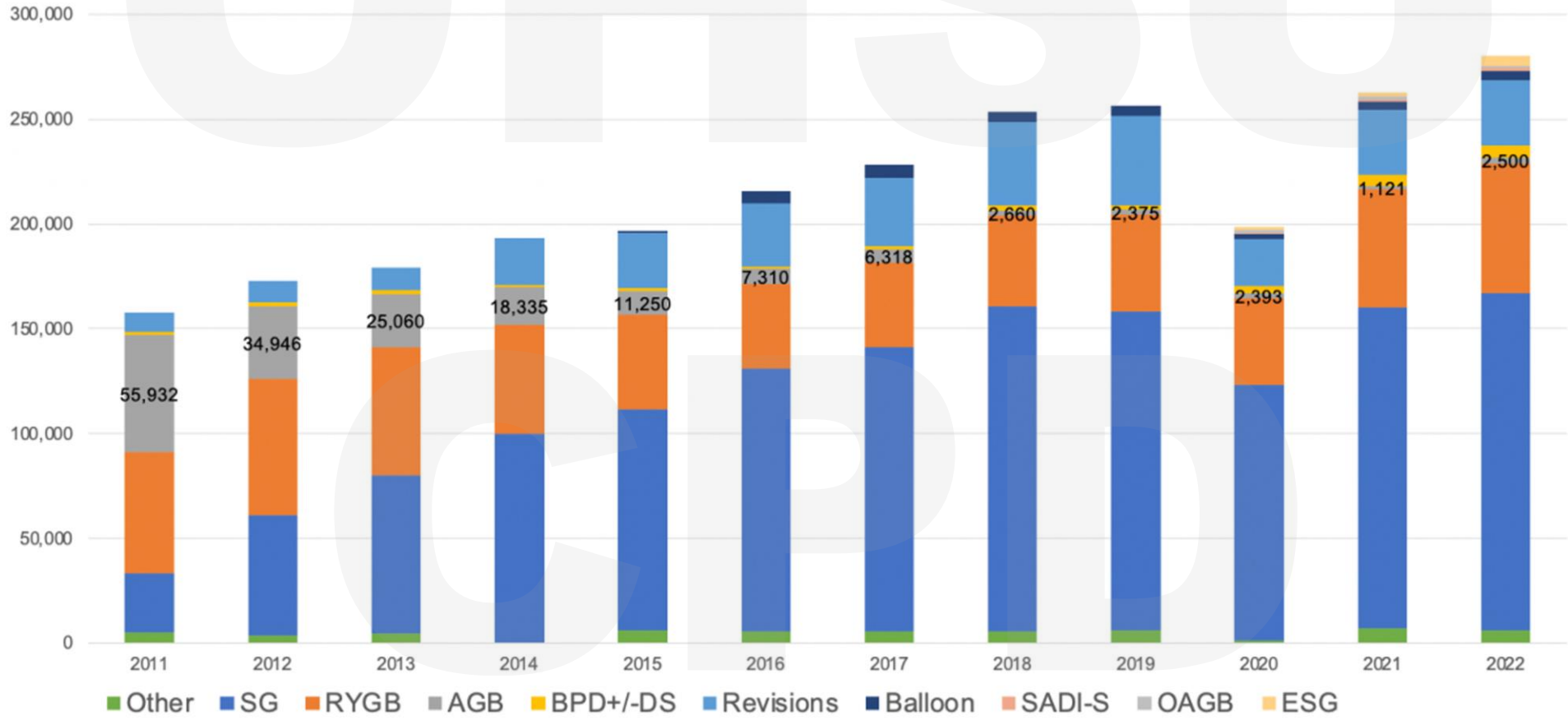
Disclosures

- None

Learning objectives

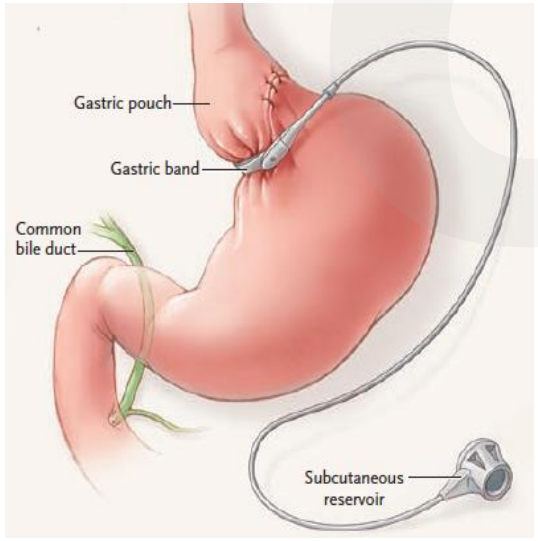
- Understand types of bariatric surgery and safety profile
- Learn the common complications after roux-en-y gastric bypass and sleeve gastroplasty
- Understand the general follow-up recommendations for patients who have had bariatric surgery

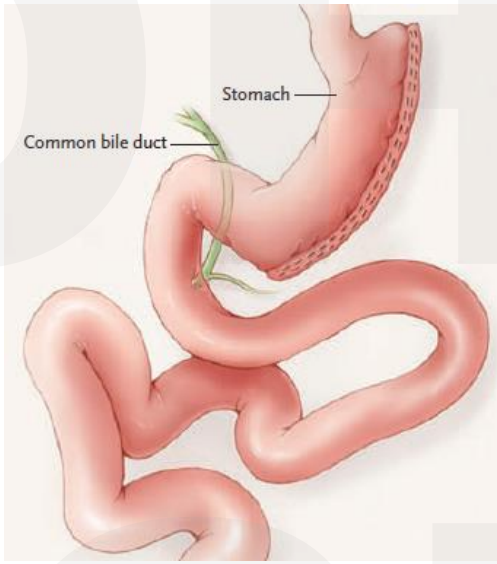
Steady increase in number of bariatric procedures performed

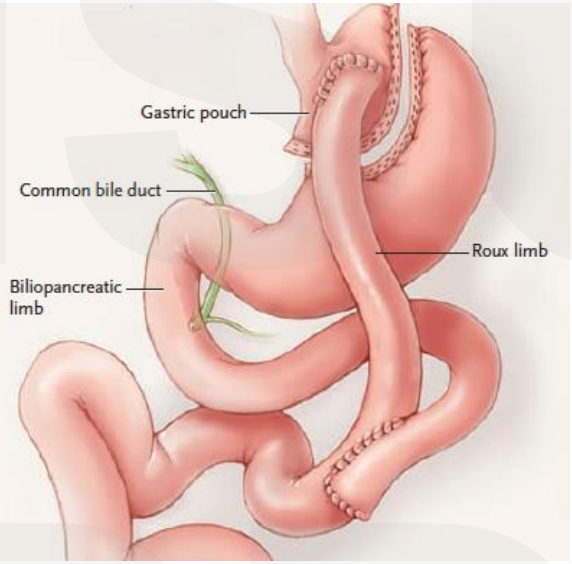


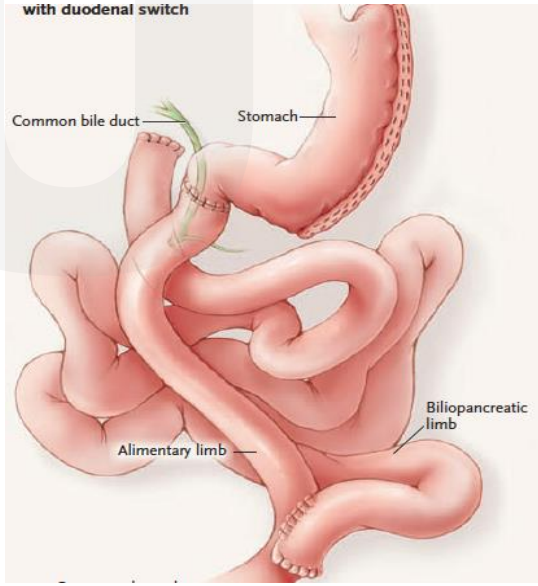
Clapp et al. ASMBS estimate of metabolic and bariatric procedures preformed in the United States. *SOARD* 2024; https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers/

Bariatric operations: prevalence USA 2022





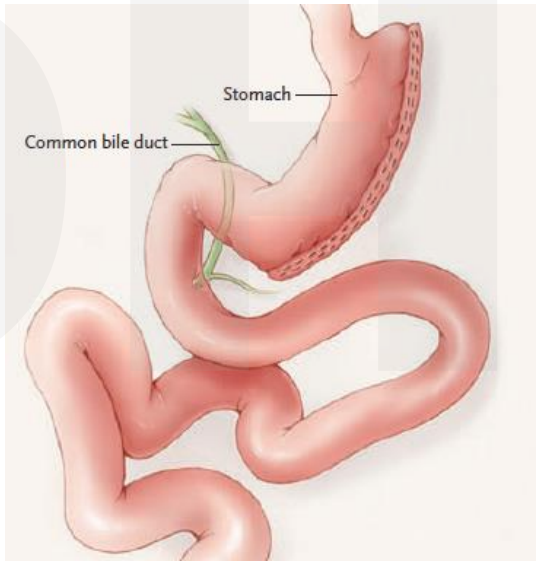


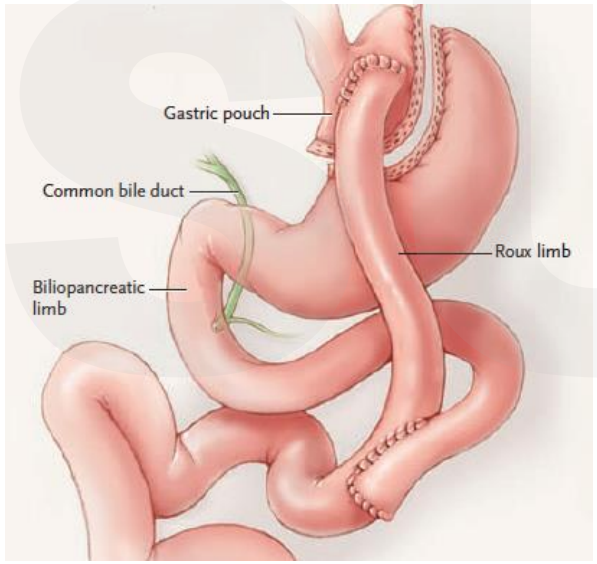


- Gastric band <1%
- Sleeve gastrectomy 57-60%
- Gastric bypass 22-23%
- Doudenal switch 2-3%

