# Caring for the Bariatric Surgery Patient in the Primary Care Setting

Karli Burridge, PA-C, MMS, FOMA
Director of Medical Weight Management
LifeWeigh Bariatrics and Wellness Centers, Downers Grove IL



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# Disclosures

- Nothing to Disclose



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# Objectives

- Describe the differences and mechanisms of action of common metabolic and bariatric surgeries (MBS) in the treatment of obesity
- Identify acute and long-term complications
- Manage the treatment of metabolic diseases in the perioperative period
- Implement proper vitamin and mineral supplementation and monitor levels post-MBS
- Manage medical complications following MBS

# Most Common Metabolic and Bariatric Surgery Procedures



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# Who is a Candidate for MBS?

- BMI ≥35 with at least one obesity-related complication
- BMI ≥40 regardless of obesity-related complications





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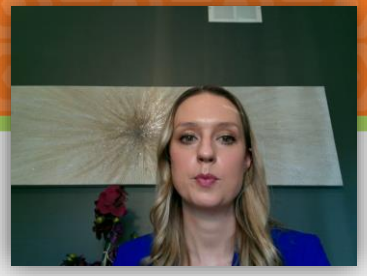
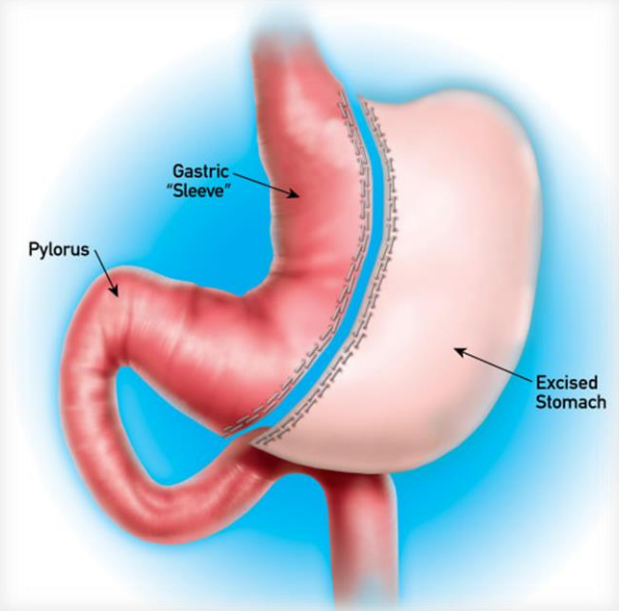
# Sleeve Gastrectomy



- 75–80% of greater curvature of stomach is removed
- Removes majority of ghrelin producing cells, reducing hunger
- Most common bariatric procedure



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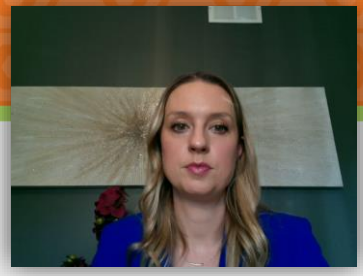
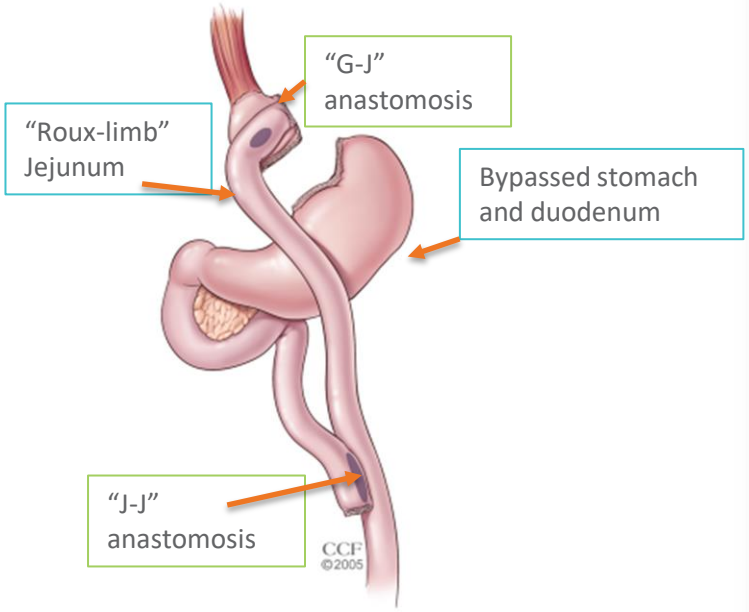
# Roux-en-Y Gastric Bypass






