



THE TREATMENT OF PATIENTS FOLLOWING BARIATRIC SURGERY: PITFALLS AND COMPLICATIONS

D. Dante Yeh, MD, MHPE, FACS, FCCM, CNSC

Associate Professor of Surgery

University of Miami / Jackson Memorial Hospital

SPECIAL THANKS TO

- Patricia Byers, MD
 - Professor of Surgery, University of Miami
 - Chief of Surgical Nutrition Division
- Matthew Martin, MD
 - Professor of Surgery, Uniformed Services University (Bethesda, MD)
 - Associate Director of Trauma Research
 - Scripps Mercy Medical Center
- Andrea Pakula, MD, MPH, FACS
 - Oak Surgical Specialists
 - MIS/Robotic Bariatric and Hernia Surgery
 - Trauma, Critical Care and Acute Care Surgery
 - Los Robles Medical Center



INTRODUCTION

- Approximately 36% of adults in US are obese
- Obesity leading cause of preventable death in the USA
- Bariatric surgery only proven long-term approach to weight loss and treatment of obesity related diseases



The NEW ENGLAND JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

AUGUST 23, 2007

VOL. 357 NO. 8

Effects of Bariatric Surgery on Mortality in Swedish Obese Subjects

Lars Sjöström, M.D., Ph.D., Kristina Narbro, Ph.D., C. David Sjöström, M.D., Ph.D., Kristjan Karason, M.D., Ph.D., Bo Larsson, M.D., Ph.D., Hans Wedel, Ph.D., Ted Lystig, Ph.D., Marianne Sullivan, Ph.D., Claude Bouchard, Ph.D., Björn Carlsson, M.D., Ph.D., Calle Bengtsson, M.D., Ph.D., Sven Dahlgren, M.D., Ph.D., Anders Gummesson, M.D., Peter Jacobson, M.D., Ph.D., Jan Karlsson, Ph.D., Anna-Karin Lindroos, Ph.D., Hans Lönroth, M.D., Ph.D., Ingmar Näslund, M.D., Ph.D., Torsten Olbers, M.D., Ph.D., Kaj Stenlöf, M.D., Ph.D., Jarl Torgerson, M.D., Ph.D., Göran Ågren, M.D., and Lena M.S. Carlsson, M.D., Ph.D., for the Swedish Obese Subjects Study

METHODS

The prospective, controlled Swedish Obese Subjects study involved 4047 obese subjects. Of these subjects, 2010 underwent bariatric surgery (surgery group) and 2037 received conventional treatment (matched control group). We report on overall mortality during an average of 10.9 years of follow-up. At the time of the analysis (November 1, 2005), vital status was known for all but three subjects (follow-up rate, 99.9%).

RESULTS

The average weight change in control subjects was less than $\pm 2\%$ during the period of up to 15 years during which weights were recorded. Maximum weight losses in the surgical subgroups were observed after 1 to 2 years: gastric bypass, 32%; vertical-banded gastroplasty, 25%; and banding, 20%. After 10 years, the weight losses from baseline were stabilized at 25%, 16%, and 14%, respectively. There were 129 deaths in the control group and 101 deaths in the surgery group. The unadjusted overall hazard ratio was 0.76 in the surgery group ($P=0.04$), as compared with the control group, and the hazard ratio adjusted for sex, age, and risk factors was 0.71 ($P=0.01$). The most common causes of death were myocardial infarction (control group, 25 subjects; surgery group, 13 subjects) and cancer (control group, 47; surgery group, 29).

CONCLUSIONS

Bariatric surgery for severe obesity is associated with long-term weight loss and decreased overall mortality.

ORIGINAL ARTICLE

Bariatric Surgery versus Intensive Medical Therapy for Diabetes — 3-Year Outcomes

Philip R. Schauer, M.D., Deepak L. Bhatt, M.D., M.P.H., John P. Kirwan, Ph.D.,
Kathy Wolski, M.P.H., Stacy A. Brethauer, M.D., Sankar D. Navaneethan, M.D., M.P.H.,
Ali Aminian, M.D., Claire E. Pothier, M.P.H., Esther S.H. Kim, M.D., M.P.H.,
Steven E. Nissen, M.D., and Sangeeta R. Kashyap, M.D.,
for the STAMPEDE Investigators*

METHODS

We assessed outcomes 3 years after the randomization of 150 obese patients with uncontrolled type 2 diabetes to receive either intensive medical therapy alone or intensive medical therapy plus Roux-en-Y gastric bypass or sleeve gastrectomy. The primary end point was a glycated hemoglobin level of 6.0% or less.

RESULTS

The mean (\pm SD) age of the patients at baseline was 48 ± 8 years, 68% were women, the mean baseline glycated hemoglobin level was $9.3\pm 1.5\%$, and the mean baseline body-mass index (the weight in kilograms divided by the square of the height in meters) was 36.0 ± 3.5 . A total of 91% of the patients completed 36 months of follow-up. At 3 years, the criterion for the primary end point was met by 5% of the patients in the medical-therapy group, as compared with 38% of those in the gastric-bypass group ($P<0.001$) and 24% of those in the sleeve-gastrectomy group ($P=0.01$). The use of glucose-lowering medications, including insulin, was lower in the surgical groups than in the medical-therapy group. Patients in the surgical groups had greater mean percentage reductions in weight from baseline, with reductions of $24.5\pm 9.1\%$ in the gastric-bypass group and $21.1\pm 8.9\%$ in the sleeve-gastrectomy group, as compared with a reduction of $4.2\pm 8.3\%$ in the medical-therapy group ($P<0.001$ for both comparisons). Quality-of-life measures were significantly better in the two surgical groups than in the medical-therapy group. There were no major late surgical complications.

CONCLUSIONS

Among obese patients with uncontrolled type 2 diabetes, 3 years of intensive medical therapy plus bariatric surgery resulted in glycemic control in significantly more patients than did medical therapy alone. Analyses of secondary end points, including body weight, use of glucose-lowering medications, and quality of life, also showed favorable results at 3 years in the surgical groups, as compared with the group receiving medical therapy alone. (Funded by Ethicon and others; STAMPEDE ClinicalTrials.gov number, NCT00432809.)

INTRODUCTION

- Weight loss
 - Ideal Body Weight (IBW) – calculated from sex and height
 - Actual body weight (ABW)
 - **Excess body weight** = $ABW - IBW$
- Bariatric surgery considered successful if:
 - >50% excess body weight loss
 - Improvements in medical co-morbidities
 - Improvements in Quality of Life



INTRODUCTION

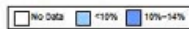
Complications of bariatric surgeries are common

Complications last the lifetime of the patient

Patients more likely to present acutely to hospital, **not the original bariatric center**

OBESITY IN THE USA 25 YEAR TREND

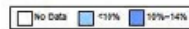
**Obesity Trends* Among U.S. Adults
BRFSS, 1985**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.



**Obesity Trends* Among U.S. Adults
BRFSS, 1990**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.

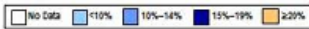
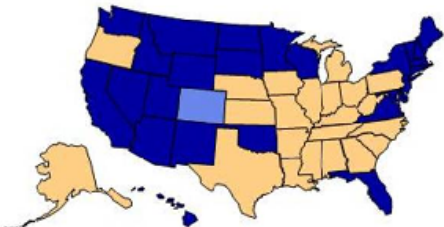


**Obesity Trends* Among U.S. Adults
BRFSS, 1995**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.

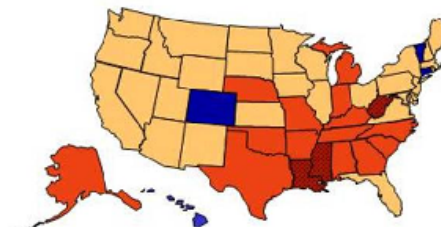
**Obesity Trends* Among U.S. Adults
BRFSS, 2000**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.



**Obesity Trends* Among U.S. Adults
BRFSS, 2005**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.



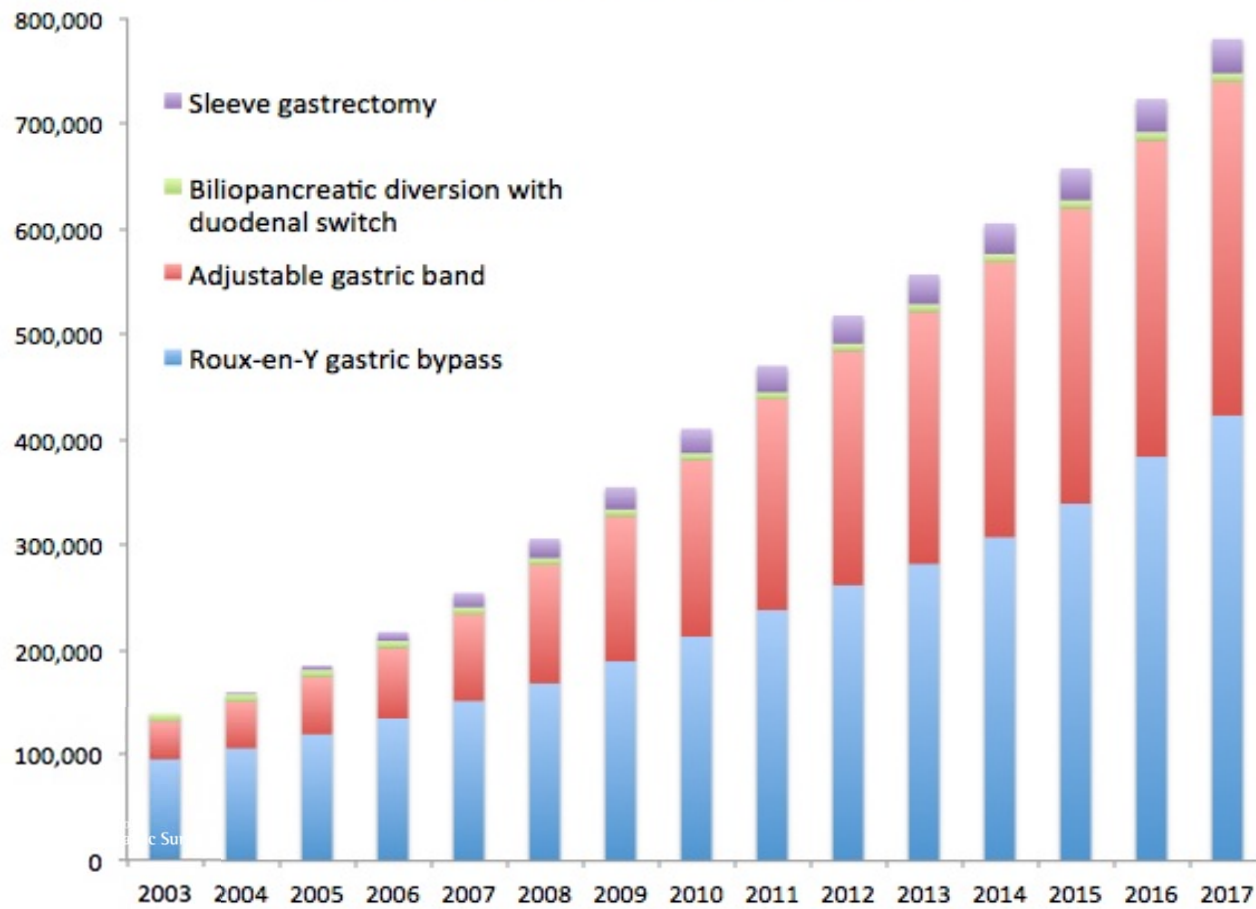
**Obesity Trends* Among U.S. Adults
BRFSS, 2010**
(*BMI ≥ 30 , or ~ 30 lbs. overweight for 5' 4" person)



Source: Behavioral Risk Factor Surveillance System, CDC.



Bariatric Surgery, Worldwide, 2003-2017



Surgical Management of Morbid Obesity

Two Epidemics: Obesity and Obesity Surgery



OBJECTIVES

- Review the anatomical configurations for bariatric operations
- Illustrate common complications
 - Surgical
 - Medical



INITIAL EVALUATION

- Bariatric history is critical!
 - Which *specific procedure* did you have?
 - Any major complications after surgery?
 - How much did you weigh before the operation?
 - How much weight did you lose after the operation? Over how much time?



Often labelled as "prior gastric bypass"

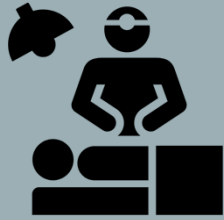
TWO PRINCIPLES OF WEIGHT LOSS



Eat Less



Absorb Less



BARIATRIC SURGERY COMPONENTS

1. Restrictive

- make the stomach capacity smaller

2. Malabsorptive/Metabolic

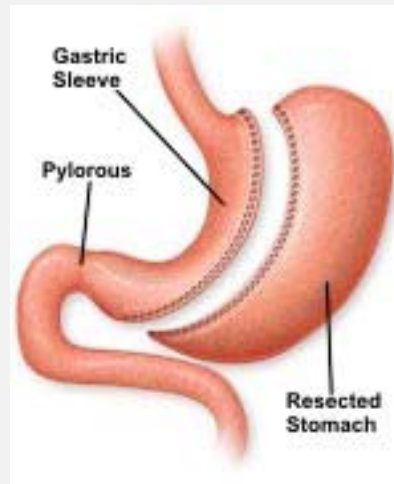
- Intestinal bypass
- **ALL current operations involve Restriction or combined R+M**

The more effective the bariatric operation and causing weight loss, the more potential for complications

Purely Restrictive

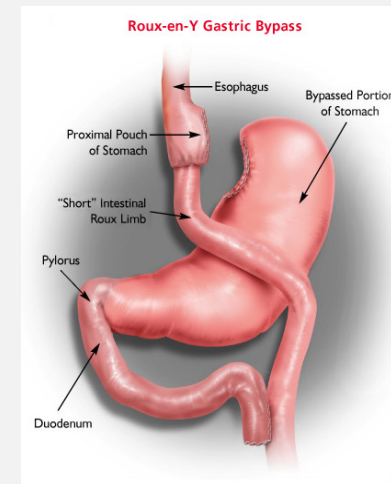


Adjustable gastric band
("Lap Band")



Sleeve gastrectomy
("Lap Sleeve")

Combined Restrictive + Malabsorptive



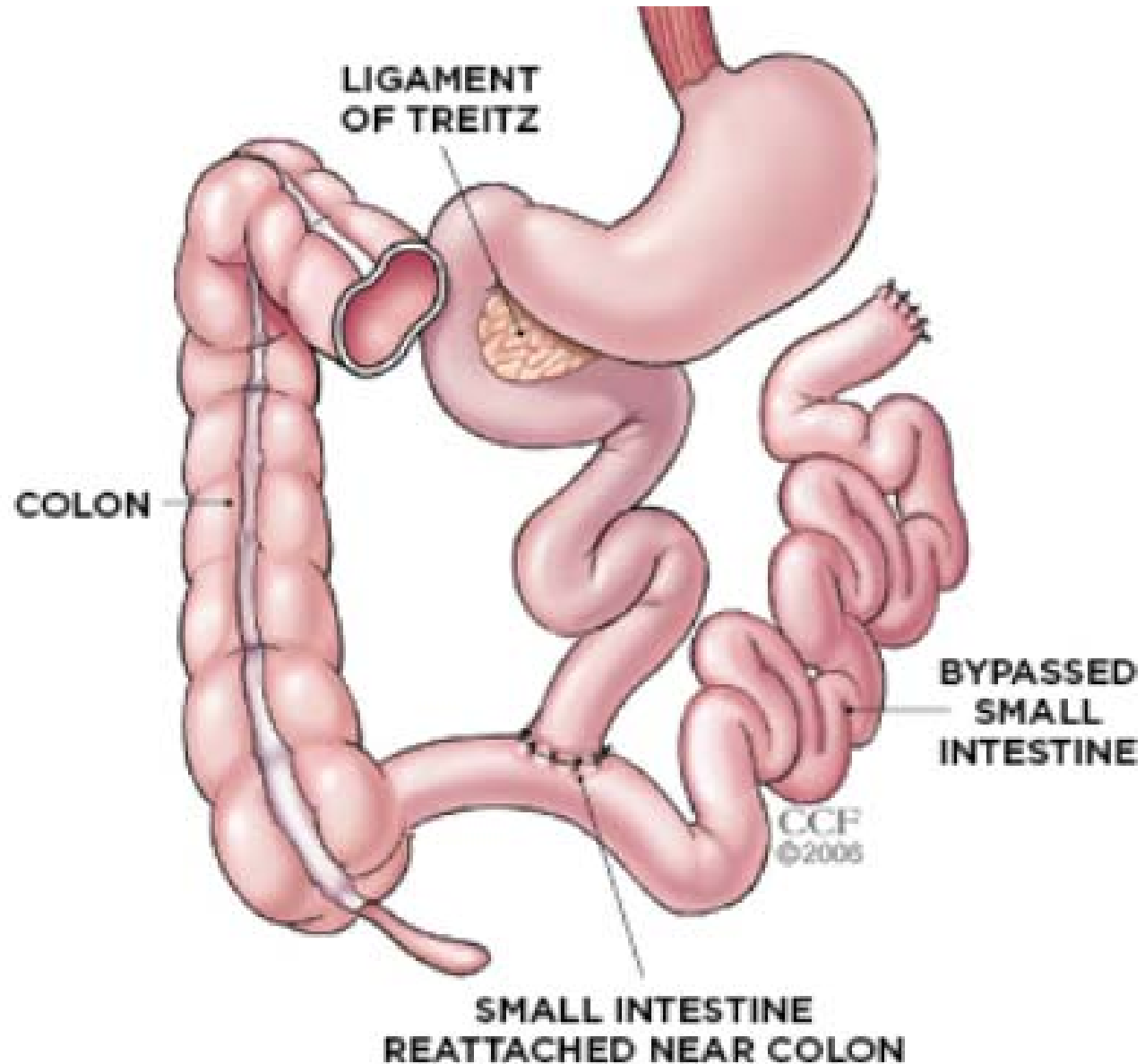
Gastric Bypass
("RYGB")

A BRIEF HISTORY OF BARIATRIC SURGERY

An Odyssey of trial and error

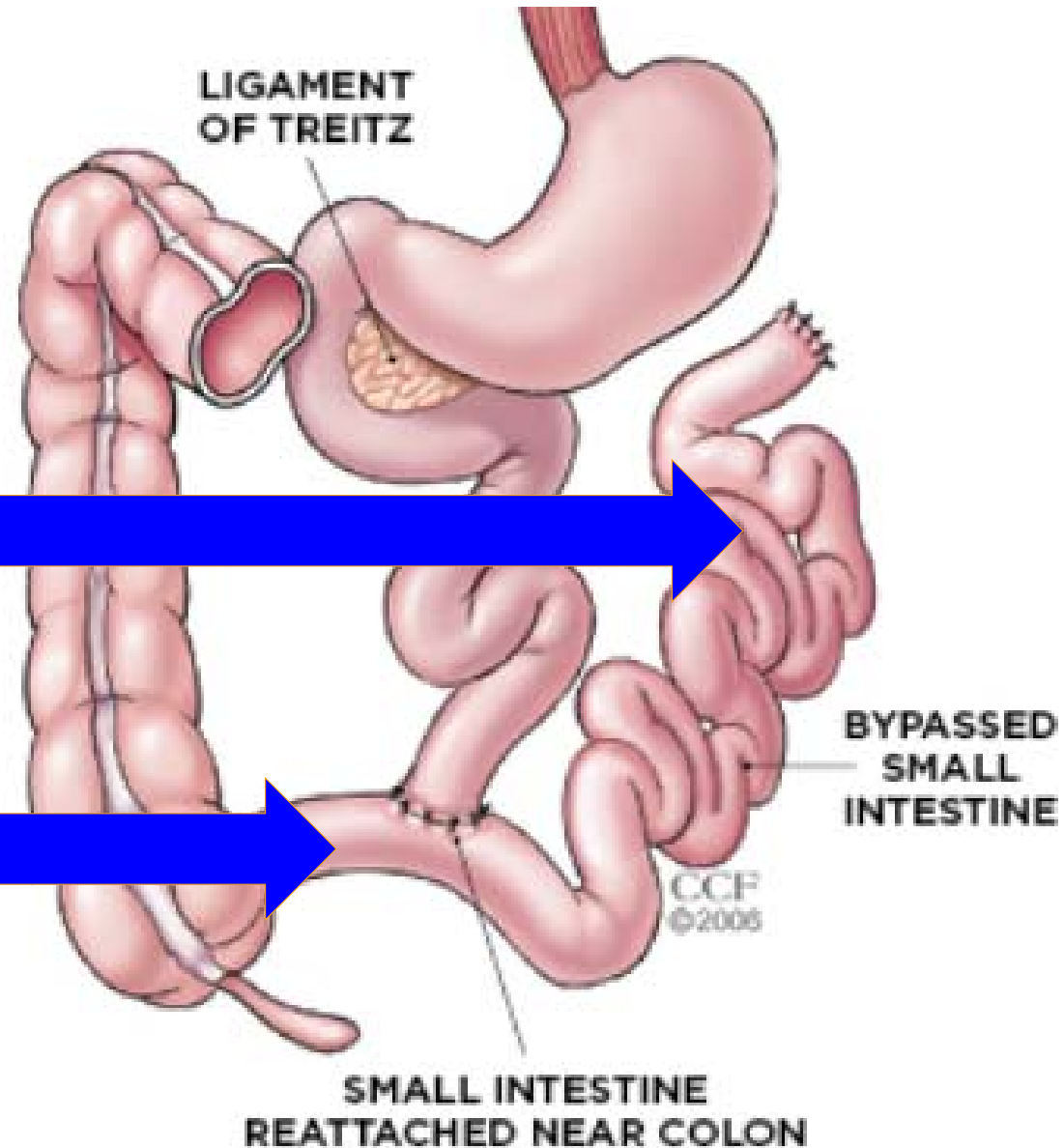
JEJUNOILEAL BYPASS (JIB) (1952)

- 35 cm of jejunum connected to 10 cm of terminal ileum
(i.e. surgical short bowel syndrome)
- Too morbid!
 - Liver failure
 - Severe nutritional deficiencies



