Primary Care Follow-Up After Bariatric Surgery

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I have no disclosures related to current presentation
Objectives

• Growing burden
• Different weight loss surgeries
• Nutritional and metabolic consequences
• Long term complications
• Special populations
Largest man in the world in 1903

American police officer in 2012
Obesity Trends* Among U.S. Adults
(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)

1990: No Data          <10%           10%–14%     15%–19%           20%–24%          25%–29%           ≥30%
1999: No Data          <10%           10%–14%     15%–19%           20%–24%          25%–29%           ≥30%
2008: No Data          <10%           10%–14%     15%–19%           20%–24%          25%–29%           ≥30%

BRFSS: Behavioral Risk Factor Surveillance System
Leanest State: Colorado (19.8)
Fattest State: Mississippi (34.4)

Percentage of Obese Adult Population (3-year average from 2008-10 CDC Behavioral Risk Factor Surveillance System data)

United States of Obesity 2011

CalorieLab's
Relation between BMI and Mortality

Dealing with Obesity Epidemic

Types of Bariatric Surgery

Restrictive

Vert Band Gastroplasty

Adjustable Gastric Band

Over 90% in US

Restrictive Malabsorptive

Roux-N-Y Gastric Bypass

Malabsorptive Restrictive

Bilio-pancreatic Diversion

Bilio-pancreatic Diversion with Duodenal Switch

Over 90% in US
Sleeve Gastrectomy
<table>
<thead>
<tr>
<th>Parameter</th>
<th>RYGBP</th>
<th>BPD-DS</th>
<th>VBG</th>
<th>LAGB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% EBW</td>
<td>65-70</td>
<td>~70</td>
<td>50-60</td>
<td>50</td>
</tr>
<tr>
<td>% BMI</td>
<td>35</td>
<td>~35</td>
<td>25-30</td>
<td>25</td>
</tr>
<tr>
<td>NAFLD</td>
<td>SI</td>
<td>SI</td>
<td>SI except fibrosis, may get worse</td>
<td>SI</td>
</tr>
<tr>
<td>Diabetes</td>
<td>SI or R 65-95%</td>
<td>SI or R 65-95%</td>
<td>SI or R</td>
<td>I or R 40-65%</td>
</tr>
<tr>
<td>Operative Mortality</td>
<td>0.5-1% 5%</td>
<td>1% 5%</td>
<td>0.1% 5%</td>
<td>0.1% 5%</td>
</tr>
<tr>
<td>Morbidity</td>
<td>Stomach dilation, ventral hernia</td>
<td>Malabsorption Increased AST/ALT, resolve after 6 mths</td>
<td>Food/pill impaction Outlet obstruction</td>
<td>Gastric prolapse, stomal obstruction, pouch dilation</td>
</tr>
<tr>
<td>Complication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>Restrictive/ Malabsorptive</td>
<td>Malabsorptive / Restrictive</td>
<td>Restrictive</td>
<td>Restrictive</td>
</tr>
<tr>
<td>Use in the United States</td>
<td>87%</td>
<td>2%</td>
<td>1.4%</td>
<td>9%</td>
</tr>
</tbody>
</table>
Gastric Bypass Surgery
The Concept

Proximal RNYGB

15-30 cc gastric pouch
Gastric remnant
Biliopancreatic limb
Alimentary limb

Gastrojejunostomy

Jejuno-jejunal anastomosis

Proximal RNYGB
Roux-en-Y gastric bypass (RYGB)

Case 1

• A 38-yo Caucasian female
• Eight month history of ascites
• Gastric bypass in 1999 at outside facility
• Complaints:
  – Leg swelling
  – Increased forgetfulness
  – Unsteady on feet
  – Recurrent falls recently
  – Weak and tired
Case 1

- **On exam:**
  - 98 lb, 5’3”
  - Poor dentition & oral hygiene
  - Muscle wasting
  - Spider angioma
  - Ecchymosis
  - Ascites and edema
  - Asterixis +

- **Labs:**
  - Hb 9.7, Plt 106, INR 1.4, Cr 1.0
  - AST 46, ALT 33, TBil 1.5, Alb 2.4
  - Ascitic fluid alb <1.0, protein 1.9

- **Cirrhosis, MELD 12, Child C**
  - Admitted 1 month later with *sepsis*, had complicated hospital course and after 5 weeks family decided for comfort care
Case 1

• 243 lb, lost 103 lb in first year after gastric bypass
• Since surgery, had seen PCP at scheduled appointments but no follow up with surgeons
• Current BMI 16.3 kg/m2
• Drinks 3-4 cans of beer/day, low vitamin B12
• Poor diet and nutrient supplements

• Decompensated Alcoholic cirrhosis
• Severe protein calorie malnutrition and cachexia
  • Vitamin B12 deficiency
Take Home Message - Case 1

• Patient compliance for successful outcome
  – Follow up visits with the surgeon and physicians
  – Diet and nutrition
  – Alcohol abstinence

• Always know the surgical details/anatomy

• Significant excess weight loss?