- Creation of a small gastric pouch
- Stomach and duodenum bypassed
- Jejunum attached to new pouch Jejunum attached distally
- Second most common procedure
- Restrictive and malabsorptive
- Favorable changes in gut hormones affecting appetite and glucose metabolism



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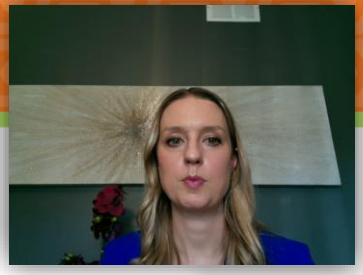
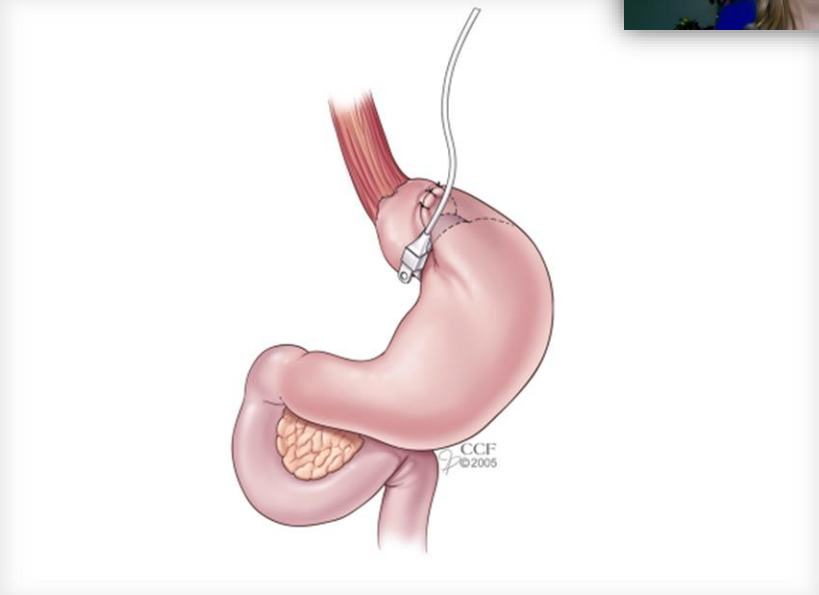
# Laparoscopic Adjustable Gastric Banding (LABG)



- Silicone band placed around top of stomach, creating a small gastric pouch
- Band is adjusted using saline injected through port under patient's skin
- Reduced popularity due to long-term complications
- Primarily restrictive



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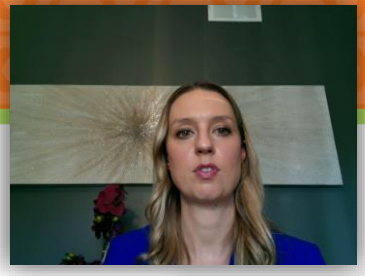
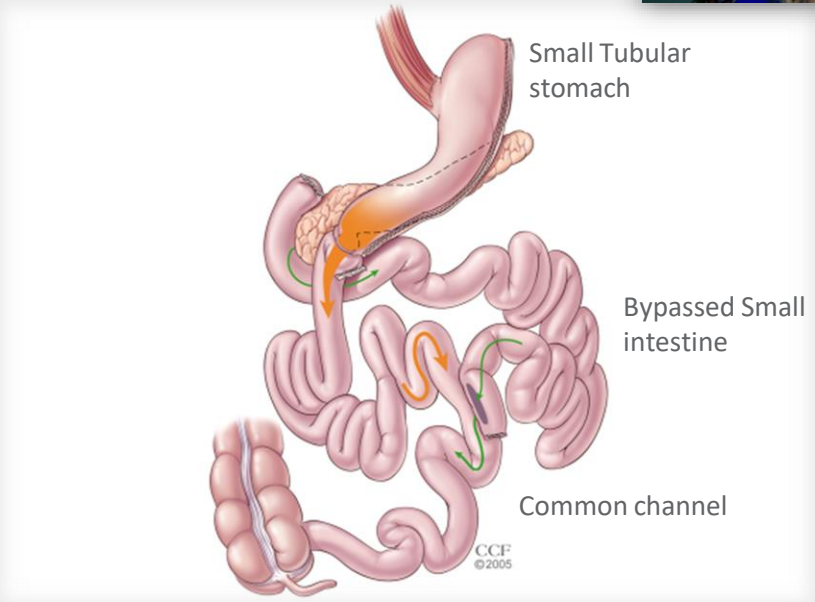
# Duodenal Switch