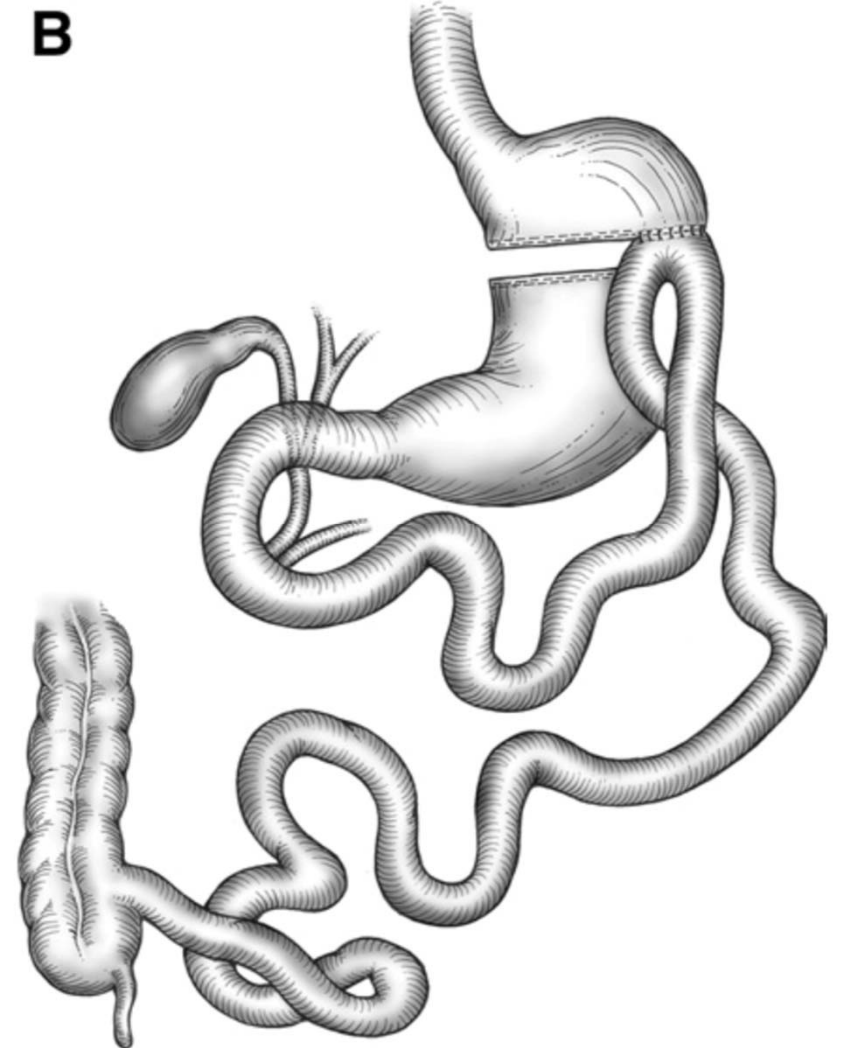
JEJUNOILEAL BYPASS (JIB) (1952)

- Bacterial overgrowth from “blind loop” syndrome
- SEVERE diarrhea



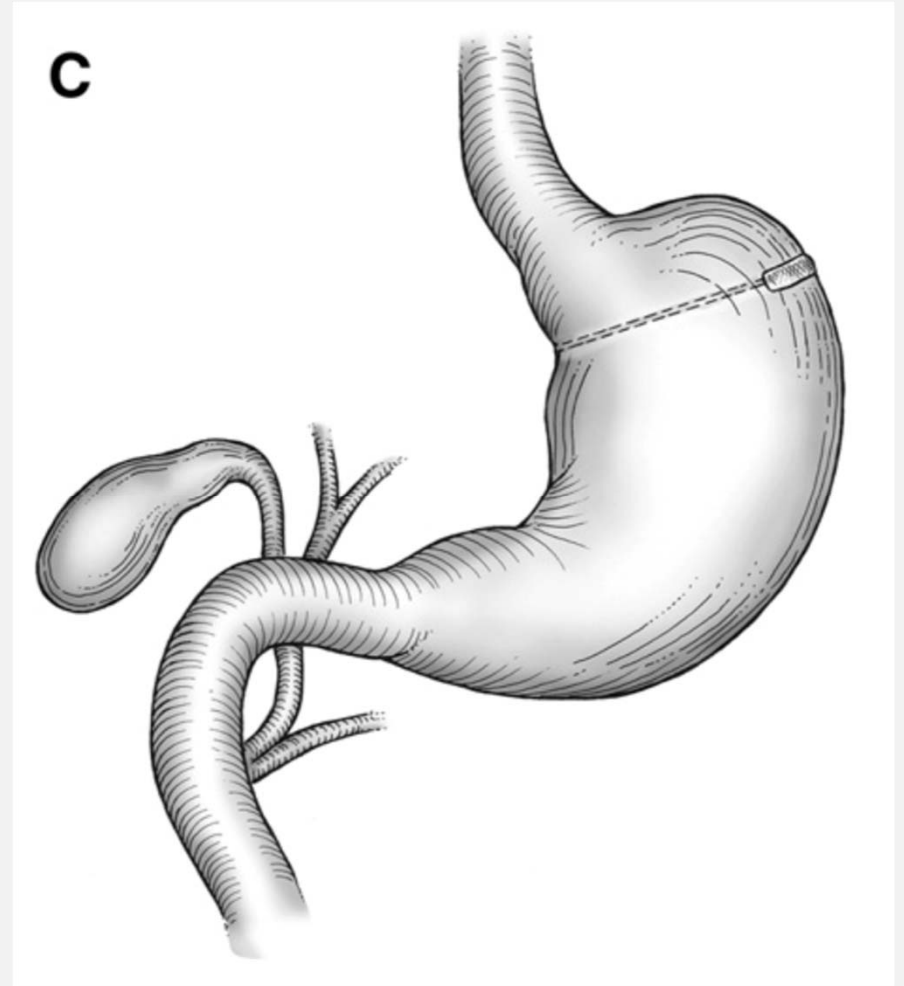
LOOP GASTRIC BYPASS

- Gastro-jejununostomy
 - Bile reflux gastritis/esophagitis
 - Stomal ulceration
 - Dumping syndrome



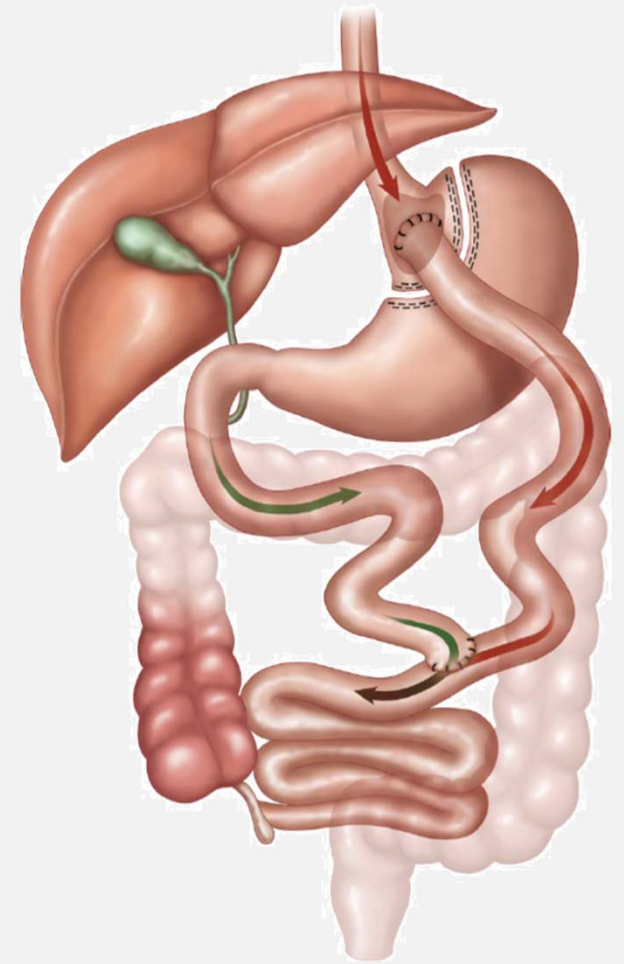
HORIZONTAL GASTROPLASTY
“GASTRIC STAPLING” (1980)

- **High** rate of weight regain



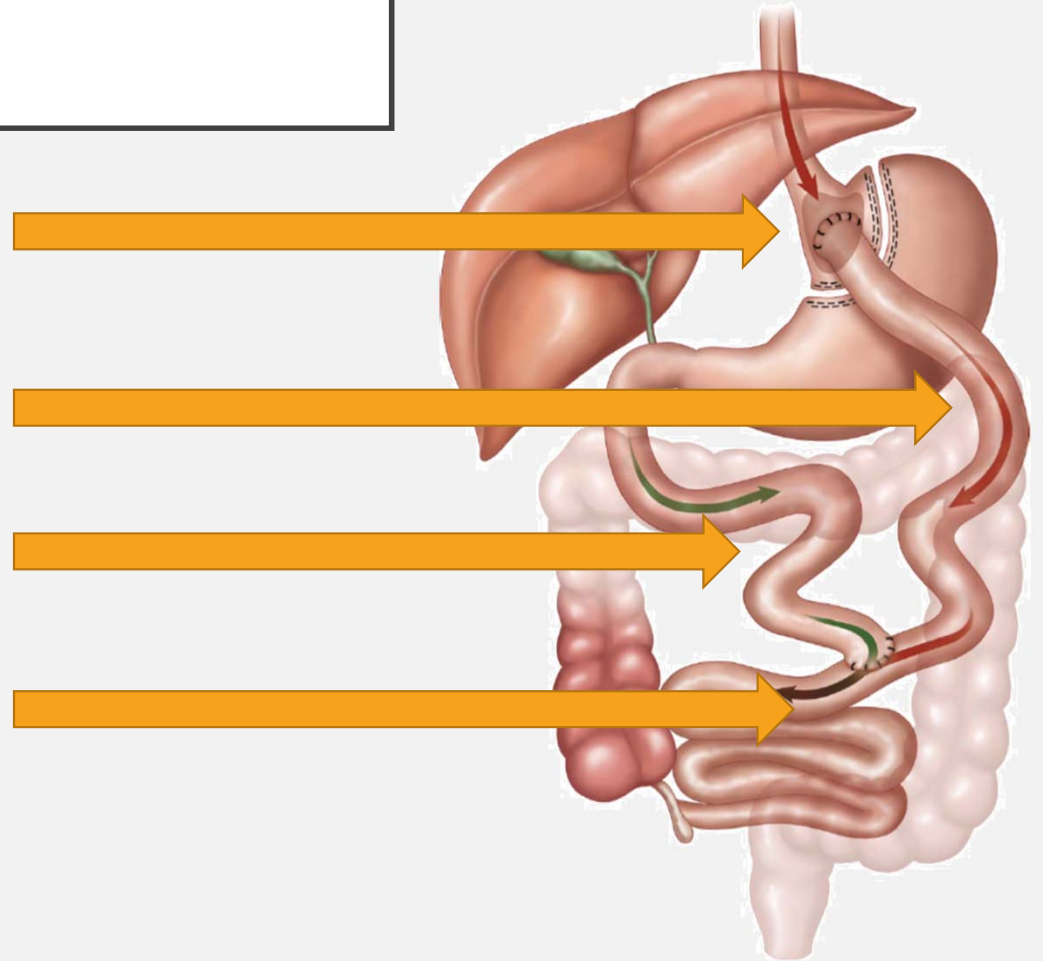
ROUX-EN-Y GASTRIC BYPASS (RYGB) (1977)

- Introduced to address the problems associated with loop gastrojejunostomy
 - Bile reflux
 - Marginal ulceration



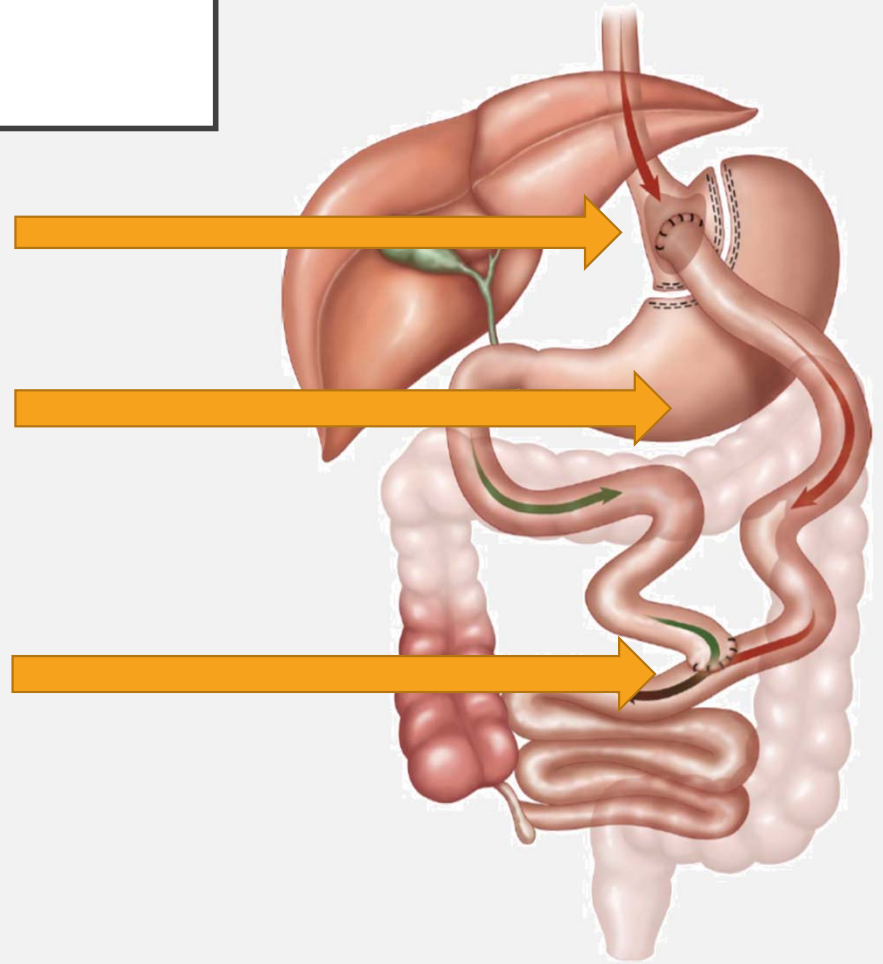
ROUX-EN-Y GASTRIC BYPASS (RYGB) (1977)

- 15- 30 mL gastric “pouch”
- “alimentary” or “Roux” limb
 - -75-150 cm
- “biliopancreatic” limb
 - 30-75 cm distal to ligament of Treitz
- “common channel” is where food and digestive enzymes combine



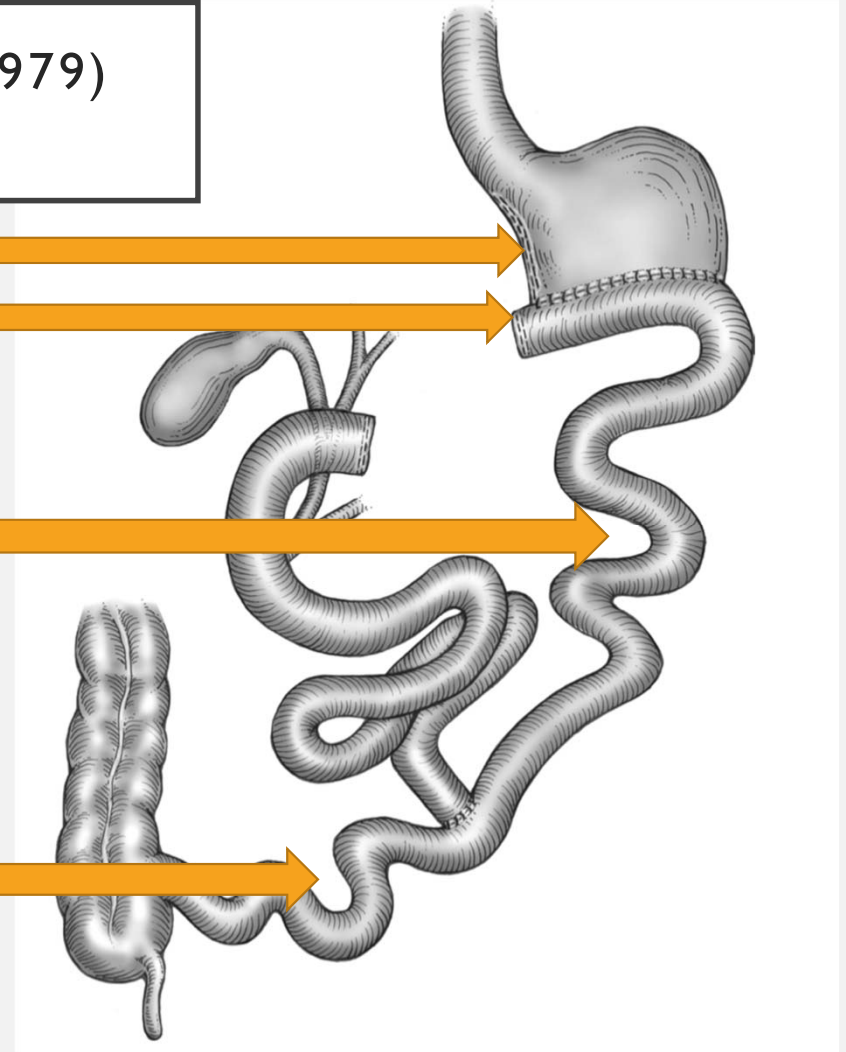
ROUX-EN-Y GASTRIC BYPASS (RYGB) (1977)

- Gastro-jejunal (“GJ”)
- Gastric “remnant”
- Jejununo-jejunal (“JJ”)



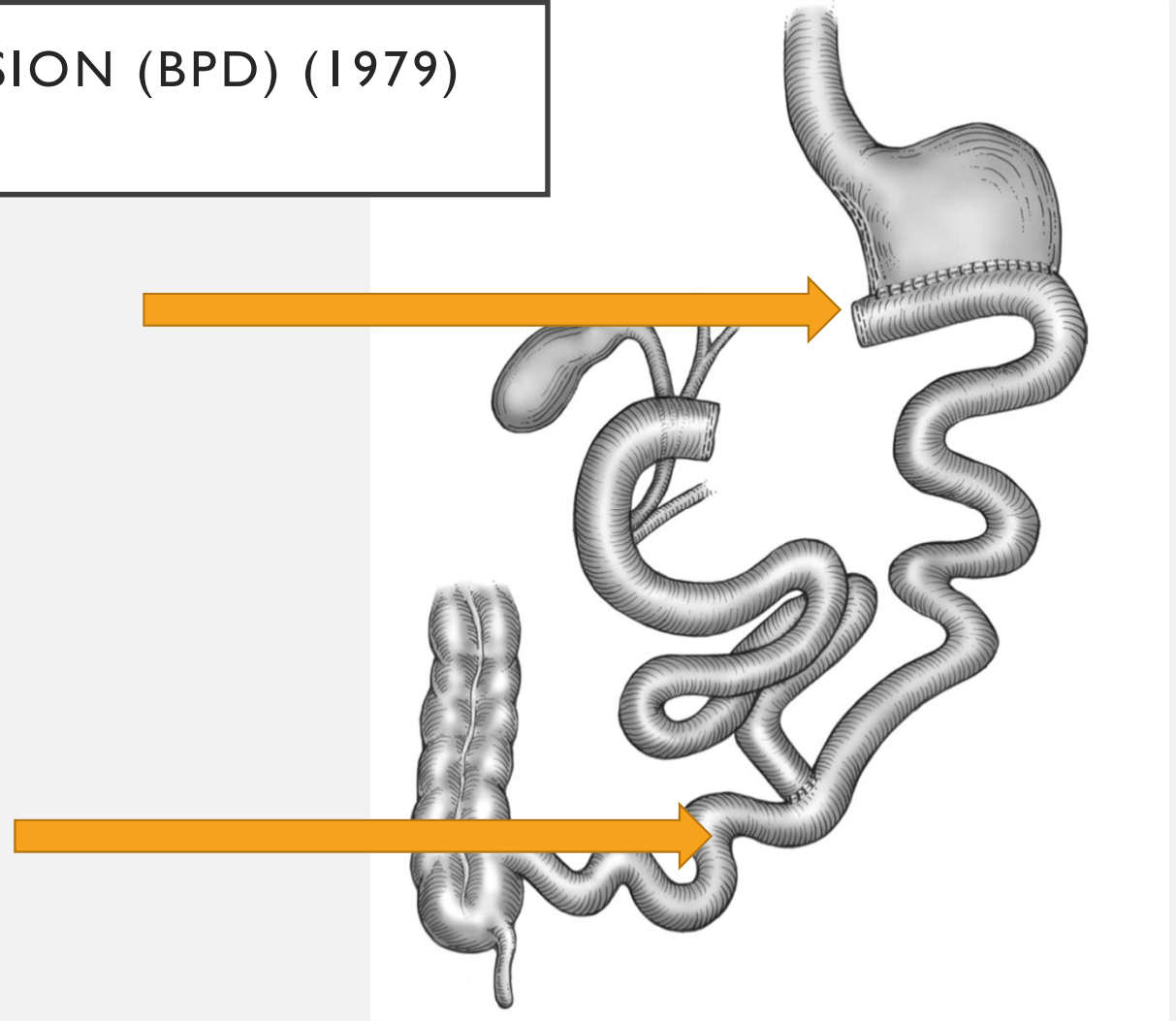
BILIOPANCREATIC DIVERSION (BPD) (1979)

- Antrectomy
- Gastroileal anastomosis
- 200 cm alimentary (“Roux”) limb
- 50 common channel
 - (very short!)



