Banner
University Medicine

Complications of Metabolic/Bariatric Surgery

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Objectives

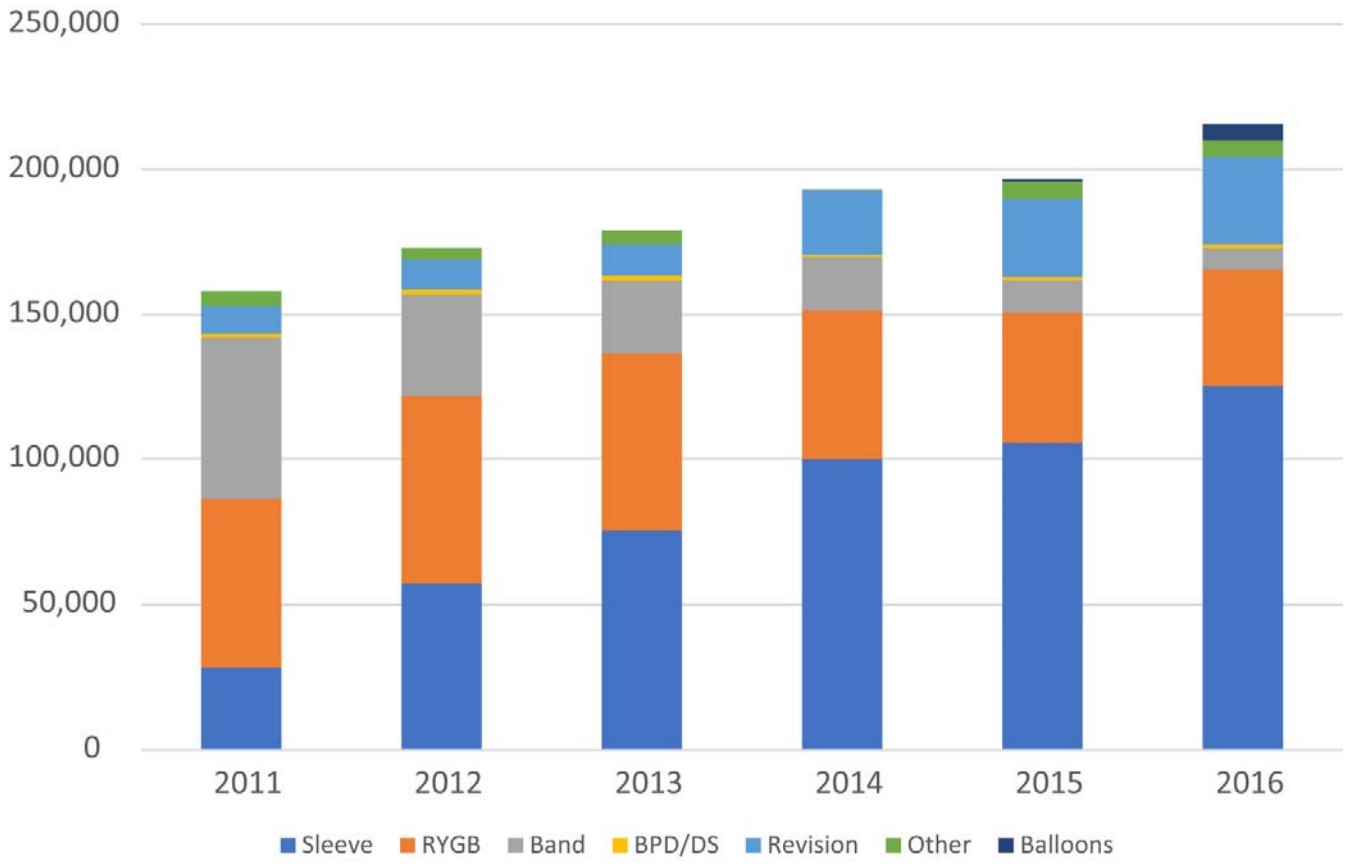
- Develop an awareness of the devices and procedures used to treat adisopathy and related disease
- Identify the signs and symptoms of complications of MBS
- Awareness of stapled procedures and outcomes in regards to management of hypoglycemia

Obesity

- Rate of obesity in US: 34.9% (78.6 million)

  JAMA. 2014;311(8):806-814. doi:10.1001/jama.2014.732
- Arizona 2013: 26.8%
- Most insurers now cover weight loss surgeries per NIH recommendations
  - BMI > 40
  - BMI > 35 with obesity related co-morbid condition
- With this many people a year getting MBS, every physician will be called upon to manage complications

Metabolic and Bariatric Surgery Procedures 2011-2016

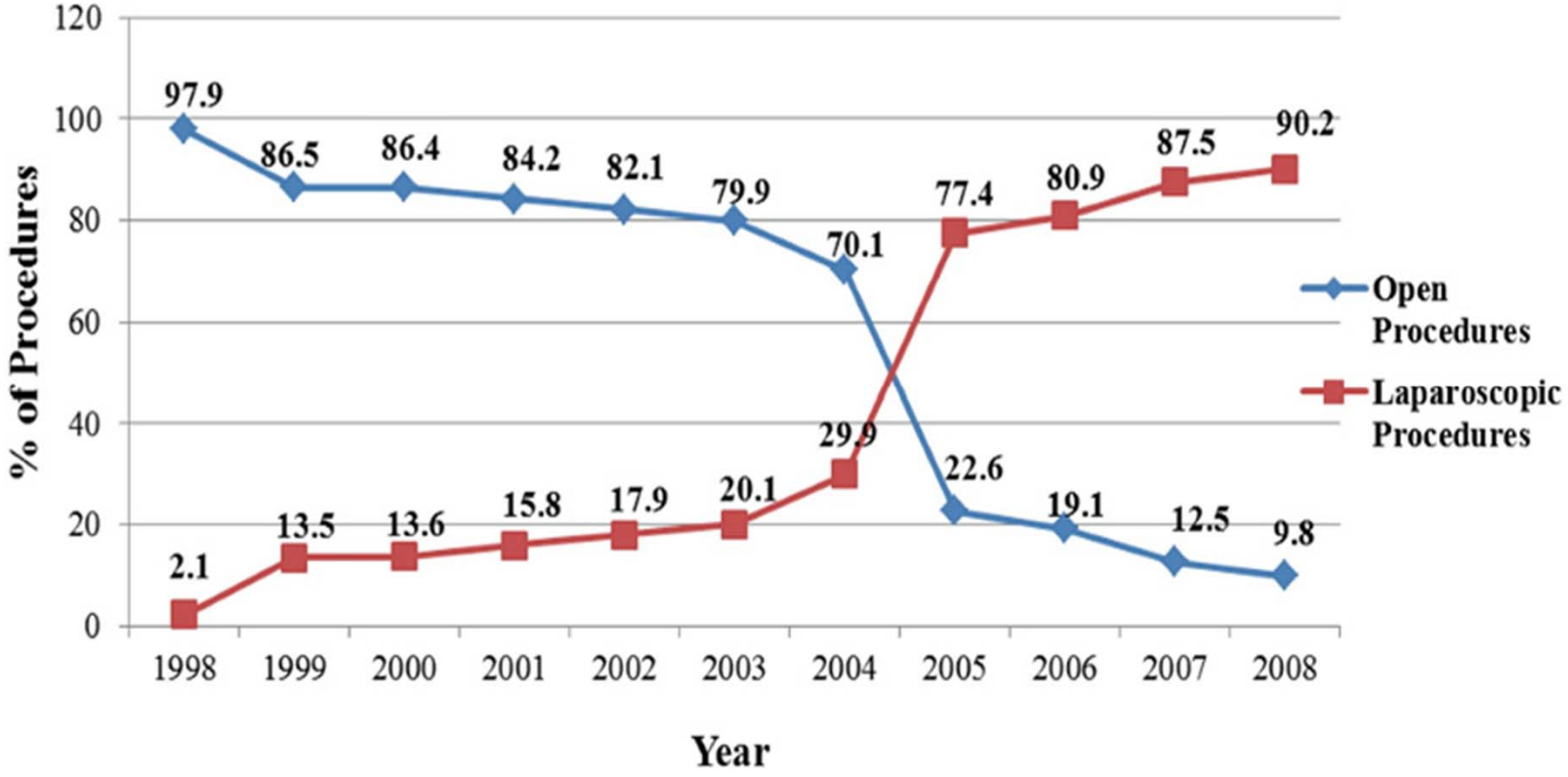


Surgery for Obesity and Related Diseases 2018 14, 259-263DOI: (10.1016/j.soard.2017.12.013)

MBSAQIP
Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program

100% reporting
Certified Abstractor
QI process as part of Accreditation
BUMCP Attained in December of 2016
2016 185,000 cases done within this network

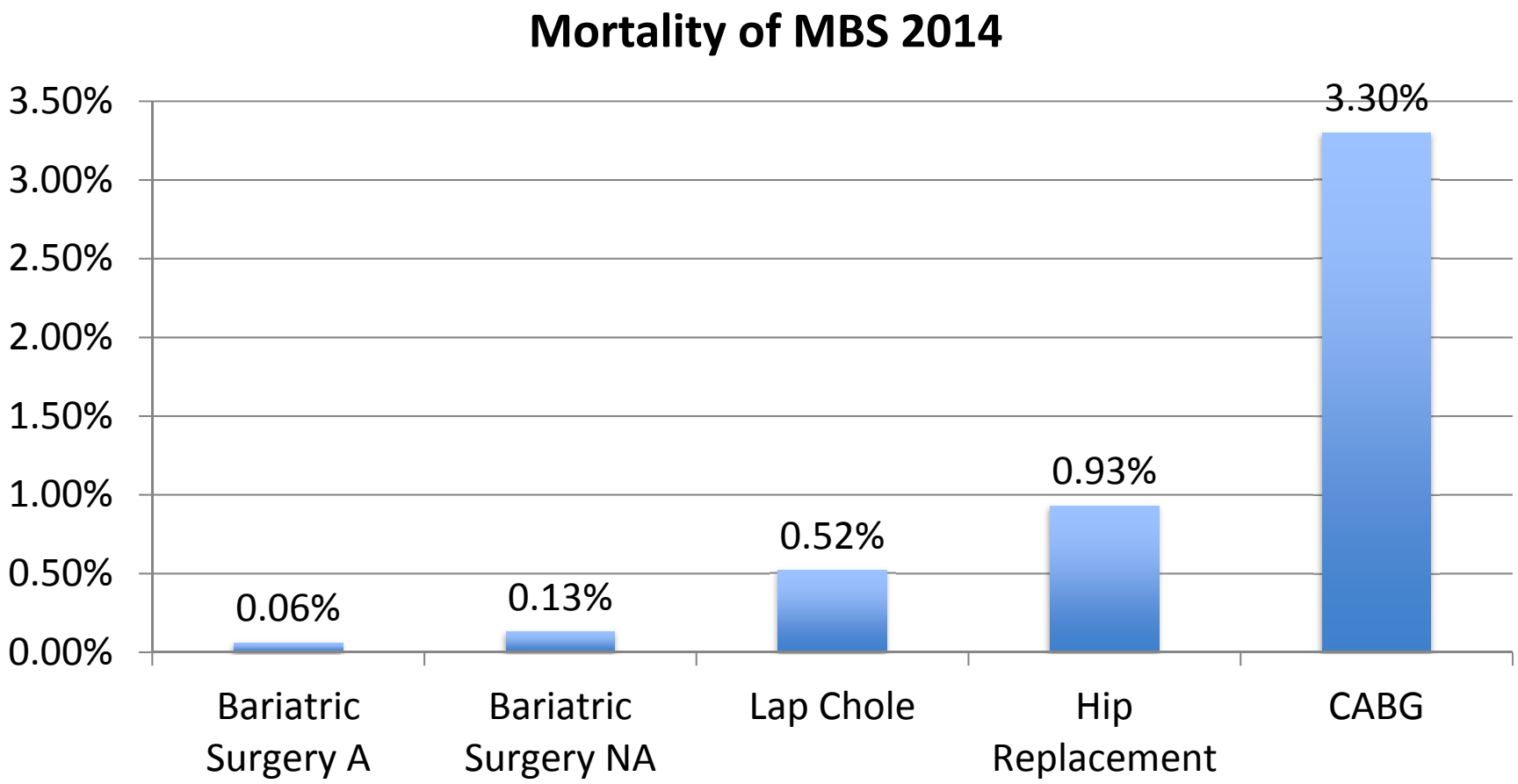
Metabolic and Bariatric Surgery (MBS)



The obese patient is best approached laparoscopically for any and all procedures. Currently the rate of laparoscopic approach for both primary and secondary procedures Is 98%+.