Clapp et al. ASMBS estimate of metabolic and bariatric procedures preformed in the United States. *SOARD* 2024; https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers/

Bariatric operations: mechanism





	Sleeve	Gastric bypass
Mechanical restriction	+	++
Malabsorption	-	+
Satiety hormones	+/++	++

Peterli et al. *Obes Surg* 2012; Nosso et al. *Horm Metab Res* 2016; Elias et al. *SOARD* 2022

Bariatric surgery safety

5-year randomized clinical trial data

Operation	Mortality	Morbidity	Internal Hernia	Ulcer	Reoperation Rate
Gastric Bypass n=199	<30d 0.5% >30d 1%	<30d 18% >30d 19%	13%	3%	21%

Operation	Mortality	Morbidity	Refractory GERD	Stricture	Reoperation Rate
Sleeve Gastrectomy n=199	<30d 0% >30d 0%	<30d 9% >30d 8%	8%	1.5%	13%

Salminen et al. *JAMA* 2018; Peterli et al. *JAMA* 2018; Arterburn,Telen & Kushner *JAMA* 2020

Bariatric surgery is as safe as other common operations: an analysis of the ACS-NSQIP

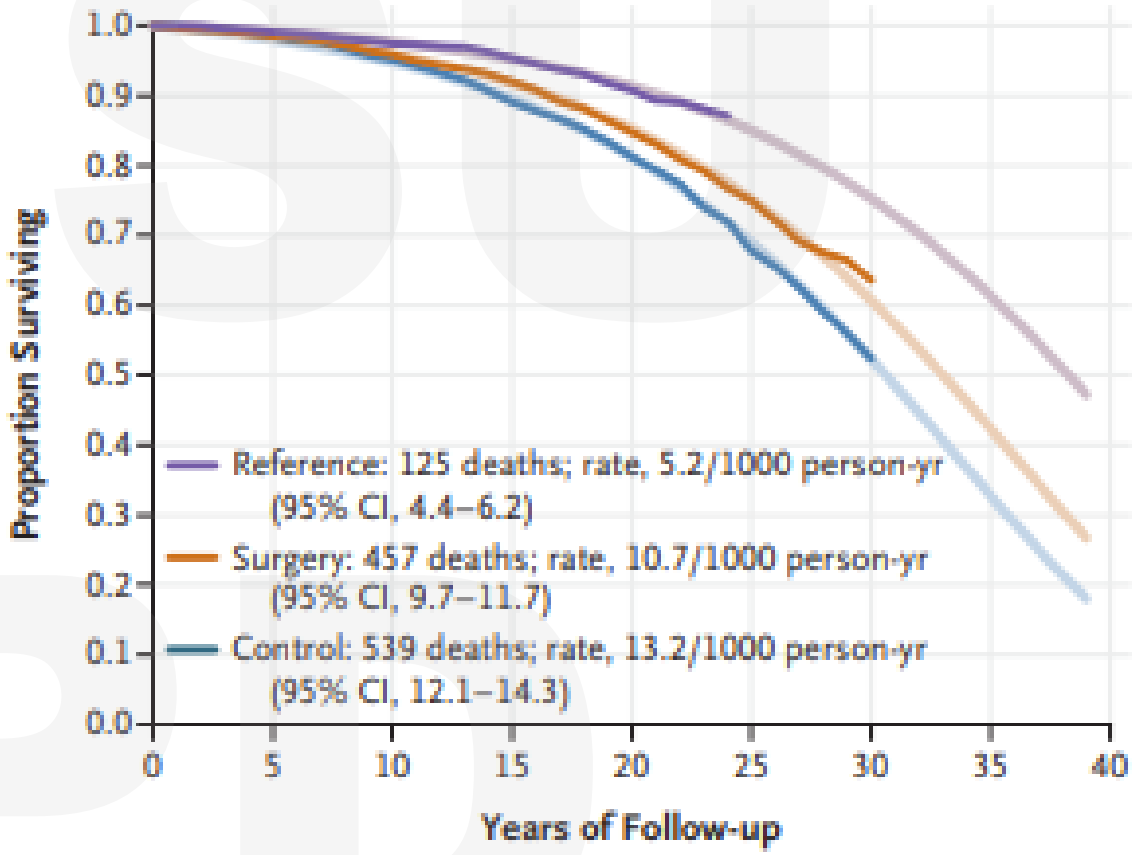
Clapp et al. Surgery for Obesity and Related Disease. 2024

Table 4
Multivariable logistic regression of metabolic and bariatric surgery compared to other operation for selected outcomes

Procedure Group	Readmission	Reoperation	Mortality	MI	Extended LOS	Reintubation
Procedure group	Bariatric (Ref)					
Hip arthroplasty						
aOR	.70	.99	.62	1.05	1.96	.36
95% CI	.68–.73	.94–1.04	.52–.74	.86–1.28	1.92–1.99	.31–.42
Lap cholecystectomy						
aOR	.88	.49	.76	.99	.32	.65
95% CI	.85–.90	.47–.52	.64–.90	.81–1.21	.32–.33	.57–.74
Lap TAHBSO						
aOR	1.24	1.35	1.30	1.86	4.37	1.19
95% CI	1.19–1.29	1.27–1.44	1.03–1.63	1.44–2.41	4.29–4.46	1.00–1.43
Lap appendectomy						
aOR	.88	.58	.70	1.29	.87	.78
95% CI	.85–.90	.55–.61	.58–.85	1.04–1.59	.85–.88	.68–.90
Lap incisional hernia						
aOR	.97	.82	.80	.79	.76	.98
95% CI	.92–1.03	.75–.91	.60–1.06	.56–1.10	.73–.78	.79–1.22
Lap nissen						
aOR	1.15	1.22	1.26	1.70	.95	1.67
95% CI	1.07–1.23	1.10–1.36	.92–1.71	1.21–2.40	.92–1.00	1.32–2.10
Lap partial colectomy + anastomosis						
aOR	1.47	1.80	1.97	1.99	16.38	1.58
95% CI	1.42–1.53	1.71–1.90	1.66–2.34	1.62–2.44	16.04–16.72	1.38–1.81
Lap ventral hernia						
aOR	.65	.52	1.21	.89	.52	1.04
95% CI	.61–.70	.46–.59	.92–1.58	.62–1.29	.50–.54	.82–1.31
Lap colectomy + coloproctostomy						
aOR	1.65	2.06	1.24	1.97	18.15	1.42
95% CI	1.59–1.71	1.95–2.18	1.02–1.50	1.58–2.45	17.75–18.56	1.23–1.65

Long term mortality benefit from bariatric surgery

Adjusted median life expectancy was 3.0 years longer than control group.



Carlsson et al. NEJM 2020

Complications after bariatric surgery

Early

- Infection
- Bleeding
- Leak
- DVT/VTE

Late

- Nutritional deficiencies
- Dumping syndrome
- Internal Hernias
- Marginal ulcers
- Fistulae
- Stenosis
- Gallstones
- GERD
- Weight regain

Nutritional deficiencies after bariatric surgery is common

	Surgery type		
Nutritional deficiency	RYGB (n = 32,190)	SG (n = 27,388)	AGB (n = 23,307)
Any nutritional deficiency %	57	55	30
Anemia %	31	23	15
Protein malnutrition %	12	9	4
Vitamin B12 %	12	9	5
Vitamin D %	25	33	14

RYGB = Roux-en-Y gastric bypass; SG = sleeve gastrectomy; AGB = adjustable gastric band.

Ba et al. Surgery for Obesity and Related Diseases 2023

Nutritional Deficiencies

- Thiamine deficiency
  - Wernicke-Korsakoff syndrome, Beri-beri syndrome
- Folate
- Iron
- Vitamin B12
- Calcium
- Fat soluble vitamins (Vit A, D, E, K)
- Trace elements (zinc, selenium, copper)

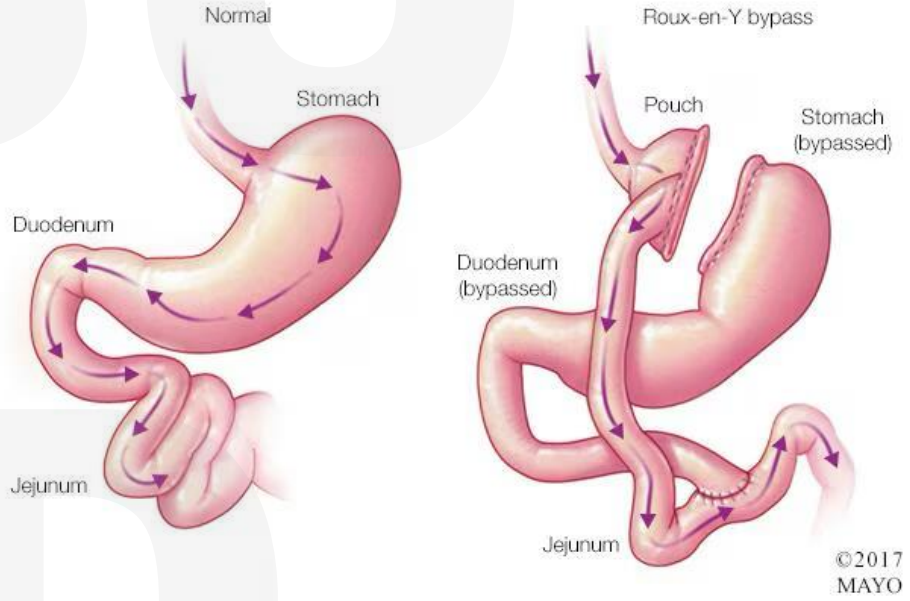
Management

- Patients should be on a bariatric multi-vitamin plus calcium
- Nutritional assessment with labs every 3-6 mos for first year then annually
  - Thiamine (treat early and often)
    - May require IV replacement, do not wait for labs if any symptoms
  - CBC, CMP, Fat soluble vitamins, Calcium, Iron, B12, Folate, Trace elements (zinc, selenium, copper)
- DEXA scan

