The Basics of Bariatric Surgery:
What RDNs need to know to serve this population

Amy Lockwood, MPH, RDN
Darlene Bellers, MS, RDN
Welcome!

- Objectives – Participants will be able to:
  - Distinguish between surgery types
    - RYGB, SG, AGB, VGB, BPD/DS
  - Understand eligibility requirements for surgery
  - Be introduced to the Michigan Bariatric Surgery Collaborative
  - Understand nutrition recommendations, including
    - Post-op diet progression
    - Protein needs
    - Vitamin/mineral recommendations
  - Learn about common nutrition complications for both:
    - Early post-op patients
    - Long-term patients
  - Become familiar with behavioral modifications for patient success
Benefits to Bariatric Surgery

- Rapid, sustained weight loss
- Nearly instantaneous improvement of blood glucose control
- Improvements in disordered sleep/sleep apnea
- Better blood pressure control
- Increased fertility/reversal of PCOS
- Improvement of joint diseases/osteoarthritis
- Improved asthma symptoms and obesity hypoventilation syndrome
- Reduction of medications
- Bottom line: *Improved quality of life!*
Surgery Types

- 5 most common surgeries:
  - Roux-en-Y Gastric Bypass (RYGB) – the gold standard
  - Sleeve Gastrectomy (SG)
  - Adjustable Gastric Banding (AGB)
  - Vertical Gastric Banding (VGB)
  - Biliopancreatic Diversion with Duodenal Switch (BPD/DS)

- 3 surgery types:

<table>
<thead>
<tr>
<th>Restrictive</th>
<th>Restrictive with Gastric Manipulation</th>
<th>Severe Malabsorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Adjustable Band</td>
<td>• RNY Gastric Bypass</td>
<td>• Biliopancreatic Diversion w/ Duodenal Switch</td>
</tr>
<tr>
<td>• Vertical Gastric Band</td>
<td>• Sleeve Gastrectomy</td>
<td></td>
</tr>
</tbody>
</table>
Surgery Types

- Restrictive - restricts total amount of food that can be eaten at one time

Adjustable Gastric Banding (AGB) (more prevalent)  
Vertical Gastric Banding (VGB) (less common)
Surgery Types

- Restrictive with Gastric Manipulation – causes some restriction and more profoundly affects secretion of gut hormones to decrease hunger and increase satiety.

Roux-en-Y Gastric Bypass (RYGB)  Sleeve Gastrectomy (SG)
Surgery Types

• Severe Malabsorption—results in significant intestinal malabsorption of protein, calories, and micronutrients

Biliopancreatic Diversion with Duodenal Switch (BPD/DS)

Fun Fact: the BPD/DS began as a 2-procedure operation. The 1st procedure, gastric manipulation, produced weight loss even before the 2nd procedure, diversion of the intestine, occurred. That 1st procedure is now called the “sleeve gastrectomy.”
## Surgery Types

### Pros and Cons to each

<table>
<thead>
<tr>
<th>Surgery</th>
<th>AGB &amp; VGB</th>
<th>SG</th>
<th>RYGB</th>
<th>BPD/DS</th>
</tr>
</thead>
</table>
| **Pros** | • Reversible  
• No malabsorption | • No hardware  
• Less technically complicated  
• Less malabsorption Dumping Syndrome  
• Good weight loss | • Reversible  
• Gold Standard (most researched)  
• Significant weight loss | • Best weight loss |
| **Cons** | • Hardware inserted causes complications  
• Low weight loss  
• Adjustments/fills needed (AGB) | • Non-reversible  
• Not ideal for those with uncontrolled acid reflux | • Malabsorption more likely  
• Greater risk of Dumping Syndrome  
• No NSAIDS after | • Non-reversible  
• Severe malabsorption  
• Technically difficult = high surgical risk |
| **Excess Body Weight Loss (EBWL)** | 20-30% EBWL | 55-65% EBWL (70-100 lbs.) | 65-75% EBWL (100-150 lbs.) | Greater than 80% EBWL |

**UofM offers:**

- 85%
- 15%
Eligibility Requirements

• In 1991, the National Institute of Health developed inclusion criteria, now used by insurance companies:
  ▫ BMI greater than 40
  ▫ or, BMI greater than 35 with 2 obesity-related comorbidities, such as diabetes, OSA, HTN, PCOS, etc.
  ▫ Failure of nonsurgical weight loss
  ▫ Absence of medical contraindications
  ▫ Well-informed, compliant, motivated patient

• Exclusion Criteria:
  ▫ Reversible endocrine disorders, current drug or alcohol abuse, severe uncontrolled psychiatric illness, pregnancy
Eligibility Requirements

What does “Failure of nonsurgical weight loss” mean?