Nguyen NT, 2009 Growth of Laparoscopic Procedures

Mortality is Rare



Morton J, 2014

A- Accredited (MBSAQIP)
NA- Not accredited

ACS-NSQIP Data

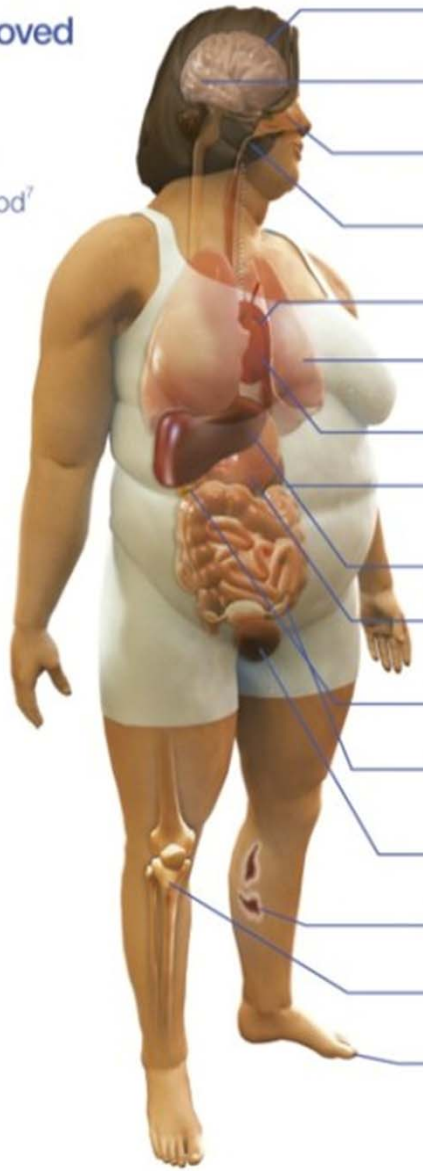
Variable	LRYGB (N=11,617)	LSG (N=3,069)	LAGB (N=5,622
Morbidity, n (%)	589(5.1%)	98 (1.4%)	114 (3.7%)
Mortality, n (%)	19 (0.2%)	3 (0.1%)	3 (0.1%)
Reoperation, n (%)	255 (2.2 %)	48 (1.6%)	55 (1.0%)
Op time, mean minutes (SD)	126.5 (50.6)	93.3 (45.9)	64.2 (31.5)
LOS, median days(IQR)	2.0 (1.0)	2.0 (1.0)	1.0 (1.0)

Sanni A, et al. Postoperative Complications in bariatric surgery using age and BMI stratification: a study using the ACS-NSQIP data. Surg Endosc 2014 doi:10.1007/s00464-014-3606-7

Resolution of Comorbidities after Bariatric Surgery

Quality of Life Improved
in 95% of patients[2]

Relative Risk of Mortality Reduced
by 89% in a five-year period[7]



- Migraines
  57% resolved[2]
- Depression
  47% reduced[2]
- Pseudotumor cerebri
  84% resolved[8]
- Obstructive sleep apnea
  74% to 98% resolved[2,5]
- Hypercholesterolemia
  63% resolved[2]
- Asthma
  69% improved[2]
- Hypertension
  62% to 70% resolved[1,2]
- Nonalcoholic fatty liver disease
  37% resolution of steatosis[6]
- Metabolic syndrome
  80% resolved[6]
- GERD
  72% to 95% resolved[2,3]
- Type 2 diabetes
  82% to 98% resolved[2,5,9]
- Polycystic ovarian syndrome
  75% resolution of hirsutism[10]
  100% resolution of menstrual dysfunction
- Urinary stress incontinence
  44% resolved[2]
- Venous stasis disease
  95% resolution of venous stasis ulcers[4]
- Osteoarthritis/Degenerative joint disease
  41% resolved[2]
- Gout
  72% resolved[2]

Adjustable Gastric Band

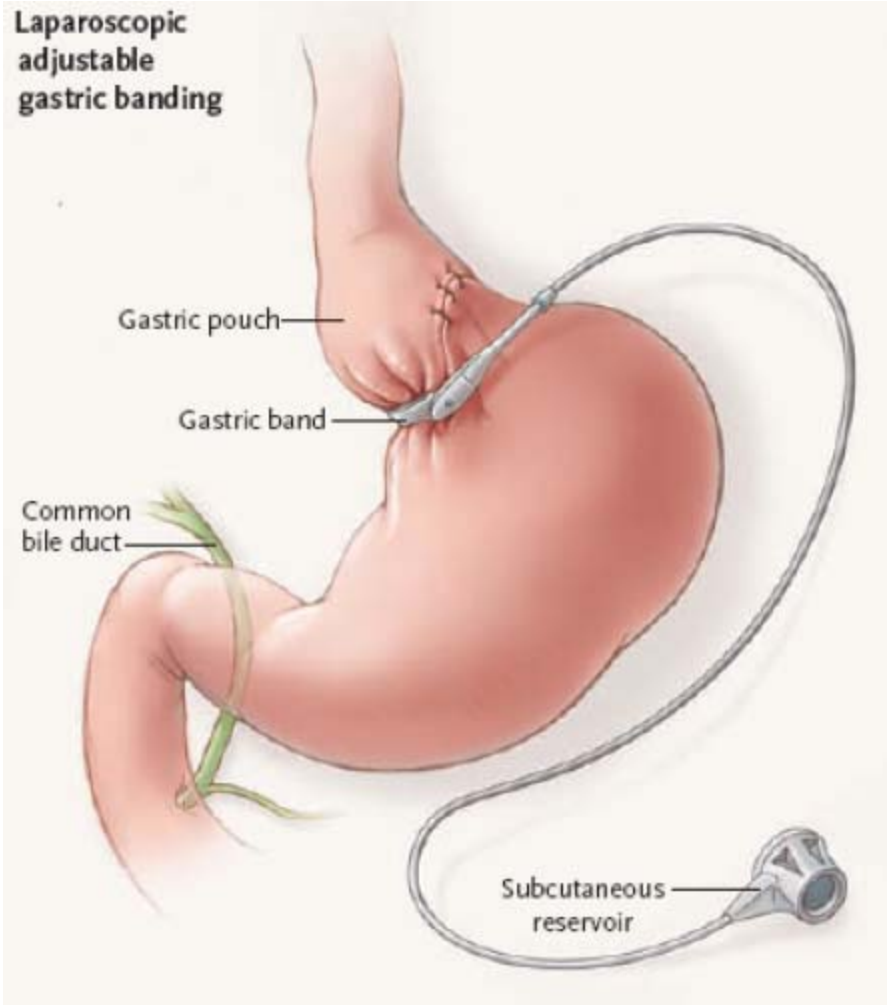
VBLOC

Balloons

DEVICES

Adjustable Gastric Band

Technique Notes:
Laparoscopic (99.9%)
Band placed cephalad to the lesser sac
    Access to place the band was gained
    pars flacida with dissection
    along the right crura to the V of the right
    and left crura
A grasper was pushed behind the stomach (usually not under direct vision) to the angle of His
Band is brought around the stomach, buckled
Gastro-gastric flap is created with suture
Tubing brought out usually on the left side of the abdomen through the 5mm left mid-clavicular line
Port is introduced by widening the incision and usually sewn down to the fascia with four Sutures

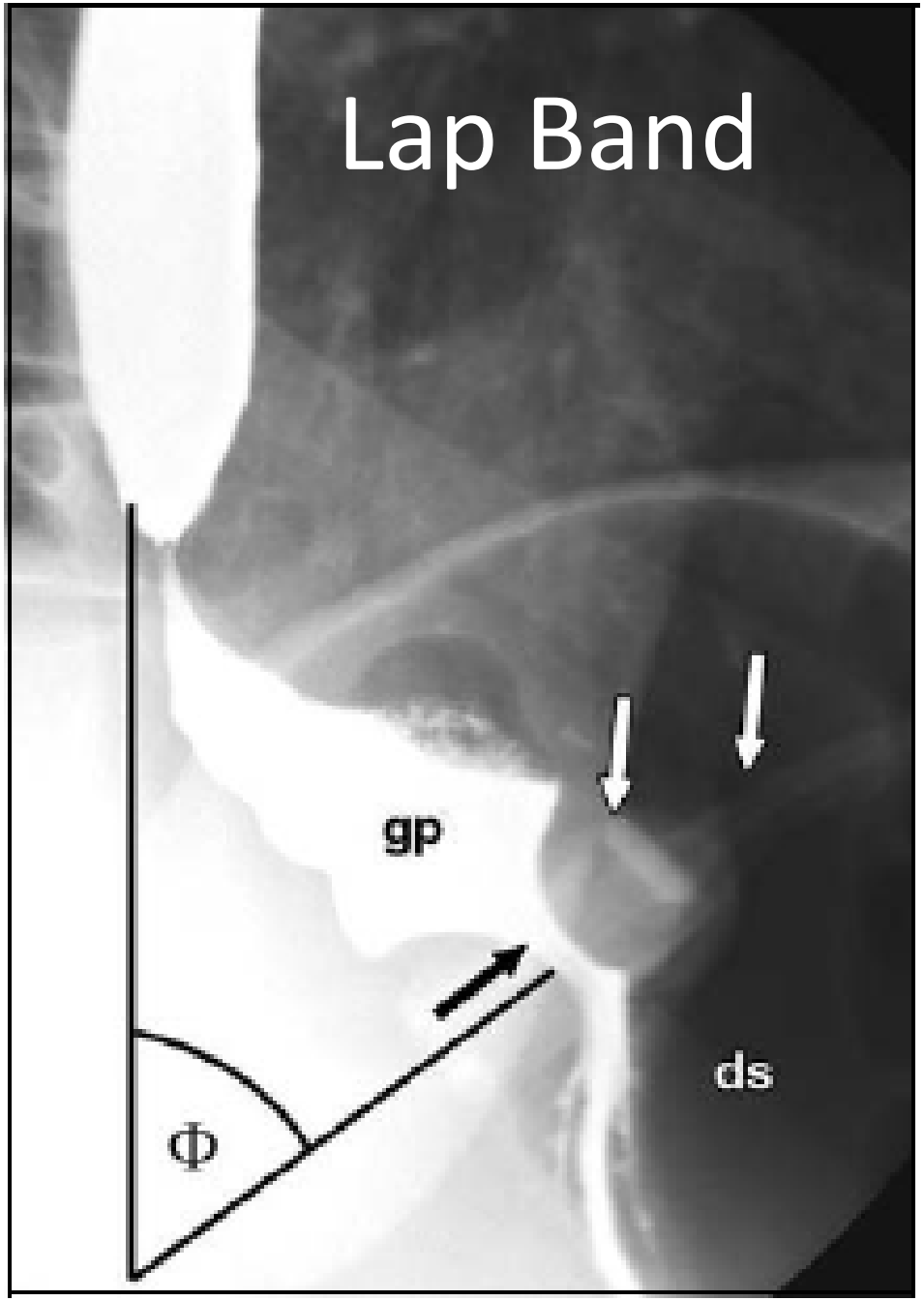


PEARL: The port is usually in the near vicinity to the largest incision – ASK THE PATIENT

Normal position of the band can be seen on a KUB/Gastrografin Swallow
The band should be about 60 degrees to the spine and angled to the left shoulder on AP film

-Gastric tissue above the band should be 3-4 cm when maximally dilated

-Emptying time varies but there should be flow across the band



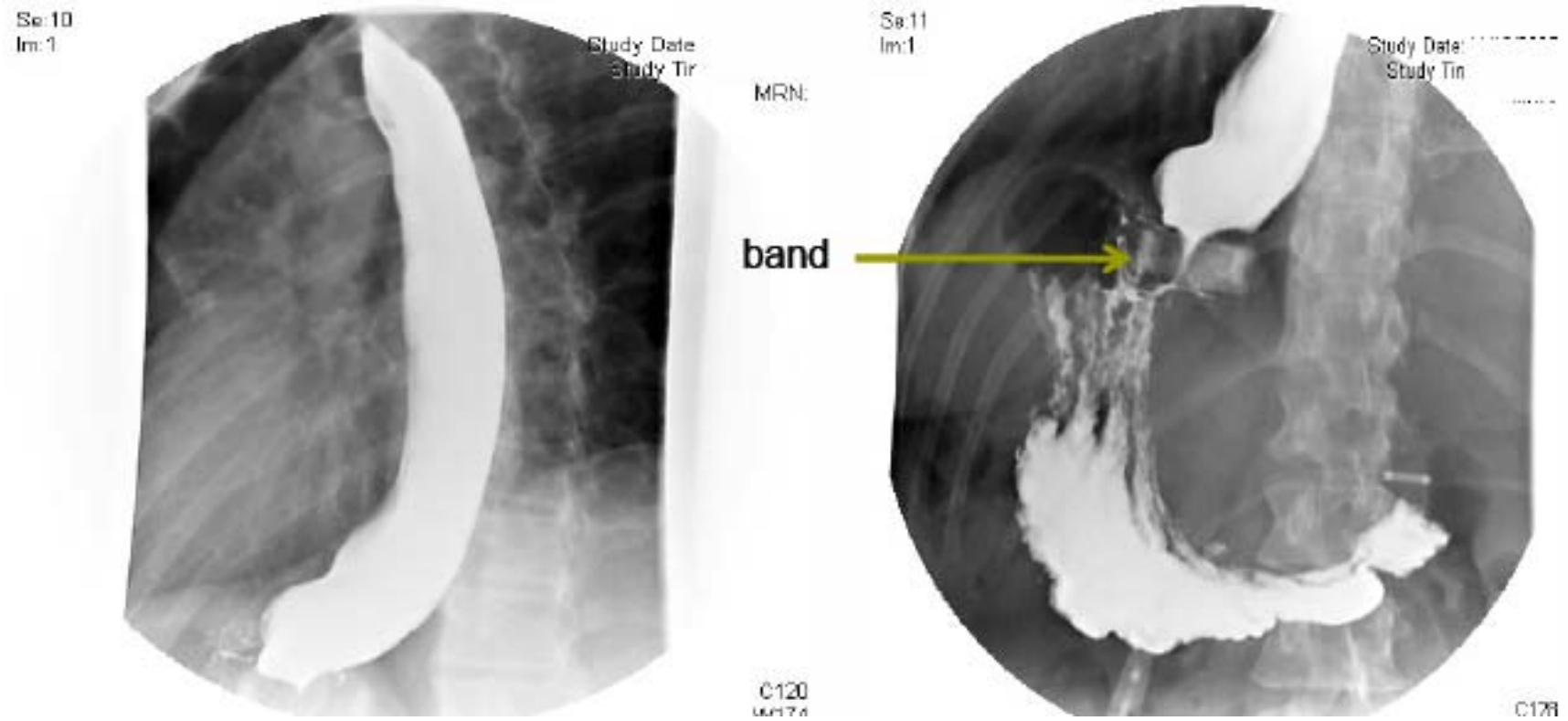
Chandler RC, et al. Imaging in bariatric surgery: a guide to postsurgical anatomy and Common complications. AJR Am J Roentgenol. 2008;190(1):122-35.