Complications after RYGB

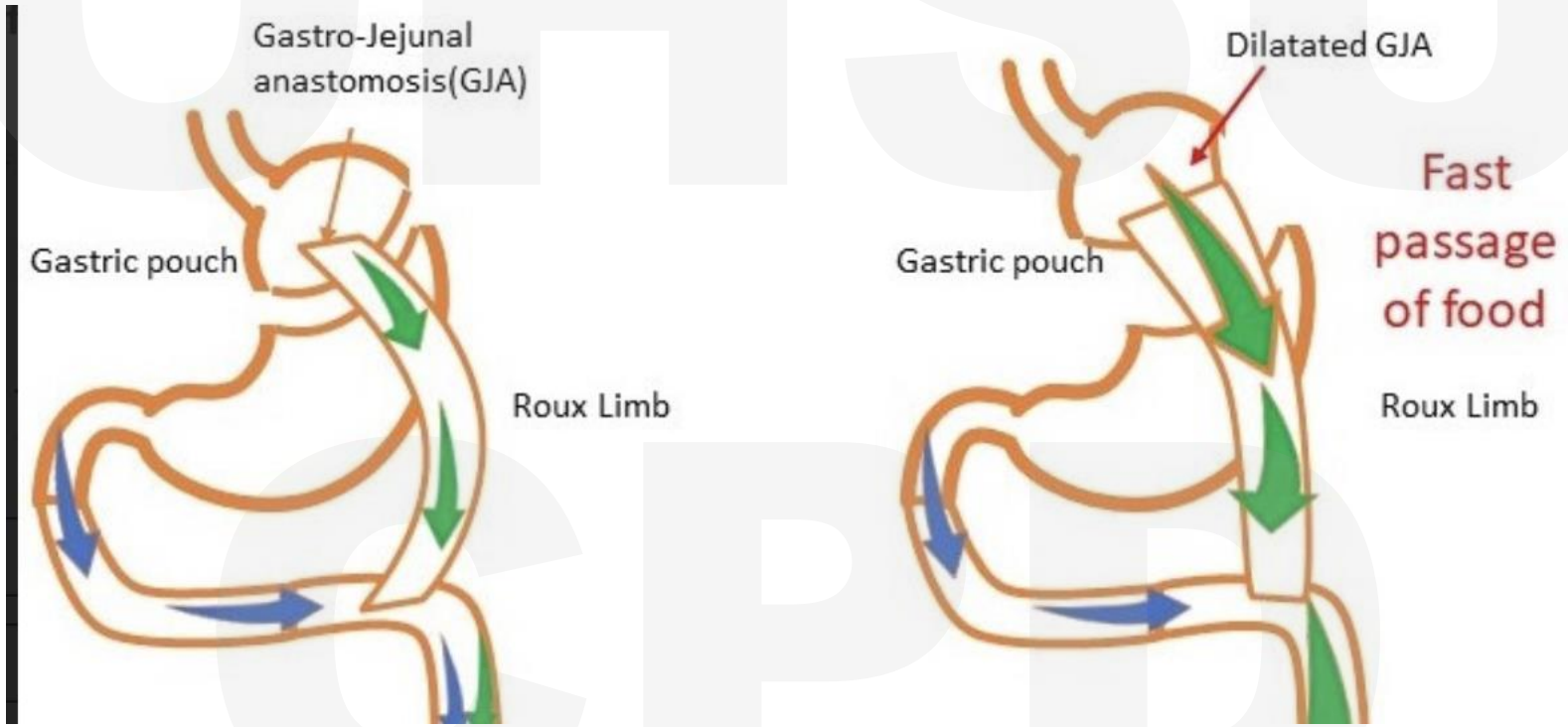
Reactive Hypoglycemia (Dumping Syndrome)

- Rapid emptying of chyme into jejunum
- Fluid shifts in intestinal lumen leads to early dumping symptoms (10-30min)
  - Abdominal cramping, tachycardia, nausea, diarrhea
- Rapid absorption of glucose leads to reactive hypoglycemia with late dumping (1-3 hours)



Adapted from Mayo.edu

Dilated outlet may contribute dumping syndrome



Mateo et al. J Pers Med 2022

Diagnosis

- Sigstad score > 7 suggest dumping

- Oral glucose tolerance test

Table 3
Dumping symptoms according to the Sigstad's scoring system

Shock	+5
Fainting, syncope, unconsciousness	+4
Desire to lie or sit down	+4
Breathlessness, dyspnea	+3
Weakness, exhaustion	+3
Sleepiness, drowsiness, apathy, falling asleep	+3
Palpitation	+3
Restlessness	+2
Dizziness	+2
Headaches	+1
Feeling of warmth, sweating, pallor, clammy skin	+1
Nausea	+1
Abdominal fullness, meteorism	+1
Borborygmus	+1
Eructation	–1
Vomiting	–4

Ukleja, A. Practical Gastroenterology 2006

Management

- Dietary modification:
  - Avoid simple sugars and dairy
  - Avoid fluid intake during meals and for at least 30 min after solid meals
  - Small meals throughout the day
  - Dietary fiber, Guar gum, Pectin

- Medication:
  - Acarbose
  - Octreotide
  - GLP1-RA (?)

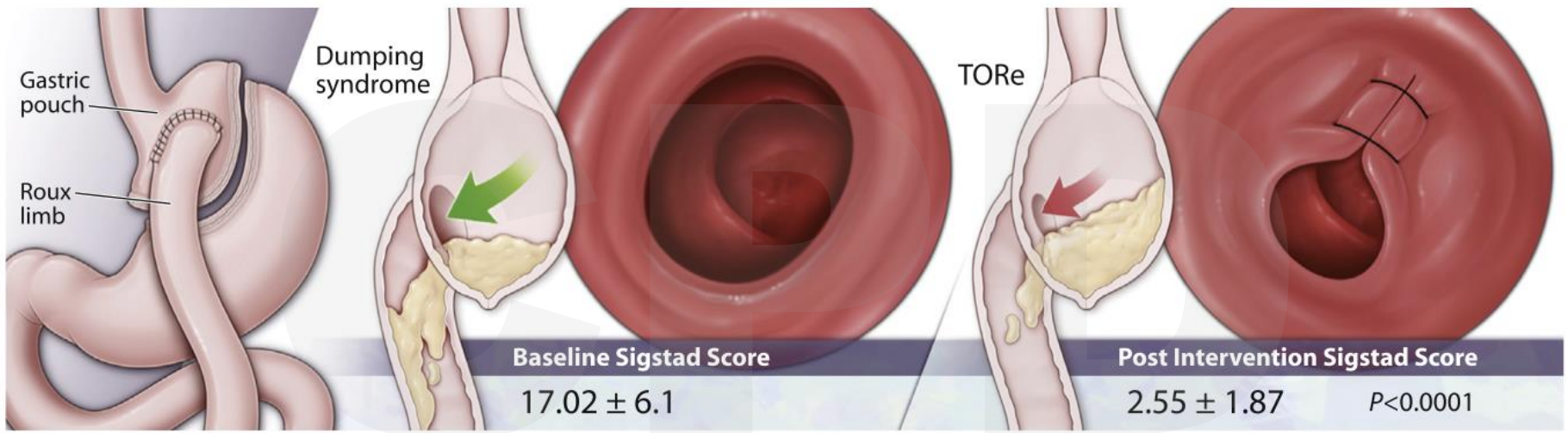
- Revision or reversal

Endoscopic management of dumping syndrome after Roux-en-Y gastric bypass: a large international series and proposed management strategy

Eric J. Vargas, MD,[1] Barham K. Abu Dayyeh, MD, MPH,[1] Andrew C. Storm, MD,[1] Fateh Bazerbachi, MD,[2] Reem Matar, BSc,[1] Adrian Vella, MD,[3] Todd Kellogg, MD,[4] Christine Stier, MD[5]

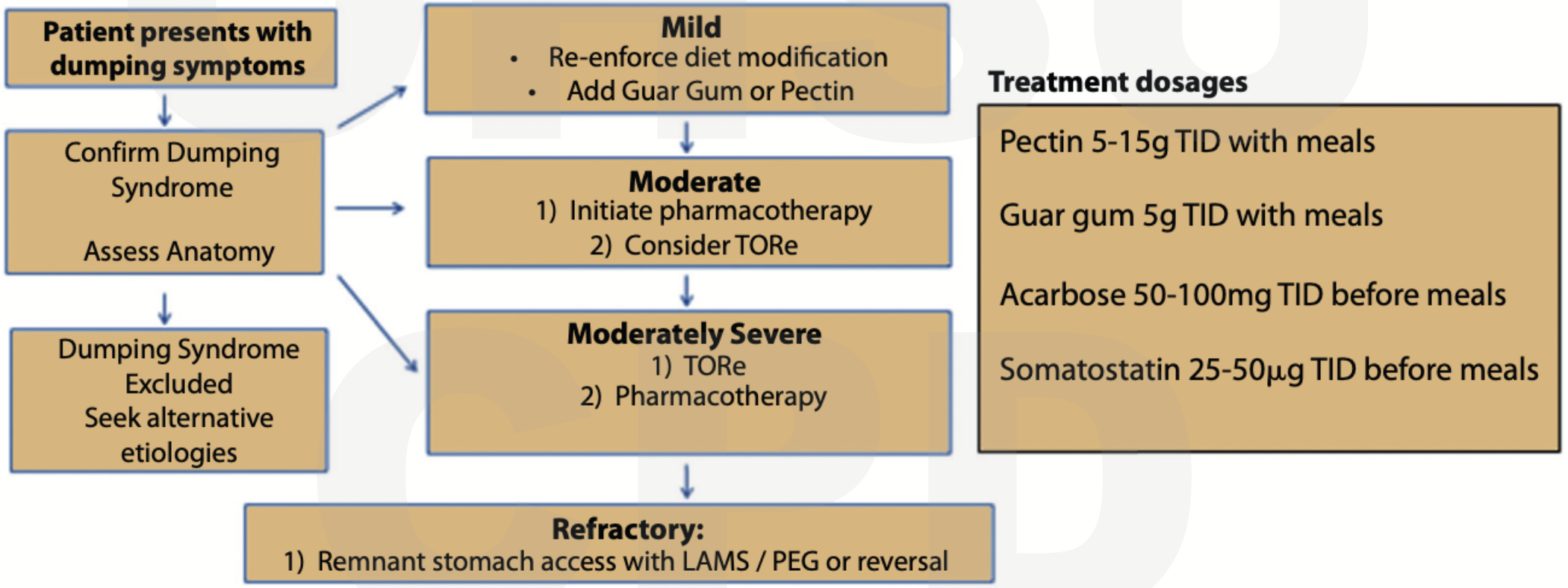
Rochester, Minnesota; Boston, Massachusetts, USA; Würzburg, Germany