- Patients need to prove they attempted weight loss
- Usually required to complete 3, 6, or 12 consecutive months of medically supervised weight loss documentation with an MD, typically their PCP
  - May be waived if BMI exceeds 50
  - 4 topics must be addressed in every visit:
    - Diet
    - Exercise
    - Behavioral interventions (food records, support groups, etc)
    - Pharmacotherapy
Michigan Bariatric Surgery Collaborative (MBSC)

• Research group that collects data on bariatric patients across the state of Michigan.
• 38 participating hospitals
• Funded by BCBS of Michigan
• Approximately 70K participants in database
# MBSC Outcomes Calculator

<table>
<thead>
<tr>
<th></th>
<th>SLEEVE GASTRECTOMY</th>
<th>RYGB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WEIGHT LOSS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEIGHT (LOST) AT YEAR 1</td>
<td>217 (83)</td>
<td>203 (97)</td>
</tr>
<tr>
<td><strong>COMORBIDITY RESOLUTION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NON-INSULIN DEPENDENT</td>
<td>81 %</td>
<td>86 %</td>
</tr>
<tr>
<td>HYPERCHOLESTEROLEMIA</td>
<td>59 %</td>
<td>77 %</td>
</tr>
<tr>
<td>SLEEP APNEA</td>
<td>70 %</td>
<td>78 %</td>
</tr>
<tr>
<td><strong>COMPLICATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANY</td>
<td>4.1 %</td>
<td>7.06 %</td>
</tr>
<tr>
<td>SEVERE</td>
<td>1.33 %</td>
<td>2.06 %</td>
</tr>
</tbody>
</table>
Nutrition Requirements

- **Pre-operative diet:** Generally a structured full-liquid VLC diet which uses protein shakes
  - Done to help reduce liver size, reduce abdominal adiposity, and help eliminate solids from the GI tract

- **Peri-operative diet (POD 1 & 2):** Clear liquids

- **Post-operative diet:** Staged advancements to help support easy digestion during the healing process
  - 4 stages
  - Length of stages vary based on procedure
Nutrition Requirements

- Post-Operative Diets:
  - Stage 1 – Clear Liquids, POD 1-2
  - Stage 2 – Full liquid diet with main source of calories derived from protein shakes/drinks; starts at discharge
  - Stage 3a – Pureed diet with main source of calories from protein shakes/drinks
  - Stage 3b – Soft food diet with fewer protein shakes/drinks needed
  - Stage 4 – Regular Bariatric Diet: low-fat, low-sugar, focused on protein, fruits/vegetables and no/very-limited grain-based carbohydrates.
## Diet Stage Timeline

<table>
<thead>
<tr>
<th>Surgery</th>
<th>AGB &amp; VGB</th>
<th>SG</th>
<th>RYGB &amp; BPD/DS</th>
<th>Food Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 2 - Full Liquid</td>
<td>POD 3 - 2 weeks</td>
<td>POD 3 - 2 weeks</td>
<td>POD 3 - 2 weeks</td>
<td>Shakes, thinned mashed potatoes, yogurt, fat-free strained cream soups</td>
</tr>
<tr>
<td>Stage 3a - Pureed</td>
<td>POD 14 - 2 weeks</td>
<td>POD 14 - 2 weeks</td>
<td>POD 14 - 4 weeks</td>
<td>Oatmeal, applesauce, eggs, pureed chili/soups, fat-free refried beans</td>
</tr>
<tr>
<td>Stage 3b - Soft Foods</td>
<td>2-4 weeks</td>
<td>4 weeks</td>
<td>2 weeks</td>
<td>Fish, moist-cooked meats, cooked vegetables, cubed cheese, baked potatoes</td>
</tr>
<tr>
<td>Inclusion of Raw Fruits/ Vegetables</td>
<td>4-6 weeks post-op</td>
<td>6 weeks post-op</td>
<td>6 weeks post-op</td>
<td>Leafy greens, all raw vegetables, all raw fruit</td>
</tr>
<tr>
<td>Stage 4 - Bariatric Regular</td>
<td>6-8 weeks post-op</td>
<td>After 8 weeks post-op</td>
<td>After 8 weeks post-op</td>
<td>Nuts, seeds, grilled or baked (dry-cooked) meats, fruit skins &amp; seeds</td>
</tr>
</tbody>
</table>
Protein Needs

• “Many programs encourage patients to consume **60 to 80g protein per day** or set a goal of 1 to 1.5g protein per kg ideal body weight.

• “…In the uncomplicated patient, the latter amount of protein likely exceeds the patient’s metabolic requirements and would likely limit the consumption of other important macronutrients due to volume restriction.

