Management of Bariatric Surgery Patients for the Family Doctor

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Objectives

1. Describe the differences among the most common types of bariatric surgical procedures, including the basics of their distinct indications.
2. Group the most common complications of bariatric surgery into immediate, late (acute), and late (subacute).
3. Identify the complications of bariatric surgery that family doctors would be most likely to prevent, identify, or treat, and review those requiring referral or higher levels of care.

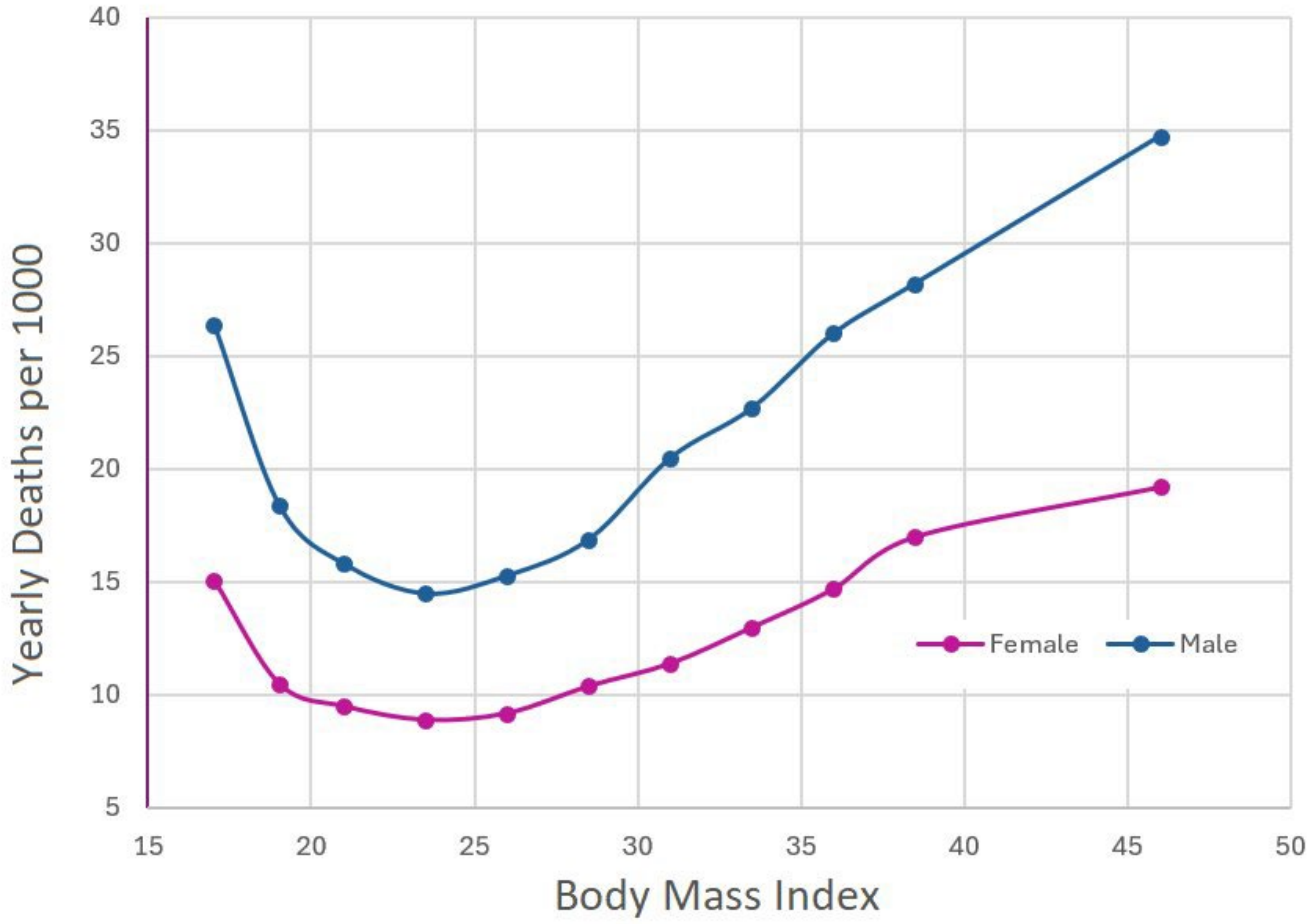
Considerations when discussing obesity and health