GRAPHICAL ABSTRACT



Vargas et al. GIE 2020

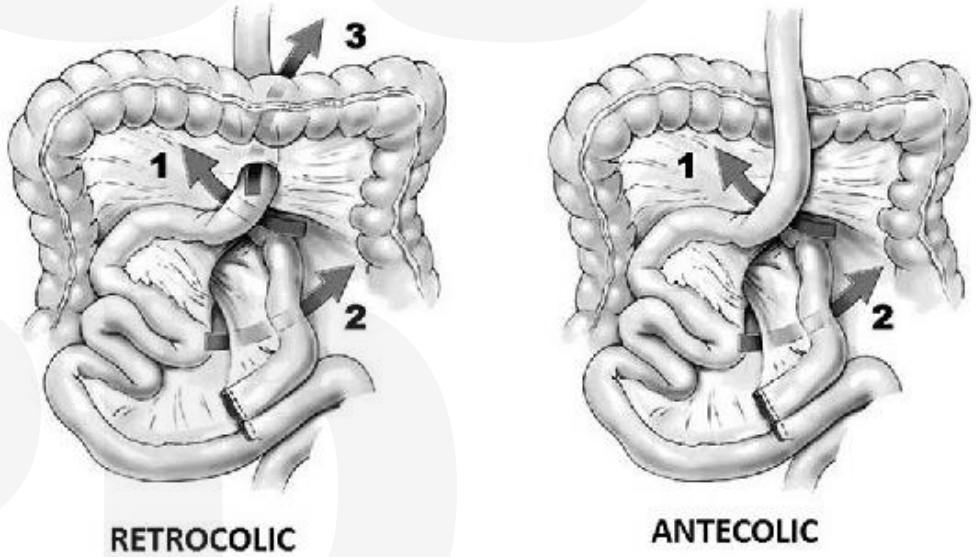
Proposed treatment options

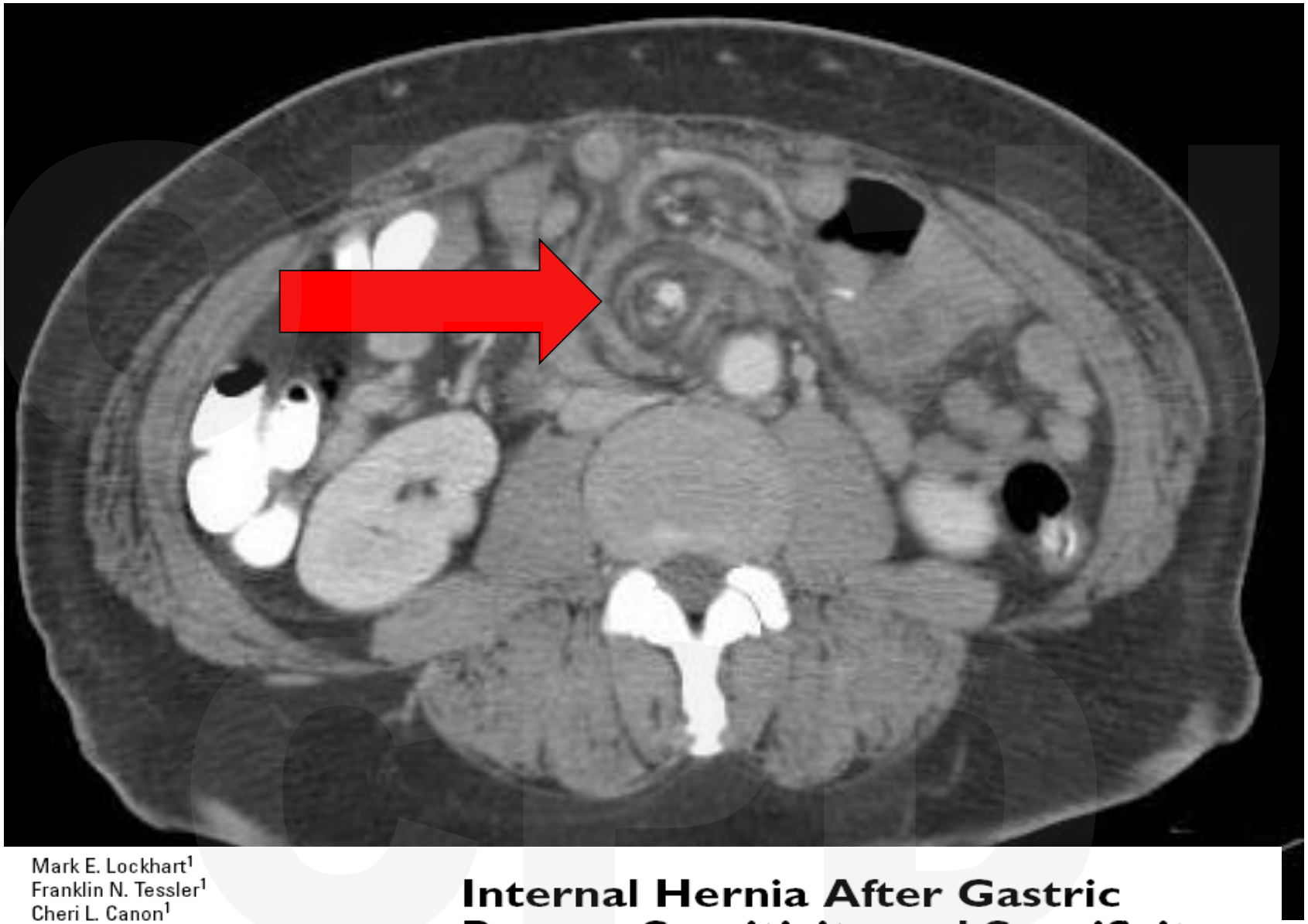


Internal Hernia

- Small bowel herniates through a mesenteric defect created during surgery

- Present with chronic, vague, post-prandial crampy abdominal pain
  - Can also present with severe pain, nausea/vomiting
  - Can lead to bowel obstruction, incarceration





Mark E. Lockhart[1]
Franklin N. Tessler[1]
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Matthew C. Larrison[1]
Naomi S. Fineberg[2]
Brandon P. Roy[3,4]
Ronald H. Clements[3]

Internal Hernia After Gastric Bypass: Sensitivity and Specificity of Seven CT Signs with Surgical Correlation and Controls


P

Diagnosis and management

- Hernias may be intermittent or spontaneously resolve
- 15% may have normal CT
- Surgical exploration may be needed empirically

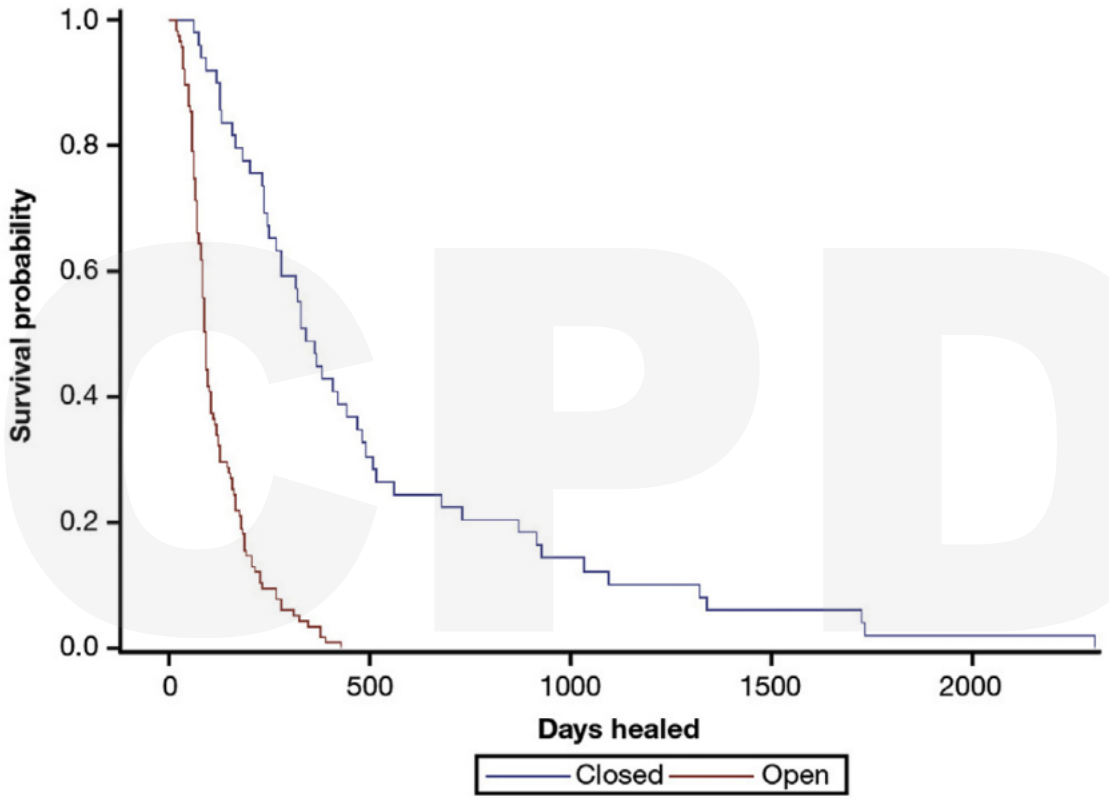
Marginal Ulcer

- Occurs in up to 16% of patients
- Presents with gnawing, post-prandial abdominal pain
- May cause anemia, bleeding, perforation or stricturing
- Diagnosed with upper endoscopy

Schulman, A et al. Am J Gastro 2017

Opened Proton Pump Inhibitor Capsules Reduce Time to Healing Compared With Intact Capsules for Marginal Ulceration Following Roux-en-Y Gastric Bypass