- First step: create small tubular stomach
- Second step: bypass 3/4 small intestines
- Highest rate malabsorption and complications, most weight loss and resolution of obesity-related complications
- Restrictive, malabsorptive, hormonal



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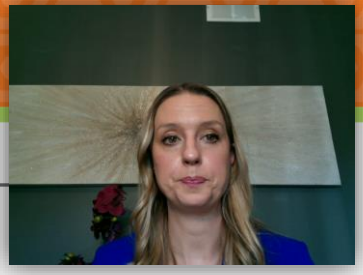
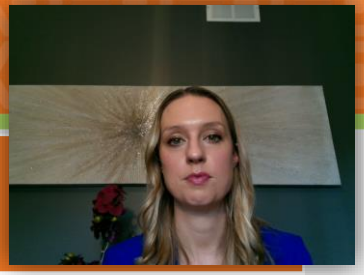
# Nutrient Absorption



| Organ | Nutrients absorbed |
|---|---|
| Stomach | Water, alcohol |
| Duodenum | Fatty acids, amino acids, minerals (calcium, iron), some vitamins |
| Jejunum | Simple sugars, fatty acids, proteins, mineral, vitamins |
| Ileum | Bile acids, bile salts, some vitamins, some minerals |
| Large intestines | Water, sodium chloride, potassium, intestinally derived vitamin K |

# Metabolic and Bariatric Surgical Procedures



| | Pros | Cons | Expected loss in percent excess body weight* at two years | Optimally suited for patients with: | |
|---|---|---|---|---|---|
| Roux-en-Y gastric bypass | Greater improvement in metabolic disease | Increased risk of malabsorptive complications over sleeve | 60–75% | Higher BMI, GERD, type 2 DM | Largest data set, more technically challenging than LAGB, VSG |
| Vertical sleeve gastrectomy | Improves metabolic disease; maintains small intestinal anatomy; micronutrient deficiencies infrequent | No long-term data | 50–70% (*three year data) | Metabolic disease | Can be used as the first step of staged approach; most common based on 2014 data |
| Laparoscopic adjustable gastric banding | Least invasive; removable | 25–40%<br>Five-year removal rate internationally | 30–50% | Lower BMI; no metabolic disease | Any metabolic benefits achieved are dependent on weight loss |
| Biliopancreatic diversion with duodenal switch | Greatest amount of weight loss and resolution of metabolic disease | Increased risk of macro- and micronutrient deficiencies over bypass | 70–80% | Higher BMI, type 2 DM | Most technically challenging |

*Excess body weight (EBW) = (total body weight) – (lean body weight)





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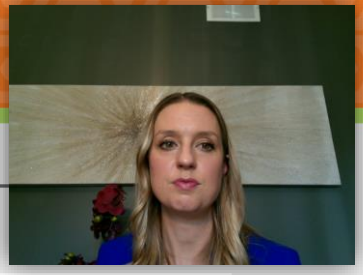
# Medical Outcomes of Bariatric Surgery



| Condition | Percent reduced or resolved | Percent resolved |
|---|---|---|
| Type 2 diabetes | 86 | 76.8 |
| Hypertension | 78.5 | 61.7 |
| Obstructive sleep apnea | 85.7 | 83.6 |
| Hyperlipidemia | 78.5 | 61.7 |



https://asmbs.org/app/uploads/2014/05/Metabolic+Bariatric-Surgery.pdf Accessed and adapted 11/8/2019.

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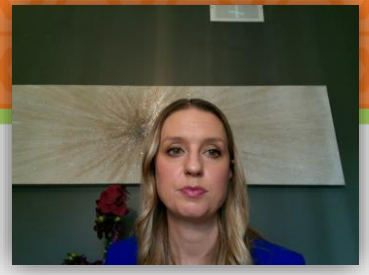
# Impact on Morbidity and Mortality



- 60% reduction in mortality from cancer, with the largest reductions seen in breast and colon cancers
- 56% reduction in mortality from coronary artery disease
- 92% reduction in mortality from type 2 diabetes
- 40% overall reduction in mortality in gastric bypass patients
- Overall mortality rate from MBS is about (0.1%)
  - Less than gallbladder (0.7%)
  - Less than hip replacement (0.93%) surgery
- Overall likelihood of major complications is about 4.3%
- Clinical evidence shows risks of morbid obesity outweigh risks of metabolic and bariatric surgery
- Studies show metabolic and bariatric surgery increases life span



https://asmbs.org/app/uploads/2014/05/Metabolic+Bariatric-Surgery.pdf Accessed and adapted 11/8/2019.