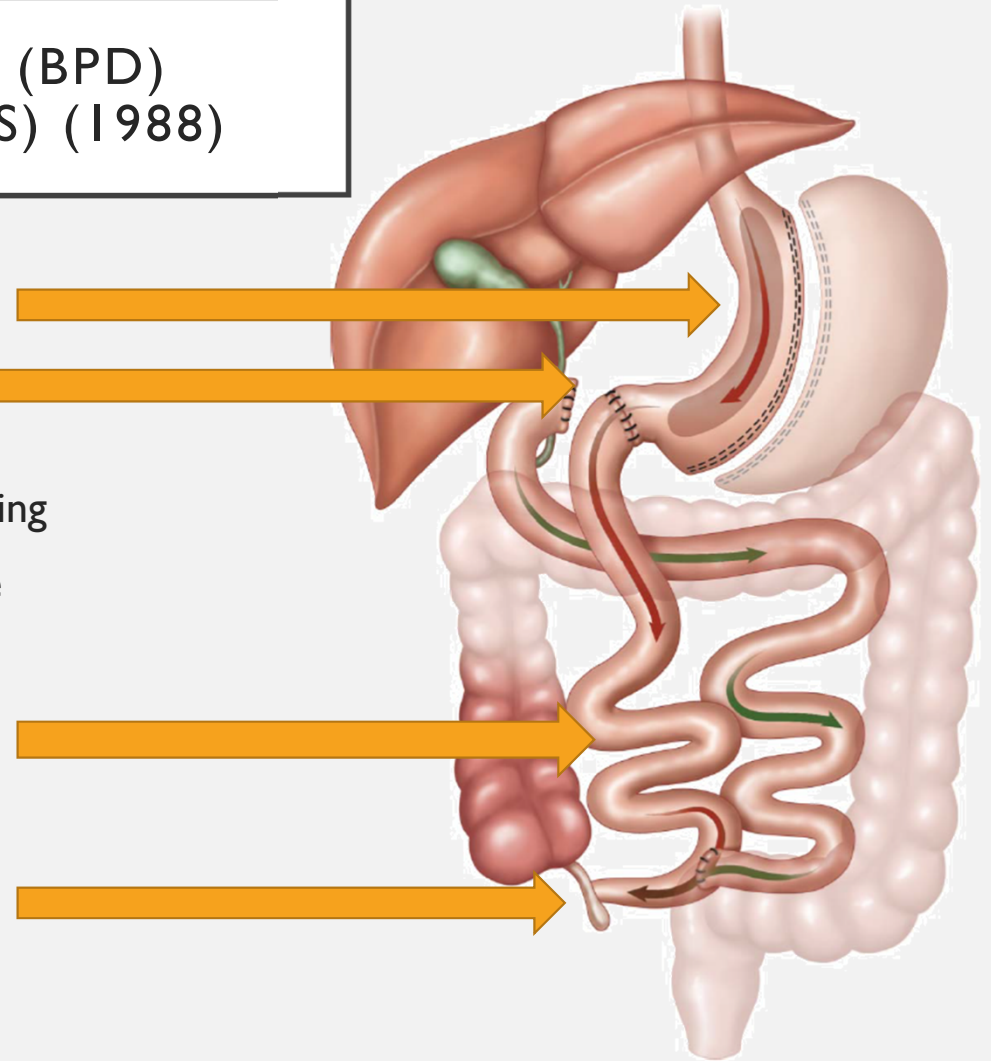
BILIOPANCREATIC DIVERSION (BPD) (1979)

- Problems:
 - Dumping syndrome
 - Stomal ulceration
- Severe malabsorption



BILIOPANCREATIC DIVERSION (BPD) WITH “DUODENAL SWITCH” (DS) (1988)

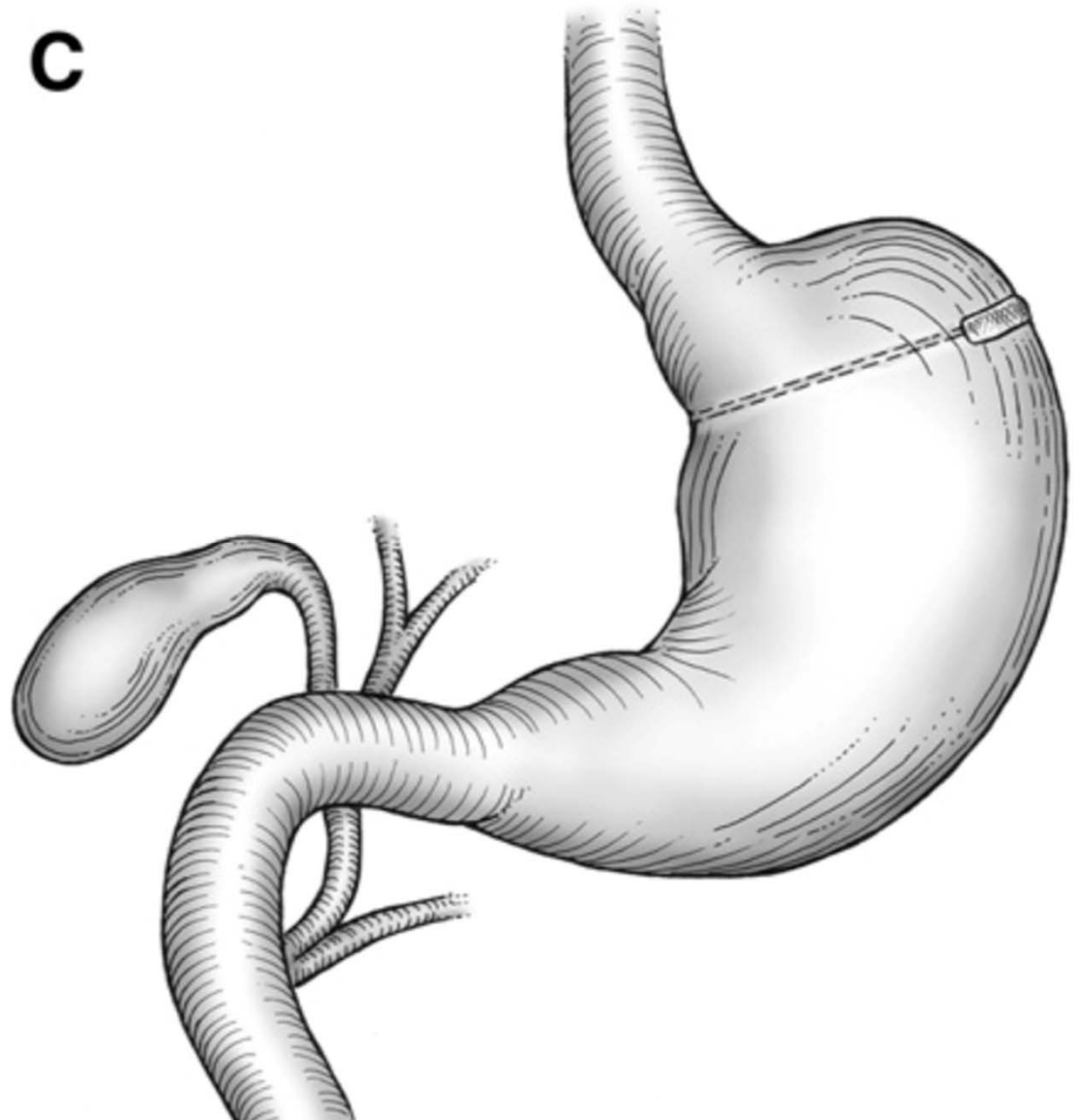
- ~ 400 mL sleeve gastrectomy
- Duodeno-ileal anastomosis
 - Retain the pylorus with the sleeve to decrease incidence of diarrhea and dumping
 - Connect duodenum to ileum to decrease incidence of marginal ulcer
- 150 cm alimentary (“Roux”) limb
- 100 cm common channel



VERTICAL BANDED GASTROPLASTY (VBG) (1982)

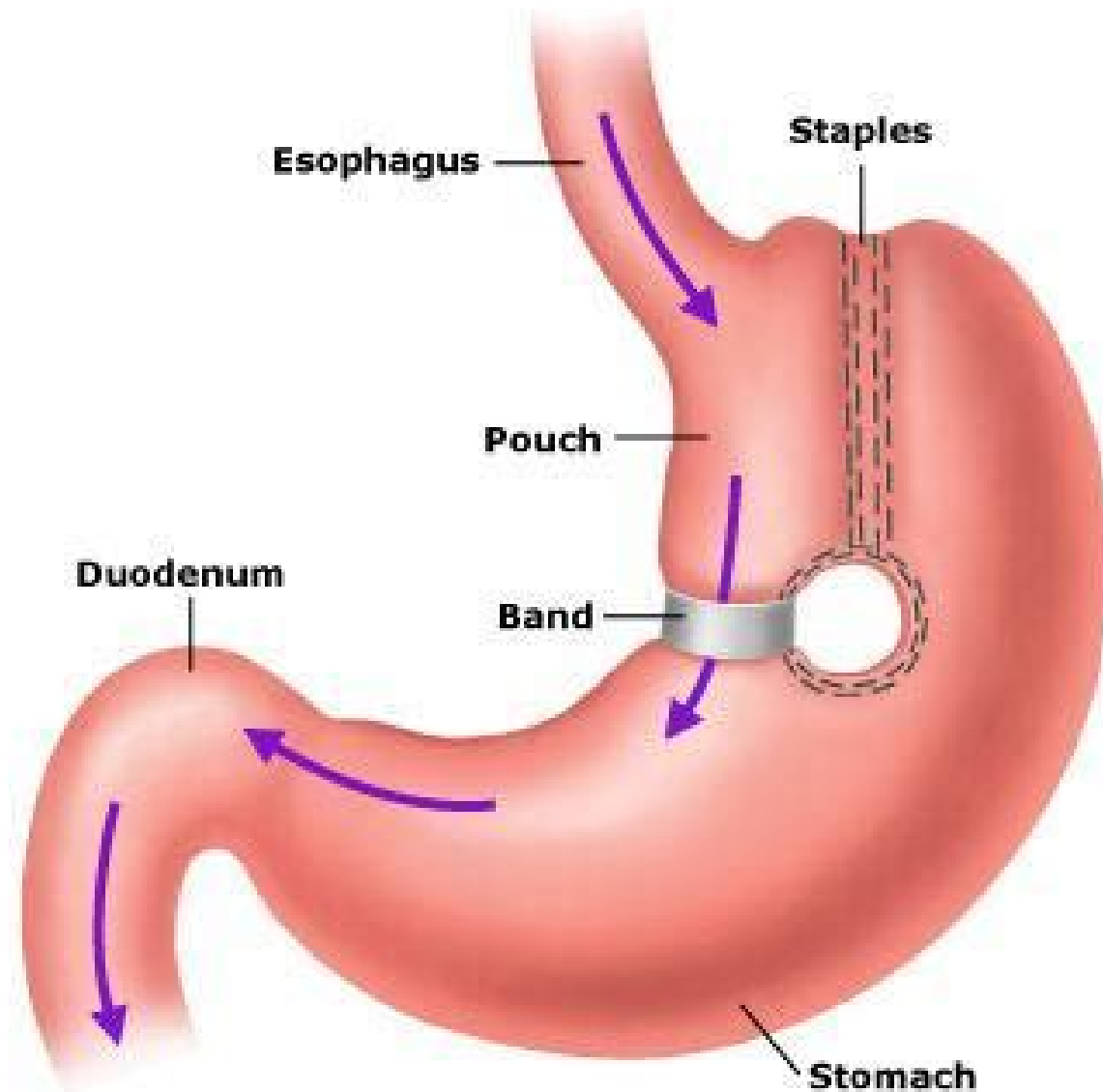
- Horizontal gastroplasty often failed because of dilation along the greater curvature
- Let's do vertical instead!

Aggarwal *Curr Probl Surg* 2008



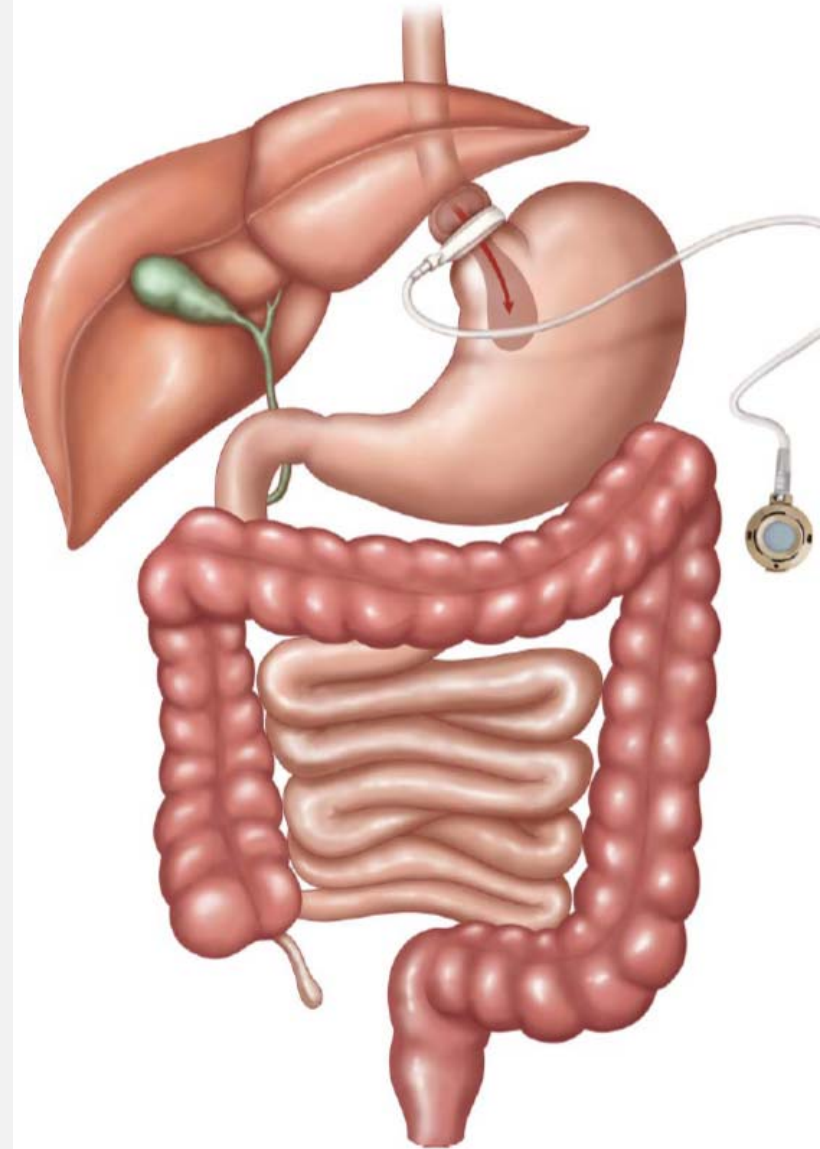
VERTICAL BANDED GASTROPLASTY (VBG) (1982)

- No longer performed
- Too many complications
- Other more effective surgical options
 - RYGB



ADJUSTABLE GASTRIC BAND (1993)

- No anastomosis
- Reversible
- Foreign body implanted into patient

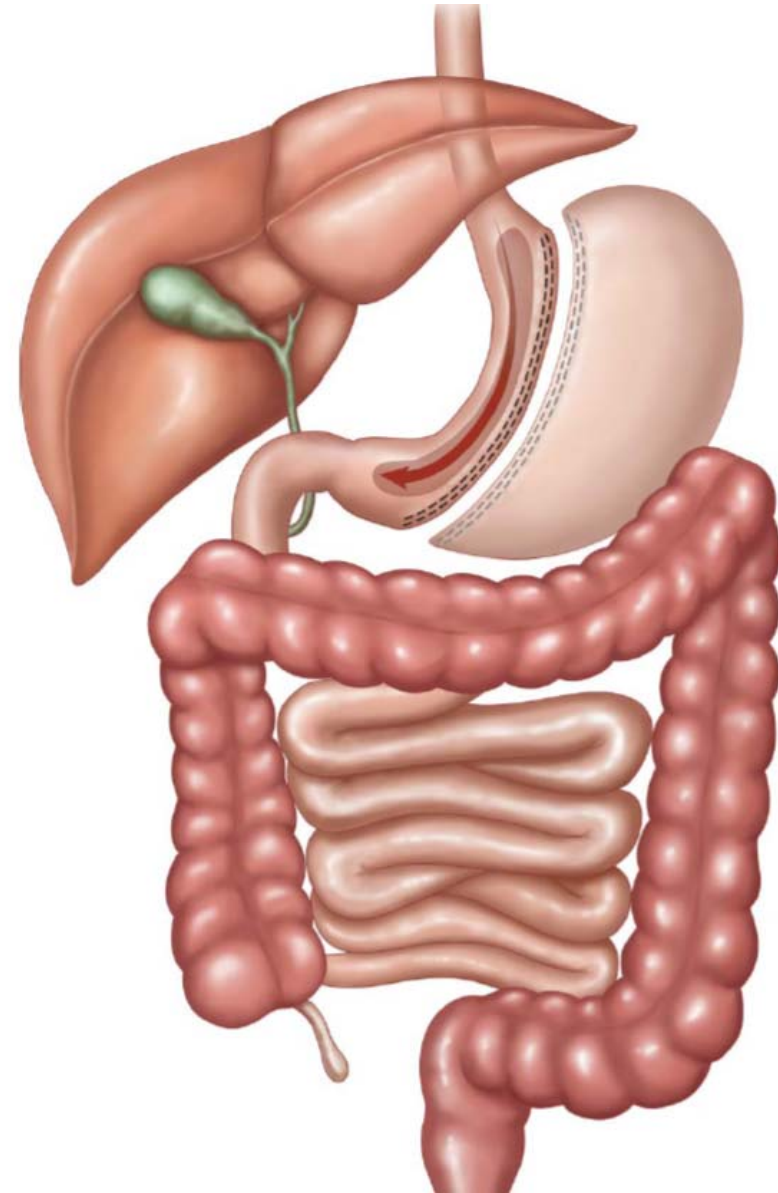


SLEEVE GASTRECTOMY

- Originally conceived as “stage I” of BPD-DS
- ~200 mL gastric tube (“sleeve”) remains
- One staple line
- Maintains normal GI configuration
- As of 2013, **most common bariatric operation in USA**

Regan *Obes Surg* 2003

Neff *J Clin Pathol* 2013



Estimate of Bariatric Surgery Numbers, 2011-2017

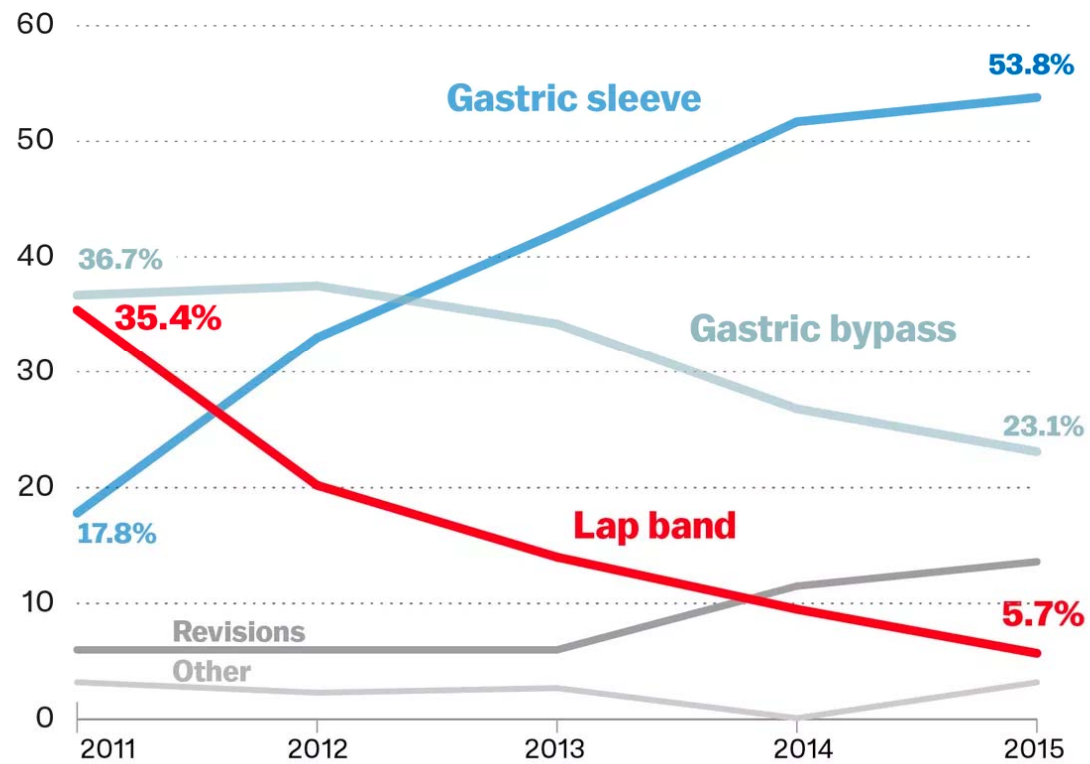
Published June 2018

	2011	2012	2013	2014	2015	2016	2017
Total	158,000	173,000	179,000	193,000	196,000	216,000	228,000
Sleeve	17.80%	33.00%	42.10%	51.70%	53.61%	58.11%	59.39%
RYGB	36.70%	37.50%	34.20%	26.80%	23.02%	18.69%	17.80%
Band	35.40%	20.20%	14.00%	9.50%	5.68%	3.39%	2.77%
BPD-DS	0.90%	1.00%	1.00%	0.40%	0.60%	0.57%	0.70%
Revision	6.00%	6.00%	6.00%	11.50%	13.55%	13.95%	14.14%
Other	3.20%	2.30%	2.70%	0.10%	3.19%	2.63%	2.46%
Balloons	—	—	—	—	0.36%	2.66%	2.75%

The ASMBS total bariatric procedure numbers are based on the best estimation from available data (BOLD,ACS/MBSAQIP, National Inpatient Sample Data and outpatient estimations).