- People with obesity face stigmatization and discrimination in medical and non-medical settings that carries significant consequences [1]
- In one study, prevalence of perceived weight discrimination in individuals with BMI 30-35 was 19.2%, and in individuals with BMI 35+ it was 41.8% [2]
- Most research, literature, and treatment guidelines use BMI as the metric for defining obesity, which is imperfect, especially at the individual level [3]
- There is controversy in the general population and in the medical field about the appropriateness of diagnosing or treating obesity as a disease state or disease risk factor [4]

Obesity as a treatable disease state or disease risk factor

- In 2020, the prevalence of obesity in the United States was 41.9%, and the prevalence of class III obesity (BMI ≥ 40) was 9.2% [5]
- Obesity is associated with many adverse health outcomes, with a dose response for higher BMIs
- These health outcomes include diabetes, hypertension, and cancers
- There is also a BMI dose-dependent relationship with mortality

Obesity as a treatable disease state or disease risk factor



Adapted from: Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900,000 adults: collaborative analyses of 57 prospective studies. Lancet 2009; 373:1083 [7]

Bariatric surgery as the gold standard treatment for obesity

- Even intensive structured lifestyle interventions result in only modest weight loss and high rates of weight regain
- GLP-1RAs and GLP-1/GIP agents, the new kids on the block, are promising interventions
- Bariatric surgery remains the most effective and durable intervention we have
- Indications: BMI ≥40, BMI ≥ 35 with comorbidities, or BMI ≥ 30 with T2DM [6]
- "Metabolic surgery"
- 199,000 procedure done in the US in 2020 [7]

Types of bariatric surgery[8]

- Intragastric balloon (2%)
- PEG tube (AspireAssist) (n/a)
- Adjustable gastric band (LapBand) (0.9%)
- Endoscopic sleeve gastroplasty (2%)
- **Sleeve gastrectomy (57%)**
- **Roux-and-Y gastric bypass (22%)**
- Duodenal switch (SADI-S vs BPD/DS) (3%)

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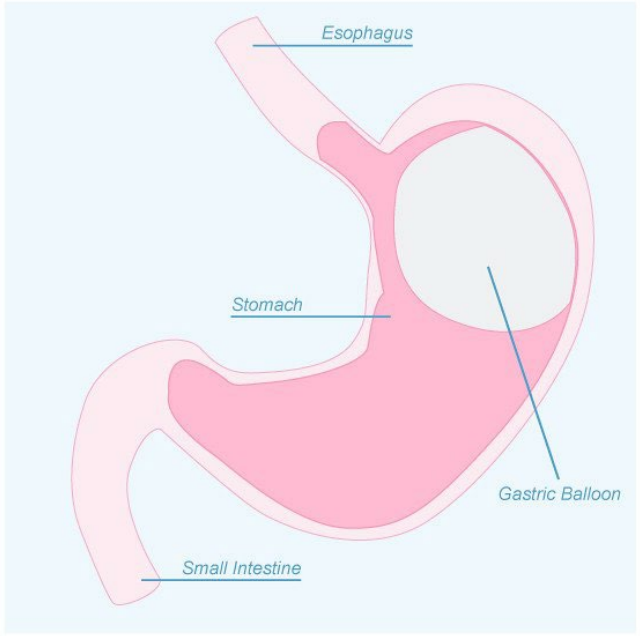
Primarily restrictive mechanism

Mixed restrictive and malabsorptive mechanism

Types of bariatric surgery[8]

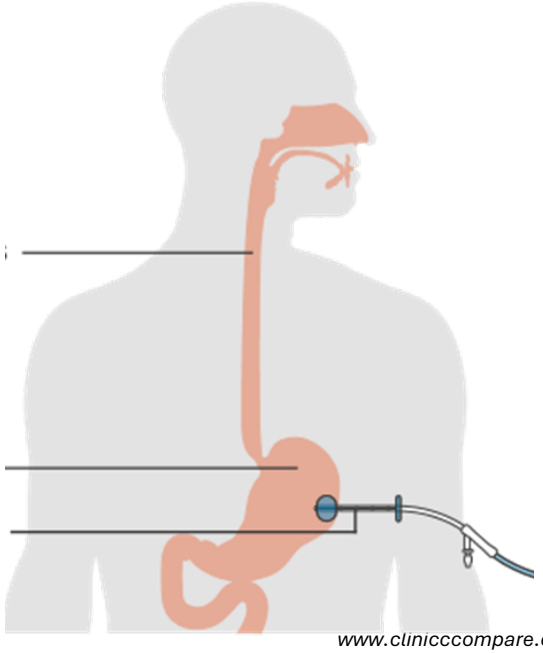
- Intragastric balloon
  - Modest efficacy, no durability, can migrate or rupture, previously some thought for neoadjuvant use but evidence is poor



www.clinicccompare.co.uk[9]