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# GI Hormone Changes

| Hormone | LAGB | SG | RYGB | DS |
|---|---|---|---|---|
| Ghrelin | ↑ ↓ ↔ | ↓ | ↑ ↓ ↔ | ↑ ↓ ↔ |
| GLP-1 | ↔ | ↑ | ↑ ↑ | ↑ ↑ |
| PYY | ↔ | ↑ | ↑ ↑ | ↑ ↑ |
| | | | | |



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# Complications

# Acute Complications

- Dehydration
- Intra-abdominal bleeding
- Leaks and sepsis
- Obstruction
- Pulmonary embolism
- Vomiting with or without abdominal pain
- Abdominal compartment syndrome


 Adapted from Clinical Pearls for Emergency Care of the Bariatric Surgery Patient © 2010 American Society for Metabolic and Bariatric Surgery

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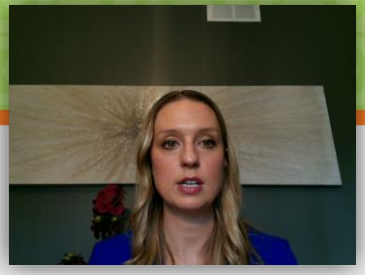
# Emergency Presentations



1. Unstable vital signs: fever over 101 degrees Fahrenheit
   - Hypotension
   - Tachycardia (≥120 bpm for ≥4 hours)
   - Hypoxia
   - Decreased urine output
2. Bright red blood by rectum or mouth, melena
3. Abdominal pain > 4 hours
4. Nausea/vomiting >4 hours
5. Vomiting with or without abdominal pain

*Immediate surgical consult, even if imaging is negative*

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# Most Common Long-Term Complications of Sleeve Gastrectomy

- Weight regain or lack of long-term weight loss
- Sleeve dilation
- Worsening GERD or de novo GERD
- Luminal stenosis/strictures
- Alkaline reflux gastritis
- Calcium deficiency
- Secondary hyperparathyroidism
- Iron deficiency
- Anemia (related to mineral and nutrition deficiencies)
- B12 and B1 deficiency (IF)




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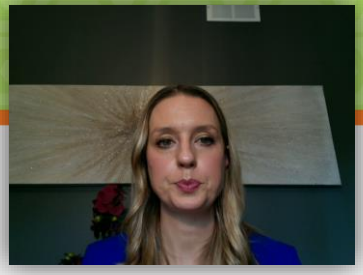
# Most Common Long-Term Complications of Roux-en-Y Gastric Bypass



- Weight regain
- Pouch/anastomotic dilation
- Gastro-gastric fistula
- Anastomotic/marginal ulcers
- Esophageal dilation
- Dumping syndrome with reactive hypoglycemia
- Small bowel obstruction caused by internal hernias or adhesions
- Anastomotic stenosis/stricture
- Protein malnutrition
- Nutritional and mineral deficiencies
- Osteoporosis (often caused by calcium deficiency and chronically elevated parathyroid hormone levels)

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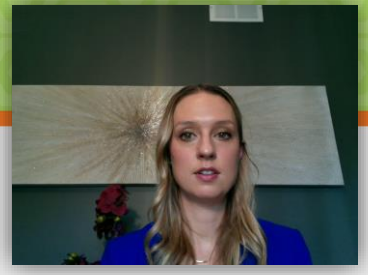
# Most Common Long-Term Complications of Laparoscopic Adjustable Gastric Banding (LABG)



- No weight loss or weight regain
- Band slippage, erosion, ulceration, port infection
- Esophageal dilation
- GERD
- Food intolerance
- Rare nutrient deficiencies if persistent vomiting or marked and sustained decrease in nutritional intake
- Potential need for removal, revision, or conversion to another procedure

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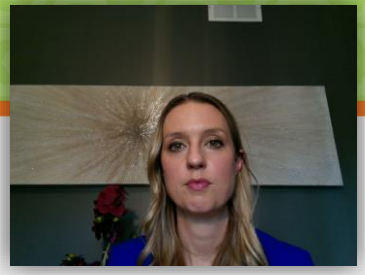
# Most Common Long-Term Complications of DS




- Similar to RYGB, but **much** higher risk of protein and vitamin/mineral deficiencies



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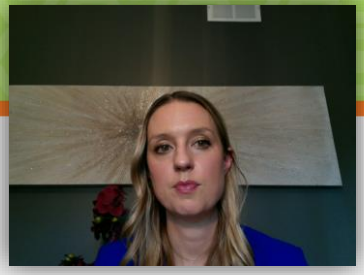
# Common Micronutrient Deficiencies



| | Vitamins | | | | | | | Minerals | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A | B1 | B9 | B12 | D* | E | K | Ca | Fe | Zn/Cu |
| RNY | | X | X | X | X | | | X | X | |
| Sleeve | | X | X | X | X | | | | X | |
| LAGB | | X | | | X | | | | | |
| BPD | X | X | X | X | X | X | X | X | X | X |

*Vitamin D deficiency is seen in a significant number of patients with obesity at baseline. However, due to malabsorption, the risk is further increased post-operatively.