Band Complications
General Approach

- History and Physical
  - Sometimes patients have a laminated card with their band type on it
- Imaging – Gastrograffin swallow is preferred
  - do this before you unfill so you can see what's wrong
- UNFILL – always take all the fluid out
- Definitive Management - not acute
- Rehydrate
- Vitamins

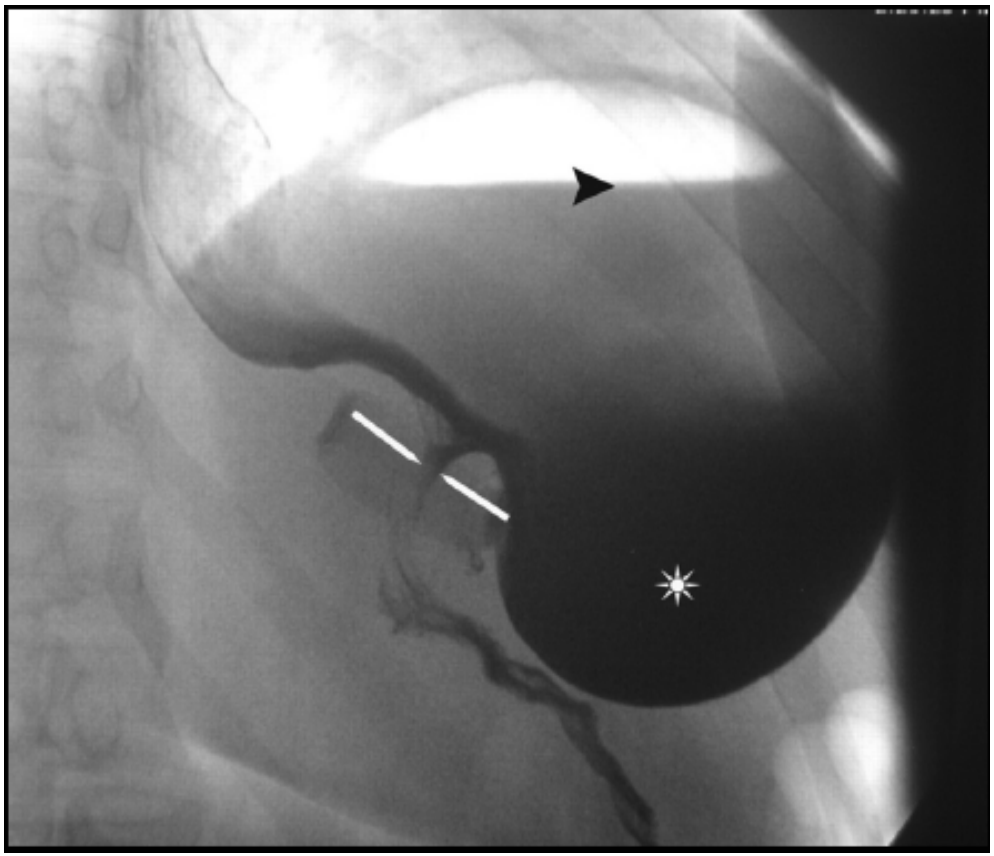
Obstruction

History: just got a band fill or I ate a piece of food and didn't chew it



Epigastric Pain
Usually ACUTE
Unfill, admit to observation, wait

Band Slippage



History

- Usually has had the band for many years but rarely acute
- May have a recent history of repeated retching or vomiting
- Usually:
  - N/V,
  - Dysphagia
  - abdominal pain

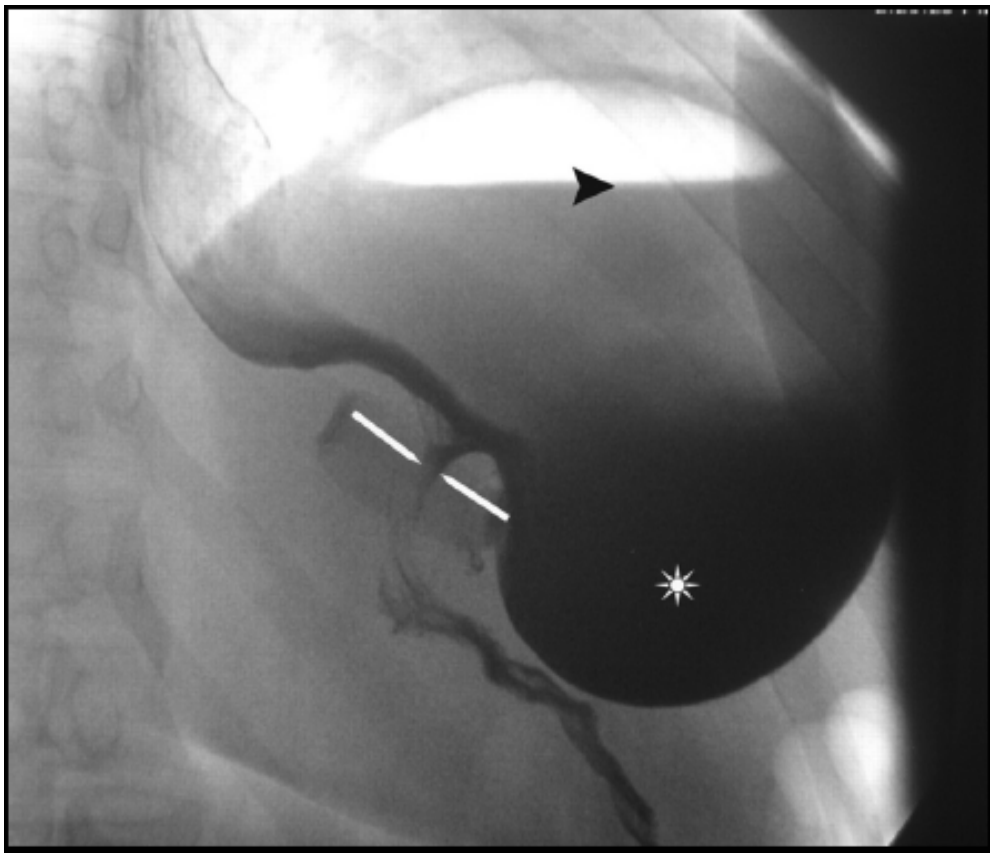
Physical Exam*

- Usually benign, may be distended or tender in RUQ

Imaging

- Distended gastric pouch proximal to the band
- Air fluid level
- Narrowed stoma at level of band

Band Slippage



- Management
  - UNFILL
  - Resuscitation
  - Can remove the next day if stable
- If the patient is throwing up blood they will need to go urgently to the operative room

AGB Erosion

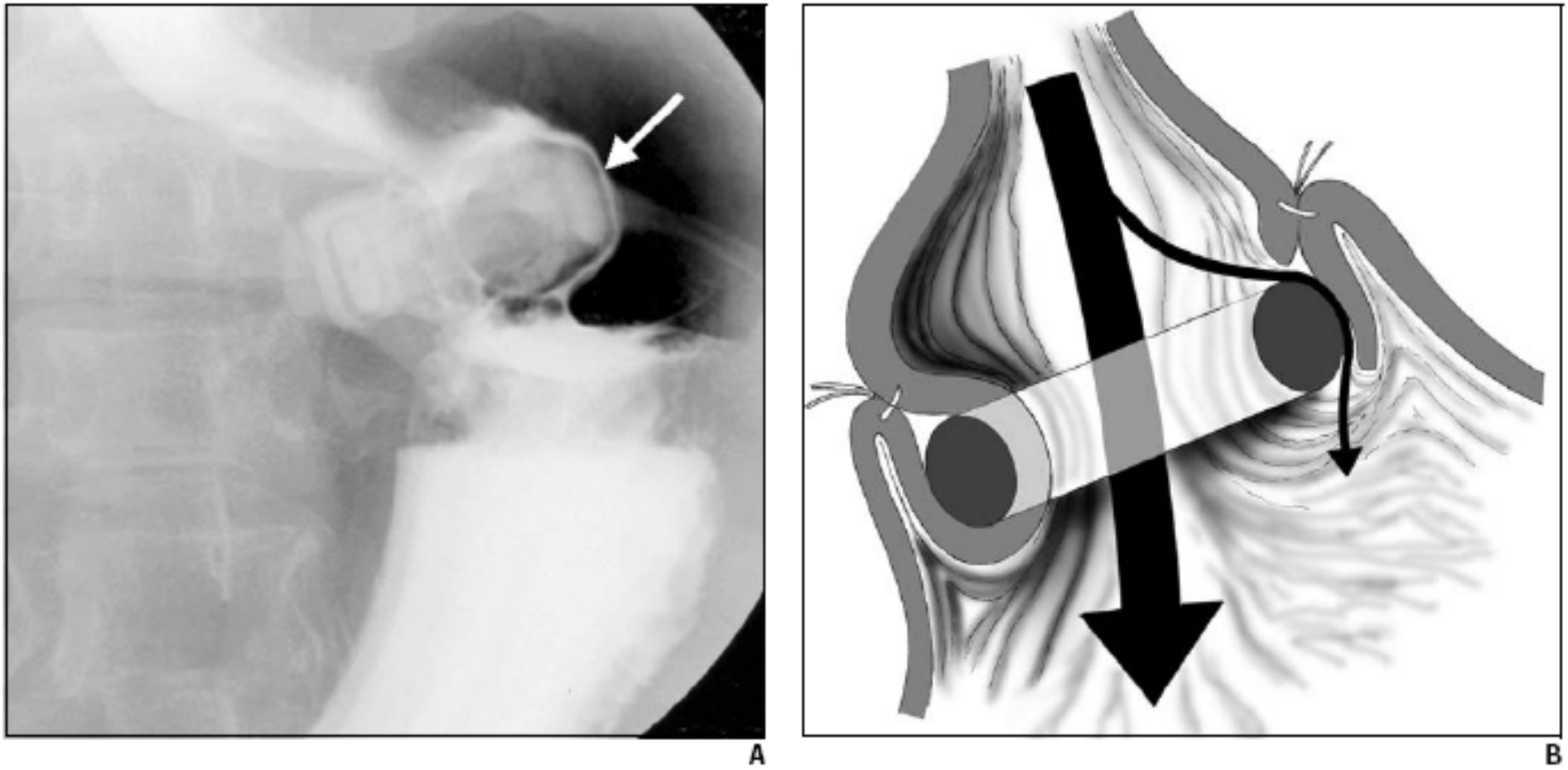


Fig. 1.—Intragastric band erosion in 23-year-old woman.
A, Radiograph from upper gastrointestinal series shows characteristic appearance of intragastric band erosion. Note contrast material on both sides of penetrating portion of band (*arrow*).
B, Drawing of radiographic findings shown in A illustrates passage of contrast material through stoma of band (*large arrow*) and around left section of band that has eroded into stomach (*small arrow*). Note normal aspect of right section of band with gastric fundus wrapped around it.

Chandler RC, et al. Imaging in bariatric surgery: a guide to postsurgical anatomy and Common complications. AJR Am J Roentgenol.2008;190(1):122-35.