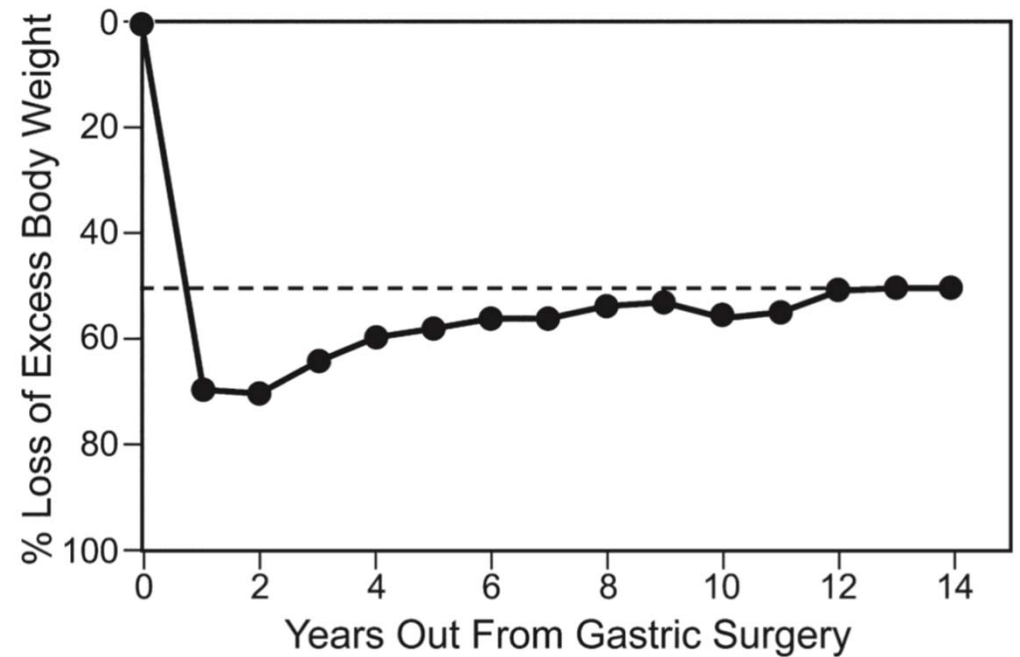
Estimate of bariatric surgery numbers 2011 to 2015



Source: ASMBS American Society for Metabolic and Bariatric Surgery

EXPECTED
OUTCOMES

- Maximal weight loss occurs **within 12-18 months**

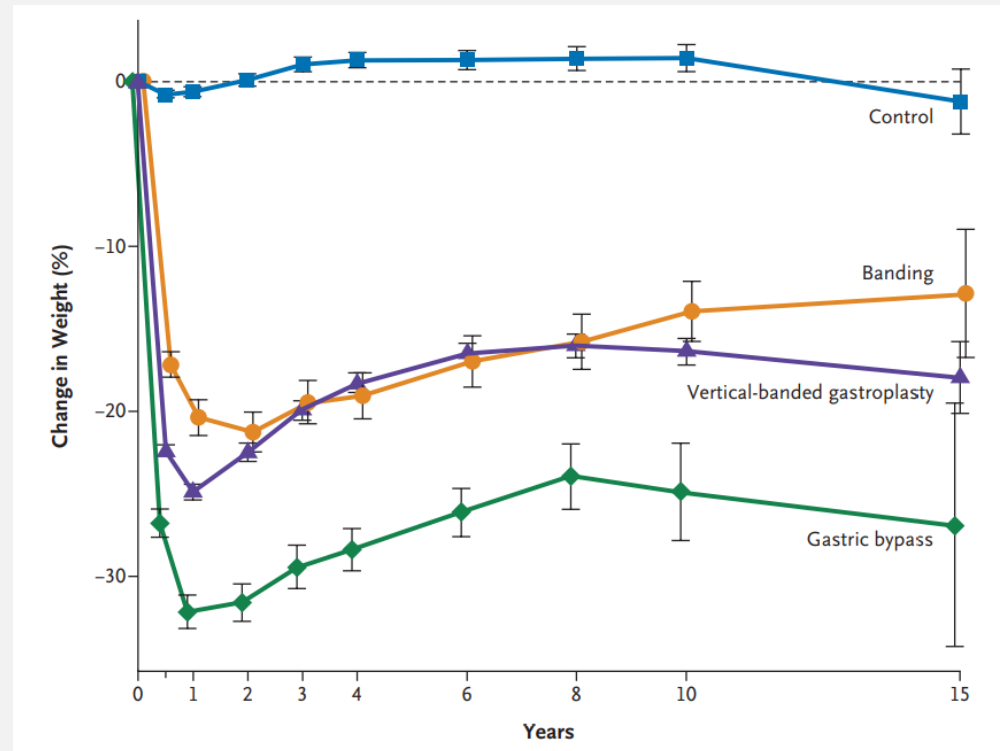


Neff *J Clin Pathol* 2013

Aggarwal *Curr Probl Surg* 2008

EXPECTED
OUTCOMES

Swedish Obese Subjects trial





EXPECTED
OUTCOMES

- Improvements in:
 - Hypertension
 - Diabetes
 - Dyslipidemia
 - Obstructive Sleep Apnea (OSA)
 - Arthritis
 - Steatohepatitis
 - Asthma

JAMA | **Original Investigation**

Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity The SM-BOSS Randomized Clinical Trial

Ralph Peterli, MD; Bettina Karin Wölnerhanssen, MD; Thomas Peters, MD; Diana Vetter, MD; Dino Kröll, MD; Yves Borbély, MD; Bernd Schultes, MD; Christoph Beglinger, MD; Jürgen Drewe, MD, MSc; Marc Schiesser, MD; Philipp Nett, MD; Marco Bueter, MD, PhD

DESIGN, SETTING, AND PARTICIPANTS The Swiss Multicenter Bypass or Sleeve Study (SM-BOSS), a 2-group randomized trial, was conducted from January 2007 until November 2011 (last follow-up in March 2017). Of 3971 morbidly obese patients evaluated for bariatric surgery at 4 Swiss bariatric centers, 217 patients were enrolled and randomly assigned to sleeve gastrectomy or Roux-en-Y gastric bypass with a 5-year follow-up period.

INTERVENTIONS Patients were randomly assigned to undergo laparoscopic sleeve gastrectomy (n = 107) or laparoscopic Roux-en-Y gastric bypass (n = 110).

MAIN OUTCOMES AND MEASURES The primary end point was weight loss, expressed as percentage excess body mass index (BMI) loss. Exploratory end points were changes in comorbidities and adverse events.

JAMA | Original Investigation

Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical Trial

Ralph Peterli, MD; Bettina Karin Wölnerhanssen, MD; Thomas Peters, MD; Diana Vetter, MD; Dino Kröll, MD; Yves Borbély, MD; Bernd Schultes, MD; Christoph Beglinger, MD; Jürgen Drewe, MD, MSc; Marc Schiesser, MD; Philipp Nett, MD; Marco Bueter, MD, PhD

RESULTS Among the 217 patients (mean age, 45.5 years; 72% women; mean BMI, 43.9) 205 (94.5%) completed the trial. Excess BMI loss was not significantly different at 5 years: for sleeve gastrectomy, 61.1%, vs Roux-en-Y gastric bypass, 68.3% (absolute difference, -7.18%; 95% CI, -14.30% to -0.06%; $P = .22$ after adjustment for multiple comparisons). Gastric reflux remission was observed more frequently after Roux-en-Y gastric bypass (60.4%) than after sleeve gastrectomy (25.0%). Gastric reflux worsened (more symptoms or increase in therapy) more often after sleeve gastrectomy (31.8%) than after Roux-en-Y gastric bypass (6.3%). The number of patients with reoperations or interventions was 16/101 (15.8%) after sleeve gastrectomy and 23/104 (22.1%) after Roux-en-Y gastric bypass.

CONCLUSIONS AND RELEVANCE Among patients with morbid obesity, there was no significant difference in excess BMI loss between laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass at 5 years of follow-up after surgery.

JAMA | **Original Investigation**

Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity The SM-BOSS Randomized Clinical Trial

Ralph Peterli, MD; Bettina Karin Wölnerhanssen, MD; Thomas Peters, MD; Diana Vetter, MD; Dino Kröll, MD; Yves Borbély, MD; Bernd Schultes, MD; Christoph Beglinger, MD; Jürgen Drewe, MD, MSc; Marc Schiesser, MD; Philipp Nett, MD; Marco Bueter, MD, PhD

- Similar improvements in:
 - Type 2 diabetes
 - Dyslipidemia
 - Hypertension
 - Obstructive sleep apnea
 - Back or joint pain
 - Depression

JAMA | **Original Investigation**

Effect of Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on Weight Loss in Patients With Morbid Obesity The SM-BOSS Randomized Clinical Trial

Ralph Peterli, MD; Bettina Karin Wölnerhanssen, MD; Thomas Peters, MD; Diana Vetter, MD; Dino Kröll, MD; Yves Borbély, MD; Bernd Schultes, MD; Christoph Beglinger, MD; Jürgen Drewe, MD, MSc; Marc Schiesser, MD; Philipp Nett, MD; Marco Bueter, MD, PhD

- GERD
 - **Worsened** in 32% for sleeve gastrectomy vs. 6% for RYGB (p=0.006)

Table 5. Mortality and Adverse Events Requiring Reoperation or Endoscopic Intervention

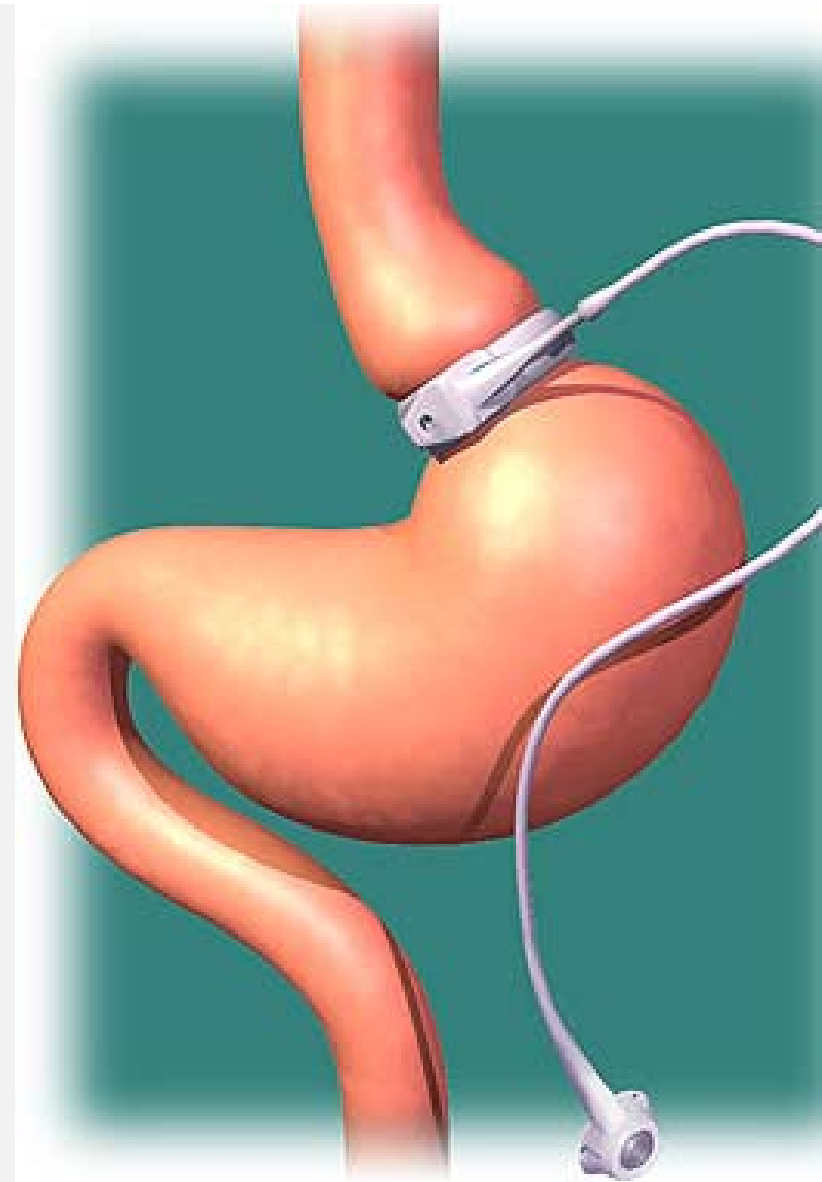
Events	No. With Event/Total No. (%)		Absolute Difference (95% CI) ^a
	Sleeve Gastrectomy	Roux-en-Y Gastric Bypass	
Early morbidity (0-30 d)	1/107 (0.9)	5/110 (4.5)	-0.19 (-0.57 to 0.20)
Leak	0	1	
Infection	0	3	
Obstruction	1	1	
Death	0	1 ^b	
Late morbidity (1 mo-5 y)	15/101 (14.9)	18/104 (17.3)	-0.05 (-0.25 to 0.16)
Operative			
Conversion to Roux-en-Y gastric bypass due to gastroesophageal reflux	9	NA	
Small bowel obstruction	0	2	
Internal hernia	0	9	
Incisional hernia	1	1	
Gastroscopy necessary: laparoscopy	NA	1	
Severe dumping	0	3 ^c	
Insufficient weight loss	5 ^d	2	
Death	0	1 ^e	
Total reoperations or interventions	16/101 (15.8)	23/104 (22.1)	-0.10 (-0.29 to 0.09)
Total mortality	0	2/104 (1.9)	-0.50 (-0.82 to -0.18)

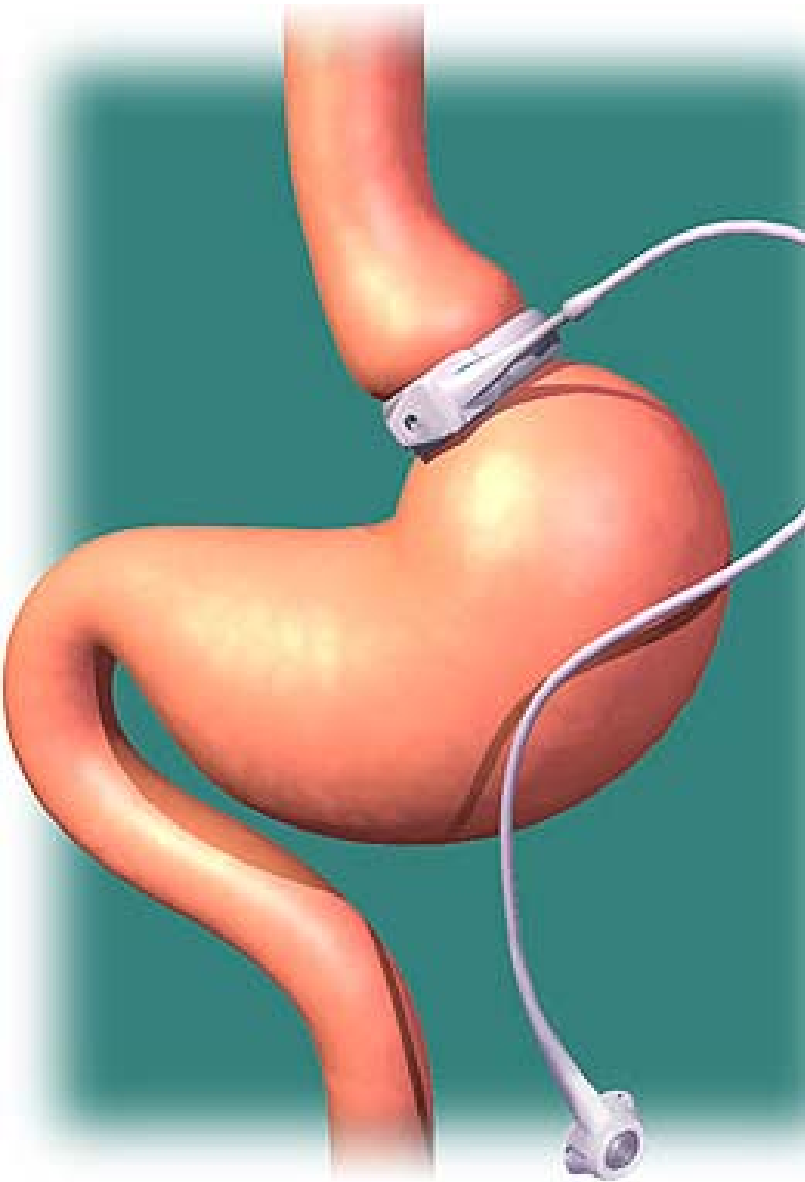
ANATOMIC COMPLICATIONS

ADJUSTABLE GASTRIC BAND

- Prosthetic circular band with inflation balloon
- Placed just below GE junction
- Long tubing connected to subq port
- Band inflated to obtain restriction

- Complications related to:
 - Erosion
 - Slippage
 - Mechanical problems

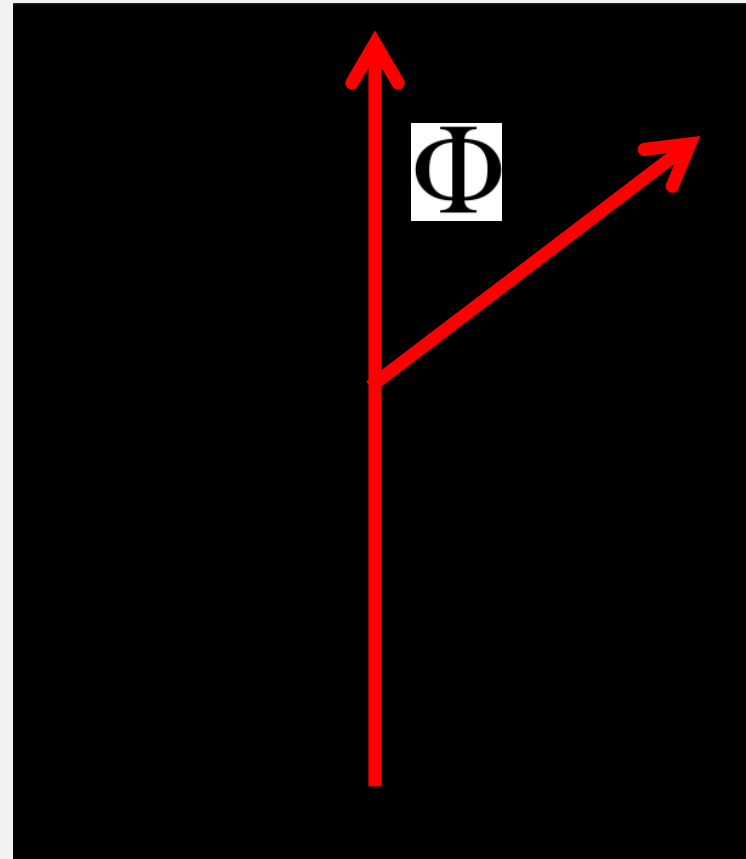
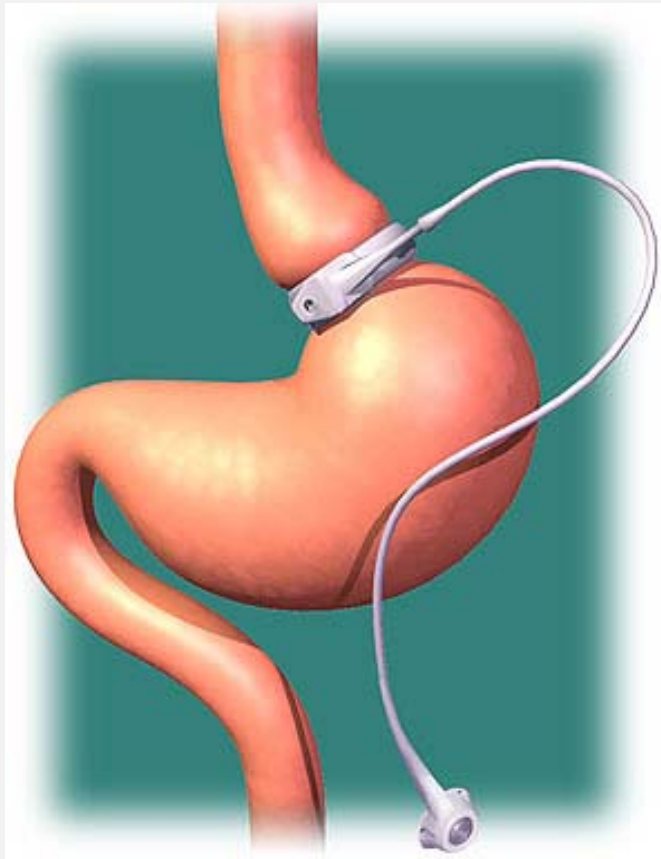




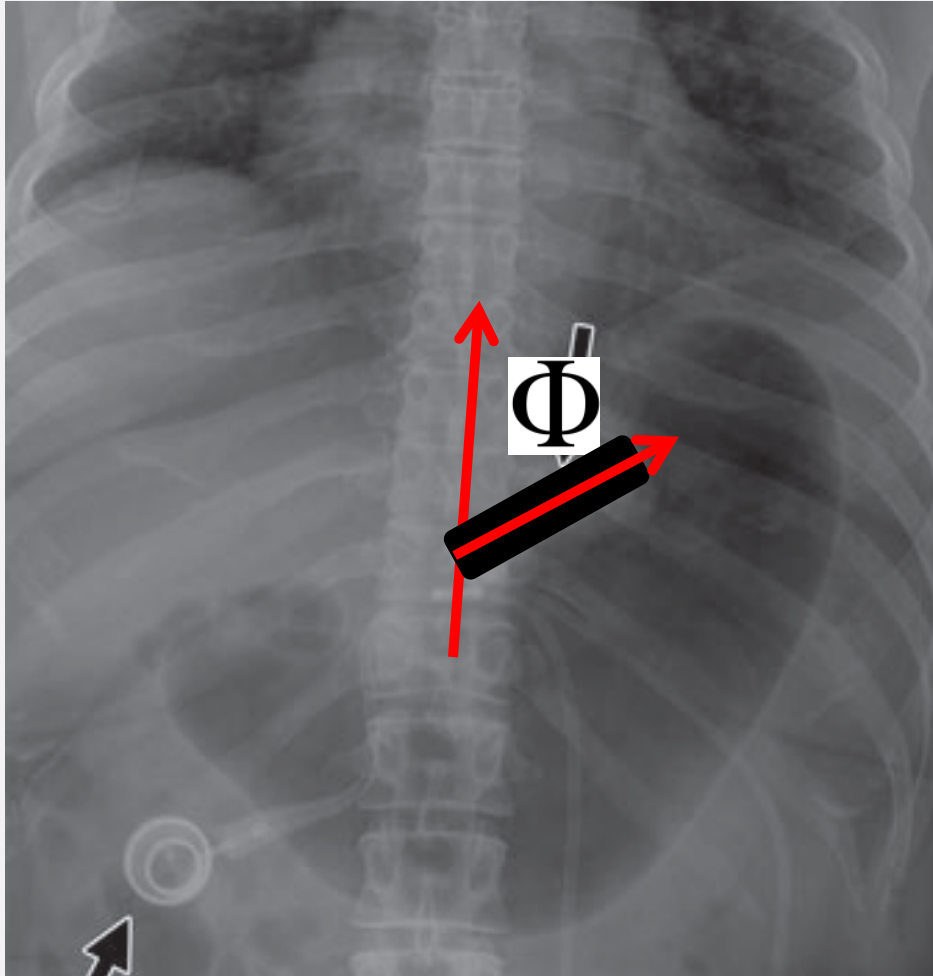
LAPAROSCOPIC ADJUSTABLE GASTRIC BAND

- Obstructive symptoms
 - emesis, po intolerance
 - severe GERD
- Differential Dx?
 - too tight, normal position
or
 - band out of position