• Physician awareness
Case 2

- A 33-yo WF, referred for nutritional management
- Gastric bypass in 2006
- C/o nausea, vomiting, abdominal pain, bloating
- Leg swelling and abdominal distension
- Unable to eat well due to above complaints
- Alcohol abuse until 10 months ago
- Pallor, abd distended, tender, BS+, edema, asterixis +
- Hb 9.6, Plt 122, AST/ALT 126/59, TBil 1.8, AlkP 187, Albumin 2.8, INR 1.4, Cr 1.1
- US abd: small nodular liver, perihepatic fluid, reversal of portal flow with portal vein 15 mm, spleen 13.8 cm
Case 2

Small bowel obstruction at the distal small bowel anastomosis: dilated Roux jejunal limb and excluded limb.

Venting gastrostomy tube by IR

Liquid diet, tolerated well initially, then became non-compliant

High surgical risk for bowel surgery, liver transplant evaluation initiated to address both liver and bowel issues

Initiated on TPN

Developed sepsis and did not survive
The ABC System of Classification of Small Bowel Obstruction

A Alimentary limb
B biliopancreatic limb
C Common channel

Alcohol Misuse After Bariatric Surgery: Epiphenomenon or “Oprah” Phenomenon?

• Lack of robust data

• Alcohol pharmacokinetics study in women with gastric bypass ≥3 years

• Compared to age and BMI matched controls, blood alcohol levels
  – Peaked more quickly
  – Remained higher

• About 90% gastric bypass patients more sensitive to alcohol after surgery

Case 3

- 25-yo AAF, had distal gastric bypass 6 months ago
- Lost 164 lbs (459 lb to 285 lb)
- Admitted with nausea, vomiting, poor oral intake and abdominal pain ~5-6 weeks
- Obese, lethargic, apathetic, weakness of extremities 4-/5
- BUN 5, Cr 0.6, Lactate 4.5, Albumin 2.8, Pre-albumin 9, AST/ALT 35/39
Thiamine Deficiency

- Thiamine levels: Low
- Thiamine replacement: Gradually improved, lactic acidosis resolved
- Thiamine deficiency can cause
  - Peripheral neurologic
  - Cerebral
  - Cardiologic
  - Gastrointestinal manifestations
- Thiamine is absorbed in the small intestine, mostly in the jejunum and ileum.
- Even VBG procedures have been associated with thiamine deficiency, probably due to reduced intake, not malabsorption
## Clinical Presentations of Thiamine Deficiency

<table>
<thead>
<tr>
<th>Beriberi Subtype</th>
<th>Symptoms and Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neuropsychiatric</strong></td>
<td>Hallucinations/aggressive behavior</td>
</tr>
<tr>
<td></td>
<td>Confusion/nystagmus/ataxia/ophthalmoplegia</td>
</tr>
<tr>
<td><strong>Wet beriberi</strong></td>
<td>Tachycardia/respiratory distress/leg edema</td>
</tr>
<tr>
<td></td>
<td>Right ventricular dilation/lactic acidosis</td>
</tr>
<tr>
<td><strong>Dry beriberi</strong></td>
<td>Numbness/muscle weakness and pain of lower to upper extremities/convulsions/Exaggerated tendon reflexes</td>
</tr>
<tr>
<td><strong>Gastrointestinal</strong></td>
<td>Nausea/emesis and megajejunum</td>
</tr>
<tr>
<td></td>
<td>Constipation and megacolon</td>
</tr>
<tr>
<td><strong>Bariatric beriberi</strong></td>
<td>Symptoms corrected by antibiotics, not by oral thiamine</td>
</tr>
</tbody>
</table>
Thiamine Deficiency

- Wernicke encephalopathy is caused by severe thiamine deficiency
- Classical clinical triad
  - Ocular changes (nystagmus, ocular nerve palsies),
  - Ataxia
  - Apathetic mental confusion
- As early as 2 weeks and as long as 13 years after surgery
- Fatalities have been reported
- Early recognition and immediate parenteral treatment
- Prevention: Multivitamin supplement is adequate
- Deficiency: parenteral thiamine 50 to 200 mg per day until symptoms clear, then 10 to 100 mg by mouth daily
Famous Words of a Bariatric Surgeon...