CT Correlation of Band Erosion

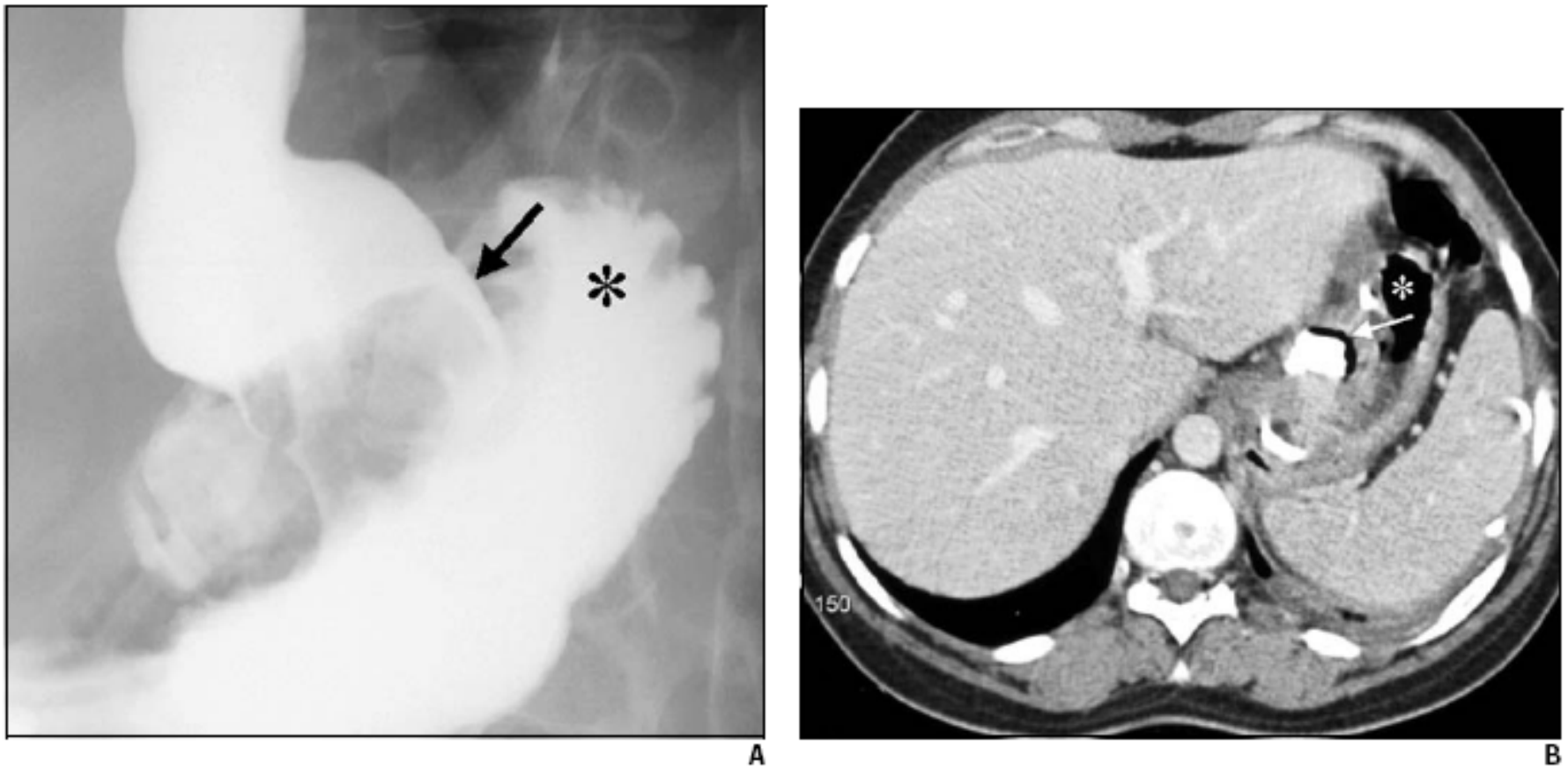


Fig. 2.—Intragastric band erosion in 39-year-old woman.
A, Radiograph from upper gastrointestinal series shows typical image of intragastric band erosion. Contrast material surrounds part of band that has eroded through wall of stomach (*arrow*). Gastric fundus is indicated by asterisk.
B, Axial CT scan obtained at level of gastric banding shows good correlation with fluoroscopic view in A. Air around eroded band (*arrow*) corresponds to contrast material around band seen on gastrointestinal series. Gastric fundus is indicated by asterisk.

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AGB Erosion
Optimal Diagnosis is with EGD

AGB Erosion

History

- Usually has had the band for many years
- May have tenderness over the port site
- Usually gives a history of not feeling restriction when filled
- Uncommonly:
  - N/V,
  - Dysphagia
  - abdominal pain

Physical Exam*

- Usually benign
- May be tender over port site or have signs of soft tissue infection around the port

Imaging

- Outline of the band with dye
- Wide open flow
- Diagnosis usually made on EGD

- Management
  - Confirm UNFILL
  - Resuscitation
  - Can remove the next day laparoscopically with gastrostomy
- Do not do these in the middle of the night!

Type of AGB and Fill Amounts

ALLERGAN ®

Regular (9.75/10.0 cm) – 4.0 cc maximum capacity

Vanguard - 10.0 cc maximum capacity

AP Standard - 10.0 cc maximum capacity

AP Large - 14.0 cc maximum capacity

JOHNSON & JOHNSON®

Realize - 9.0 cc maximum capacity

Realize C - 11.0 cc maximum capacity

FDA approved bands – but we see many odd types that are not approved and placed OUS

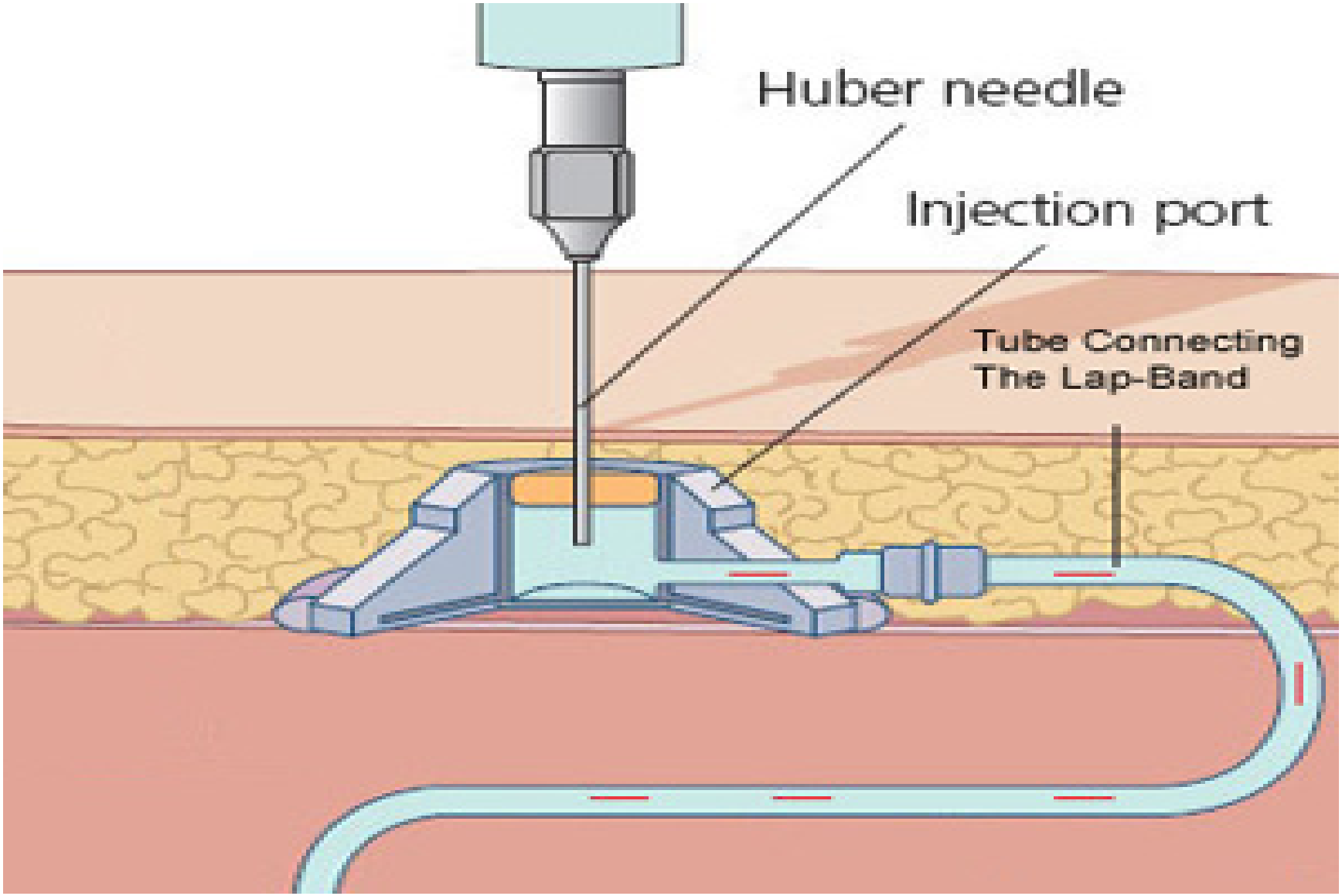
AGB Unfill Supplies

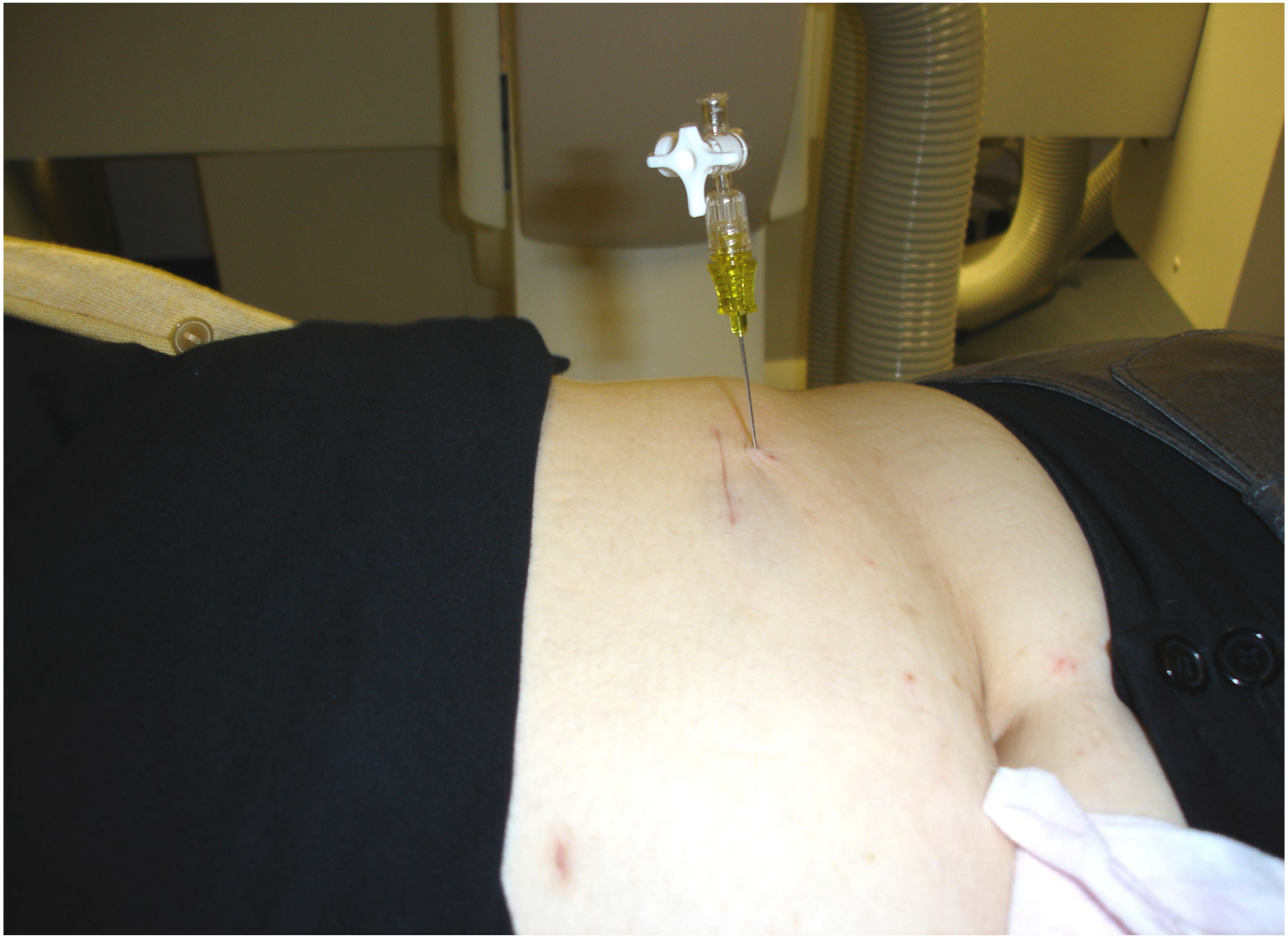
- Sterile Gloves
- Sterile Syringe (5ml best as it does not collapse the tubing)
- 3 way stopcock
- Sterile Huber needle (Trauma Bay- if you are sitting at the nurses station looking at the beds, in the cabinet on the left)
- Band-Aid
- Chlorhexidine -Gluconate Prep Stick

THIS IS DONE WITH STERILE TECHNIQUE!!!!!