ASSESSING BAND POSITION



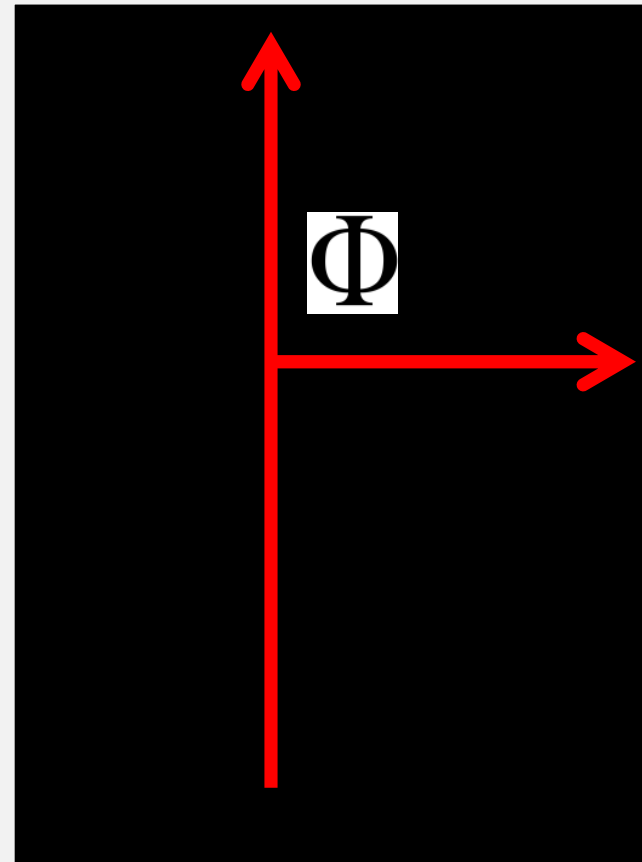
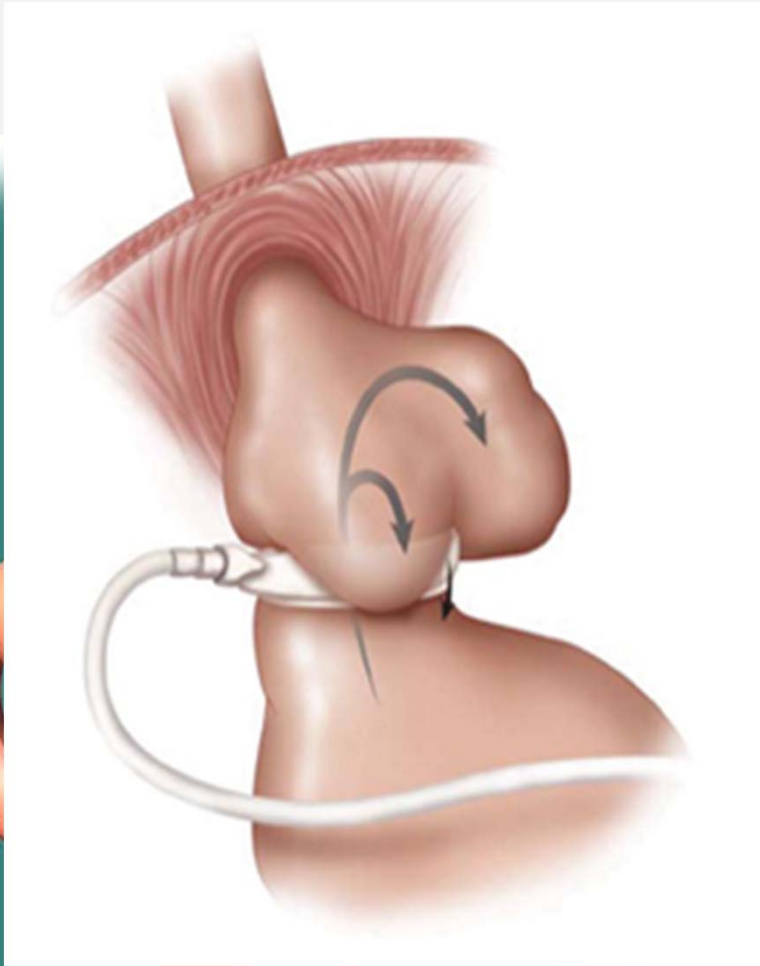
NORMAL BAND POSITION



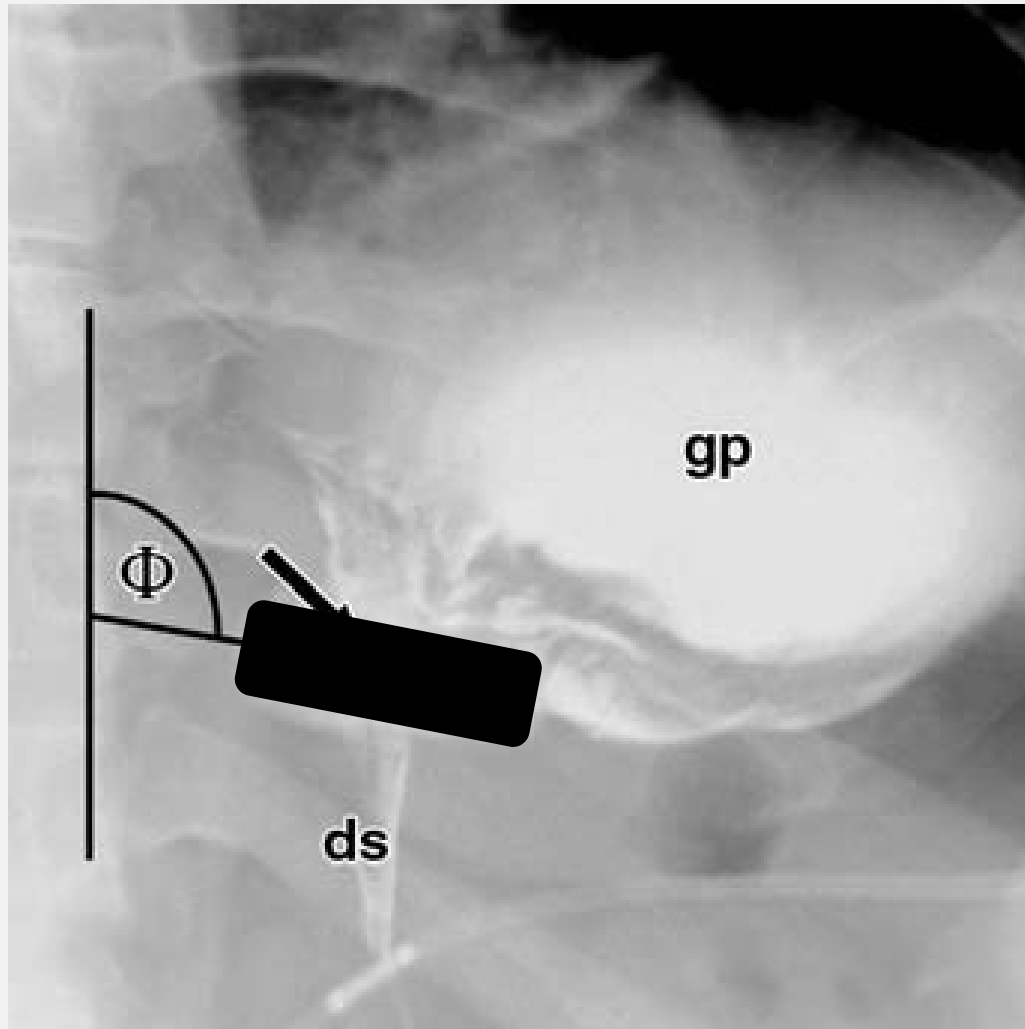
Normal phi angle = 45
to 58 degrees

phi > 60 = slipped band

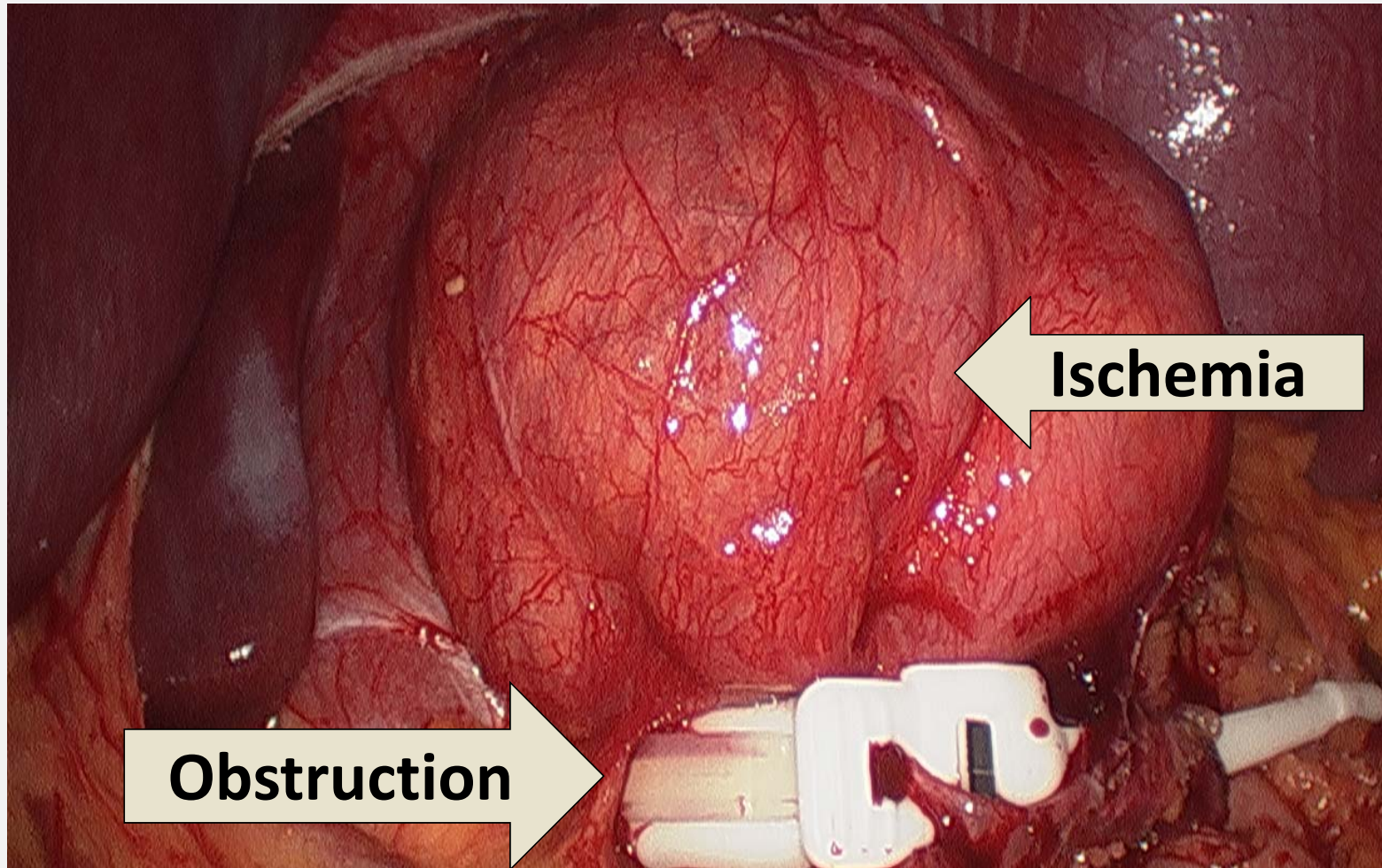
The "Slipped" Band

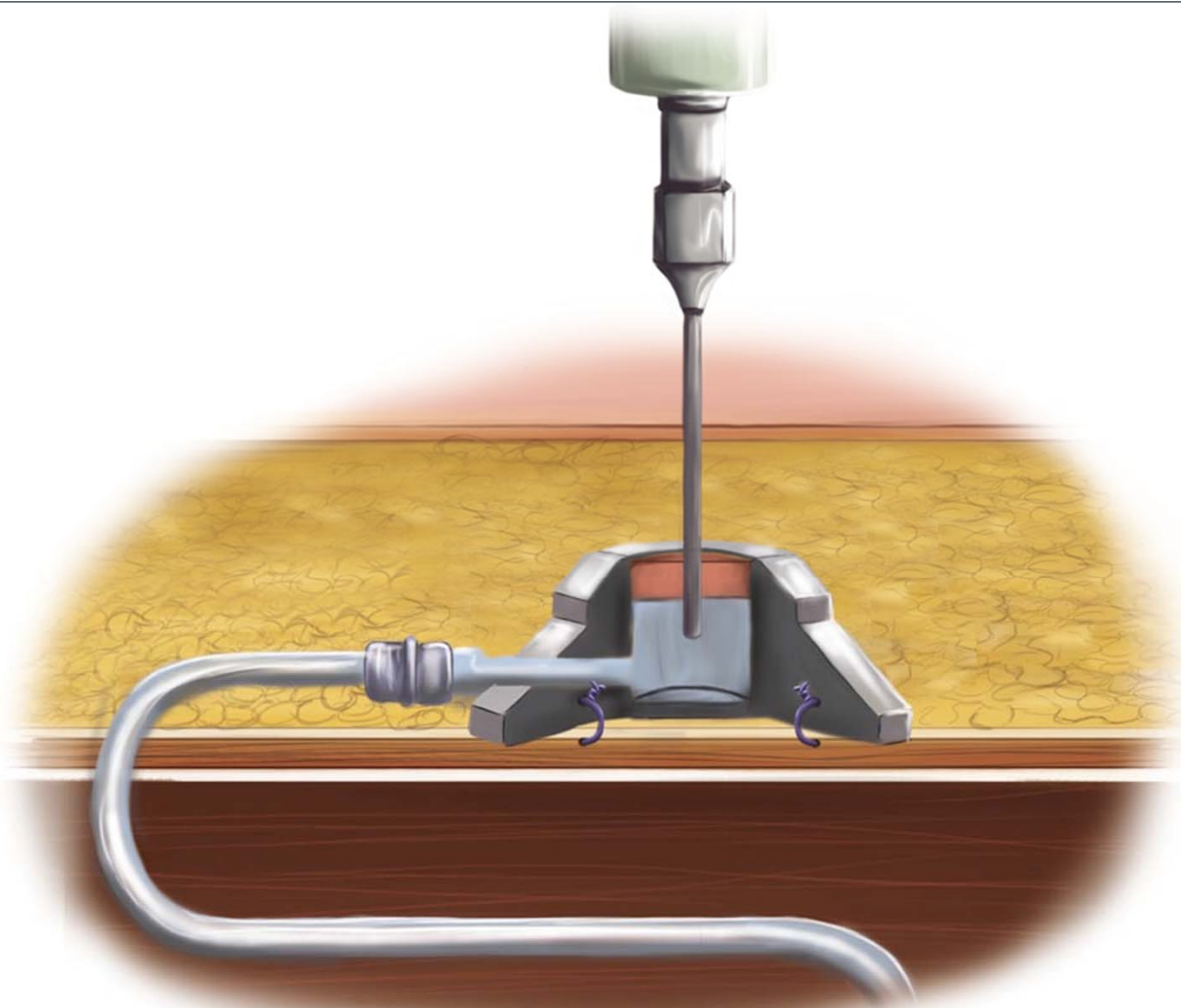


SLIPPED BAND



SLIPPED BAND





EMERGENCY SURGERY?

- Remove all fluid
 - Palpate subcutaneous port
 - 22 – 25g needle
 - 4 to 13 cc max
- Often resolves symptoms
 - Elective surgery

BAND EROSION

- Usually NOT an emergency!
 - Symptoms can be subtle
 - Loss of restriction
 - New onset reflux
 - Infection of tubing
- Slow erosion
- No perforation



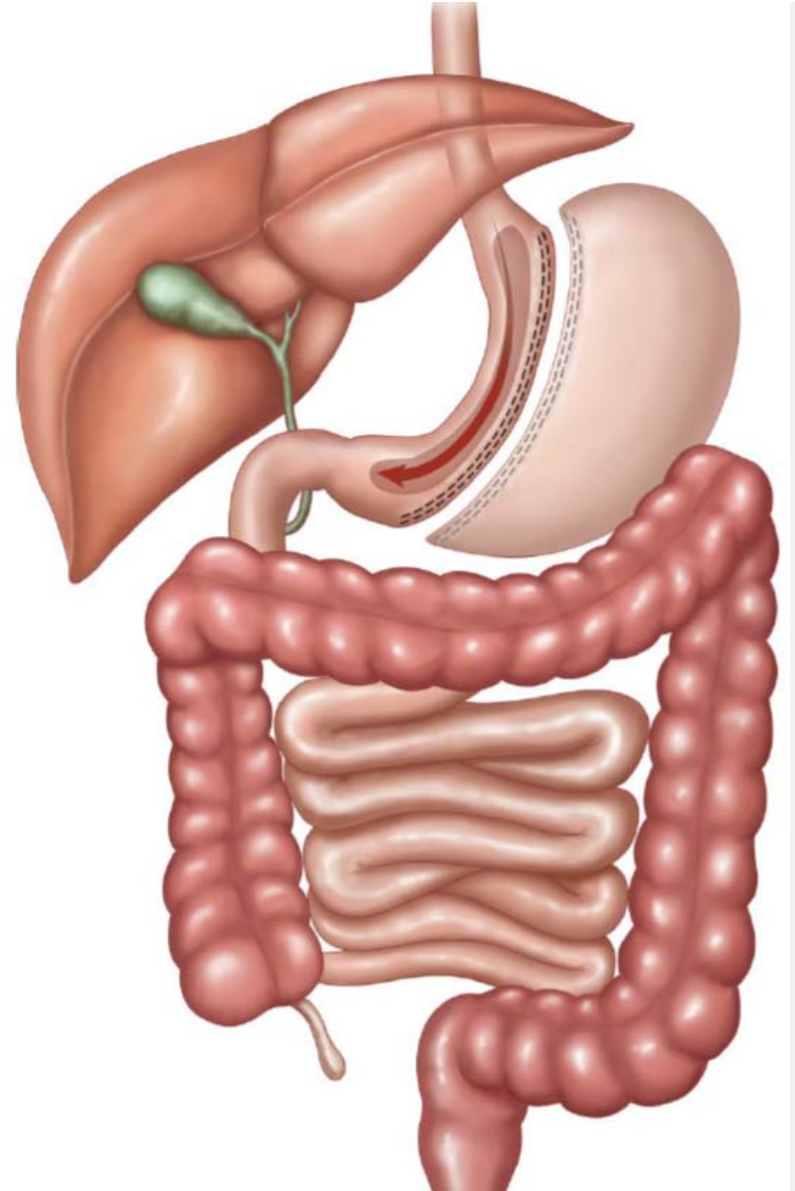
SLEEVE GASTRECTOMY

- Narrow gastric tube
- Antrum/pylorus left intact
- No manipulation of bowel
- No anastomosis



LAPAROSCOPIC SLEEVE GASTRECTOMY

- Fastest growing worldwide
- Purely restrictive
- Fast
- "Simpler"
 - false security
- Complications related to long staple line, leaks, bleeding, narrowing

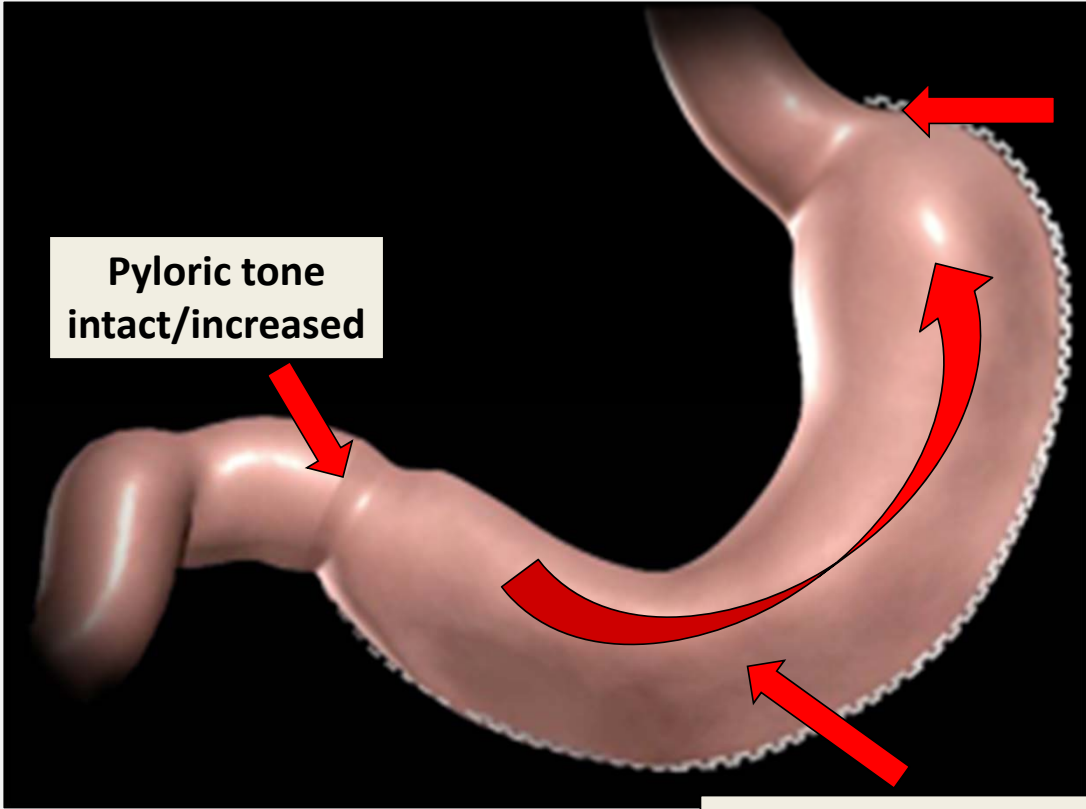


TOP 3 EARLY CONCERNS? (WITHIN 30 DAYS)

- Leak, leak, and then leak
 - any patient not doing “normally”
 - usually within first 2-7 days but can be later
 - may be obvious or subtle
- Abdominal pain, tachycardia
- Fever, Nausea/emesis
- Beware pulmonary symptoms!



ANATOMY IS DESTINY



Pyloric tone intact/increased

Thin tissue & avascular

Risk of stricture or kink

WHICH STUDY FOR LEAK?