Types of bariatric surgery[8]

- PEG tube (AspireAssist)
  - Used to aspirate about 30% of calories per meal. Solid results, but off the market as of 2022



www.clinicccompare.co.uk[10]

Types of bariatric surgery

- Adjustable gastric band (LapBand)
  - Steep drop-off in popularity as rates of sleeve increased around 2012

Wikimedia Commons[11]

Types of bariatric surgery

- Endoscopic sleeve gastroplasty
  - Introduced in about 2020 – internal gastric suturing

jschoi.org, Creative Commons, with alterations[12]

Gastric sleeve[13]

- Unique indications a
  - Quicker procedure (
  - Less surgical maneu
  - Lower incidence of r
  - Opportunity for revis
  - Bridge to more adva
- Relative contraindic
  - GERD
- Names: gastric slee
- Mechanism: restrict

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ctomy (VSG), laparoscopic sleeve gastrectomy
nrelin decrease, postprandial GLP-1 a

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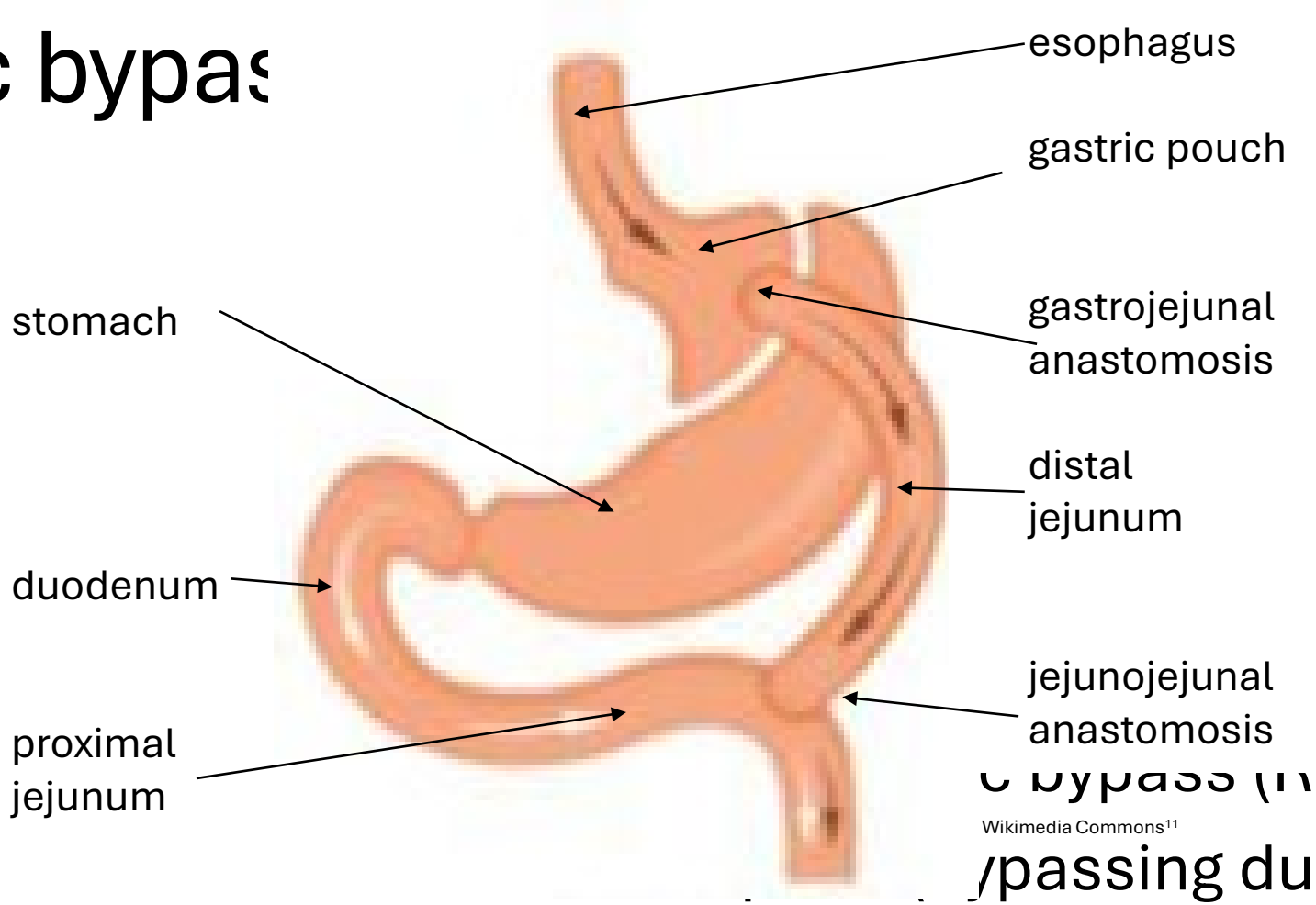