Unfill PROTOCOL

- Palpate abdomen for port location and anticipated injection site – ask the patient where it is if you cannot find it! Can mark with a permanent marker
- Prep abdomen.
  * Remind patient to NOT touch this area after prep.
- Allow prep solution to dry.
- Open sterile gloves. Follow with syringe, stopcock, & huber needle
  (Packaging serves as sterile field for gloves, syringe, needle, and stopcock.)
- Don sterile gloves. Assemble syringe, stopcock, & huber needle
- "Flatten" port with non-dominant hand (sometimes easier to unfill from the side opposite the port)
- Insert huber needle at 90 degree angle to hub of port.
  (*feel for metal back of port)
- Withdraw all fluid - if necessary in multiple aspiration – keep track of the amount of fluid taken out and record
- Sit patient up (holding needle in port). Aspirate syringe again.
- Inspect injection site and apply Band-Aid.


Huber needle
Injection port
Tube Connecting
The Lap-Band



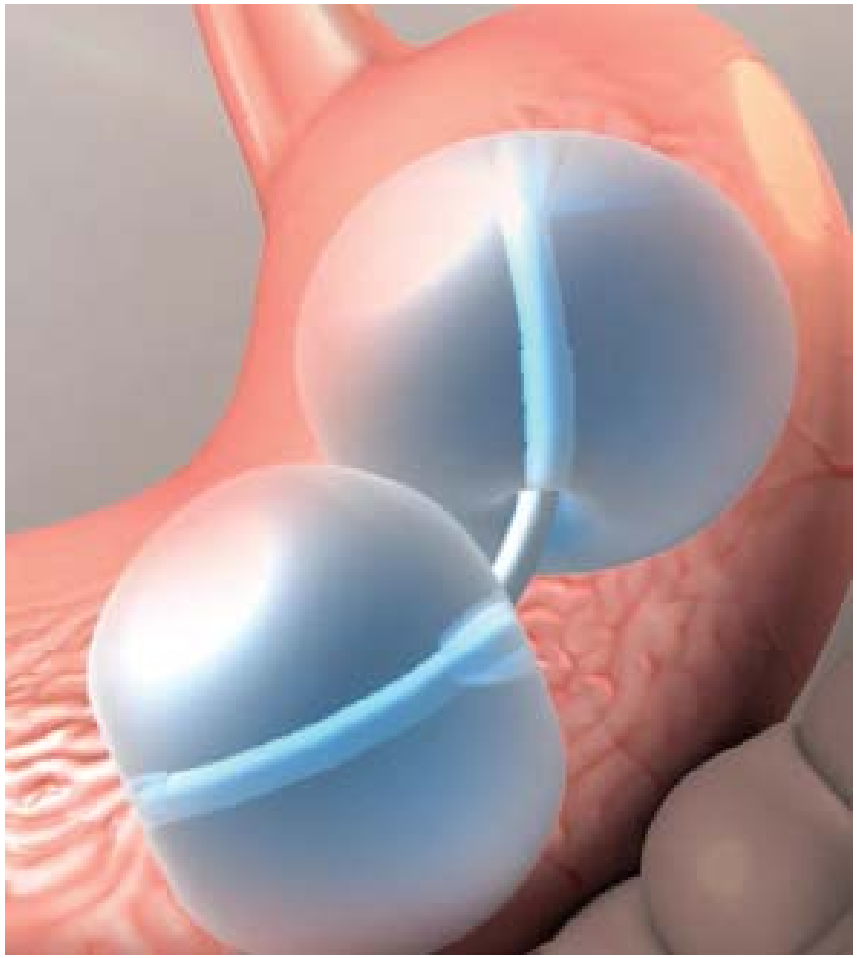
VBLOC and Balloons

DEVICES

Vagal Blocking Device (VBLOC)

Very few in the world – only acute complication usually from implanting the battery which is in the left lower thorax under the skin. Not emergent. (Note: we were the largest Volume center in both FDA A and B trials – so there are some of these patients in Arizona)

Obalon Balloon



Aspiration

Gastric Outlet Obstruction

Endoscopic retrival

Still very rare to see one and the complication rates are low.
FDA has approved two different balloons

Bleeding, Leaks, Obstruction, Perforations, Ulcers

STAPLED PROCEDURES

Stapled Procedures
General Approach

- History and Physical
  - Time course is critical – when was the procedure
  - The shorter the time course since surgery the more dangerous the situation for leaks and bleeds
- Imaging
  - CT with Bariatric Protocol – 100 cc of oral contrast given within a few minutes before scanning
  - DO not go to imaging if the patient is unstable –
    - RESUSCITATE
    - LAPAROTOMY
- Damage Control – good general surgery principles
- Definitive Management - not acute and should involve MBS
- Getting the previous operative report is optimal in terms of planning
- Higher BMI and Older age increase risk
- Many patients have multiple obesity related diseases that must be managed
- Rehydrate
- Vitamins

Sanni A, et al. Postoperative Complications in bariatric surgery using age and BMI stratification: a study using the ACS-NSQIP data. Surg Endosc 2014 doi:10.1007/s00464-014-3606-7

Most common acute complications

- Bleeding
- Leak
- Obstruction
- Perforation

Sleeve Gastrectomy

Technique

Disconnect the spleen and transverse colon from blood supply

Measure 4-6cm along greater curve from pylorus

Pass a bougie (different sizes used 36-40 common – leak rate goes up exponentially if bougie is less than 36)

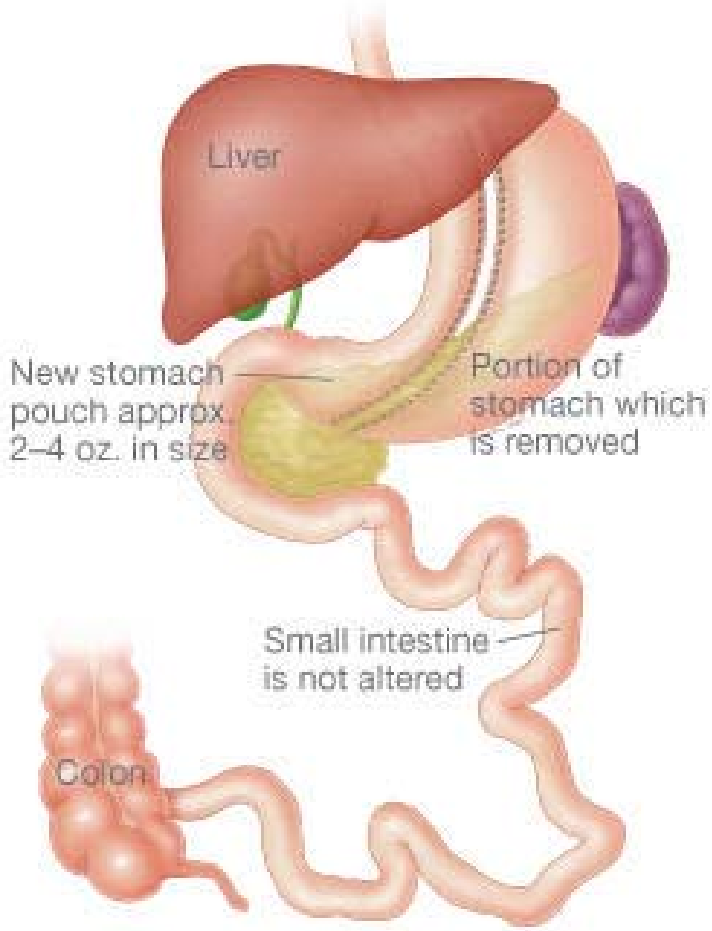
Using stapler (black loads) divide stomach into two portions

Imbricate Staple Line (some people use artificial product on staplers)

Remove disconnected stomach

Usually one or two 12.5mm trocars and three five mm trocars

Rarely to never use drains



Sleeve:
Acute Complications- Bleeding(0.49%)

- Significant first 24 hours – Presentations
  - Throwing up blood - usually in the PACU
    - Can sometimes be addressed endoscopically
    - Start Octreotide drip
    - Very rare
  - Bleeding into the abdomen – more common
    - Patient is anticoagulated
    - Takedown of the short gastric artery/vein – common source of bleeding
    - Usually shows up when they get up with postural hypotension or if very rapid in hypotension in PACU or early on the Bariatric Unit (6D)
    - Type and Cross, rapid return to the OR – do not wait for imaging
    - HH as usual not very helpful
    - Only approach laparoscopically if patient has good BP and you are extremely experienced otherwise laparotomy

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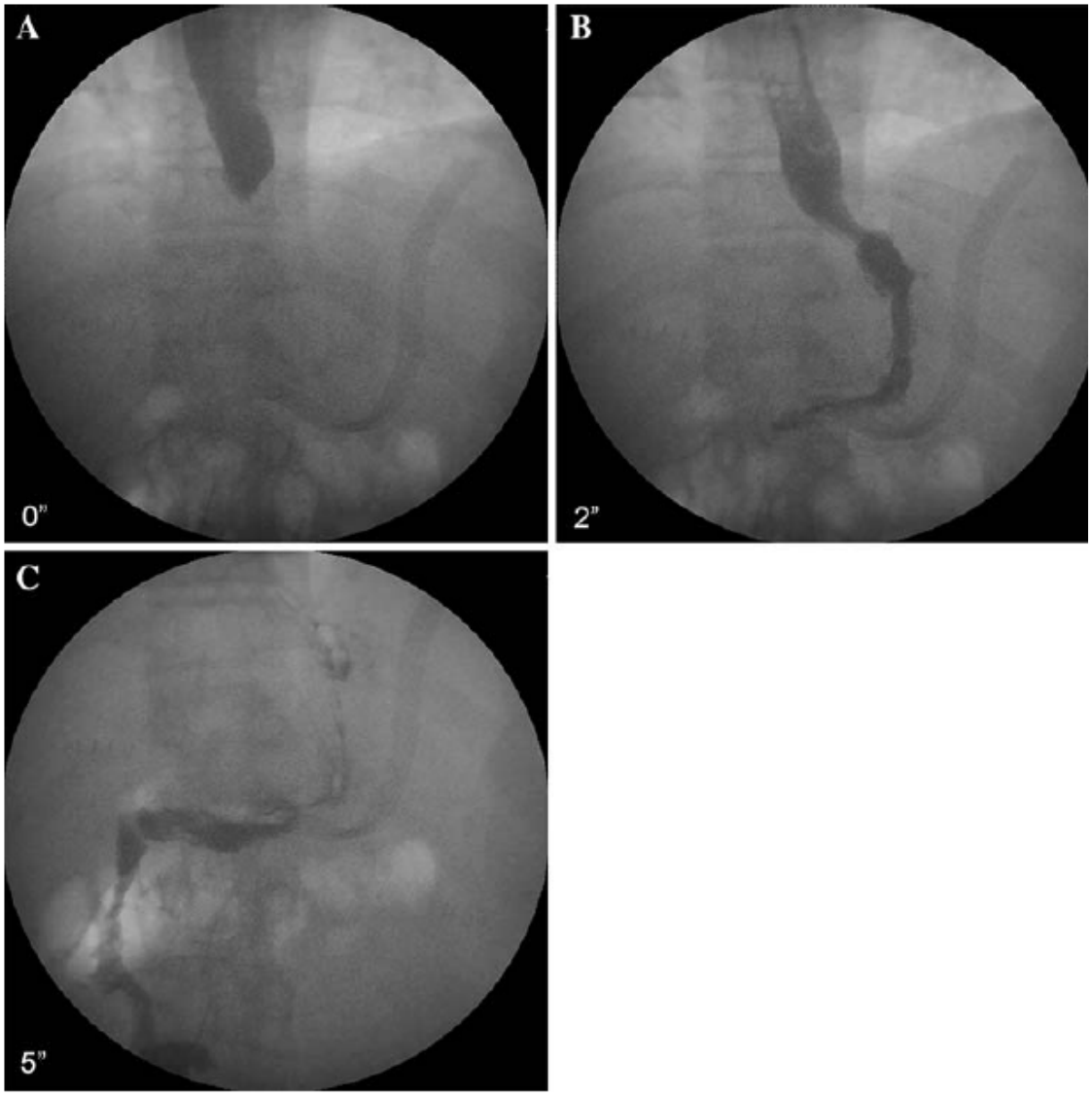
Sleeve:
Acute Complications – Leak

- Leak (.8-2.2%)
  - Time course determines presentation
    - If in the first 24-72 hours presents as sepsis with patient in extremis
    - DO NOT WASTE TIME WITH IMAGING
      - OR
      - Laparotomy
    - Wash out abdomen – usually not able to close hole – drains
    - Stent by GI in OR if possible
  - Usually leaks at 4-21 days with the most common at 14 days
    - Presentation is small fluid collection with air around upper 2-3cm of sleeve near GE junction
    - Patient has mildly elevated heart rate and WBC
    - Resuscitation
    - Treatment : Stenting by GI
      - GI consult for stent
      - He will be able to drain the pocket of fluid as he places the stent
      - IR placement of drain