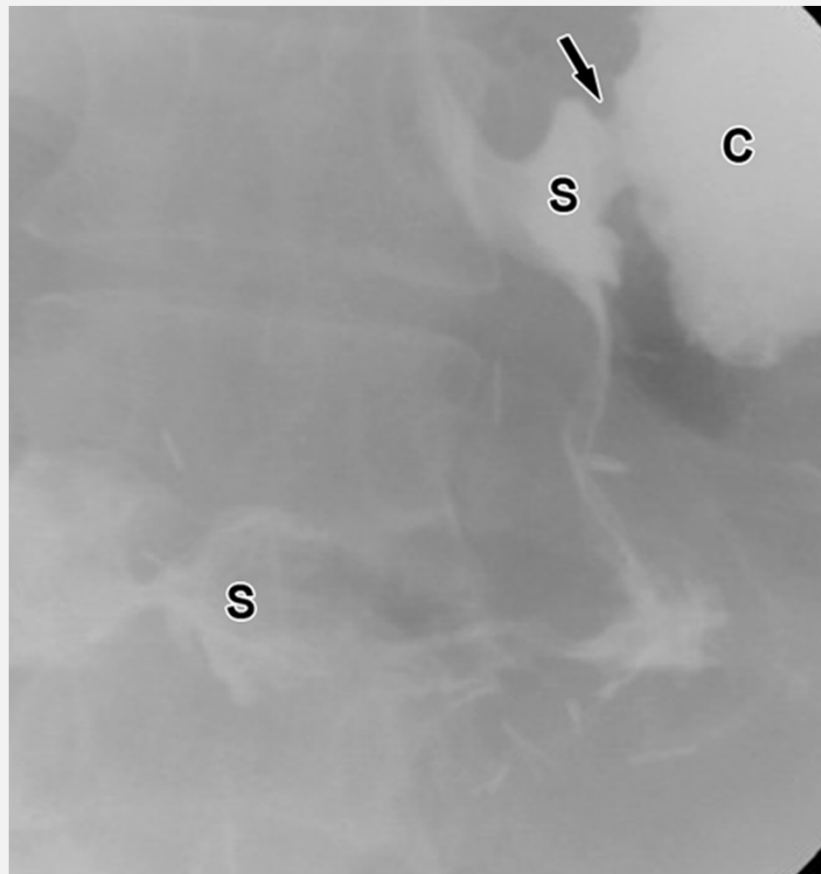
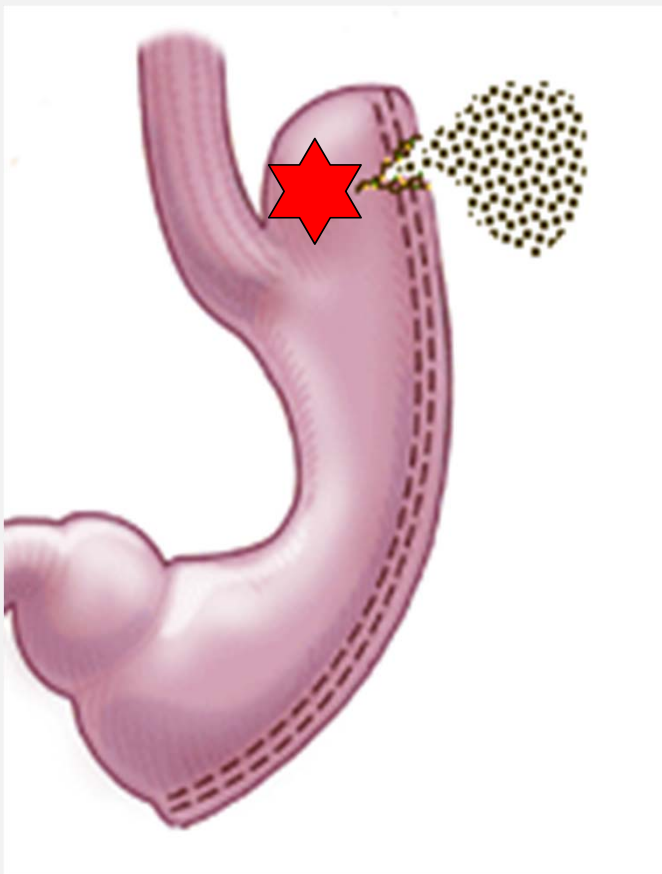
- **UGI contrast study**
 - sensitivity only 22 to 75%
- **CT scan** improved to 80-90%
 - even higher if combined
- Adjust contrast volume
- Can still miss some leaks

**ASMBS POSITION STATEMENT ON PREVENTION AND DETECTION OF
GASTROINTESTINAL LEAK AFTER GASTRIC BYPASS INCLUDING THE ROLE OF IMAGING
AND SURGICAL EXPLORATION**

**The American Society for Metabolic and Bariatric Surgery Clinical Issues Committee
Approved by the ASMBS Executive Council, January 2009**



SLEEVE LEAK: BADLANDS



MANAGEMENT TECHNIQUES: SLEEVE GASTRECTOMY



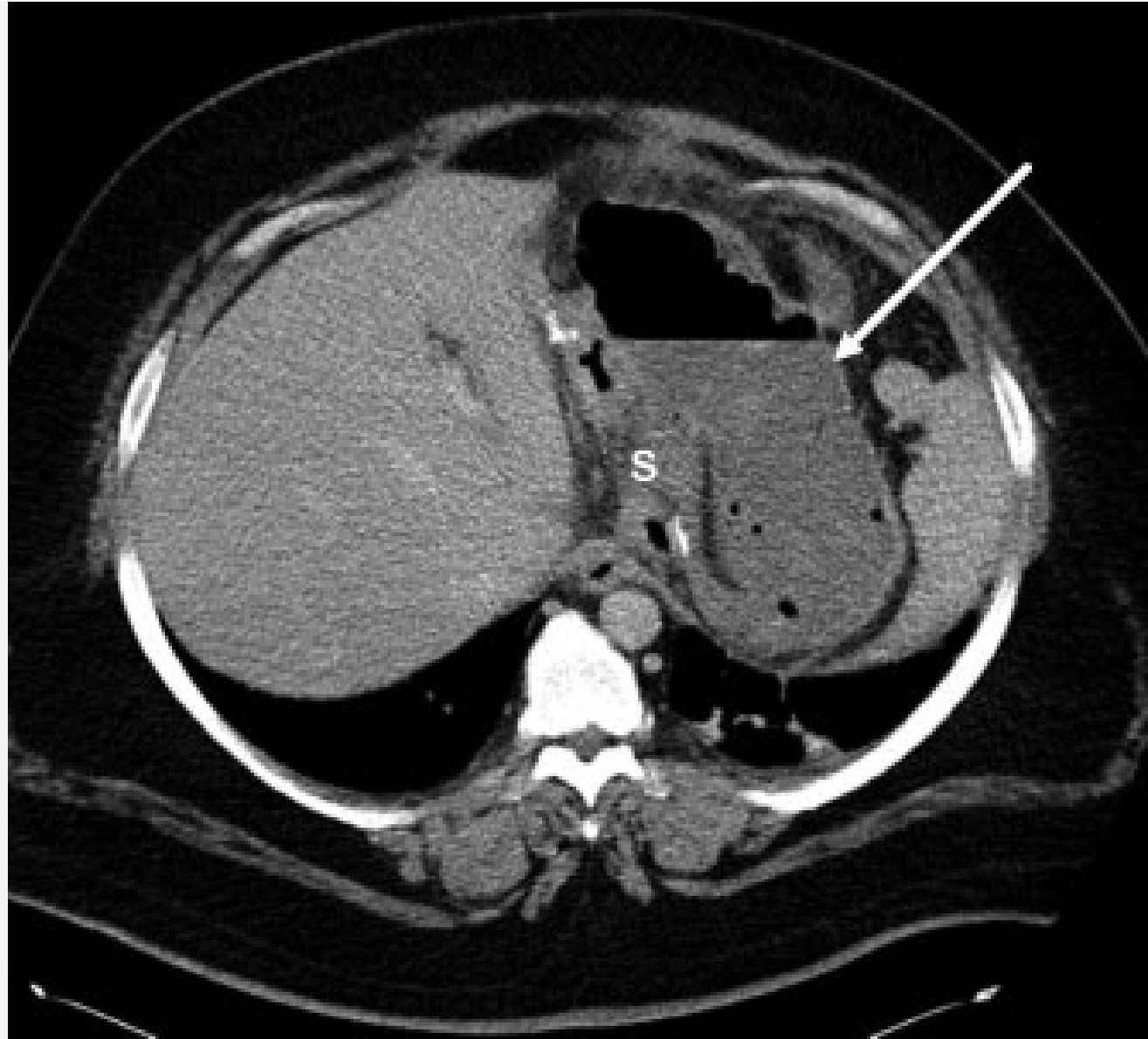
SLEEVE LEAK – NOW WHAT?

- Immediate surgery if indicated
 - can attempt repair but assume it will fail
 - WIDE LOCAL DRAINAGE
- Most will have a relatively contained leak
- Urgent concern is controlling the leak
 - eval why the leak occurred?
 - get an UGI series (even if CT already done)



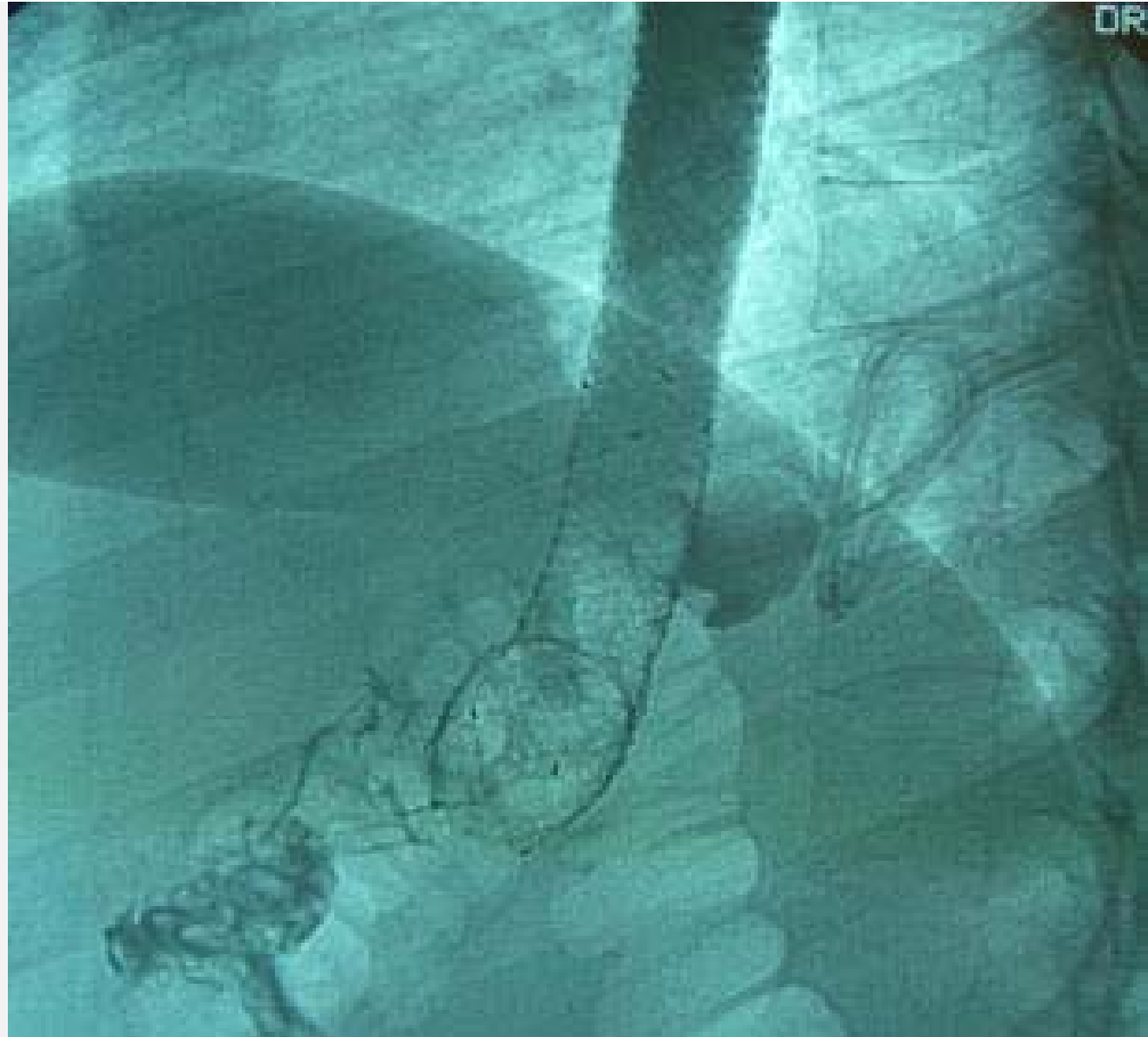
CONTROL THE LEAK!

- Percutaneous drain
- Laparoscopy
- NPO
- IV abx
- Bariatric surgeon
- Gastroenterologist



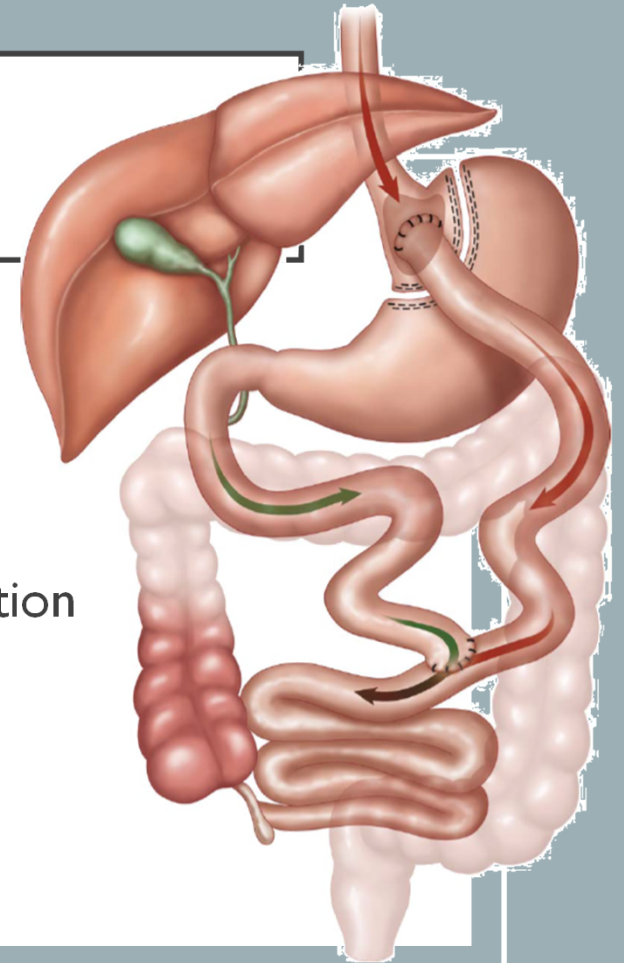
STENT FOR SLEEVE LEAKS

- Settle in for long haul
- Stent problems
 - migration
 - inadequate length
 - continued leak
- Address other causes
 - stricture
 - pyloric pressure



GASTRIC BYPASS

- Formation of small gastric pouch
- Remaining stomach left in situ
- Small bowel divided and 2 anastomoses
- Length of Roux limb dictates degree of malabsorption
- Complications related to leaks at GJ, JJ, staple line
- Multiple sites for herniation/obstruction



- Leak, leak, and leak
 - know where to look
 - know where imaging can mislead you
 - rare (1%) but can be fatal

- Small bowel obstruction
 - understand causes

- immediate exploration is the rule

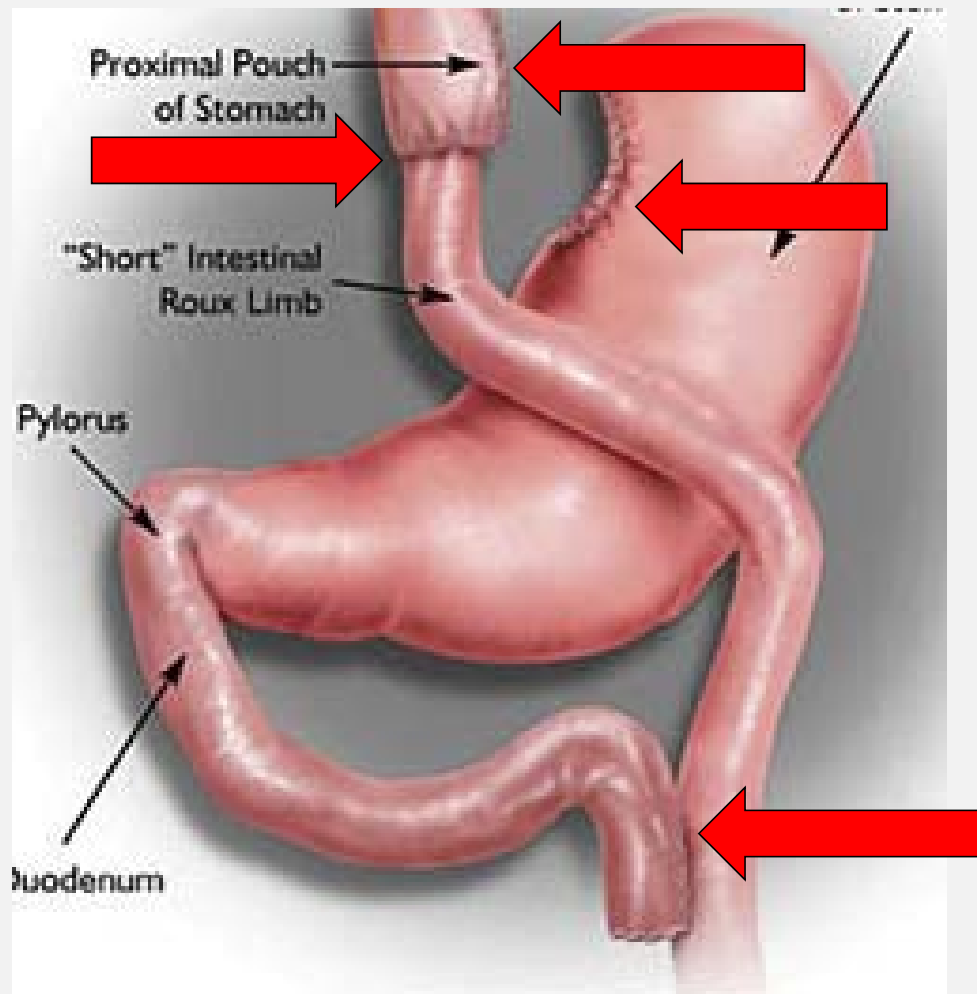
GASTRIC BYPASS



GASTRIC BYPASS: LEAK

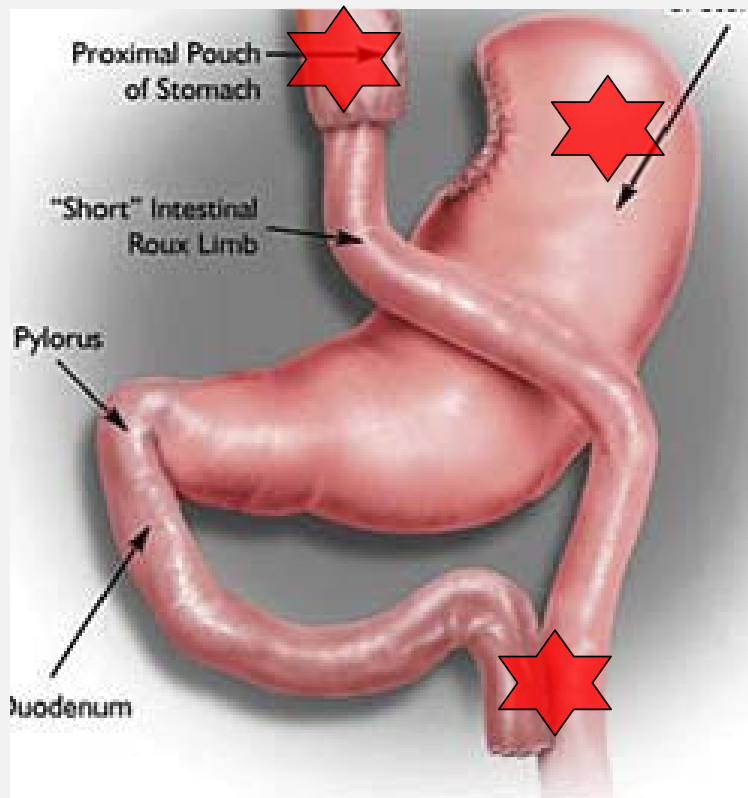
- May present with florid peritonitis and sepsis
- May be contained, subacute with mild signs and symptoms
 - Tachycardia, fever, pain, nausea

LEAK SITES AND IMAGING OPTIONS



- GJ anastomosis
- Gastric pouch
- JJ anastomosis
- Gastric remnant

COMMON IMAGING MISTAKES



- Contrast extravasation
 - reliable for GJ/pouch
 - needs to reach JJ
 - will not fill remnant
- Look for secondary signs
 - free air
 - free fluid
 - bowel thickening