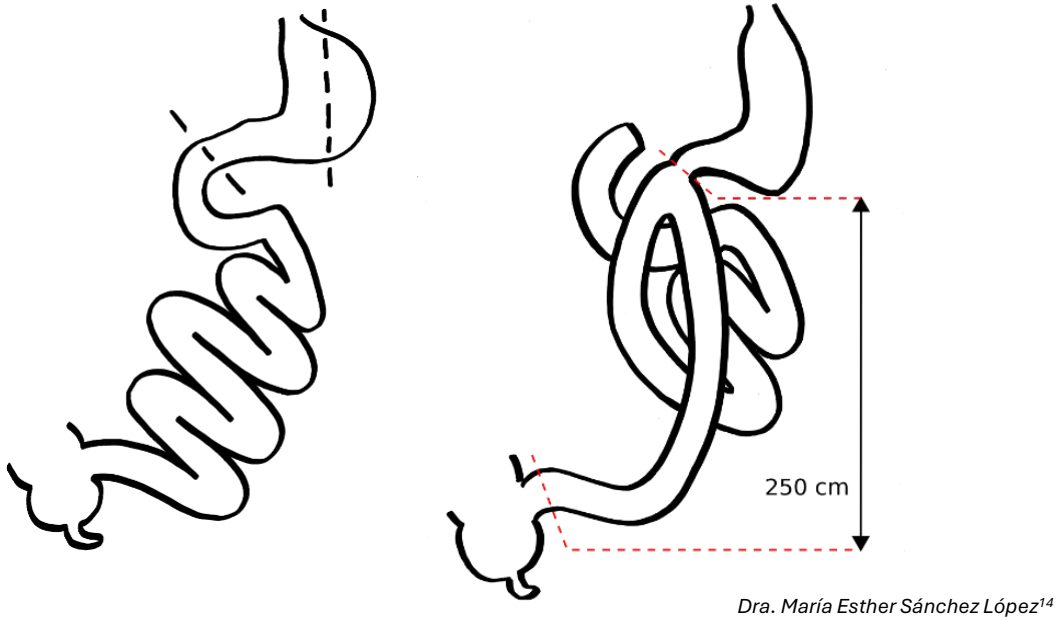
Wikimedia Commons[11]

c bypass (RNYGB)

/passing duodenum entirely), and hormonal (ghrelin decrease, GLP-1 and leptin increase)

Biliopancreatic Diversion with Duodenal Switch (BPD-SD) or Single Anastomosis Duodenal-Ileal Bypass with Sleeve (SADI-S)

Wikimedia Commons[11]



Dra. María Esther Sánchez López[14]

Long-term benefits of bariatric surgery – weight loss and durability

- Variably described as percent total body weight loss **(%TBW**) or percent excess body weight loss **(%EBW)**, or sometimes BMI lost

Procedure	%TBW	%EBW	BMI
Gastric band	-	38-63%	10
Gastric sleeve	24%	53-68%	14
Gastric bypass	35%	57-68%	17
Duodenal switch	39%	70-80%	18

15, 16, 17, 18

- Bariatric Surgical Risk/Benefit Calculator (facs.org)
- Based on data collected from over 775,000 operations across 955 centers participating in MBSAQIP* from 2015 – 2019
  - *Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program

Bariatric surgery vs incretin mimetics

- **Incretin mimetics are a treatment. Bariatric surgery is a cure.**
- Tirzepatide: mean 15-20% TBW loss at 72 weeks [19, 20]
- Semaglutide: 50% of subjects with >15% TBW loss at 68 weeks[21]
- At least partial weight regain occurs quickly with medication cessation – approximately ½ total amount lost after one year [22, 23]
- Six-study meta-analysis showed mean weight loss 50-55lb greater with surgery vs GLP-1 RAs, and mean BMI loss 8-10.5 points greater [24]

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  - 23-60
  - NNT[2
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Number needed to treat (NNT):