• “…RD should encourage patients to achieve a balanced diet.” (1)
## Vitamins & Minerals after Surgery

<table>
<thead>
<tr>
<th>Surgery</th>
<th>AGB &amp; VGB</th>
<th>SG</th>
<th>RYGB &amp; BPDDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin with Iron</td>
<td>1 daily</td>
<td>1 daily</td>
<td>2, BID</td>
</tr>
<tr>
<td>Calcium Citrate</td>
<td>Consider if diet is low in dairy</td>
<td>500-600mg BID, apart from MVI (iron)</td>
<td>500-600mg TID, apart from MVI (iron)</td>
</tr>
<tr>
<td>Sublingual Vitamin B12</td>
<td>Not needed</td>
<td>500 mcg daily</td>
<td>500 mcg daily</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>2000-3000 IU daily</td>
<td>2000 IU daily</td>
<td>2000 IU daily</td>
</tr>
<tr>
<td>Frequency of Supplements</td>
<td>Once</td>
<td>3 times</td>
<td>5 times</td>
</tr>
</tbody>
</table>
Vitamins & Minerals after Surgery

Multivitamin with Iron

• **Reasoning:**
  ▫ Patients with restrictive eating or malabsorption procedures should take additional vitamin/mineral supplementation as needs might not be met through diet alone.

• **Deficiency:**
  ▫ Monitor blood serum levels

• **Toxicity:**
  ▫ Patients should avoid “mega-dose” varieties of MVI
  ▫ Pregnant patients need to be cautious of excessive Vitamin A intake
Vitamins & Minerals after Surgery

**Calcium Citrate**

- **Reasoning:**
  - Reduced stomach acid greatly reduces absorption of dietary Ca.
  - Calcium Citrate does not require an acidic environment for absorption and can be taken regardless of meal time
  - 1,000-1,500mg/d divided into 2-3, 500mg doses for maximum absorption
  - Best to take doses 4 hours apart

- **Deficiency:**
  - Serum Calcium levels are unreliable to detect deficiency. Bone density scan needed.

- **Toxicity:**
  - If high serum levels occur, patient should cease until levels normalize.
Vitamins & Minerals after Surgery

Vitamin B12 (cobalamin)

• Reasoning:
  ▫ Low stomach acid and reduced production of Intrinsic Factor inhibits the absorption of dietary Vitamin B12.
  ▫ Recommended to take 500 mcg/day sublingually or 1000mcg intramuscular monthly injections

• Deficiency:
  ▫ Deficiency may not be evident for up to 2 years. Symptoms include weakness, shortness of breath, numbness/tingling, heart palpitations

• Toxicity:
  ▫ If high serum levels present, what to do? Stop supplementation for 1-2 months, or keep taking? No risk of toxicity.
  ▫ Check to make sure patient is using correct dose
Vitamins & Minerals after Surgery

**Vitamin D**

- **Reasoning:**
  - 2016 Micronutrient Update (2) states that 90% of pre-bariatric patients are deficient, and 100% of bariatric patients are deficient.
  - Total of 3,000 international units daily recommended
  - Subtract amount in Calcium Citrate to determine amount needed in single format

- **Deficiency:**
  - No symptoms. Serum levels must be monitored. Markers include low Vit D 25-OH, increased PTH, increased ALP, low serum phosphorous

- **Toxicity:**
  - No risk of toxicity unless taken in extreme amounts (50,000 IU daily)
Vitamins & Minerals after Surgery

**Single Format Iron**

- **Reasoning:**
  - After RYGB or BPD/DS, major sites of iron absorption are bypassed
  - 18mg/d for low-risk patients, generally iron in MVI is sufficient
  - 45-60mg/d total for high-risk populations including menstruating women

- **Deficiency:**
  - Iron-deficient anemia, presents as extreme fatigue, weakness, pale skin
  - Encourage addition of single format Vitamin C to aid absorption.
  - Important to separate Calcium intake (supplement or dietary) from Iron intake (or MVI w/ Iron) by a minimum of 2 hours.

- **Toxicity:**
  - Rare, patients encouraged to cease iron supplementation
## Vitamins & Minerals after Surgery

<table>
<thead>
<tr>
<th>Surgery</th>
<th>AGB &amp; VGB</th>
<th>SG</th>
<th>RYGB &amp; BPDDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multivitamin with Iron</td>
<td>1 daily</td>
<td>1 daily</td>
<td>2, BID</td>
</tr>
<tr>
<td>Calcium Citrate</td>
<td>Consider if diet is low in dairy</td>
<td>500-600mg BID, apart from MVI (iron)</td>
<td>500-600mg TID, apart from MVI (iron)</td>
</tr>
<tr>
<td>Sublingual Vitamin B12</td>
<td>Not needed</td>
<td>500 mcg daily</td>
<td>500 mcg daily</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>2000-3000 IU daily</td>
<td>2000 IU daily</td>
<td>2000 IU daily</td>
</tr>
<tr>
<td>Frequency of Supplements</td>
<td>Once</td>
<td>3 times</td>
<td>5 times</td>
</tr>
</tbody>
</table>
Biochemical Surveillance