Sleeve Gastrectomy- Leak



Sleeve:
Acute Complications – Obstruction

- Food impaction
- Twisting of the middle part of tube opposite the "crows foot" usually from poor technique
- Not actually obstruction but often functional
- In patients with previous band, the surgeon converting may not have taken down the scar tissue and left a "funnel" shaped sleeve at GE junction, narrow tube and larger antrum – shape is like a dumbbell, usually presents with severe GERD which may be unresponsive to PPI because the source of discomfort is BILE reflux

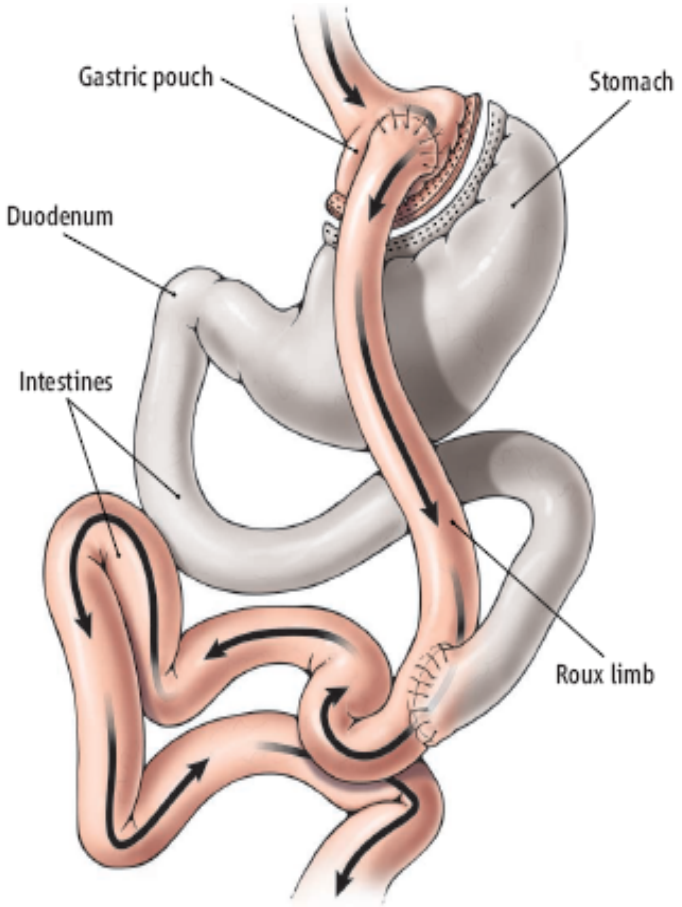
Sleeve:
Long Term Complications

- Esophageal dysmotility
- Hiatal Hernia
- Rare vitamin deficiencies
- GERD

Roux en Y Gastric Bypass

Technique

- Stomach divided into a small stomach pouch (15-30ml) and a large “distal remnant” with staples
- Distal remnant staple line is generally not over sewn
- Jejunum is divided distal to the ligament of treitz – the length of the biliopancreatic limb varies from 20-30cm in a retrocolic technique to 75cm in an anterocolic approach
- Gastrojejunostomy (GJ) created with linear stapler, hand sewn or circular technique – usually 12.5mm opening
- Jejunojejunostomy created with linear stapler technique
- Roux limb (usually75-120cm) brought up **retrocolic**, or anterocolic depending on surgeon preference
- Technique of bringing up the roux limb changes the way the imaging looks
- Distal stomach remains in place.
- All mesenteric defects are closed with permanent suture



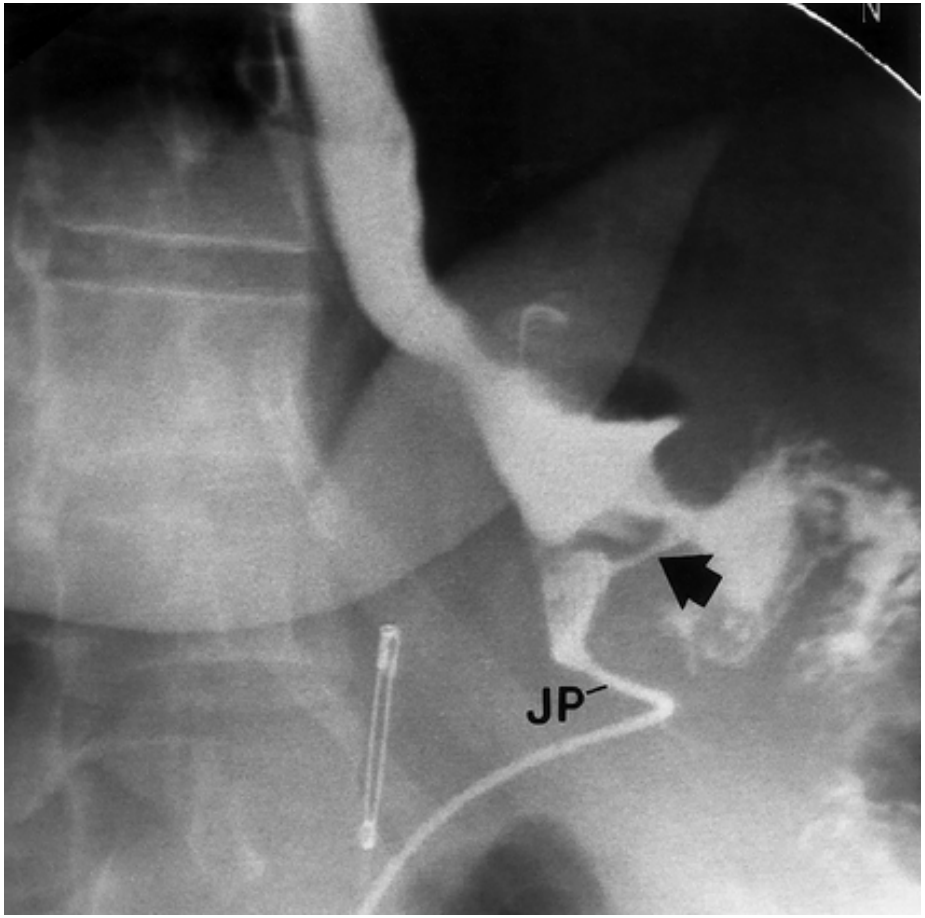
RYGB Acute Complications

- Anastomotic leaks or staple line leak
- Bleeding
- Stricture
- Obstruction
- PE or DVT

RYGB Complications – Leak

- Patient in house 48 hours after surgery
- No routine use of imaging during this period
- Study is selective and based on signs and symptoms
  - Increased O2 requirement
  - Increased heart rate
- CT abdomen **with contrast** to check for anastomotic leaks at gastrojejunostomy and distal jejunojejunostomy (Give 100CC oral contrast right before scan)

GJ Anastomotic Leak



- A high degree of suspicion must be maintained by both radiologist and surgeon for this complication
- Typical signs of peritonitis/abscess not reliable
- Reaction of the patient to getting oral contrast often diagnostic

GJ Anastomotic Leak on CT

- Oral contrast is seen extravasated from gastric pouch
- Oral contrast is seen around the spleen

RYGB Complications
Management of Leak

- NPO
- Resuscitation
- Operative Management always an option if patient is septic
- GI may be able to stent (stents may migrate)
- IR drainage if stable with stent
- MUST CONTROL CONTAMINATION FOR SUCCESSFUL MANAGEMENT
- Antibiotics are an adjunct to good surgical principles for management not a substitute for them
- May result in GG fistula long term

RYGB
Complications-Obstruction

- Dangerous early after procedure because of risk of gastric remnant distension and staple line disruption
- Can occur at GJ – stricture/food impaction
- **Can occur at JJ – presents as distal remnant distension**
- **Can occur in a unclosed ventral hernia defect**
- Can occur after massive weight loss as SBO from internal hernia – usually >1 year post procedure

Anastomotic Stricture-Week 3-4

- Narrowing or partial blockage

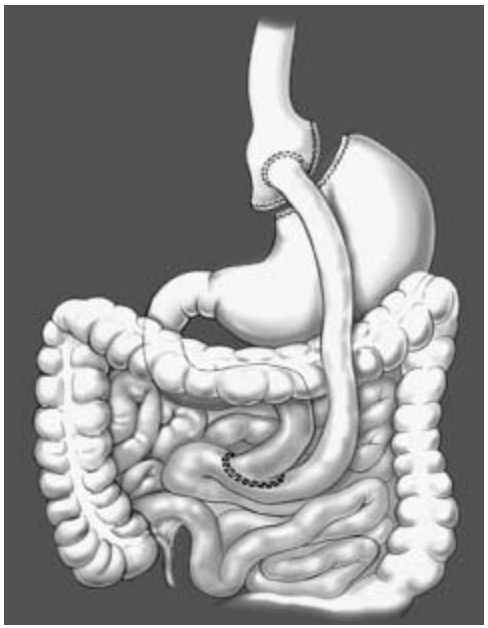
Most common:

Gastrojejunostomy

- **Diagnosis by EGD**
- Tx balloon dilation
- Less common with hand sewn anastomosis

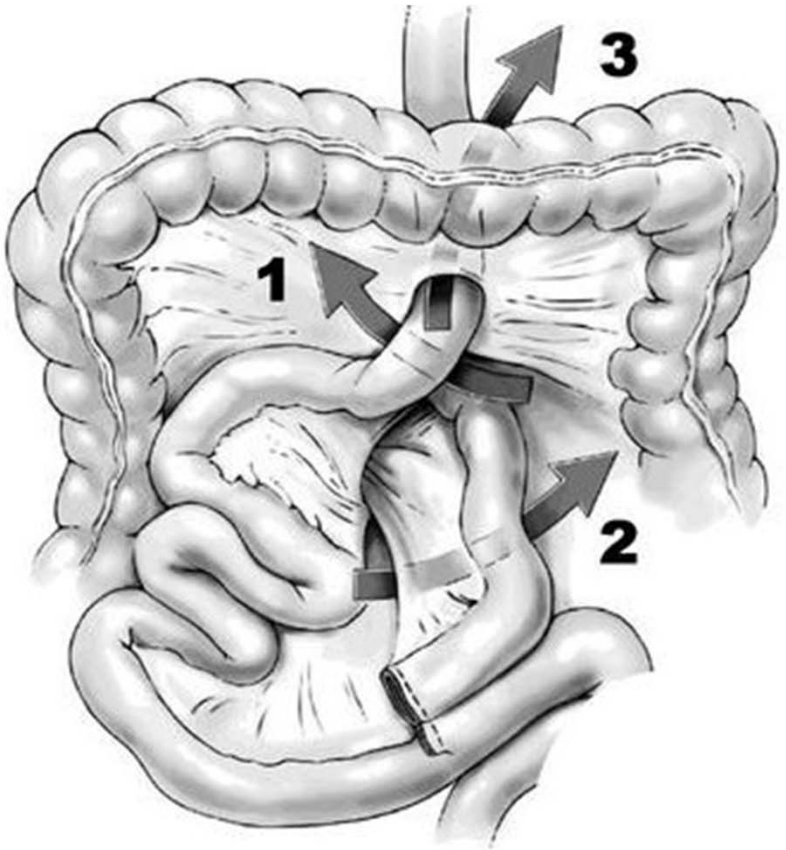
Internal Hernias

- 3-5% of cases
- Even when sewn closed they may reopen with massive weight loss
- Different from SBO in general surgery
- Resuscitate
- If VS stable (HR Normal) then resuscitate and operate first thing in am
- Is VS unstable or do not respond to resuscitation operate immediately
- Usually can operate laparoscopically if you do advanced cases, especially if it is early in the time course

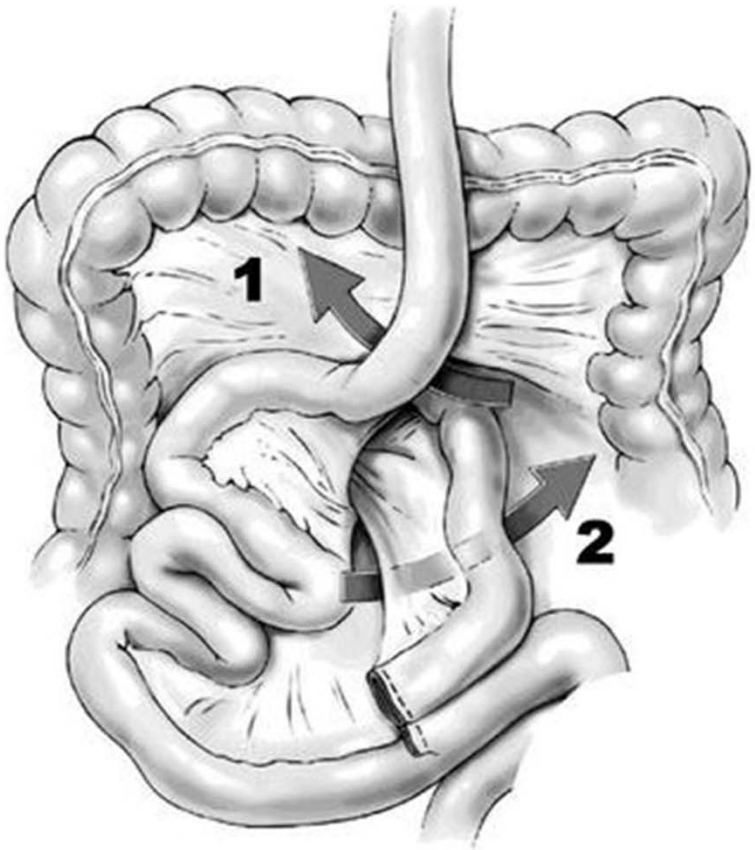


Patients are well coached not to leave ED without CT if they came for abdominal pain