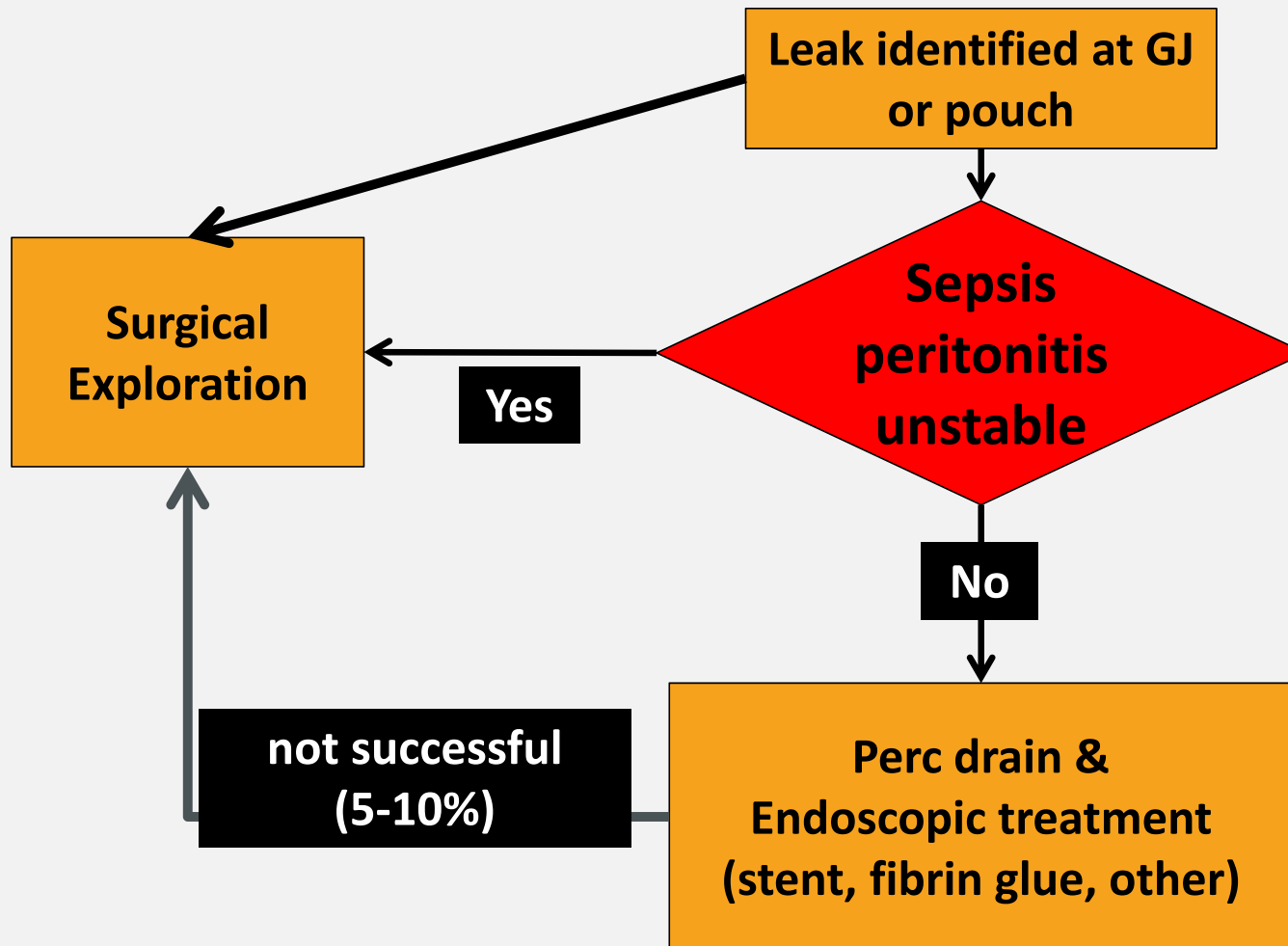
GASTRO JEJUNOSTOMY LEAK



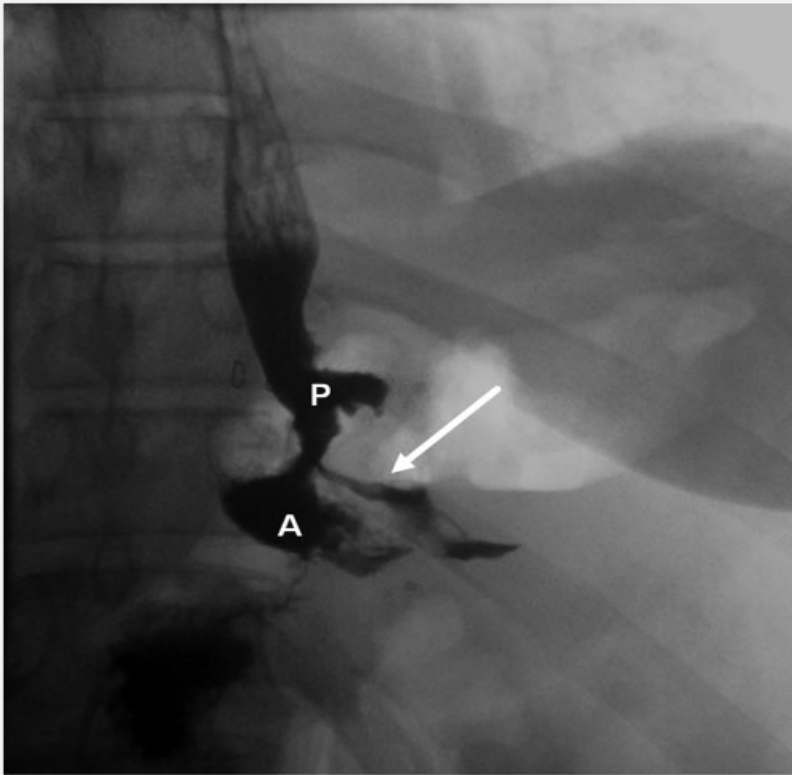
GASTRIC REMNANT LEAK



PARADIGM SHIFT FOR RYGB LEAK



ANASTOMOTIC LEAK - GJ



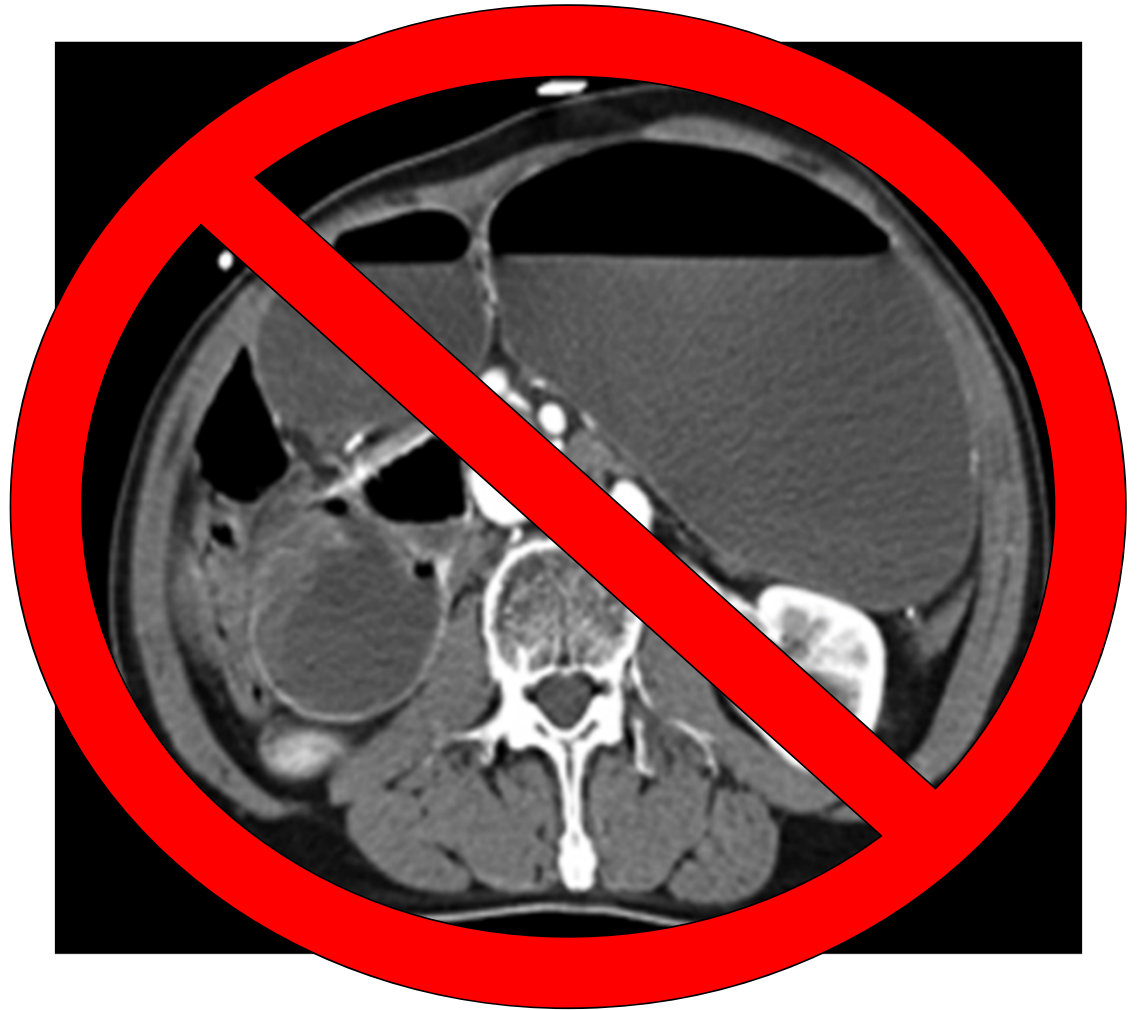
Easier to stent, high success rates (70-90%)

**EVALUATION AND DIAGNOSIS:
SBO AFTER PRIOR GASTRIC BYPASS**

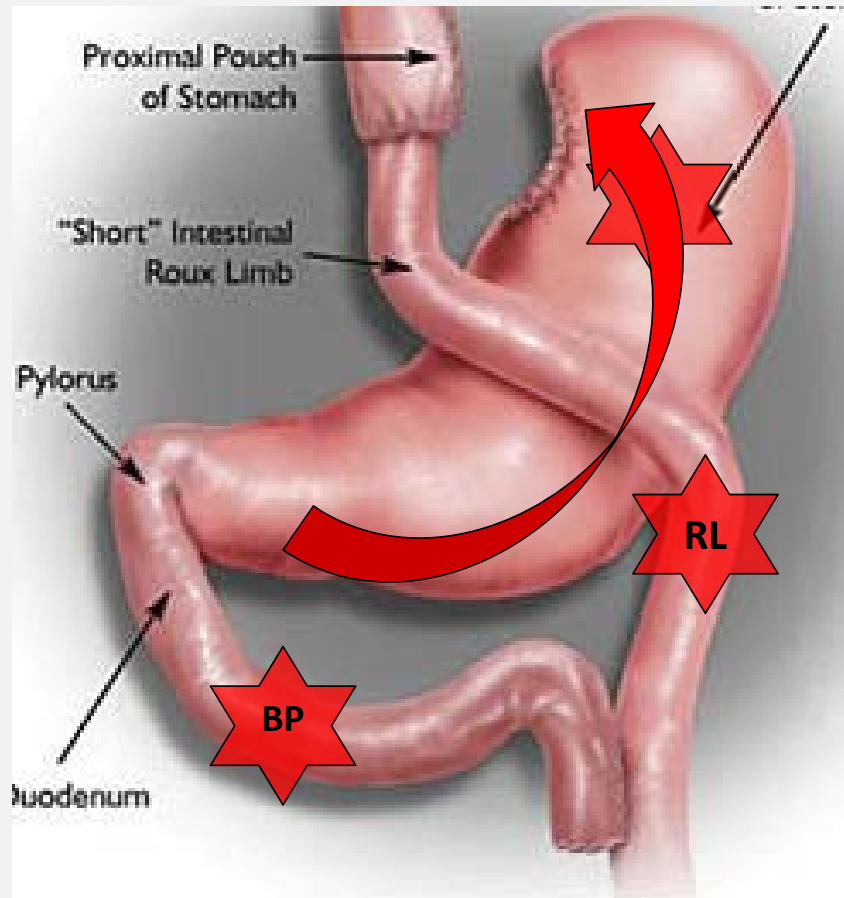
SMALL BOWEL
OBSTRUCTION IN THE
GASTRIC BYPASS PATIENT



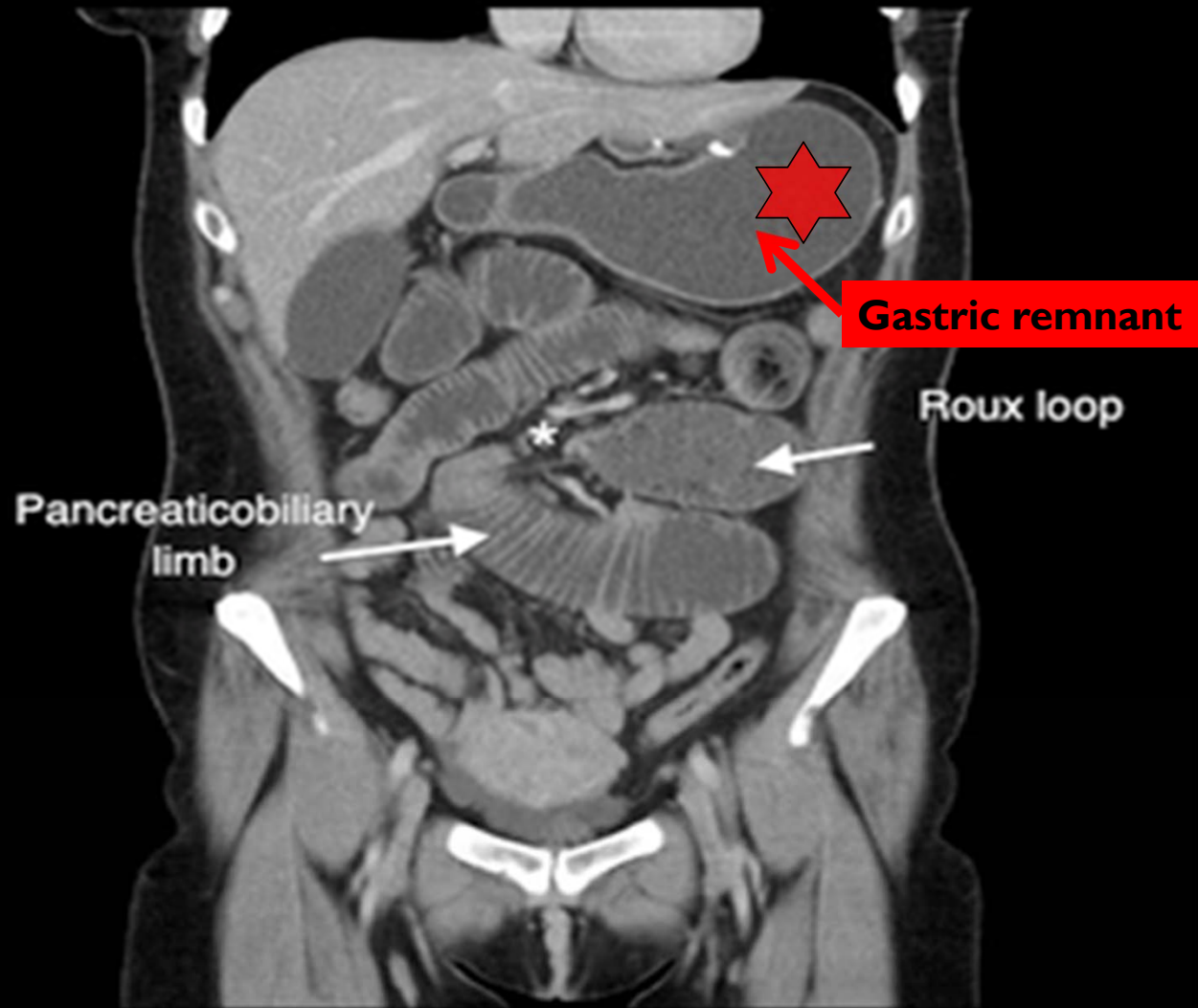
ROUTINE
SBO – NEEDS
NG TUBE



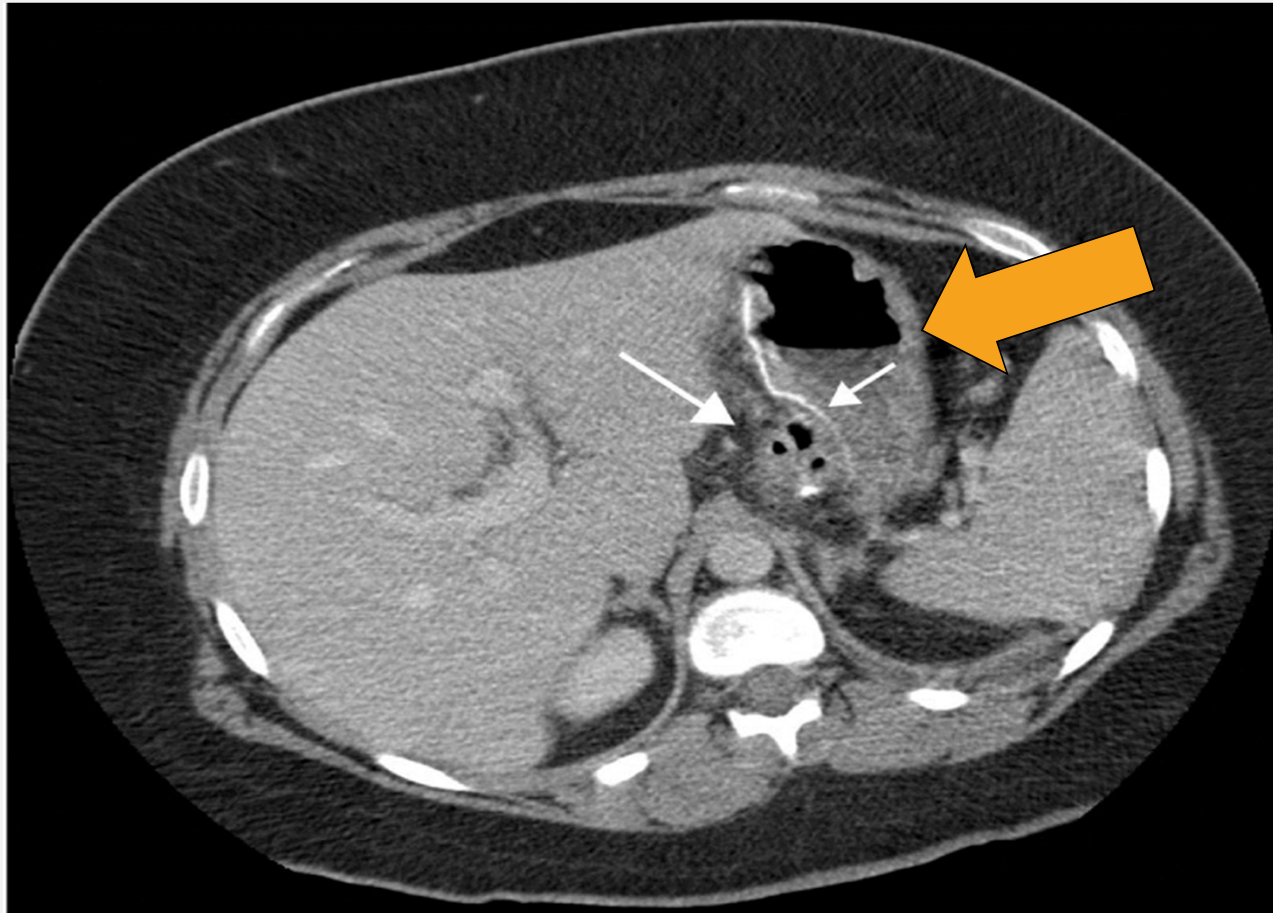
GASTRIC BYPASS AND SBO



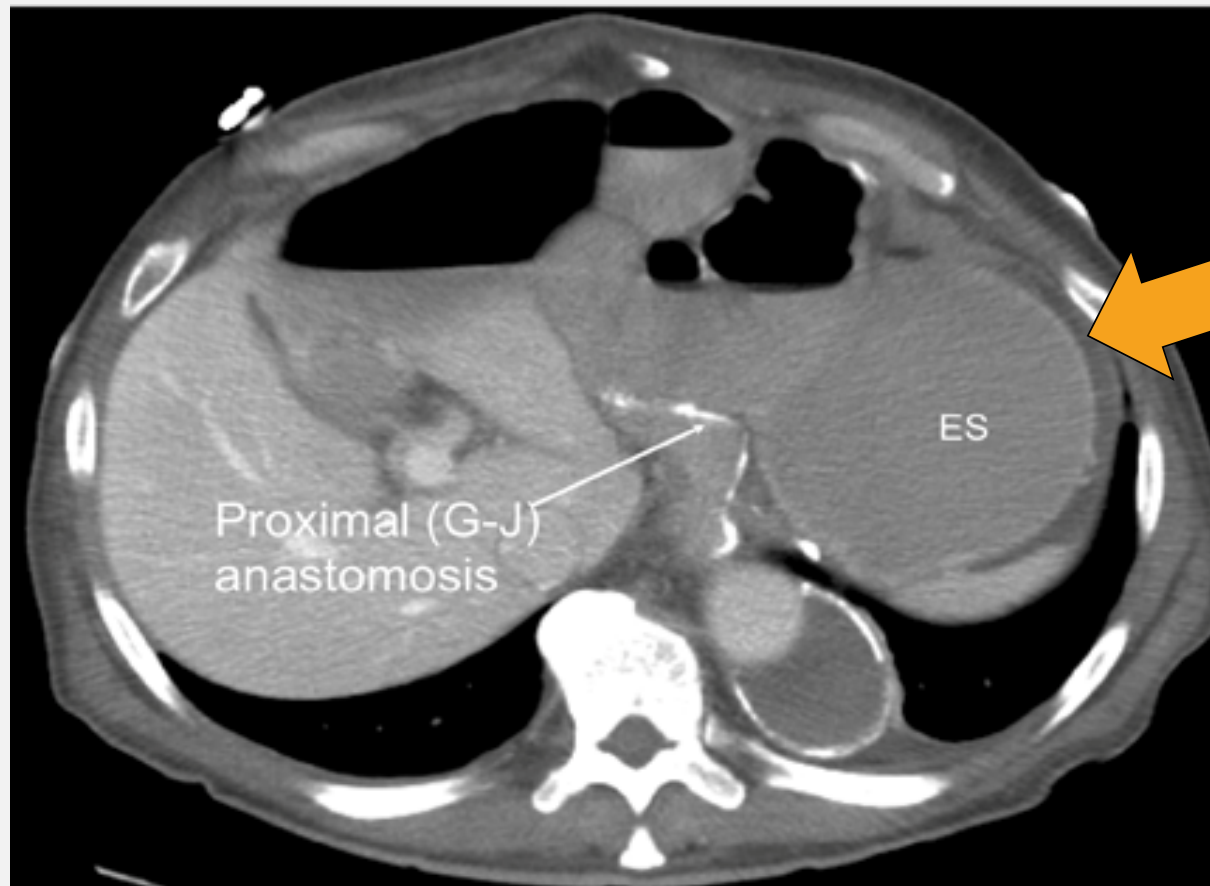
- Identify key anatomy
- Dilated or not?
- No outlet for BP limb or gastric remnant!!
 - not relieved by NGT



NORMAL RYGB CT SCAN:
NO DILATION

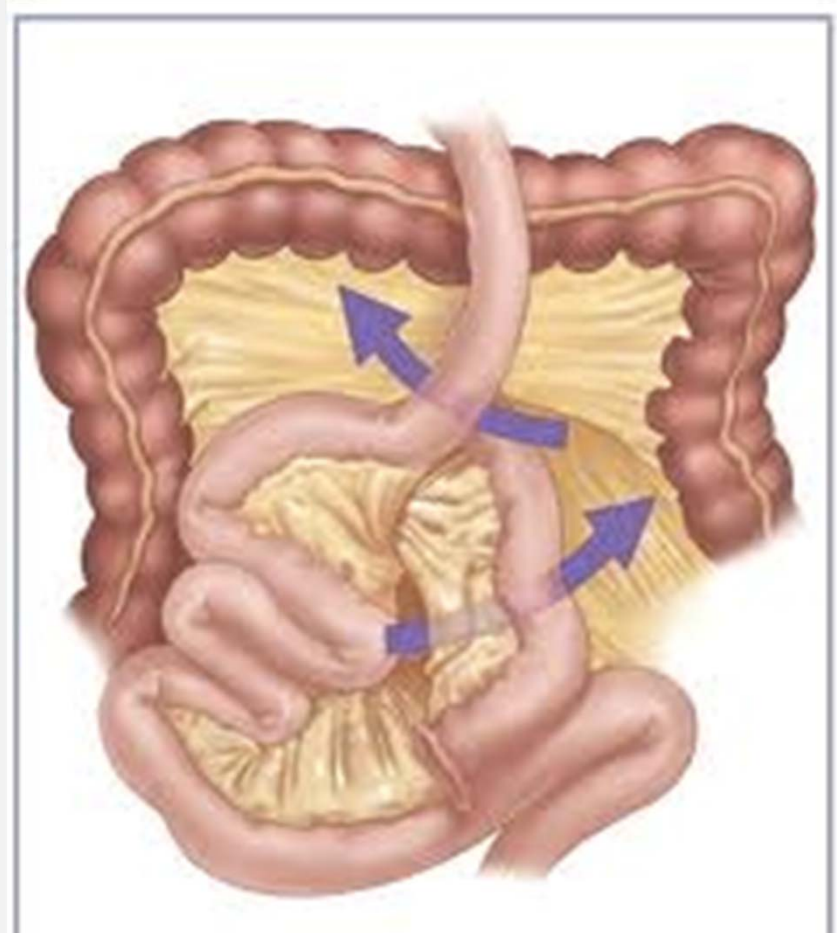


DILATED SB AND REMNANT:
NEEDS AN OPERATION!