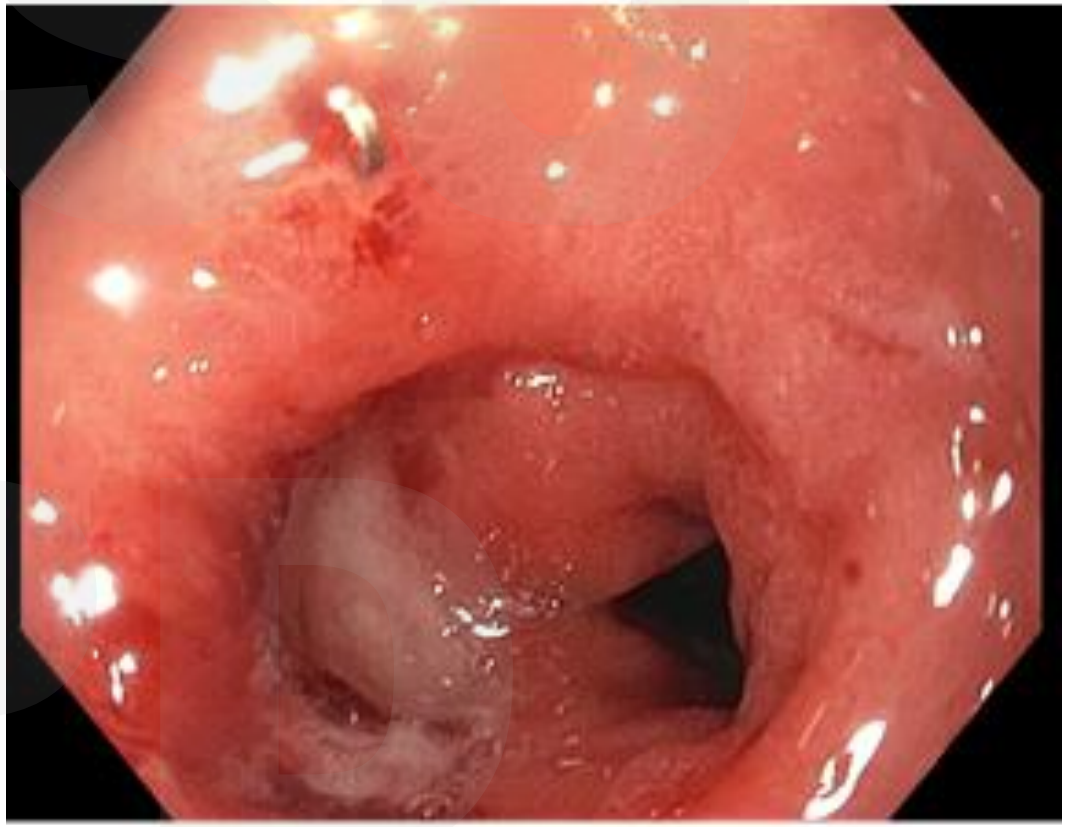
Allison R. Schulman,[*,‡] Walter W. Chan,[*,‡] Aiofe Devery,[*] Michele B. Ryan,[*] and Christopher C. Thompson[*,‡]



Schulman, A et al. CGH 2017

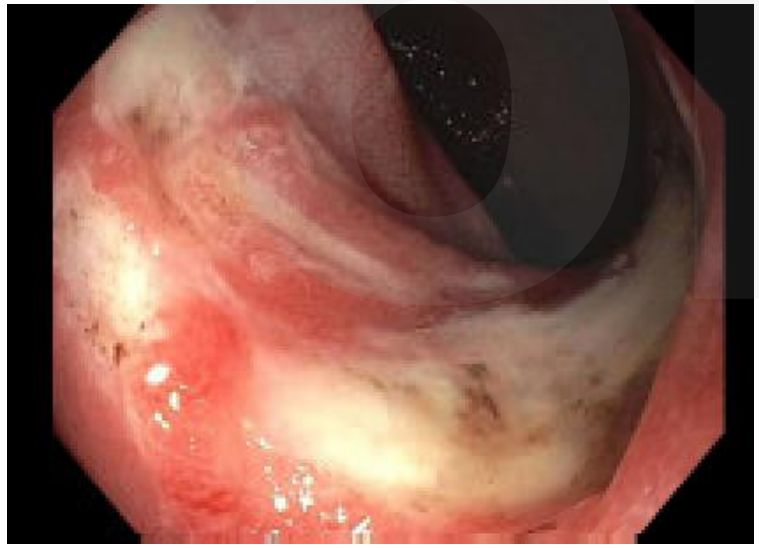
Adjunctive treatment

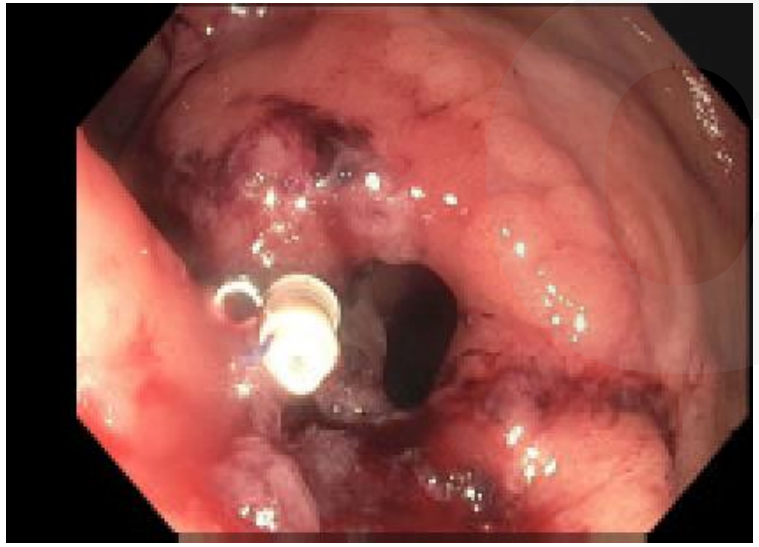
- H pylori stool antigen
- Lifestyle modifications:
  - Smoking cessation
  - NSAID avoidance
- Sulcrafate 1gram QID slurry or solution
- Remove foreign suture material



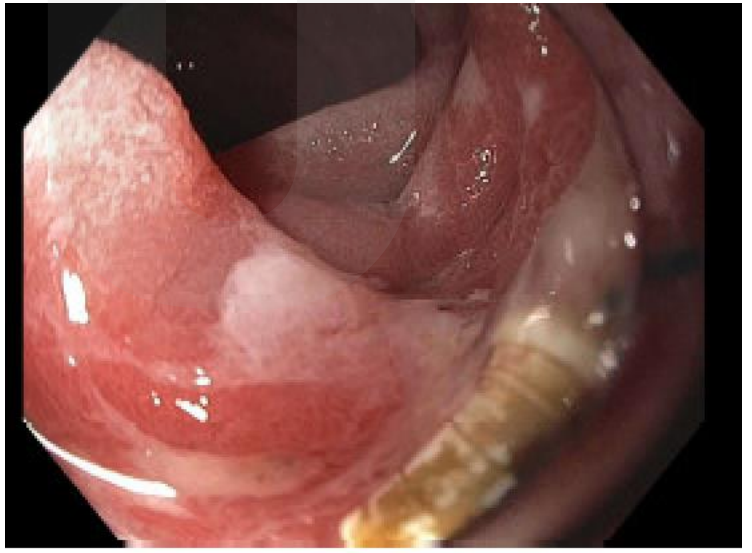
Schulman, A et al. Am J Gastro 2017

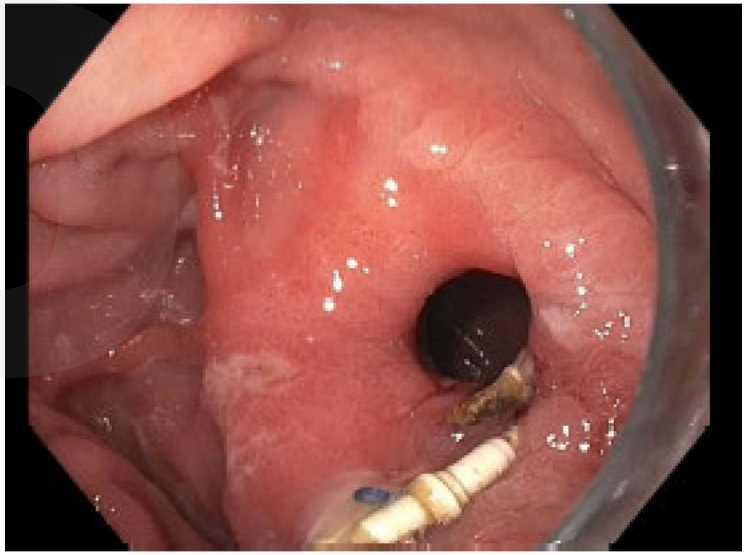
Endoscopic oversewing of refractory ulcers





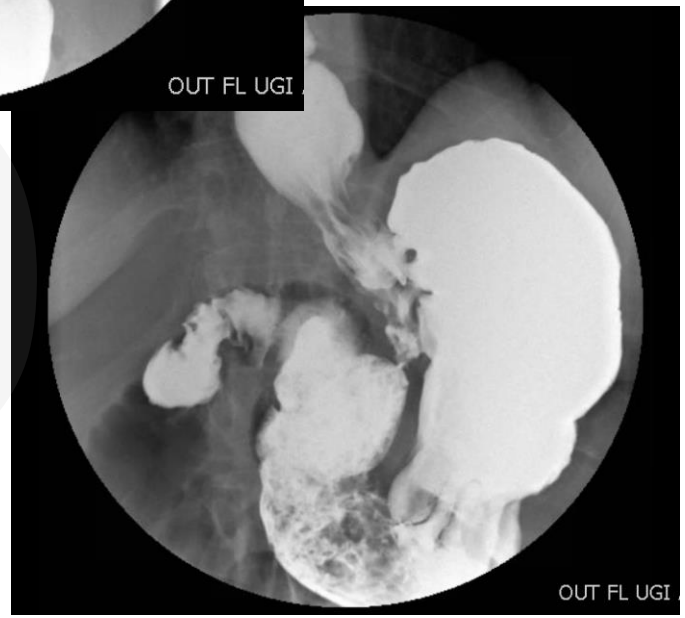
2 months





Gastrogastric fistulas

- Reported incidence 1.3-12% after gastric bypass, incomplete division of the stomach or staple line dehiscence
- Present with weight regain, pain, nausea/vomiting, reflux, marginal ulcers
- Diagnosed with upper GI series, upper endoscopy