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# Managing Metabolic Conditions in the Perioperative Period



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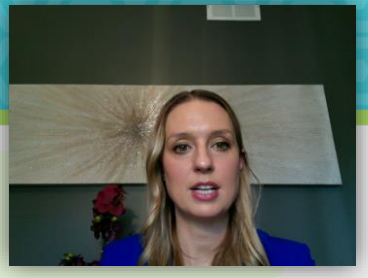
# Preoperative Evaluation

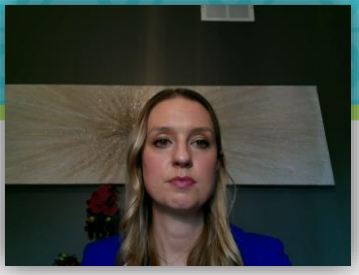


- Complete H&P
- Routine labs: CBC, CMP, lipid profile, UA, PT/INR
- Nutrient screening: iron studies (iron, TIBC, ferritin), B12, folic acid, 25-hydroxy vitamin D (vitamin A and E, zinc, copper for RYGB, DS)
- GI evaluation: H. pylori, EGD as indicated
- Cardiopulmonary evaluation: EKG, CXR, echo (if needed)

# Preoperative Evaluation (cont.)

- Endocrine evaluation: HbA1c, thyroid panel, possible testosterone, DHEAS, Cushings?
- Clinical nutrition evaluation by RD
- Psychosocial evaluation
- Optimize glycemic control: 6.5–7.0%
- Pregnancy counseling: avoid pregnancy 12–18 months post-op; increased fertility after surgery
- Smoking cessation counseling: tobacco free over six weeks pre-op
- Verify cancer screening

# Post-Operative Management of Type 2 Diabetes




- Close glucose monitoring is crucial, especially if on insulin
- Continued regular monitoring of HbA1c long-term
- RYGB:
  - 2 years: 75% remission
  - 6 years: 62% remission
  - 12 years: 51% remission
- LAGB: LABS-2 study: seven years—20% remission



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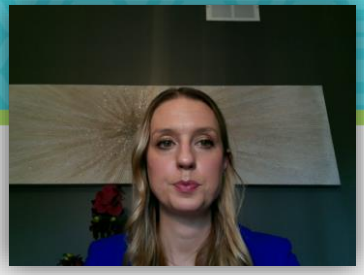
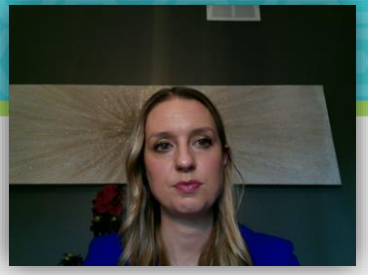
# Post-Operative Management of Type 2 Diabetes



- Dramatic improvements in glucose homeostasis both dependent and independent of weight reduction (especially after RYGB)
- **Oral insulin secretagogues** (sulfonylureas and meglitinides): discontinue at the time of surgery due to risk of hypoglycemia
- **Insulin:** reduced and adjusted during hospital stay—usually sliding scale insulin upon discharge with close monitoring (targets: 140–180 mg/dL)
- **Metformin** may be continued
- **Incretin based therapies** (GLP-1 receptor agonists and DPP-4 inhibitors) can be continued, but are often discontinued due to impact of bariatric surgery on incretin physiology (especially RYGB and DS)
- **TZDs and SGLT2 inhibitors** can be continued, but are often discontinued due to expected changes in insulin sensitivity and volume status
- **Alpha glucosidase inhibitors** should be discontinued due to their GI side effects
- *Note: if possible, use weight negative anti-diabetes medications*

# Hypertension



- One-year remission
  - 83% DS
  - 68% RYGB
  - 17% LAGB
- Seven-year remission
  - 38% RYGB
  - 17% LAGB

Reductions in BP seen almost immediately after surgery

Weight dependent and independent mechanisms



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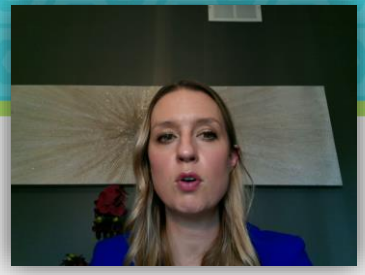
# Hypertension