In more than 2,000 RYGB procedures, we never saw any evidence of protein-calorie malnutrition, unless the patient had a mechanical problem with excessive vomiting or had undergone a distal gastric bypass.

Harvey Sugerman, Former Vice Chair
Department of Surgery, VCU Medical Center
Letter J Am Coll Surg Nov 2005
Protein Calorie Malnutrition in Gastric Bypass Patients

• A real risk

• Some patients suffer troublesome vomiting after surgery, until their GI tract adjusts to the changes, and cannot eat adequate amounts even with 6 meals a day

• Many patients require protein supplementation during the early phases of rapid weight loss, to prevent excessive loss of muscle mass

• Patient compliance and dedicated team can prevent this
Medication Management

• Prevention of gallstone formation
• Diabetes
• Hypertension
• Dyslipidemia
• Monitor closely for diuretics
• No NSAIDs
Luminal Complications of Gastric Bypass

• Anastomotic
  – Leak
  – Stricture/stenosis
  – Ulcer

• Obstruction
  – Internal herniation
  – Adhesions

• Dumping syndrome
Anastomotic Ulcer
Anastomotic Ulcer

• In up to 16% of patients. Possible causes include:
  – Altered blood supply to the anastomosis
  – Anastomotic tension
  – Gastric acid
  – Helicobacter pylori
  – Smoking
  – Use of Non-steroidal anti-inflammatory drugs

• Treatment:
  – Use of Proton pump inhibitors
  – Use of a cytoprotectant and acid buffering agent
  – Temporary restriction of the consumption of solid foods
Anastomotic Stricture

- If the inflammation and healing process outpaces the stretching process, scarring may result in stricture formation.

- Treatment: EGD and dilation.
Internal Herniation

**Mesenteric Swirl Sign** and **Mushroom-shaped mesenteric root.**
Enhanced transverse CT scan through mesenteric root shows narrowed mesenteric root with fat and vessels passing between superior mesenteric artery (arrow) and distal mesenteric arterial branch (arrowhead).
Nutritional Aspects of Bariatric Surgery

• **Diet recommendation at VCU Medical Center:**

• **Day of surgery:**
  – No food or drink

• **Day 1 after surgery: (Category 1)**
  – 1/4 cup clear liquids or juice per hour (2 small medicine cups).

• **Day 2 after surgery: (Category 2)**
  – Full liquid diet (to be followed for 2 full weeks after surgery)
Category III – Up to 2 weeks post Gastric Bypass

• Full liquid diet (sugar free)
• Minimum daily protein intake
  – Women: 50-60 grams
  – Men: 65-75 grams
• No juice
• No sweetened beverages
Category IV: 2-4 weeks post Gastric Bypass

• Pureed diet (consistency of applesauce)
• Minimum daily protein intake
  – Women: 50-60 grams
  – Men: 65-75 grams
• No juice
• No sweetened beverages
Category V: After 4 weeks of Gastric Bypass

- Regular foods with emphasis on avoiding more difficult to tolerate foods
  - Meat, Chicken
  - Bread, Pasta, Rice
  - Pork, Firm fish
- Minimum daily protein intake
  - Women: 50-60 grams, Men: 65-75 grams
- No juice
- No sweetened beverages
- Avoid sugar, junk, high calorie processed foods
- LAGB drink liquids 1 hour before meals
- GBP drink liquids 30 minutes before or 1 hour after meals
# Nutrient Deficiency After Bariatric Surgery