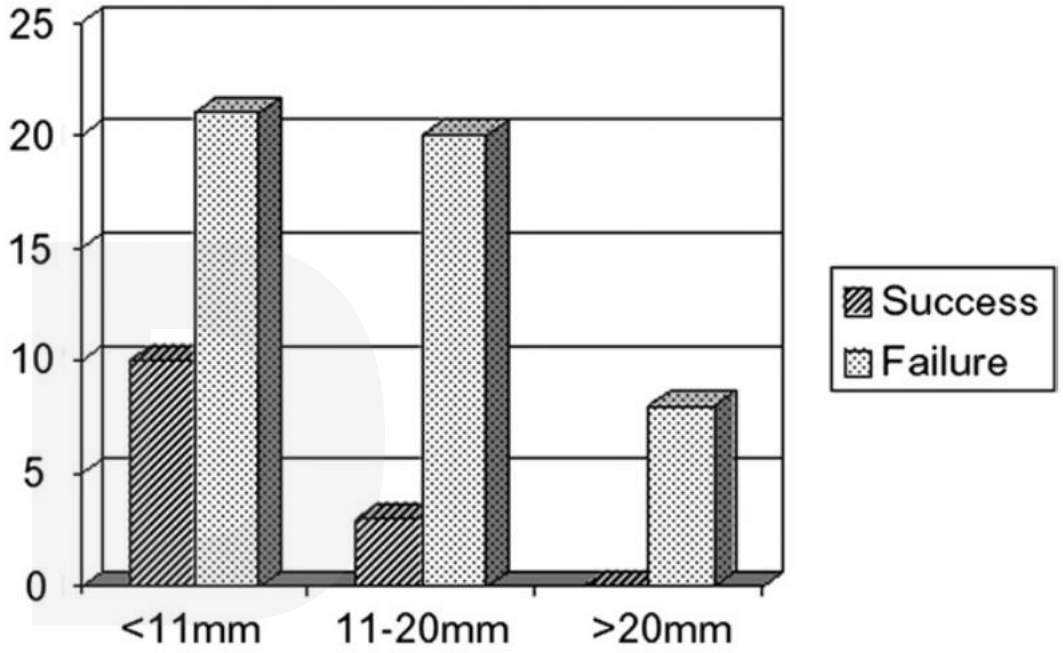


GG fistula - management

- Endoscopic closure or surgical revision
- <10mm has better long-term success with endoscopic closure

Endoscopic repair of gastrogastric fistula after Roux-en-Y gastric bypass: a less-invasive approach

Gloria Fernandez-Esparrach, M.D., Ph.D.[a], David B. Lautz, M.D.[b], Christopher C. Thompson, M.D., M.Sc., F.A.C.G., F.A.S.G.E.[a,*]



Mukewar et al. Endoscopy 2016
Niland et al. Surg Obes Relat Dis 2017
Fernandez-Esparrach et al. Surg Obes Relat Dis. 2010

Anastomotic strictures

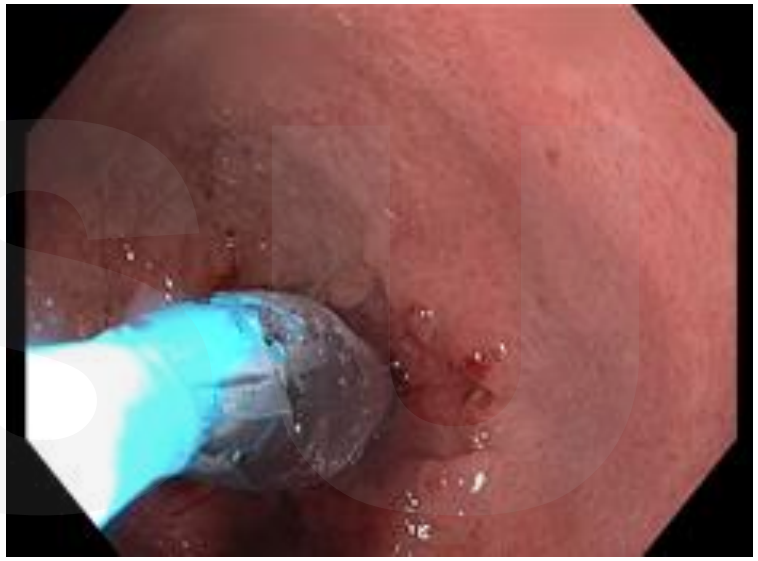
- Can present weeks to years after surgery
- Present with dysphagia, nausea, vomiting, abdominal pain, malnutrition (paradoxical weight gain)
- Diagnosed by EGD, inability to pass endoscope

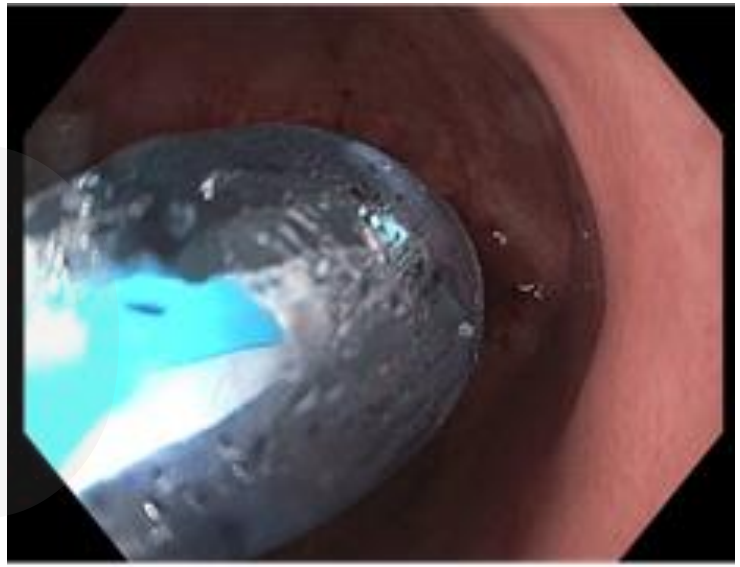
Schulman et al. Am J Gastro 2017
Storm et al. Gastro Endosc Clin N Am. 2017

Anastomotic strictures

- Balloon dilation (97% success)

- Perforation rate 1-3%
  - Avoid dilating 4 wks post-op
  - Consider fluoroscopy, wire-guidance

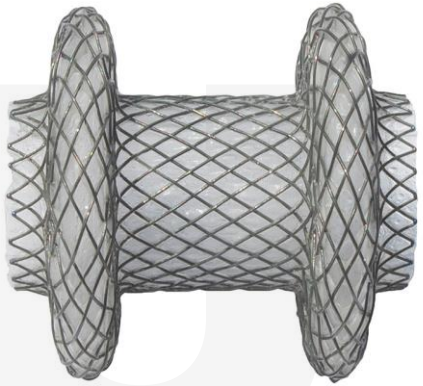


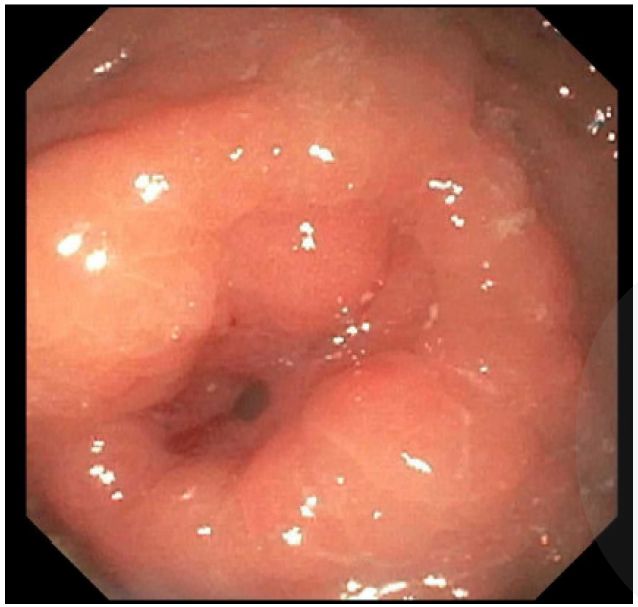


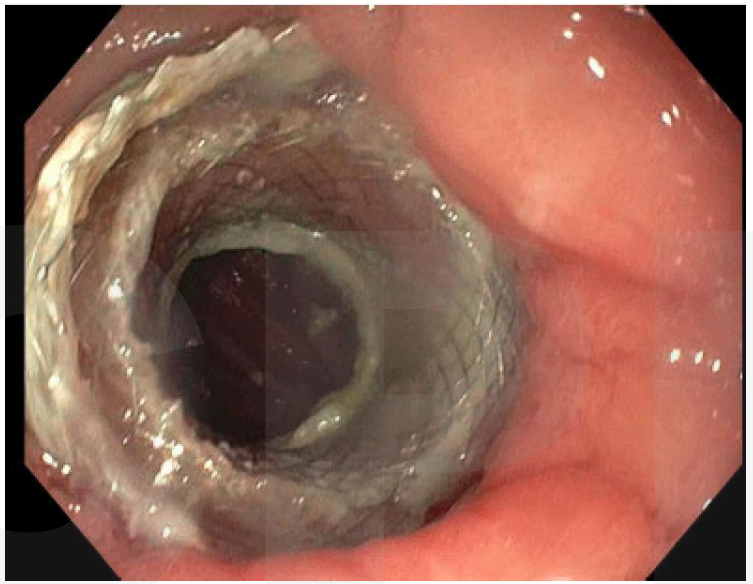
Bauman, A et al. Obes Surg 2018
Piefer, K et al. GIE 2007