- Due to more variability and potentially less durable results, monitor BP regularly and adjust medications as needed.
- *If possible, use weight-neutral antihypertensive medications.*

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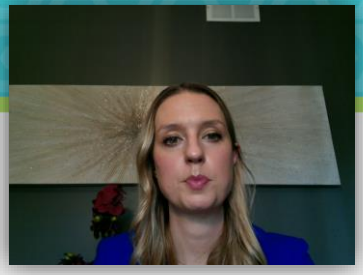
# Dyslipidemia



- LDL improved in 71%
- TG improved in 82%
- Three-year outcomes
  - RYGB: 62% remission
  - LAGB: 27% remission
- Similar results after 7 years
- Individualize treatment based on risk factors to determine elimination or reduction of cholesterol-lowering medications



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# Micronutrient Management

# Micronutrient Supplementation

| Micronutrient | Dose |
|---|---|
| Thiamine | 12 mg/day |
| Vitamin B12 (Cobalamin) | Oral/SL: 350–500 mcg/day; intra-nasal: 1,000 mcg/week, IM: 1,000 mcg/month |
| Folate (folic acid) | 400–800 mcg/day; women of child-bearing age: 800–1,000 mcg/day |
| Iron | 18 mg/day, RYGB/SG/DS or menstruating women: 45–60 mg/day; *take separately from calcium supplements; taking with vitamin C or meat can help with absorption* |
| Vitamin D3 | 3,000 IU/day |
| Vitamin A | LAGB: 5,000 IU/day, RYGB or SG: 5,000–10,000 IU/day, DS: 10,000 IU/day |
| Vitamin E | 15 mg/day |
| Vitamin K | LAGB, SG, RYGB: 90–120 mcg/day, DS: 300 mcg/day |
| Zinc | SG or LAGB: 8–11 mg/day, RYGB: 8–22 mg/dy, DS: 16–22 mg/day |
| Copper | SG or LAGB: 1 mg/day, RYGB or DS: 2 mg/day |
| Calcium (separate) | Calcium citrate: LAGB, SG, RYGB: 1,200–1,500 mg/day, DS: 1,800–2,400 mg/day (divided doses) |

# Schedule for Post-Operative Micronutrient Monitoring

**Schedule**

- 6 months
- 12 months
- 18 months
- 24 months
- Annually

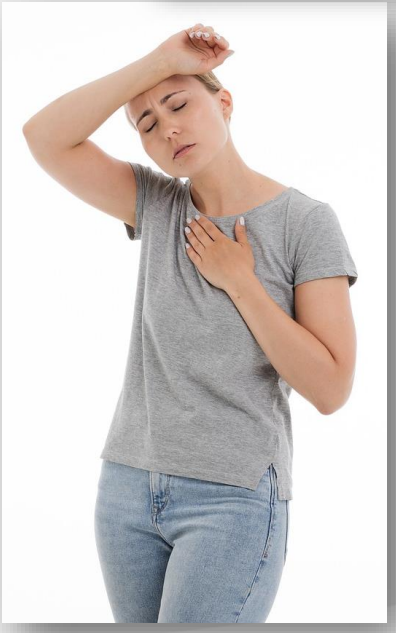
**Micronutrient**

- Vitamin B12
- Folate
- Iron, ferritin, TIBC
- 25-hydroxyvitamin D
- Calcium
- Intact PTH
- 24-hour urinary calcium
- Thiamine (optional)
- Vitamin A (optional at 24 months, annually)
- Zinc (optional)
- Copper (optional)

# Micronutrient Deficiencies

**Iron deficiency**

- The most common deficiency after RYGB (up to 50%)
- Microcytic anemia with low iron levels, low ferritin levels, and increased transferrin or total iron-binding capacity
- Fatigue, pica
- Spoon-shaped nails, vertical ridges on nails
- Repletion
  - 150–200 mg/day, up to 300 mg two to three times/day
  - IV iron infusion for severe/refractory





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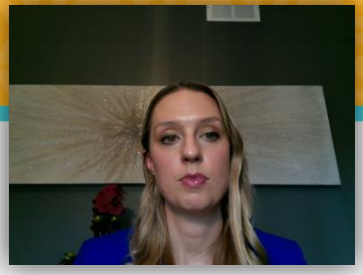
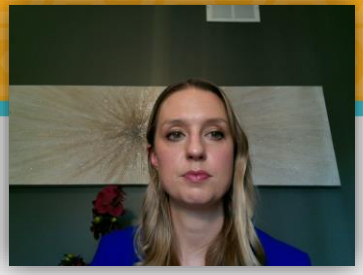
# B12 Deficiency