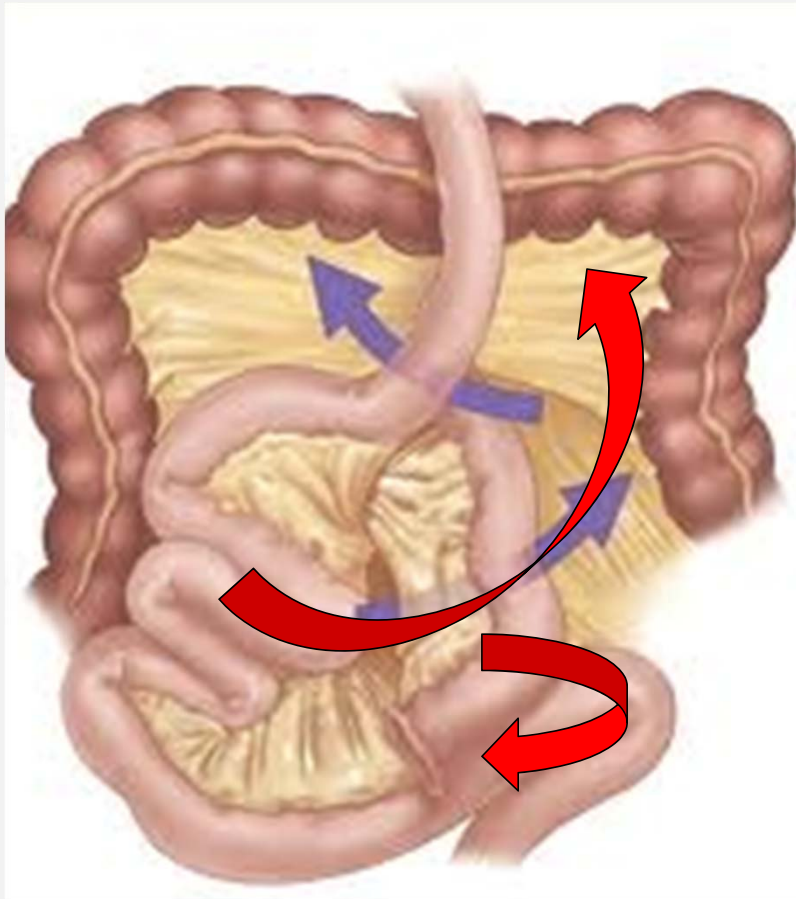


INTERNAL HERNIA AFTER RYGB

- "Achilles heel"
 - 1 to 5% lifetime
- Several potential spaces
- No way to prevent
- Missed on imaging

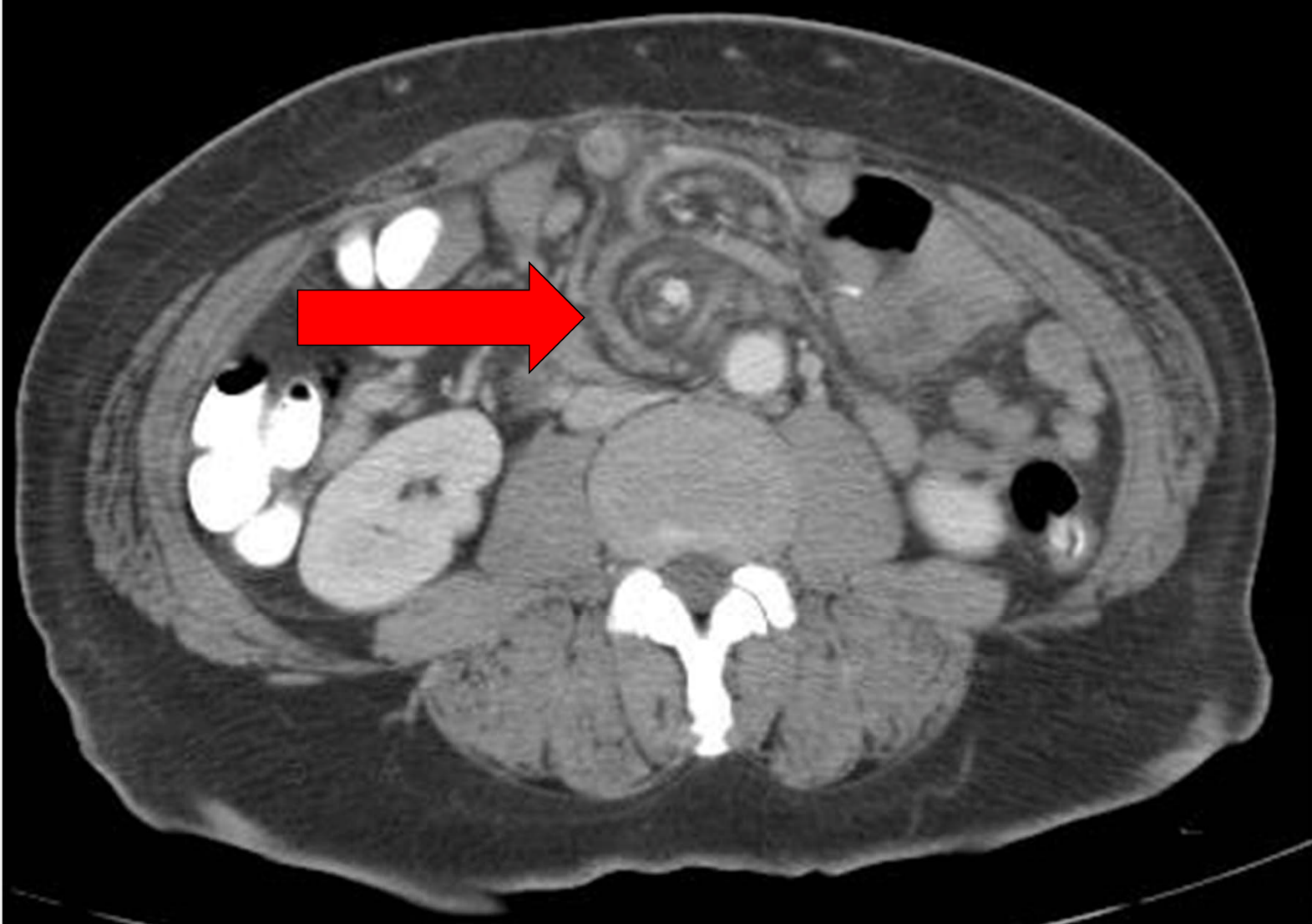


ANATOMY OF INTERNAL HERNIA



- Bowel to LUQ
- JJ will twist on vascular pedicle
- Pan-dilation seen







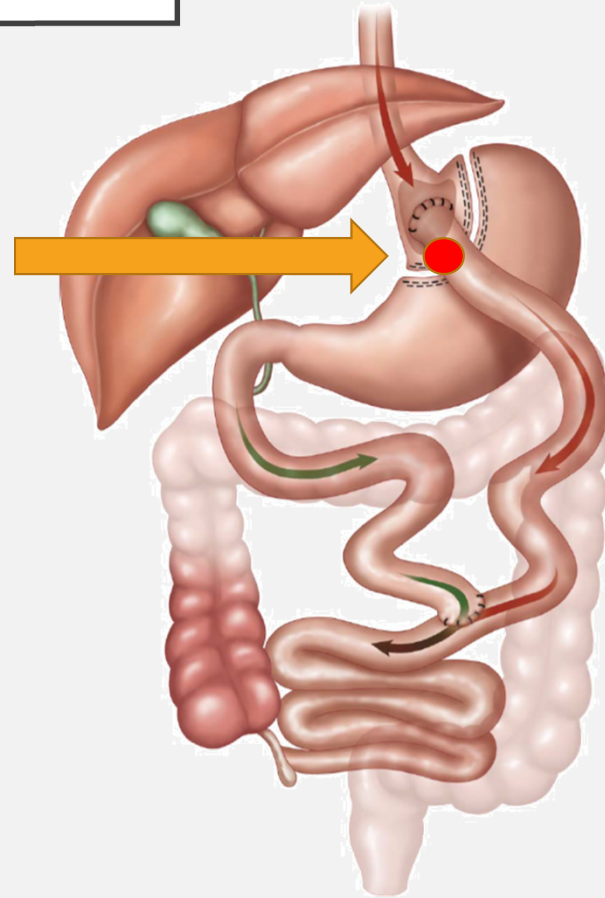
PRINCIPLES OF POST-BYPASS SBO

- Do NOT write it off to adhesions
- **INTERNAL HERNIA** until proven otherwise!!



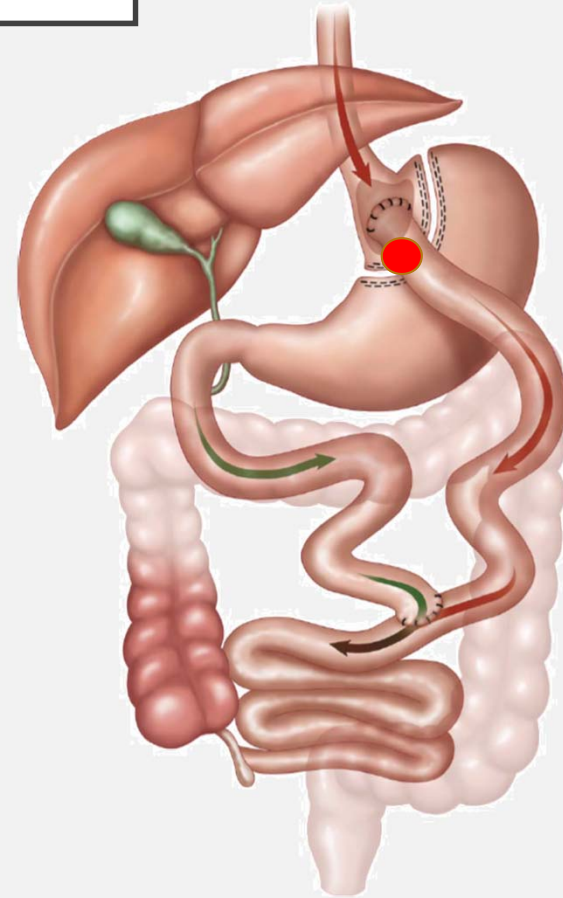
MARGINAL ULCER

- Ulceration of the jejunum *just beyond the GJ anastomosis*
- Incidence 2-15%
- Most commonly presents **>1 year after operation**
- Epigastric pain with eating or spontaneous perforation



MARGINAL ULCER

- Upper endoscopy
 - Assess the status of the pouch and the anastomosis
 - Biopsy for *H. pylori*
- Upper GI and/or CT
 - Assess for fistula between pouch and remnant
- Serum gastrin
 - Rule out gastrinoma or G-cell hyperplasia



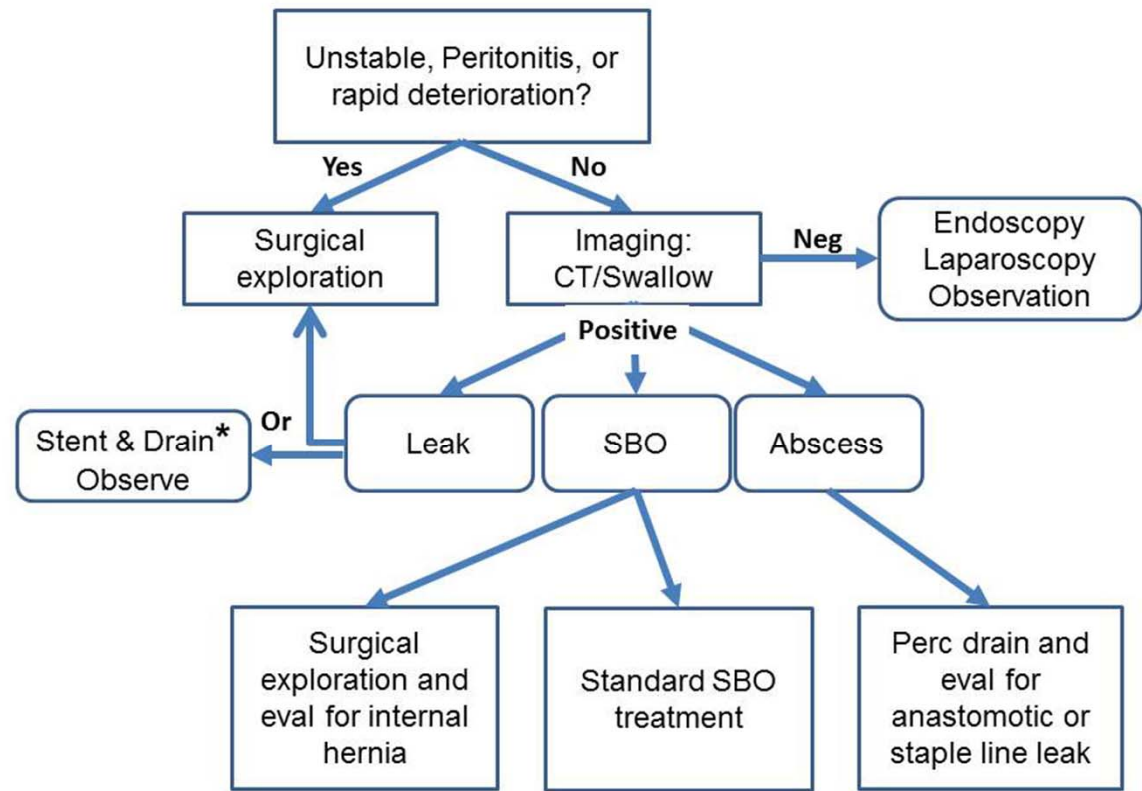


Fig 1. Simplified algorithm for acute abdominal complaints after bariatric surgery

MEDICAL COMPLICATIONS

DIARRHEA

- Up to 40% incidence after bariatric surgery
- Rx: dietary modification and anti-diarrheal meds



DUMPING SYNDROME

- **“Early”** (within 1 h of eating)
 - Fluid is drawn into the lumen, causing:
 - intravascular depletion → lightheadedness, dizziness, sweating
 - Luminal distention → abdominal pain and bloating



DUMPING SYNDROME

- **“Late”** (up to 3 h after eating)
 - *Reactive hypoglycemia* secondary to mismatch in absorption time of simple sugars and insulin half-life
 - Lightheadedness, dizziness, sweating
- Symptoms are responsive to simple sugars



DUMPING SYNDROME

- Rx: dietary modification with **small, frequent meals** with **low glycemic index foods**
 - Oats, milk, chickpeas, carrots, kidney beans, lentils
- This “complication” can be a potent negative reinforcement eliminating the desire for concentrated sweets



PSYCHIATRIC

- Eating disorders
- Depression
- Anxiety



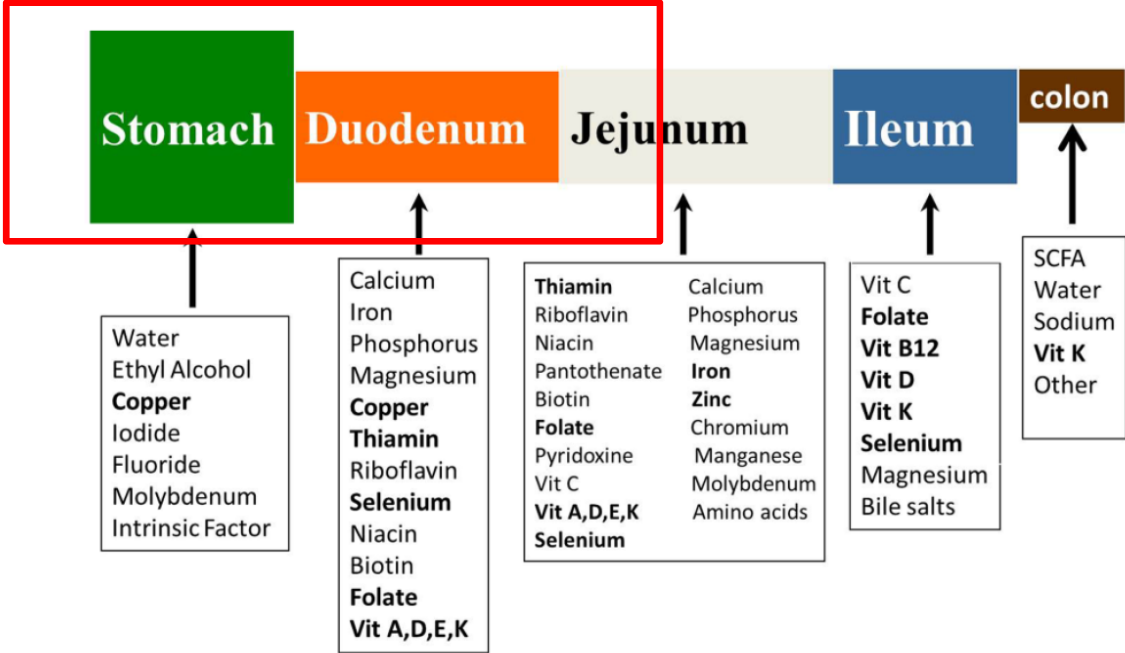
MICRONUTRIENT DEFICIENCIES

- Present in up to 35% of bariatric patients before their operation
- About 50% present within the first year after RYGB

Kazemi *Curr Gastroenterol Rep* 2010
Schweiger *Obes Surg* 2009



MICRONUTRIENT DEFICIENCIES



MICRONUTRIENT DEFICIENCIES

Up to 70%
prevalence at 4
years



- Fat soluble
 - A
 - D
 - E
 - K
 - Essential Fatty Acids

- Minerals
 - Zinc
 - Selenium
 - Copper

- Water soluble

- C
- B₁ (thiamine)
- B₂ (riboflavin)
- B₆ (pyridoxine)

- B₇ (biotin)
- B₉ (folate)
- B₁₂ (cyanocobalamin)
- iron



Most common micronutrient deficiency
after bariatric surgery

ACUTE POST GASTRIC REDUCTION SURGERY (APGARS) NEUROPATHY

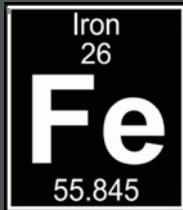
- “bariatric beriberi”
 - Polyneuropathy, including “burning feet syndrome”
 - Commonly occurs with **history of frequent vomiting**
-
- B₁ (thiamine)
 - B₁₂ (cyanocobalamin)
 - Copper

B12 (CYANCOBALAMIN)

- Mainly provided in red meat and dairy
- Meat intolerance after bariatric surgery
- Normal (American) diet results in reserves that can last 2 – 5 years
 - Delayed presentation of deficiency
- Can give sublingual or intramuscular

B₉ (FOLATE)

- Absorbed mainly in the **proximal small intestine**
- Absorption optimal in **acid environment**
- Incidence up to 35%



IRON DEFICIENCY

Most common micronutrient deficiency (50-100% incidence at 5 years)

- Fatigue
- Weakness
- Headache
- Pica

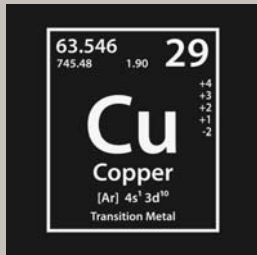
Gastric acid needed for iron absorption

Predominantly absorbed in *duodenum and proximal jejunum*

Calcium and copper both compete with iron for absorption

Recalcitrant to supplementation?

- Consider **vitamin C deficiency**!!
 - Vit. C enhances iron absorption



COPPER DEFICIENCY

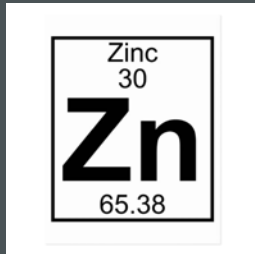
Absorbed mainly in stomach and duodenum

Up to 70% prevalence after BPD-DS

~10% after RYGB

Neurologic symptoms (identical to B₁₂ deficiency)

Microcytic anemia



ZINC DEFICIENCY

Pre-operative deficiency present in up to 50%

Excreted in feces → deficiency seen in chronic diarrhea

Dry/brittle hair or alopecia

Altered taste sensation

Impaired immune function and wound healing

Plasma zinc level is inaccurate to diagnose clinical deficiency

****CAUTION:** Zinc supplementation may unmask or worsen copper deficiency through competition **

Table 2. Recommended Supplement Doses After Bariatric Surgery.

Supplement	Dosage
Vitamin A ^a	500 mcg
Vitamin E ^a	10 mg
Vitamin K ^a	90–120 mcg
Thiamin ^a	1.2 mg
Folic acid ^a	400 mcg
Biotin ^a	30 mg
Selenium ^a	55 mg
Zinc ^a	8–11 mg
Copper ^a	2 mg
Calcium citrate/carbonate (PO)	1200–1500 mg/d
Vitamin D (PO)	800 units/d
Iron (PO)	40–65 mg elemental iron/d
Vitamin B ₁₂ (PO, SL, IN, or IM)	>350 mcg/d tablet 1000 mcg IM/month

IM, intramuscular; IN, intranasal; PO, per oral; SL, sublingual.

^aAs contained in a multivitamin.

BILIARY COMPLICATIONS

CHOLELITHIASIS

- Common sequelae of rapid weight loss
- Up to 50% will develop gallstones post-operatively
 - 10% will become symptomatic
- Controversy about prophylactic cholecystectomy during bariatric operation

CHOLEDOCHOLITHIASIS

- May need to do trans-gastric ERCP
- Or
- Percutaneous transhepatic cholangiogram (PTC) catheter

VASCULAR COMPLICATIONS

THROMBOEMBOLIC COMPLICATIONS

- Pulmonary embolism and DVT
- Obesity-related hypercoagulability persists for at least 6 months following bariatric surgery

Tuovila *Obesity Surgery* 2018

PORTOMESENTERIC VENOUS THROMBOSIS

- Presenting symptoms: 98% abdominal pain 8 days to 2 months
- Diagnosis: CT scan
- 92% have hematologic abnormality found – 76% Factor VIII elevation
- Treatment with hydration and anticoagulation

Parikh *Surg Obes Relat Dis* 2017

SUMMARY

- Take a ***detailed*** bariatric history, including the exact type of operation performed
 - Different complication profiles
- SBO after RYGB is treated differently than standard adhesive SBO
 - ***High suspicion for internal hernia***

SUMMARY

- Micronutrient deficiencies are common
 - Anatomy and absorption
 - Non-compliance with supplements
- Life-long monitoring is recommended for RYGP and BPD-DS

SUMMARY

- Biliary complications common
- Extended hypercoagulable state

QUESTIONS