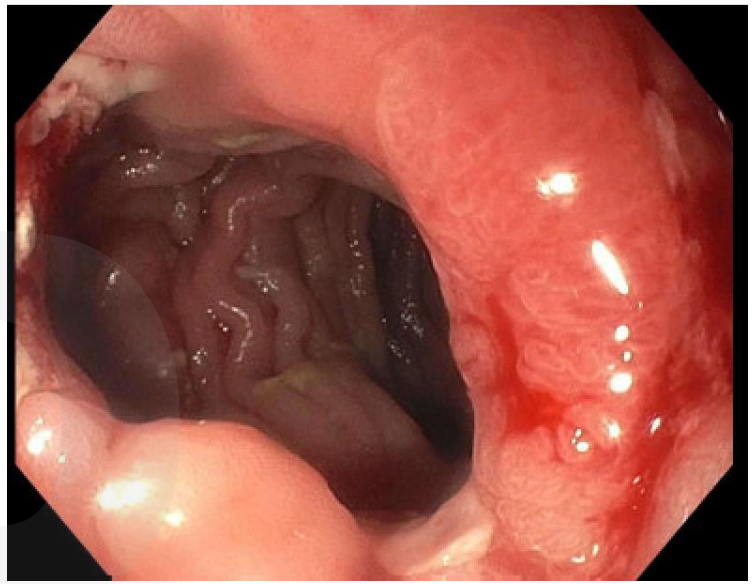
Refractory Stricture

- Endoscopic stenting





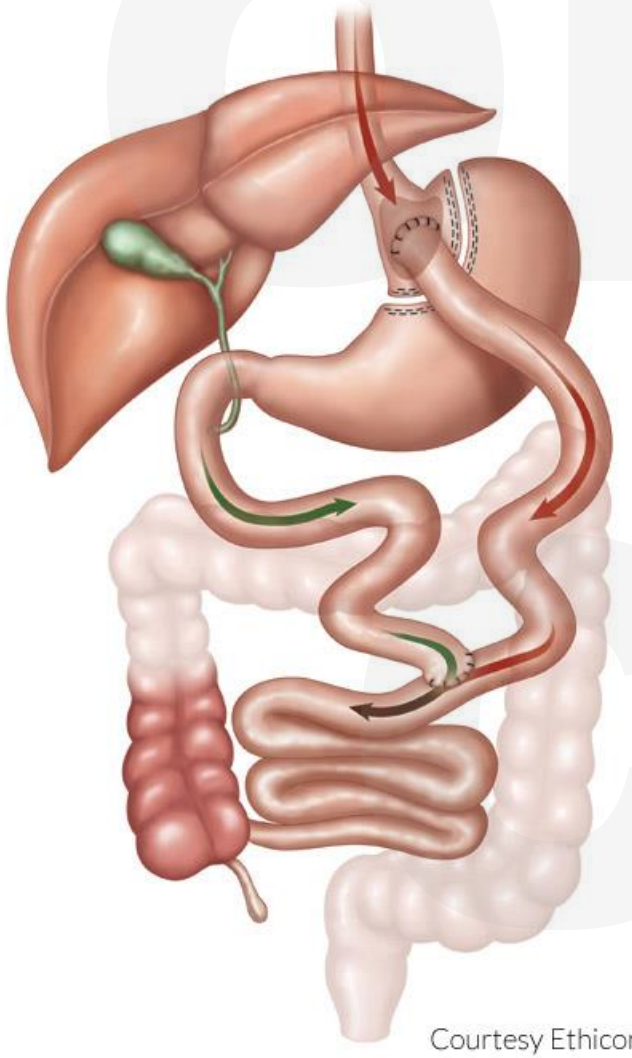




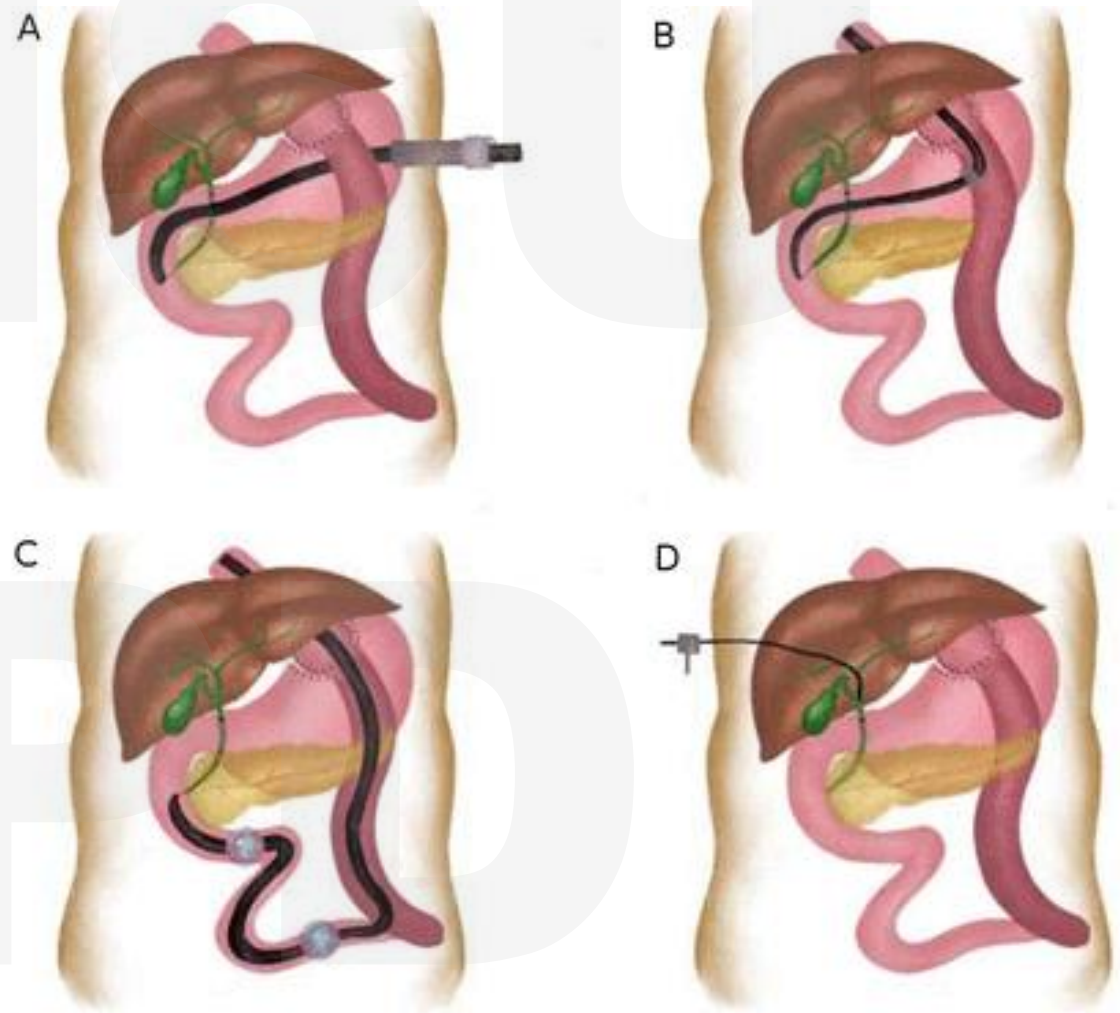
Gallstone disease

- 5-15% of patient develop gallstone disease
- Present with episodic post-prandial epigastric and RUQ pain and biliary colic
- Work-up with CBC, Liver function test, RUQ USN, HIDA scan
- Roux-en-y anatomy complicates endoscopic evaluation

ERCP in Roux-en-y anatomy



Courtesy Ethicon



Martin H et al. Frontline Gastroenterology 2022

Common causes of pain after RYGB surgery

Table. Prevalence, Presentation, Diagnosis, Management, and Clinical Pearls for Common Causes of Abdominal Pain After RYGB Surgery

Etiology	Prevalence	Presentation	Diagnosis	Management	Clinical pearl
Internal hernia	3%-14%	Often vague, postprandial abdominal pain, nausea; examination results may be benign; laboratory results typically unremarkable	Abdomen CT: only approximately 80% sensitive and specific Diagnostic laparoscopy: especially for severe pain or signs of obstruction	Urgent/emergent surgical exploration, evaluation of mesenteric defects, reduction of hernia ± bowel resection if ischemic, closure of defects with permanent suture	No perfect diagnostic test; if clinical suspicion high enough, diagnostic laparoscopy is warranted
Marginal ulcer	Up to 16%	Constant midepigastric pain worse with eating; possible occult anemia or bleeding; chronic ulcers can lead to scarring/stricture that presents with obstructive symptoms	Upper endoscopy (EGD)	High-dose PPI (soluble form or open capsules for increased absorption) ± sulcralfate, cessation of smoking/NSAID use	Persistent nausea/vomiting may lead to thiamine deficiency and Wernicke-Korsakoff syndrome
Biliary disease	5%-15% (Symptomatic)	Postprandial right upper quadrant/epigastric pain, nausea, and vomiting; may have jaundice if biliary obstruction	CBC, liver function tests; right upper quadrant ultrasonography to evaluate for stones and biliary dilation	Cholecystitis: IV antibiotics, urgent laparoscopic cholecystectomy Choledocolithiasis: laparoscopic-assisted ERCP or endoscopic ultrasonography-directed transgastric ERCP (EDGE procedure), followed by same admission cholecystectomy	Access to the ampulla difficult given RYGB anatomy; MRCP may be useful in confirming diagnosis if uncertainty exists
JJ anastomotic stricture or intussusception	<5% (Rare)	Obstructive symptoms, often chronic or intermittent: abdominal pain, bloating nausea, and vomiting	Abdomen CT, upper GI series with small bowel follow-through	Stricture: surgical exploration with revision of JJ anastomosis Intussusception: reduction of intussusception with enteropexy or revision of JJ anastomosis; if recurrent, may require reversal of RYGB	Symptoms may be vague and imaging may not point to a clear issue at the JJ anastomosis; diagnostic laparoscopy can be helpful to determine etiology

Fry et al. JAMA surgery 2023

Complications after gastric sleeve

GERD after sleeve gastrectomy is common

- Obesity is a risk factor for GERD -> weight loss should decrease GERD

- Sleeve gastrectomy less likely to alleviate GERD symptoms compared to RYGB (13% vs 38%, $p < 0.001$) and more likely to worsen symptoms (49% vs. 9%, $p < 0.001$)

- 14% conversion to RYGB due to GERD

Salminen et al. JAMA surgery. 2022

Proposed mechanism of GERD after sleeve gastrectomy

Table 2 Putative pathophysiological mechanisms of gastroesophageal reflux disease post laparoscopic sleeve gastrectomy