- Derived from the **absolute risk reduction**
- Describes how many patients need to be treated with the intervention in order to produce one specific outcome
- **The lower the number, the more powerful the intervention**
- Parachute example: how many skydivers do you need to treat with a parachute backpack to prevent one death?
  - Absolute risk of death with placebo: 100%
  - Absolute risk of death with parachute: 0%*
  - Absolute risk reduction: 100%
  - **NNT = 100/ARR**
  - NNT for parachute to prevent death: 1
- Treatment of symptomatic bacteriuria in pregnancy to prevent pyelonephritis
  - Not treated: 198/994 = 19.9%
  - Treated: 55/1023 = 5.5%
  - 19.9% - 5.5% = 14.4% ARR
  - 100/14.4 = 6.9
  - NNT of 7; 7 pregnant patients with asymptomatic bacteriuria need to be treated with antibiotics to prevent one case of pyelonephritis

(TheNNT.com)

Long-term benefits of bariatric surgery – end disease-based outcomes

- For patients with diabetes, NNT of 45 at 5 years to prevent one macrovascular event (e.g. MI, CVA) [32]
  - Compare to NNT 50 for ASA secondary prevention [33]
- Lower rates of many cancers, with NNT of 50 at 10 years for cancer and cancer-related mortality [34]

Long-term benefits of bariatric surgery – mortality

- For patients who start at similar BMIs, all-cause mortality is lower for those managed surgically vs those who do not undergo surgery
  - All-cause mortality decreased by 16% [35]
  - NNT of 28 for mortality at 20-24 year median follow-up (22.8% vs 26.4%), with 3 years median increased life expectancy [36]
  - NNT of 30 (patients without diabetes) or 8 (patients with diabetes) for mortality at 10 years [37]
  - NNT of 91 for mortality at 4.9 years (for patients age 55 or older, NNT of 30) [38]
- Note that none are RCTs

Why would complications be managed by family medicine doctors?

- Typically, bariatric surgery programs advise yearly follow-up for life, but studies widely show high rates of loss to follow-up – up to 50% after one year and worsening year over year[39, 40]
- Loss to follow-up may occur in the setting of medical tourism, relocation, waning motivation to follow-up, or barriers to care
- **As a common first point of contact with the health care system, family doctors have an opportunity to recognize and prevent complications in bariatric patients**

Complications

Immediate surgical complications

- Likely to be recognized and managed by surgical teams in the acute setting
- Includes complications general to all surgeries
  - Anesthesia complications, DVT, infection, intraoperative injuries
- Also includes complications more specific to bariatric procedures
  - Anastomotic leak (gastric bypass, 1%) or staple line dehiscence (gastric sleeve, 1.5%) [41, 42]
  - Stenosis, causing symptoms resembling obstruction [43]
  - PO intolerance, dehydration [44]
    - Leading cause of readmission

Late complications – acute presentation

- Marginal ulcer foll
  - Typically at gastr
  - Risk factors inclu
  - Symptoms includ
  - Diagnosis with en
- Stenosis
- Small bowel obstr
  - Lifetime incidenc

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and, rarely, bleeding

l and risk factor avoidance [45]

[46]

esophagus

Late complications – subacute presentation

Cholelithiasis

- Gallbladder disease occurs in 8% of postoperative bariatric surgery patients[47]
- A known complication of rapid weight loss, particularly common in the acute post-surgical period
  - Increased biliary cholesterol concentration following weight loss
  - Surgery-specific factors including gallbladder hypermotility, disturbed enteric biliary salt processing
- Presentation the same as gallbladder disease in non-bariatric patients – most commonly, postprandial abdominal pain
- Opportunistic cholecystectomy for all patients is associated with increased complication rates, but could be considered during index surgery for selected patients
- Six months of postoperative prophylaxis with ursodeoxycholic acid (ursodiol) significantly decreases rate of gallbladder disease [48]