- 26–70% after RYGB
- Decreased serum B12, increased MMA (methylmalonic acid)
  - Pernicious anemia due to lack of intrinsic factor
  - Megaloblastic anemia
  - Low platelets, low WBC
  - Glossitis: “beefy red tongue,” pale skin
  - Neuropathy (numbness and paresthesias)
  - Fatigue, depression
  - Lightheadedness
  - Tinnitus
  - Palpitations
  - Rapid HR
  - Anorexia
  - Diarrhea

- Late symptoms
  - Angina
  - Altered mental status
  - Dementia
  - Psychosis
- Repletion
  - Oral: 1,000mcg/day
  - IM: 1,000 mcg/month to1,000–3,000 mcg/6–12 months

# B1 Deficiency (Thiamin)



**Early signs/symptoms**

- **Dry Beriberi** (without edema): brisk tendon reflexes, peripheral neuropathy, muscle weakness/pain upper and lower extremities, gait ataxia, convulsions
- **Wet Beriberi**: heart failure with high CO, edema (LE), tachy- or bradycardia, lactic acidosis, dyspnea, cardiac hypertrophy and dilation, SOB, systemic venous HTN, bounding arterial pulses
- **Other/GI**: slow gastric emptying, nausea, vomiting, megacolon, constipation

# B1 Deficiency (Thiamin) (cont.)

## Advanced signs/symptoms

- **Wernicke's encephalopathy**: polyneuropathy and ataxia, ocular changes (ophthalmoplegia and nystagmus), confabulation, short-term memory loss
- **Korsakoff psychosis**: psychosis/hallucinations
- **Repletion**
  - Oral: 100 mg two to three times daily
  - IM: 250 mg daily for three to five days or 100–250 mg monthly
  - IV: 200 mg two to three times daily to 500 mg one to two times daily for three to five days, followed by 250 mg/day for three to five days
  - Administer thiamine prior to dextrose-containing solutions (glucose)

# Folate Deficiency

- Changes in pigmentation or ulceration of skin, nails, or oral mucosa
- Megaloblastic anemia
- Reduced sense of taste
- Numbness/tingling (paresthesias)
- Weakness
- Depression
- **Pregnancy: NTD***
- Repletion
  - 1,000 mcg/day



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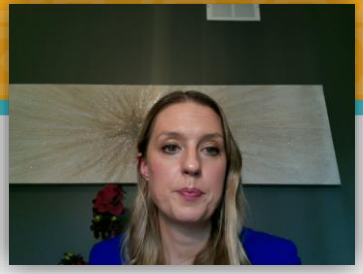
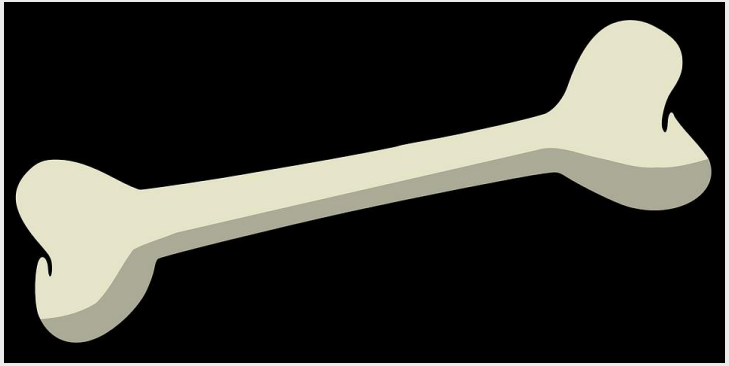
# Calcium Deficiency



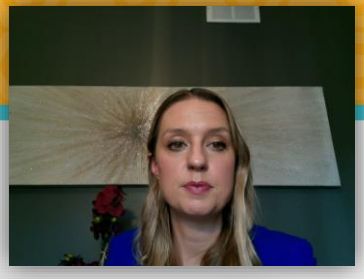
- Elevated PTH, low serum calcium
- DXA: baseline and after 2 years
- Signs/symptoms
  - Leg cramping, tetany
  - Neuromuscular hyperexcitability
  - Muscle weakness
- Osteopenia/osteoporosis
- Repletion
  - RYGB/sleeve: 1,200–1,500 mg/day (Divided in 500-600 mg doses)
  - DS: 1,800–2,400 mg/day



# Vitamin D Deficiency

- Low 25-hydroxyvitamin D
- Elevated PTH
- 90% patients with obesity
- Signs/symptoms
  - Hypocalcemia, tetany, cramping, tingling
- Repletion
  - D3 6,000 IU/day or D2 50,000 IU one to three times weekly