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Prevalence (or risk)</th>
<th>Complications or consequences</th>
<th>Laboratory test * or other investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>AGB: +</td>
<td>Microcytosis, anaemia, fatigue, brittle nails</td>
<td>↓% transferrin saturation (iron) CBC (haemoglobin), ↓ferritin &lt; 20mg/L (transferrin soluble receptor)</td>
</tr>
<tr>
<td></td>
<td>GBP: ++</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG: +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium, vitamin D</td>
<td>AGB: – or ±</td>
<td>Osteomalacia, osteoporosis, fractures</td>
<td>1,25(OH)2D, ↑PTH, ↑alkaline phosphatase, ↓calcaemia: rare, DEXA (↓bone density)</td>
</tr>
<tr>
<td></td>
<td>GBP: ++</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SG: - (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td>AGB: –</td>
<td>Oedema</td>
<td>↓Albumin, ↓prealbumin, DEXA (↓fat-free mass)</td>
</tr>
<tr>
<td></td>
<td>GBP: ±</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG: – (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc, selenium</td>
<td>AGB: +</td>
<td>Hair loss (?zinc), selenium: no symptoms</td>
<td>↓Zinc RBC, ↓selenium</td>
</tr>
<tr>
<td></td>
<td>GBP: ++</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG: (?)</td>
<td></td>
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<th>Laboratory test * or other investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vitamin B12</strong></td>
<td>AGB: +</td>
<td>Macrocytosis, anaemia, neuropathy</td>
<td>↓Vitamin B12, ↑MMA (optional), ↑homocysteine (optional)</td>
</tr>
<tr>
<td></td>
<td>GBP: ++</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG: + (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vitamin B9 (folate)</strong></td>
<td>AGB: ±</td>
<td>Macrocytosis, anaemia, pregnant women: fetal neural-tube defects</td>
<td>↓Folate, ↓RBC folate, ↑homocysteine (optional)</td>
</tr>
<tr>
<td></td>
<td>GBP: ±</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SG: ±</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vitamin B1 (thiamine)</strong></td>
<td>AGB: ±</td>
<td>Neuropathy, Gayet–Wernicke encephalopathy</td>
<td>↓Thiamine</td>
</tr>
<tr>
<td></td>
<td>GBP: ±</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SG: ± (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other vitamins (A, E, K)</strong></td>
<td>AGB: –</td>
<td>Vitamin A: night blindness, vitamin E: ↑oxidative stress, vitamin K: bleeding disorder</td>
<td>Vitamin A, vitamin E, vitamin K1 + INR</td>
</tr>
<tr>
<td></td>
<td>GBP: – or ±</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>SG: –</td>
<td></td>
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</tr>
<tr>
<td>Test</td>
<td>1 month</td>
<td>3 months</td>
<td>6 months</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>CBC, BMP, Hepatic (optional)</td>
<td>AGB</td>
<td>AGB</td>
<td>AGB</td>
</tr>
<tr>
<td></td>
<td>GBP</td>
<td>GBP</td>
<td>GBP</td>
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<tr>
<td></td>
<td>SG</td>
<td>SG</td>
<td>SG</td>
</tr>
<tr>
<td>Iron (% transferrin saturation), ferritin</td>
<td>AGB</td>
<td>AGB</td>
<td>AGB</td>
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<tr>
<td></td>
<td>GBP</td>
<td>GBP</td>
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<td></td>
<td>SG</td>
<td>SG</td>
<td>SG</td>
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<tr>
<td>Vitamin B12 (± MMA)</td>
<td>AGB</td>
<td>AGB</td>
<td>AGB</td>
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<tr>
<td></td>
<td>GBP</td>
<td>GBP</td>
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<td></td>
<td>SG a</td>
<td>SG a</td>
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<tr>
<td>RBC, folate</td>
<td>AGB</td>
<td>AGB a</td>
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<tr>
<td></td>
<td>GBP</td>
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<td></td>
<td>SG a</td>
<td>SG a</td>
<td>SG a</td>
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<tr>
<td>Calcaemia + 25OH D</td>
<td>GBP</td>
<td>GBP</td>
<td>GBP</td>
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<td></td>
<td>GBP a</td>
<td>GBP a</td>
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<td>SG a</td>
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<td>SG a</td>
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<tr>
<td>Intact PTH</td>
<td>GBP</td>
<td>GBP</td>
<td>GBP b</td>
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<tr>
<td></td>
<td>SG a</td>
<td>SG a</td>
<td>SG a</td>
</tr>
<tr>
<td>DEXA, bone density</td>
<td>GBP</td>
<td>AGB</td>
<td>Every 2–5 years</td>
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<tr>
<td></td>
<td>SG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin (prealbumin)</td>
<td>AGB</td>
<td>AGB</td>
<td>AGB</td>
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<tr>
<td></td>
<td>GBP</td>
<td>GBP</td>
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<td>SG</td>
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<td>SG</td>
</tr>
</tbody>
</table>
### Vitamins and Minerals

<table>
<thead>
<tr>
<th>VITAMIN</th>
<th>FIRST MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-vitamin</td>
<td>2 chewable children’s vitamin (does not have to be ‘sugar free’)</td>
</tr>
<tr>
<td>Iron</td>
<td>Iron 65mg twice a day (for menstruating women only). You may have to ask the pharmacist for this.</td>
</tr>
</tbody>
</table>
| Vitamin B12   | Vitamin B12 **500mcg tablet** per day  
or  
one injection (1000 mcg) per month (prescription required)  
or  
B12 (1000mcg) sublingual (under tongue)  
** Please note the different doses, depending on the type of B12** |