Gastroesophageal reflux disease

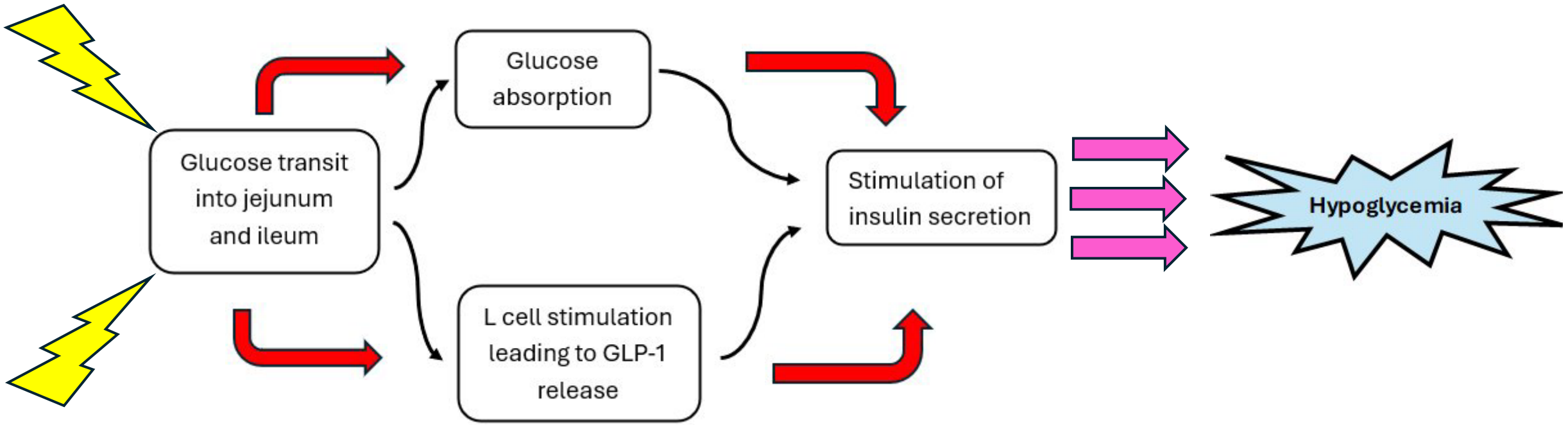
- Specific to gastric sleeve
- De novo development of GERD occurs in up to 23% of patients, and Barrett's esophagus occurs in up to 12% [49, 50]
- Treatment with standard therapies, emphasizing small meals and avoiding eating shortly before sleep, and PPI
- Revision of gastric sleeve to gastric bypass required in 4-7% of sleeve patients for refractory disease, which results in remission in 99% of patients [51]

Dumping syndrome

- Results from rapid passage of food contents into the jejunum
- Hyperosmolar intraluminal contents shift fluids into small bowel, leading to hypotension and sympathetic symptoms
- Symptoms vary, but typically follow eating by 20-60 minutes and including cramping, nausea, diarrhea, tachycardia, diaphoresis, and dizziness, and tend to pass in 20-60 minutes
- Symptoms may be limited to an initial postsurgical period, but for some patients may be lifelong
- Treatment includes avoidance of triggering foods and behaviors [52, 53]

Postprandial hyperinsulinemic hypoglycemia

- Symptomatic hypoglycemia 2-4 hours following eating or drinking [52]



Postprandial hyperinsulinemic hypoglycemia

- Prevalence unknown
  - Reports range from <1% to 70%
- Risk factors including being non-diabetic, younger age, more weight loss, lower starting BMI
  - Likely related to baseline health of beta cells
- Onset usually 1-3 years post surgery
- More commonly associated with high-sugar foods or beverages and alcohol, and likely with meals that are predominantly carb-based (rather than tempered by protein/fat). Exercise may trigger
- Treatment is supportive and preventative; potential role for acarbose and some emerging data on both GLP-1 agonists and antagonists [52]

Suboptimal/insufficient weight loss – incidence

- No widely agreed-upon definition
  - Some definitions include a total weight loss (TWL) <20% or excess body weight (EBW) loss <50%
- Rates likely in realm of 20-40%, with lower incidences for gastric bypass vs gastric sleeve[54, 55]

Significant weight regain – incidence

- Definitions also vary considerably
  - Lack of maintenance TWL>20%, gain of >15-25% of total EBW lost, >5 BMI points from nadir weight, >10-15% regain of TWL, >10kg weight regain from nadir, etc [54]
- Best estimates of incidence range from about 20-50% [55], with rates considerably lower for gastric bypass vs gastric sleeve

Insufficient weight loss and weight regain – risk factors

- Male gender
- Higher initial BMI
- Comorbidities including T2DM, HTN, and OSA
- Micronutrient deficiency [54, 56]

Insufficient weight loss and weight regain – possible etiologies

- Changes in metabolic balance (GLP-1, leptin, ghrelin)
- Anatomic surgical failure (pouch distension, gastrogastric fistula)
- Dietary factors
  - Increased portions, calorie dense foods, grazing, improved tolerance
- Physical inactivity
- Mental health disorders [54, 56]

Refractory weight problems – treatment with behavioral change

- Establish or reestablish connection with registered dietician
- Some may benefit from “pouch resets” – return to immediate post-surgical diets
- Physical activity plans
- Consider behavioral health assessment and treatment[54, 56]