Internal Hernias Roux-en-Y



RETROCOLIC



ANTECOLIC

Internal Hernias

- Often nonobstructive, intermittent, crampy, epigastric abdominal pain that often **radiates to the back**
- Unless the obstruction has led to ischemic compromise of the bowel, the abdominal examination is usually unrevealing
- If herniation involves afferent limb, then no air fluid levels on plain x-ray

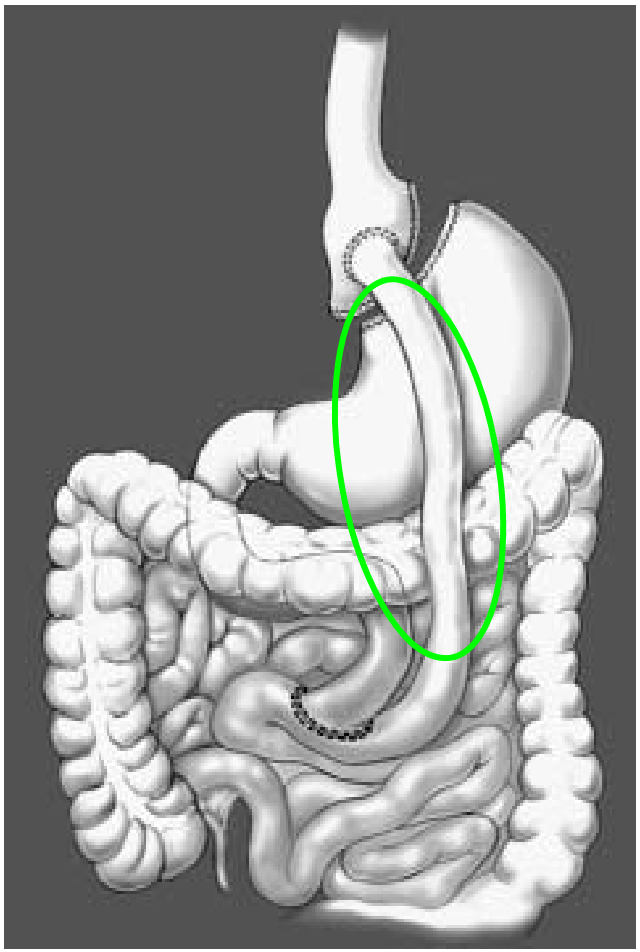
Internal Hernias

- CT with bariatric protocol

- Findings may include areas of intussusception, transition points, or the classic “swirl sign” created by twisting of the bowel mesentery
- **Any patient with unexplained abdominal pain, regardless of laboratory or radiologic findings, should be considered for surgical exploration**

Gastric Dilation

- obstruction of the Jejunojejunostomy that causes acute gastric dilatation (2° stenosis/stricture)
- Symptoms include **abdominal pain, nausea, and vomiting** if the distended stomach occludes the gastrointestinal tract by compression of the Roux limb
- *diagnosis* is confirmed by CT
- *Management:* percutaneous decompression in interventional radiology
- May also get distension if on CPAP and distal remnant paresis (Diabetic)
- Can be an acute emergency (IR to place gastrostomy tube for decompression – to prevent the staple line from blowing out)



RYGB Long Term Complications

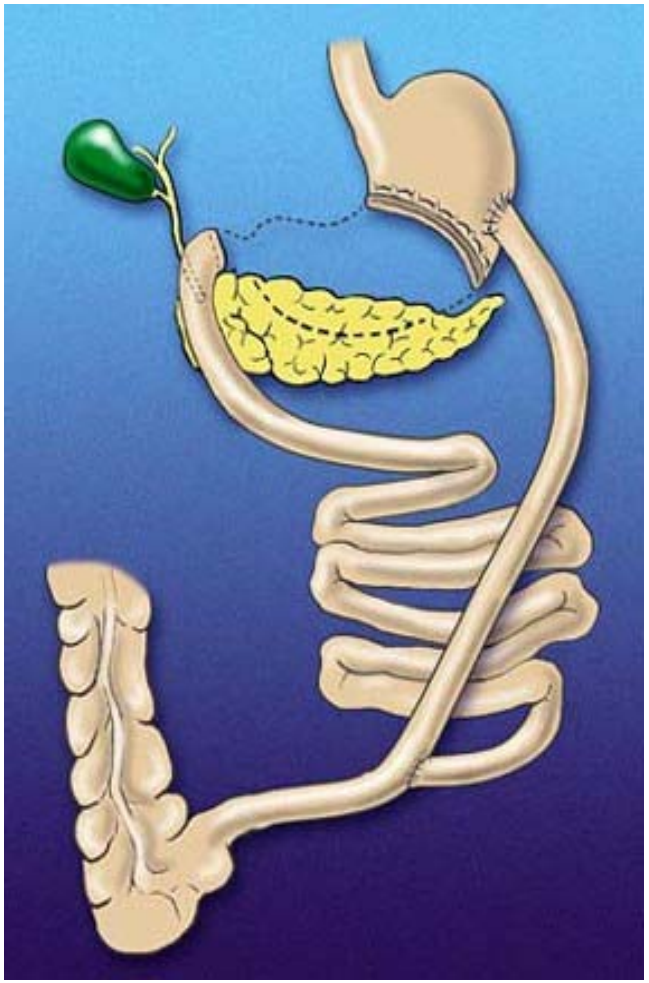
- Obstruction
- Cholelithiasis
- Ulcer at GJ
- Dumping syndrome
- Constipation
- Vitamin Deficiency
- Thiamine!!
  - B12
  - Folate
  - Iron
  - Calcium
  - Vitamin D

Vertical Banded Gastroplasty/Biliopancreatic Diversion/Duodenal Switch

THE OLD OR EXOTIC

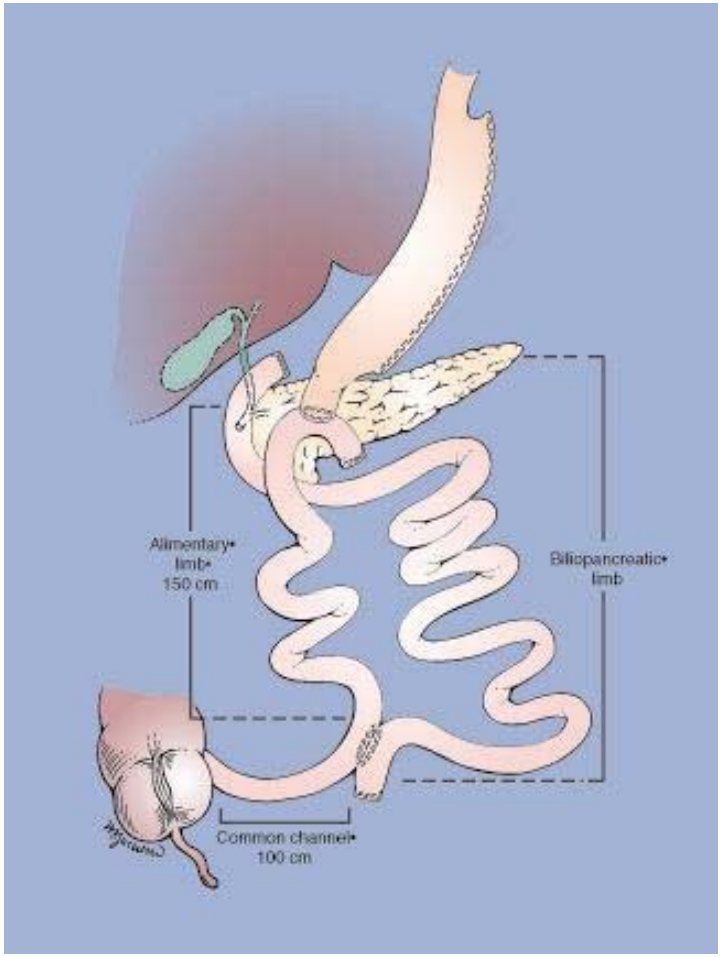
Biliopancreatic Diversion

- Nicola Scopinaro, Italy 1976
- Large gastric pouch
- Alimentary limb
  - 250 cm
- Biliopancreatic limb
- Common channel
  - 50-75 cm
- Mechanism:
  - Neurobiologic
  - malabsorptive

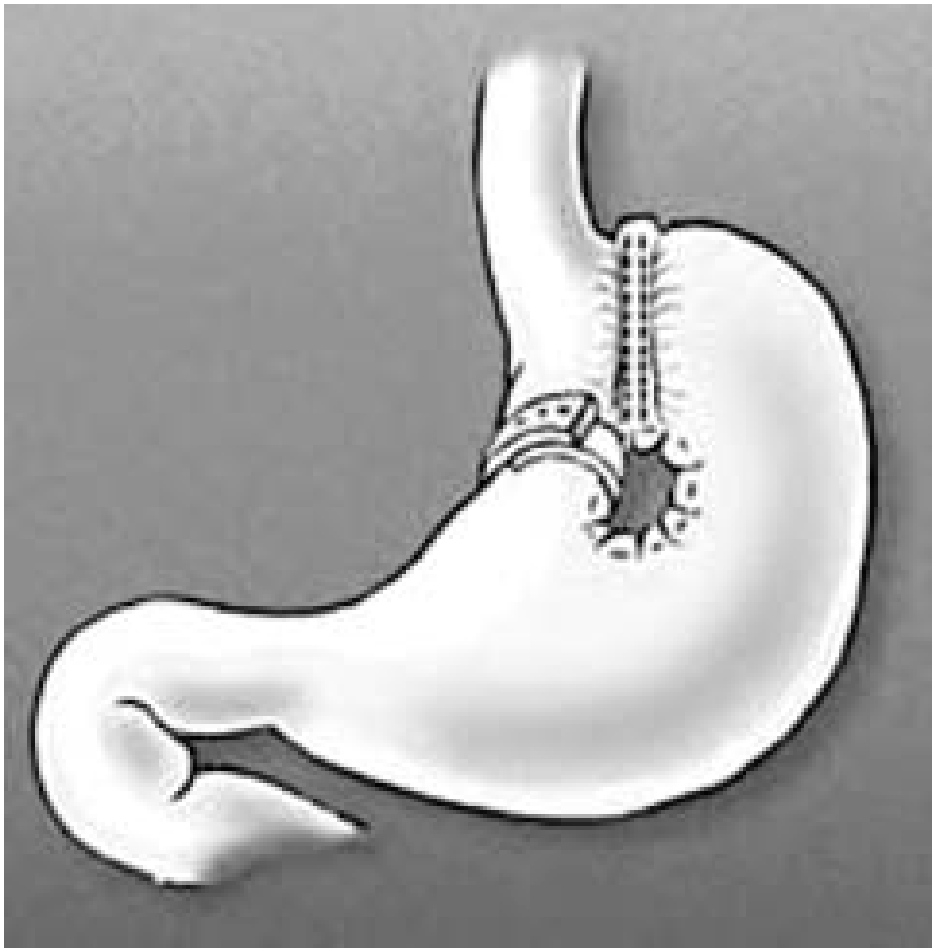


BPD/DS Today

- Laparoscopic Approach
  - Michel Gagner, 1999[1]
- "Sleeve" gastric pouch
- Alimentary limb: 250 cm
- Common channel: 150 cm
- Complications similar to GBP
- Usually sicker patient



Vertical Banded Gastroplasty



Hypoglycemia After Bariatric Surgery

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MISS 2018

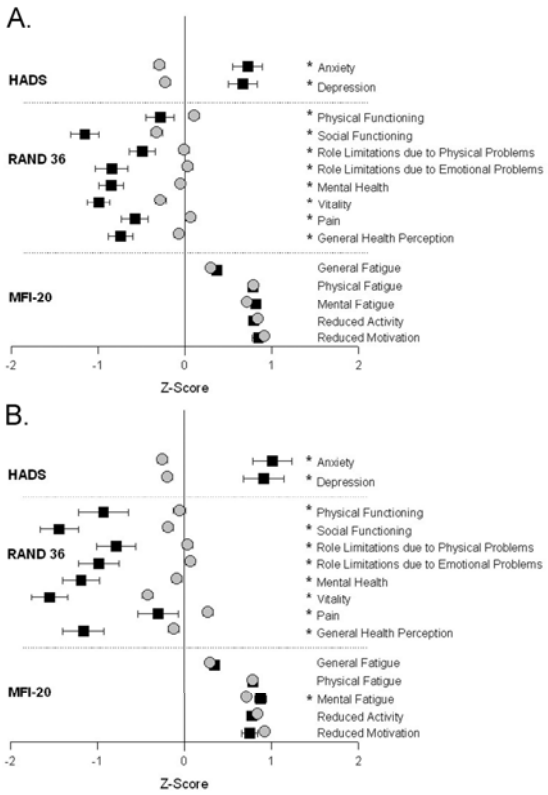
Disclosures

- None

The short- to mid-term symptom prevalence of dumping syndrome after primary gastric-bypass surgery and its impact on health-related quality of life

Marloes Emous, M.D., Bruce H.R. Wolffenbuttel, M.D., Ph.D., Eric Totté, M.D., Ph.D., André P. van Beek, M.D., Ph.D.