- Daily vitamin supplementation
# Vitamins and Minerals

<table>
<thead>
<tr>
<th>VITAMIN</th>
<th>AFTER 1 MONTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-vitamin</td>
<td>2 chewable children’s (does not have to be ‘sugar free’ or one adult multivitamin (non-chewable) per day.</td>
</tr>
<tr>
<td>Calcium Citrate plus D</td>
<td>Calcium CITRATE plus D, 4 caplets per day- 2 in the am and 2 in the pm. (Citrical plus D or generic is acceptable) Calcium Citrate is required because it is the only calcium that is properly absorbed after gastric bypass. Ask your pharmacist if you need assistance.</td>
</tr>
<tr>
<td>Iron</td>
<td>Iron 65mg twice a day (for menstruating women only). You may have to ask the pharmacist for this strength</td>
</tr>
</tbody>
</table>
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or  
one injection (1000 mcg) per month (prescription required)  
or  
B12 (1000mcg) sublingual (under tongue)  
** Please note the different doses, depending on the type of B12** |
DO’s

• **DO** spread the vitamins and minerals throughout the day

• **DO** consider B12 injections or sublingual (under the tongue) B12 if you do not like to take pills. The sublingual dissolves under the tongue and does not need to be swallowed. You can purchase it at GNC or other vitamin stores.

• **DO** use calcium citrate for calcium supplementation, as it is better absorbed by the body.
DO NOT’s

• To avoid nausea, **DO NOT** take vitamins and minerals on an empty stomach, especially iron. If the iron causes nausea or stomach upset, you can try a less nauseating form of iron called Slow Fe.

• **DO NOT** take calcium and iron at the same time; take at least four hours apart. If you take them together, you will not absorb either of them and are likely to become constipated.

• **DO NOT** take vitamins and minerals with tea, coffee, or cola. The caffeine will prevent them from being absorbed.

• **DO NOT** take Caltrate or calcium carbonate. It will not be absorbed properly. You MUST take Calcium CITRATE plus D (4 pills per day)
Five Keys to Success

• No sugar
• No junk food
• Exercise
• Dietary compliance
  – Full liquid (0-2 weeks)
  – Pureed diet (2-4 weeks)
• Attitude, attitude, attitude!!
Vitamin and Mineral Supplements after Malabsorptive Bariatric Surgery

1. **MULTIVITAMIN with MINERALS**: 1 chewable tablet, daily to twice a day
2. **CALCIUM SUPPLEMENTS**: chewable tablets, 1.2 g elemental calcium, daily

**Specific deficiencies**
3. **THIAMINE**: 100 mg tablet, twice daily or THIAMINE: 100–250 mg intramuscular, monthly
4. **NIACIN**: 500 mg orally, 3 times daily
5. **FOLIC ACID**: 1–5 mg orally, daily
6. **VITAMIN B12**: 1000 mg, intramuscular, monthly or SUBLINGUAL VITAMIN B12: 500 mg tablet once daily
7. **VITAMIN A**: 10,000 IU orally, daily
8. **VITAMIN D (ergocalciferol)**: 50,000 IU with a meal once weekly (up to 12 weeks) followed by **VITAMIN D3 (cholecalciferol)**: 1000 IU with a meal twice daily
9. **VITAMIN E**: 800–1200 IU orally, daily
10. **VITAMIN K**: 5–20 mg orally, daily
11. **IRON**: iron/vitamin C complex, 1 tablet daily before a meal, iron elixir (through a straw), or parenteral iron
12. **ZINC SULFATE**: 220 mg capsule, daily to every other day
13. **COPPER GLUCONATE**: 2 mg capsule, daily to every other day
Special Situations

- Pregnancy consideration
- Adolescents
- Eating disorder
- Binge Eating Disorder (BED)
- Depression
- Risk of suicide
- Addictive behavior
Summary

• Early diagnosis and treatment of small bowel obstruction (SBO) after gastric bypass (RYGB) is crucial to avoid the development of catastrophic complications

• A very common cause of SBO after RYGB is internal herniation

• Protein calorie malnutrition, vitamin and mineral deficiencies are common if not addressed appropriately

• Even modest amounts of alcohol can be deleterious in gastric bypass patients

• Pay attention to special situations