Refractory weight problems – treatment with drugs

- Most drugs approved for obesity treatment in non-surgical patients can be used in post-surgical patients, with similar expected response [54, 57]
  - These include phentermine/topiramate, bupropion/naltrexone, orlistat
- Incretin mimetics are safe and effective in both gastric sleeve and gastric bypass patients
  - 24-week RCT with liraglutide vs placebo plus lifestyle intervention resulted in 9% body weight decrease in liraglutide group vs 0.5% for placebo [58]
  - Systematic review of 10 non-RCT studies showed good efficacy and tolerability of incretin mimetics[59] (mostly lira and sema)
  - As in non-surgical patients, tirzepatide is likely more effective than semaglutide [60]

Refractory weight problems – treatment with revision

- Insufficient weight loss or weight regain is sometimes an indication for revision to a more aggressive procedure
  - e.g. sleeve → bypass or bypass → duodenal switch
  - May be more effective in IWL than WR
- Patients with gastric sleeve who are found to have enlarged pouches may also benefit from “re-sleeve”
- Revisional procedures lead to BMI decreases between 7-15 points[61]

Alcohol use disorder

- Bariatric procedures, especially gastric bypass, can affect alcohol metabolism
- After gastric bypass, alcohol levels peak faster and higher
- Rates of alcohol use disorder are high following bariatric surgeries, especially gastric bypass[62]
- Consider strict avoidance of alcohol for 6 months following surgery and consider limiting or eliminating it for life
- Utilize standard screening and treatments

Suicide

- Rates of depression and depression severity scores seem to improve after bariatric surgery (8-74% decrease and 40-70% decrease respectively) [63]
- Paradoxically, incidence of suicide is significantly higher following bariatric surgery
  - 3.2 vs 2.0 suicides per 10000 patient-years, mean follow-up 7.1 years [64]
  - 3.63 vs 2.2 self-harm emergencies vs 1000 patient-years during 3 year follow-up period [65]
- Etiology of this is unknown; more cautious screening for suicidal risk factors or behaviors may be warranted

Nutritional deficiency – prevention and monitoring

- There is a high rate of pre-surgical micronutrient deficiency in bariatric patients and most surgical problems will screen for this prior to surgery
- Micronutrient deficiency is near-universal following bariatric surgeries in the absence of appropriate supplementation [66]
- All patients with bariatric surgery, both restrictive and malabsorptive, need lifelong vitamin supplementation with a multivitamin and calcium supplementation at minimum

Nutritional deficiency – prevention and monitoring[66, 67]

	LAGB	SG	GB	DS	Deficiency	Notes
Vitamin A	First year	Yearly				
B1 (thiamine)	Screen if risk factors present (female, Black, alcohol use, GI symptoms, SIBO)					
B12	No	Every 3 months (first year), then yearly			<200pg/mL(def) <400pg/mL (sub)	Check B12 and MMA
Calcium	Yearly				PTH >65pg/mL	Check serum Ca and PTH
Copper	No		Yearly			Serum copper and ceruloplasmin
Vitamin D	Yearly				<30ng/dL(insuf) <20ng/dL (def)	
Folate	Yearly					
Iron	Every 3 months (first year), then yearly					CBC, ferritin, iron/TIBC/TS
Zinc	No		Yearly			Also if symptoms of anemia without iron deficiency

Nutritional deficiency – prevention and monitoring[66, 67]

Supplementation	LAGB	SG	RNYGB	BPD/DS
Vitamin A	5000IU	5000-10000IU		10000IU
B1 (thiamine)	12-50mg			
B12	350-500mcg			
Calcium (calcium citrate preferred)	1200-1500mg			1800-2400mg
Copper (gluconate or sulfate)	1mg		2mg	
Vitamin D	3000IU			
Vitamin E	15mg			
Folate	400-800mcg (all), 800-1000mcg (people of childbearing capacity)			
Iron – non-menstruating	18mg		45-60mg	
Iron - menstruating	45-60mg			
Vitamin K	90-120mcg			300mcg
Zinc	8-11mg		8-22mg	16-22mg

Nutritional deficiency – prevention and monitoring[66, 67]