# Protein Malnutrition



- Most common after malabsorptive procedures
- Kwashiorkor = severe protein malnutrition w/o calorie deficiency
- Edema, hair loss, muscle wasting
- Check albumin and pre-albumin
- Minimum 60 g protein per day
- 1.5–2.1 g/kg ideal body weight
- 90–120 g protein/day BPD/DS
- Resistance training to reduce muscle mass loss

Image: © Obesity Action Coalition



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# Managing Complications Following MBS



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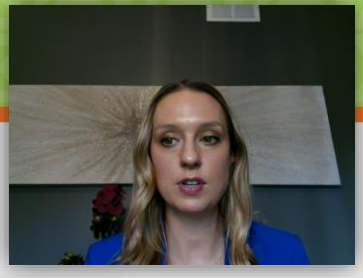
# Dumping Syndrome - RYGB



- Within one hour of eating
- GI: nausea, diarrhea, abdominal fullness
- Vasomotor: weakness, diaphoresis, fatigue, syncope
- Likely due to osmotic shift caused by rapid delivery of nutrients to small intestine: rapid increase of fluids into GI tract to “dilute” content
- Typically occurs with high sugar/ carbohydrate foods
- Treatment: small portions, avoid high sugar/carb/fat foods

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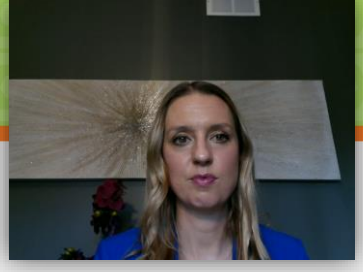
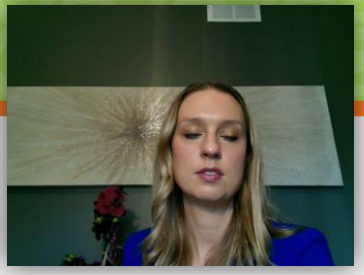
# Post-Gastric Bypass Hypoglycemia (PGBH)



- Rare!
- Can occur months to years after RYGB
- Postprandial hypoglycemia (glucose under 55 mg/dL)
- Signs/symptoms
  - Confusion, loss of consciousness
- Stimulated by carbohydrate containing meal
- Distinguished from dumping syndrome: no vasomotor symptoms
- Beta cell hyperfunction: hypersecretion of insulin, high GLP-1 levels after RYGB
- Mismatch of glucose clearance and insulin clearance?
- No standardized testing: 3-day continuous blood glucose monitoring or mixed meal tolerance test with glucose before and 30 minutes postprandial
- Treatment: small meals, very low carbohydrate, high in protein and fiber

# Weight Recidivism

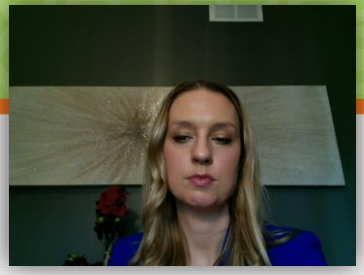


- No standard definition of recidivism
- 25–70% of patients are affected by weight recidivism, depending on definition
  - Under 50% EWL, under 20% TBWL, over 25% weight regain, over 5 BMI points regain
- Obesity is a *chronic* disease with *no cure*
- Weight regain *does not* equal failure
- Bariatric surgery is a *tool*, and tools can get dull over time!
- Even after bariatric surgery, additional tools to manage obesity will likely be needed
- Return of medical complications of obesity
- Lifelong follow-up and management by PCP or obesity clinician

# Conclusion

- Bariatric and metabolic surgery is the most effective and durable treatment available for the treatment of severe obesity
- One percent of patients who qualify for bariatric surgery are receiving MBS
- Referring to bariatric surgeon is standard of care for severe obesity as well as for many conditions caused by excess adiposity
- BMS increases life expectancy and quality of life
- Risks and complications: know how to screen for and manage
- Obesity is a chronic, progressive, relapsing disease regardless of treatment, and should be treated as such
- Most common complaint: “I wish I had done it sooner”

# References

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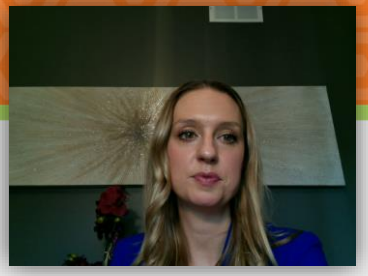

Thank you!

kburridge@lifeweigh.com



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