Surgery for Obesity and Related Diseases
Volume 13, Issue 9, Pages 1489-1500 (September 2017)
DOI: 10.1016/j.soard.2017.04.028

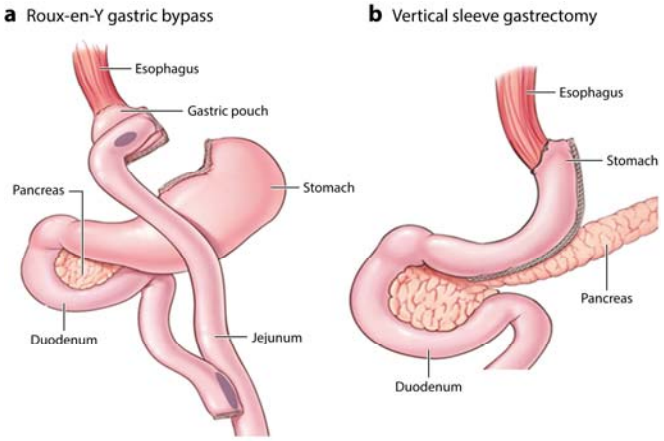


Hypoglycemia during oral glucose tolerance test among post–bariatric surgery pregnant patients: incidence and perinatal significance

Amihai Rottenstreich, M.D., Ram Elazary, M.D., Yossef Ezra, M.D., Geffen Kleinstern, Ph.D., Nahum Beglaibter, M.D., Uriel Elchalal, M.D.

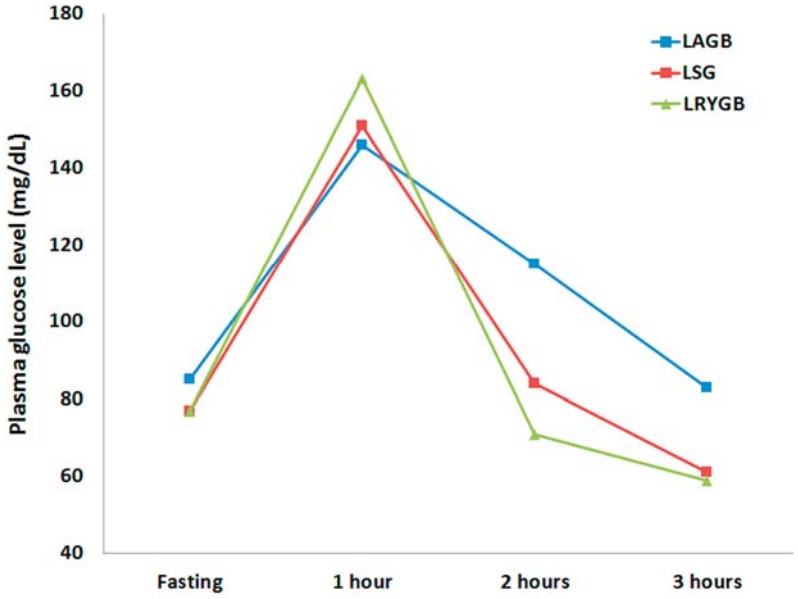
Surgery for Obesity and Related Diseases

DOI: 10.1016/j.soard.2017.11.031



Evers SS, et al. 2017.
Annu. Rev. Physiol. 79:313–34

Annual Reviews



	LAGB	LSG	RYGB
Fasting glucose SD (mg/dL)	18.1	5.9	3.6
1 hour glucose SD (mg/dL)	18.7	20.3	25.1
2 hours glucose SD (mg/dL)	20.4	14.2	17.5
3 hours glucose SD (mg/dL)	29.8	9.8	13.9

Surgery for Obesity and Related Diseases DOI: (10.1016/j.soard.2017.11.031)

Early Dumping – not hypoglycemia

- 30-60 minutes after eating
- Usually occurs in the early period after surgery
- Rapid emptying of hyperosmolar gastric contents into the small bowel
- Causes a fluid shift from the intravascular space into the bowel lumen
- Vasomotor symptoms result: palpitations, diaphoresis, flushing, fatigue, dizziness, faintness, syncope and headache
- GI symptoms: bloating, nausea, diarrhea, abdominal cramps, loud stomach grumbling

Late Dumping – Hyperinsulinemic hypoglycemia

- 1-4 hours after a meal
- ONLY reactive (post prandial) hypoglycemia
- Can occur years after the procedure
- Similar pathophysiology as nesidiobastosis and noninsulinoma pancreatogenous hypoglycemia syndrome (NIPHS)
- Hyper functioning beta cell

Hypoglycemia

- Hypoglycemic Symptoms after Bariatric Surgery
  - ≥ 3 symptoms
    - Edinburgh Hypoglycemia Questionnaire – Likert scale 1-7
  - **or** history of requiring assistance, seizure or medical diagnosis of hypoglycemia
  - Measured glucose level of ≤ 70mg/dl (≤3.9mmol/L)
- Incidence
  - 34% incidence in some studies with continuous monitoring and in response to mixed meals
  - Post operative hypoglycemia significantly affects QOL (Rand-36)
  - Incidence of <1% in large data sets using EHR, self reported or clinic visits

Engstrom BE et al. Diabetes 2014;63:A27
Haperin F et al. J Obes 2011
Emous M. et al. SOARD 13(2017) 1489-1500

Edinburgh hypoglycemia questionnaire Likert Scale for severity (1-7)

Autonomic	Neuroglycopenic	Genera
• *Sweating* • *Palpitations* • *Shaking* • *Hunger*	• Confusion • Drowsiness • Odd Behavior • Speech Difficult • Incoordination	• Heada • Nause

A spectrum of severity – reflects glycemic variability after RYGB

- Asymptomatic/ Non severe hypoglycemia – glucose ≤70mg/dl – none or mild symptoms – **becoming more clinically important**
  - as it appears to be associated with cardiac arrhythmias in patients with T2DM on Insulin[1]
  - May be the associated with cardiovascular deaths over non-bariatric controls[2]
- Severe hypoglycemia – defined as requiring assistance
- Neuroglycopenia (passing out as a result of hypoglycemia) can lead to serious adverse events: seizure, syncope, equipment or automobile accidents

1. Chow E et al. Diabetes 2014;63(5):1738-47.
2. Gribsholt SB et al. SOARD 2017;13(4):581-7

Neuroglycopenia

- A deficiency of glucose in the central nervous system
- May not be from only one etiology
  - E.g. after any surgical remedy – patients still affected
- Late Dumping Syndrome (probably the most common explanation)
  - Blocked with GLP1 Antagonist
  - Increased b-cell mass
  - Increased nuclear diameter
- Nesidioblastosis (Rare)
  - Pancreatic B-cell hypertrophy, islet hyperplasia, islet cell dysplasia
- Insulinoma (Rare)
  - Presents with hypoglycemia in both fasting and post-prandial sates
  - Fasting hypoglycemia is classically associated with Insulinoma

Physiology

- Confirmation that basal insulin secretion and action was not different between RYGB patients with and without hypoglycemia – confirms this occurs after eating
- No difference in insulin clearance
- Response of insulin to IV glucose was proportional - i.e. intrinsic β-cell function is appropriate
- Response to a mixed meal increased in patients with neuroglycopenia
  - C peptide to glucose ratio
  - Insulin to glucose ratio
  - Corrected insulin response
- B-cell response is exaggerated following oral but not IV stimulation
- Glucose effectiveness at zero insulin higher may contribute to more profound neuroglycopenia
- Improved glucose effectiveness may promote glucose uptake or disposal
- **Support gut-derived peptides contribute to increased insulin secretion and not due solely to intrinsic excessive B-cell function**

Patti ME, Ping L, Goldfine AB. Obesity 2015 April;23(4):798-807

GLP 1

- Exendin (9-39) – GLP-1r receptor antagonist
- Confirmed PBH
- Comparators BMI and glucose-matched non-surgical controls (NSC)
- Double blind, cross over study of Exendin 9 vs placebo during OGTT
- Peak postprandial insulin normalized

- **GLP-1 mediates Hyperinsulinemic Hypoglycemia in PBH**
- **GLP-1r blockade prevented hypoglycemia in 100% of individuals**
  - normalized beta cell function
  - reversed neuroglycopenic symptoms

PBH – post bariatric hypoglycemia

Craig CM et al. Diabetologia 2017 Mar;60(3):531-540.

Workup of Hypoglycemia

- HISTORY
- Biochemical testing
  - Plasma glucose
  - C-petide
  - Insulin level
  - Proinsulin in hypoglycemia still a research tool
  - 72 hour fasting test – negative in nesidioblastosis and dumpling and positive in insulinoma

Malik S et al. Obes Res Clin Pract 2016;10(1):1-14

- Radiology
  - Used to find/localize insulinoma
  - Selective arterial calcium stimulation testing
- Glycemic pattern and continuous glucose monitoring
  - CGM devices available to provide a 3 day evaluation
  - Useful to diagnose asymptomatic hypoglycemia

Medical Treatment of Hypoglycemia

- Control portions of low glycemic index carbs
- Inhibition of intestinal α glucosidase to slow carb absorption
- Reduce insulin secretion: somatostatin analogues, diazoxide/calcium channel blockers
- Continuous glucose monitoring
- Nutrient delivery to remnant stomach – normal insulin response

ASMBS Position Statement Eisenberg D et al. SOARD 13(2017)371-378
Patti ME, Ping L, Goldfine AB. Obesity 2015 April;23(4):798-807

Surgical Treatment of Hypoglycemia

- Most appropriate surgical intervention is undefined at this time
- Partial pancreatectomy – recurrent hypoglycemia is significant
- Subtotal pancreatectomy – creates new problems
- Laparoscopic conversion of RYGB to Sleeve or reversal of RYGB
- Only small case series exist for any of these procedure choices
- One-anastomosis jejunal interposition with gastric remnant resection (Branco-Zorron Switch)
  - 4 patients at 24 m follow up normalized insulin, postprandial glucose and OGTT

ASMBS Position Statement Eisenberg D et al. SOARD 13(2017)371-378
Clancy TE et al. J Gastrointest Surg.2006;10:1116-9.
Zorron et al. Obes Surg 2017Apr;27(4):990-996.

Sleeve vs. Bypass vs. AGB

- Not many studies on Sleeve
- Studies show gut hormone response in sleeve is less exaggerated but still elicits a GLP-1 response and increase in insulin

- Prospective cohort 351 patients tested before and 12 months after surgery with either RYGB or AGB
- Hypoglycemic episodes in response to OGTT was increased in RYGB
- RYGB prevalence was 10.4%

Malik S et al. Obes Res Clin Pract 2016:10(1):1-14

Hypoglycemia in Special Settings Pregnancy

- 119 patients (55 sleeve, 34 AGB, 30 RYGB)
- Hypoglycemia 59/119 (49.6%) during OGTT
- Nadir glucose level at 2 hours (42%) and three hours (57.6%)
- Highest risk after RYGB (83%) than Sleeve (54.5%) or AGB (11.8%)
- Patients with hypoglycemia had higher proportion of Low birth weight and small for gestational age infants
- Other diagnostic methods than OGTT should be used because it produces profound hypoglycemia
- This data warrants further investigation
- Diagnosis and and prevention of hypoglycemia will improve fetal outcomes

Rottenstreich A et al. SOARD DOI.org/10.1016/j.soard.2017.11.031

Don’t give oral glucose to treat hypoglycemia in Bariatric Patients

May require reengineering of standard orders in hospital settings. Teach patients/colleagues

Conclusion

- Hypoglycemia after bariatric surgery has a higher incidence than previously understood
- There is a range of hypoglycemia from mild to Neuroglycopenia
- Recognition and treatment often begins with primary care colleagues
- Late Dumping (severe hypoglycemia or Neuroglycopenia) is caused by GLP1
- Majority of cases can be addressed with medical treatment
- Surgical Treatment has imperfect results
- Implications for protocols that require treating hypoglycemia with oral glucose in bariatric patients admitted to all services

"Knowing is not enough; we must apply.
Willing is not enough; we must do."

Goethe

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