	Centrum	One-A-Day Womens	Nature Made	Flintstones Complete	Bariatric Choice	BariMelts	BariatricPal
Vitamin A	3500IU	2300IU	2500IU	3000IU	10000IU	5000IU	10000IU
B1	1.5mg	2.4mg	1.5mg	1.5mg	20mg	12mg	20mg
B12	6mcg	9.6mcg	6mcg	1.7mg	1000mcg	500mcg	1000mcg
Calcium	200mg	130mg	160mg	100mg	n/a	n/a	n/a
Copper	0.5mg	1.35mg	2mg	2mg	2mg	2mg	2mg
Vitamin D	1000IU	1000IU	1000IU	600IU	3000IU	3000IU	3000IU
Vitamin E	13.5mg	15mg	22.5mg	20mg	40.2mg	30mg	40.2mg
Folate	400mcg	400mcg	400mcg	400mcg	800mcg	1360mcg	800mcg
Iron	18mg	18mg	18mg	18mg	45mg	n/a	45mg
Iron - mens.	18mg	18mg	18mg	18mg	45mg	n/a	45mg
Vitamin K	25mcg	n/a	80mcg	55mcg	120mcg	160mcg	120mcg
Zinc	11mg	8mg	15mg	12mg	15mg	16mg	15mg

Supplement facts from amazon.com

Nutritional deficiency – repletion[66, 67]

	Repletion
Vitamin A	without corneal changes: 10k-25kIU/until normal; with corneal changes: 50k-100kIU IM for 3d then 50kIU/d IMx2w
B1 (thiamine)	100mg BID-TID until symptoms resolve
B12	1000mcg until WNL
Calcium	same as supplementation
Copper	mild to moderate: 3-8mg/d; severe: 2-4mg/d IV for 6d (neuro sx)
Vitamin D	3000-6000IU daily or 50000IU 1-3/week
Folate	1000mcg until WNL
Iron	150-200mg up to 300mg BID-TID
Zinc	unknown - previously 60mg BID

Nutritional deficiency – calcium, bone health

- Mechanism of deficiency after surgery is decreased dietary intake, decreased absorption, and vitamin D deficiency[66, 67, 68]
  - Decreased absorption related to bypass and to decreased gastric acid secretion
  - Decreased mechanical loading on bones
  - In vitro, metabolic changes of gastric bypass (e.g. GLP-1, ghrelin) affect osteoclast activity
- Secondary hyperparathyroidism occurs in 23-42% of gastric bypass patients
- Bariatric patients develop decreased bone mineral density at a higher rate than lifestyle change weight loss patients[66]
- Increased load-bearing exercise (e.g. resistance training) may mitigate bone loss effects
- DEXA scan is recommended at 2 years post-op for all patients

Nutritional deficiency – anemia, iron, B12

- Iron deficiency is very common due to decreased acid production and decreased absorption (in gastric bypass) [65, 66]
  - Gastric acid cleaves protein-bound dietary iron
  - In one study, 42% of women and 22% of men developed iron deficiency after gastric bypass
- Iron supplements should not be taken at the same time as calcium
- Oral iron repletion frequently fails, requiring IV iron treatment[69, 70]
- B12 deficiency occurs in up to 42% of gastric bypass patients (and about 5-25% of gastric sleeve patients)[71,72]
  - Relationship with decreased gastric acid, which is required for cleavage of dietary B12 prior to absorption

Dental complications[73, 74]

- Following surgical interventions, both gastric bypass and sleeve gastrectomy patients had increased rates of dental caries and dental interventions
  - Worse outcomes following gastric bypass
  - Worse outcomes for sleeve patients who lost less weight
  - Worse outcomes for patients with previous poor dentition
- Potential mechanisms:
  - Increased GERD after sleeve gastrectomy
  - Post-surgical hormonal effects on saliva
  - Gut microbiome changes
  - Calcium deficiency

Excessive weight loss/protein-calorie malnutrition

- Uncommon, but can occur particularly in patients with exaggerated food intolerance following these procedures
- Protein insufficiency can occur in the absence of underweight status and should be assessed regularly
  - 60-120g daily protein intake recommended
- Treatment can be behavioral or, rarely, may require more intensive treatment (e.g. TPN) or reversal surgery[75, 76, 77]

Practice recommendations

- Prescribe or refer to effective weight loss interventions for patients with obesity to decrease long-term morbidity and mortality
- Recognize that all bariatric surgery patients require lifelong specific follow-up and monitoring, and be prepared to do this monitoring in the primary care setting
  - *Treat "history of bariatric surgery" on the problem list as an active, chronic medical problem, not just a historical status, in the same way you would see "history of myocardial infarction"*
- Use published society guidelines to screen for and treat common nutritional deficiencies following bariatric surgery
- Be vigilant for diagnoses that occur with higher frequency in post-bariatric surgery patients, including GERD, postprandial hypoglycemia, cholelithiasis, osteoporosis, alcohol use disorder, suicide, and refractory or recurrent obesity

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