Hypotensive lower esophageal sphincter[48]
Loss of angle of His flap valve[55]
Increased gastro-esophageal pressure gradient and intra-thoracic migration of the remnant stomach[56]
Reduction in the compliance of the gastric remnant provoking an increase in transient lower esophageal sphincter relaxations[57]
Lack of gastric compliance and emptying during the first postoperative year[58]
Relative gastric stasis in the proximal remnant and increased emptying from the antrum (suggested on time-resolved MRI studies)[59]
Excessively large or dilated sleeve retaining increased acid production capacity leading to reflux[60]
Overly narrowed or strictured sleeve resulting in reflux and decreased esophageal acid clearance[61]

Daher et al. World J Gastro 2019

Increased risk of GERD and barrett's esophagus after sleeve gastrectomy

Risk of De Novo Barrett's Esophagus (BE) Post Sleeve Gastrectomy (SG): A Systematic Review and Meta-analysis of Studies with Long Term Follow up

- 19 studies with 2046 patients
- Mean → 2 to 11.4 years
- Pooled rate of de novo BE → 5.6%

	Pre SG	Post SG
Reflux Symptoms	14.6%	48%
Erosive Esophagitis	7.7%	33.4%
Hiatal Hernia	14.8%	32.1%
PPI Use	13.5%	54.6%

Clinical Gastroenterology and Hepatology

Chandan et al. Clin Gastro Hep Jan 2025

ELSEVIER

Surgery for Obesity and Related Diseases 17 (2021) 837–847

ASMBS Guidelines/Statements

ASMBS position statement on the rationale for performance of upper gastrointestinal endoscopy before and after metabolic and bariatric surgery

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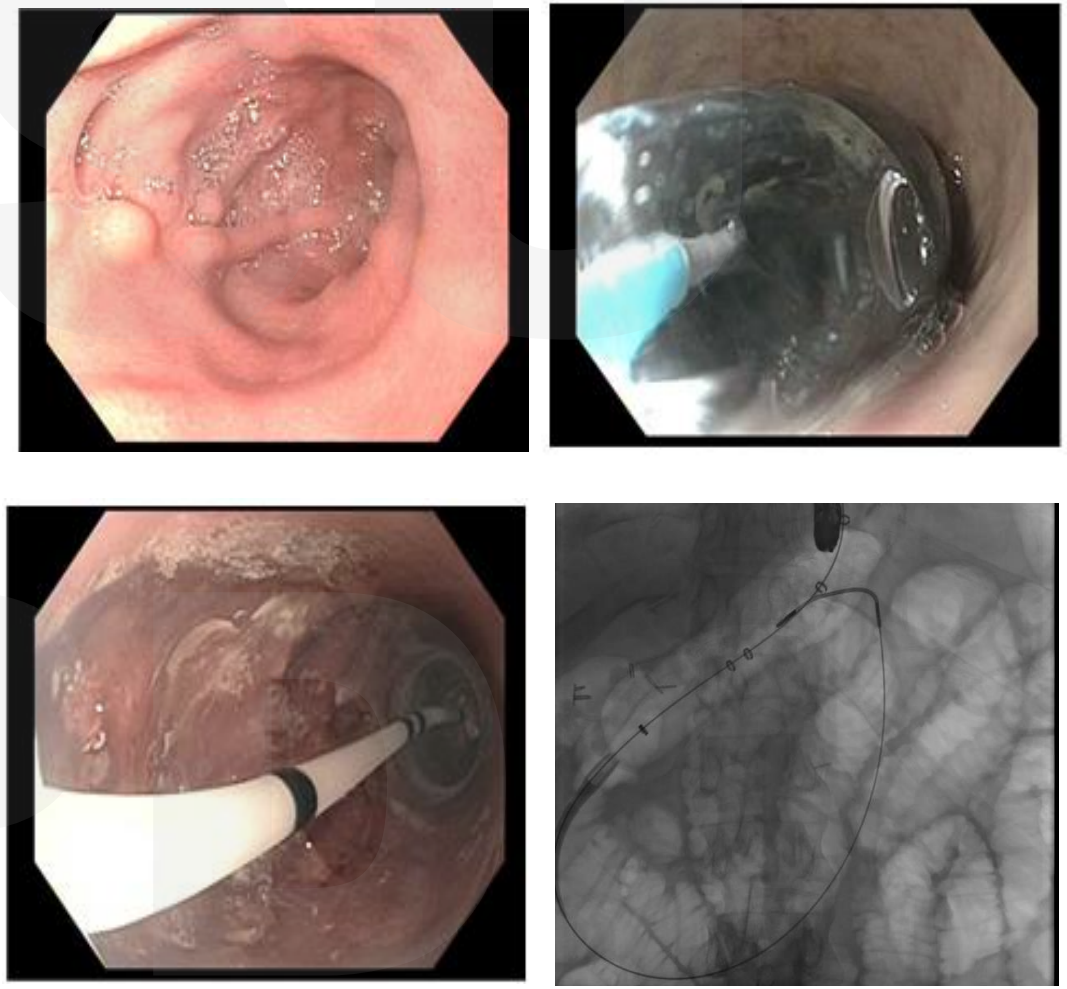
EGD on patients ≧3 years after sleeve gastrectomy with long term follow-up pending initial finding

Sleeve stenosis

- Occurs after 4% of sleeve gastrectomy
- Narrowing or twisting/angulation on endoscopy
- Present with reflux, dysphagia, vomiting, regurgitation, pain
- 88-100% response to serial pneumatic dilations (30-35mm)
- Surgical revision

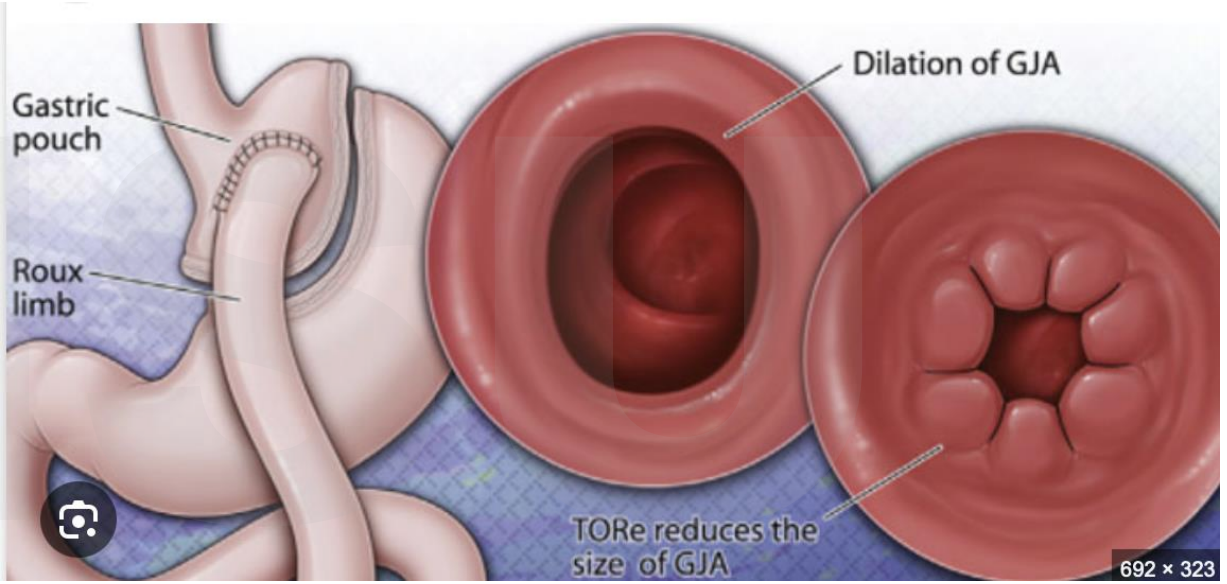


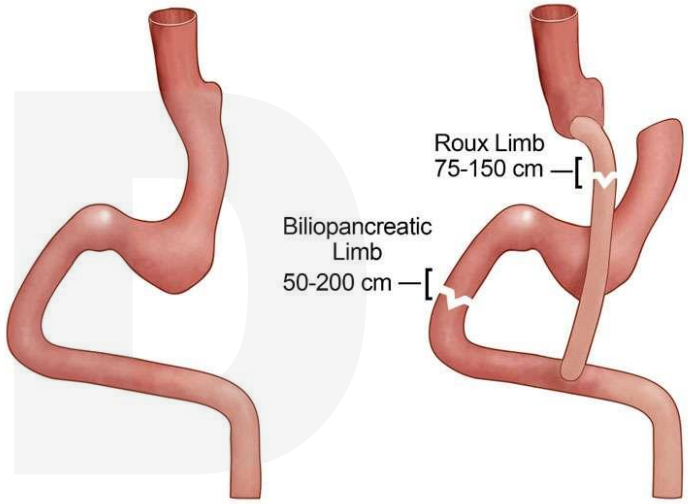
Deslauriers et al. Surg Endosc 2018
Yu et al. Obes Surg. 2019

Weight regain

- Anti-obesity medications
  - Wait 6-12 months

- Assess for underlying etiology
  - Endoscopic revision
  - Surgical revision or conversion





Sleeve Revision RNY

OHSU follow-up protocol

- Patients should be on MVI, Calcium, Vit D, B12
  - Iron and other supplements as dictated by labs and clinical findings
- Omeprazole 20mg daily for 3 months
- Ursodiol for 6 months
- Assess symptoms: nausea/vomiting, dysphagia, abdominal pain etc.

OHSU follow-up protocol

1 week	1 month	3 months	6 months	1 year (annually)
• NP visit • CBC, CMP • Check surgical healing • Review symptoms, diet, activity etc.	• Surgeon visit • CBC, CMP • Review symptoms, diet, activity etc.	• Review symptoms, diet, activity etc • CBC, CMP • Vit D, PTH • B12, B1, folate, TIBC, iron	• Review symptoms, diet, activity etc • CBC, CMP • Vit D, PTH • B12, B1, Folate, TIBC, iron	• Review symptoms, diet, activity etc • CBC, CMP • Vit D, PTH • B12, B1, Folate, TIBC, iron

Take home

- Bariatric surgery is safe option for patients with obesity
- Close post-surgical monitoring is important to ensure safety and success of procedure
- Watch for micronutrient deficiencies and symptoms and partner with bariatric surgery if concerns

Thank you!

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Digestive Health