- Labs to monitor following bariatric surgery:
  - Lipid Panel
  - Kidney Function
  - Liver Profile
  - CBC
  - Iron (serum iron, ferritin, TIBC)
  - Thiamin (B1) – only if vomiting present
  - Folate (RBC folate, serum folate)

- B-12 (serum B-12)
- Vitamin D, 25-OH
- Serum Calcium
- PTH – RYGB only
- Insulin – as needed
- TSH – as needed
- Hemoglobin A1C

*Baseline DXA to assess bone density, and repeat DXA recommended every 2 years after surgery, especially for peri- and post-menopausal women.
Early post-op Complications

- Medical complications:
  - Stricture, Leak, Wound Infection, Leg Cramps, DVT/PE

- Nutritional Complications:
  - Vomiting
    - Reduce diet to clear liquids, encourage fluids
      - Clear protein drinks are advantageous
    - RD should consult medical team
  - Nausea/Regurgitation
    - Problem-solve possible causes
    - Return to earlier diet stage if problem not identified
    - Refer to RN for prescription anti-nausea medication
Early post-op Complications

- **Nutritional Complications:**
  - **Dehydration**
    - #1 reason for ER visits post-operatively
    - Severe? Consult medical team or present to ER for IV fluids
    - Encourage electrolyte-rich, low-calorie beverages (Smart Water, Propel, Powerade Zero) or regular bouillon/broth
    - Prioritize fluids above all else
  - **Lactose Intolerance**
    - If severe, omit all milk-based until diarrhea subsides
    - Switch to lactose-free products or add lactase-enzyme tablets
    - Add water to protein or use clear fruity protein drinks
Early post-op Complications

• Nutritional Complications, continued:
  ▫ Constipation
    • The RD should assess frequency & consistency of BMs
    • Less frequent but soft and easy to pass = no concern
    • Hard consistency and difficult to pass = intervention needed:
      ▫ Okay to use stool softener, Miralax, Milk of Magnesia
      ▫ Avoid laxatives or colon stimulants
      ▫ Behavioral: Increase fluids, increase dietary fiber or add powdered fiber supplement, increase exercise as tolerated
  ▫ Diarrhea
    • RD should consider possible lactose-intolerance
    • Additionally, consider overuse of sugar alcohols
    • Drinking while eating? Food choices?
    • Encourage fluids to avoid dehydration

Look for Sugar-free options!
Early post-op Complications

• Nutritional Complications, continued:
  ▪ Dumping Syndrome (early & late stages)
    • More prevalent in RYGB, reported in 1/3 SG patients
    • Early dumping (RYGB only) occurs 10-30 minutes post-prandial. Results in nausea, weakness, rapid pulse, cold sweats, cramps, and diarrhea.
    • Late dumping (RYGB & SG) occurs 1-3 hours after meal. Results in reactive hypoglycemia symptoms
  • Prevention of Dumping Syndrome includes:
    ▫ Avoiding hypertonic solutions: juice, soda, frosting, concentrated sweets
    ▫ Limit food choices to less than 25 grams total sugar per serving/meal
    ▫ Avoid added sugars: sucrose, honey, HFCS
Early post-op Complications

- Nutritional Complications, continued:
  - Hair Loss/Shedding
    - Peaks around 3-6 months post-op
    - Patients who lose weight rapidly tend to shed more
    - No true preventative measures
      - RD should encourage adherence to vit/min and ensure protein needs are met
  - Food intolerances
    - Patient’s learn by trial and error
      - “it sits heavy,” “it get’s stuck,” “felt pressure in my chest”
    - Common ones: Beef/steak, eggs, raw leafy greens
    - Could be anything; intolerances are individual
Early post-op Complications

Nutritional Complications, continued:

- **Acid Reflux**
  - Avoid: carbonation & drinking with straws, spicy food, laying down for 2 hours after meal, foods too hot/cold
  - OTC medications may help, or prescription
  - Severe? Consult medical team, could indicate surgical complication

- **Dizziness, lightheadedness or headaches**
  - Increase fluid intake with electrolyte-rich beverages
  - Eat every 3-4 hours
  - Avoid concentrated sugars
  - Avoid drinking while eating

Possible Dumping Syndrome
Long-Term post-op Complications

- **Medical Complications:** Gallstones, muscle wasting, depression/psychiatric disorders, excess skin

- **Nutritional Complications**
  - **Protein Deficiency**
    - More likely with BPD/DS, uncommon in others
    - RD should assess dietary intake at every visit
      - Help patient prioritize protein, protein at every meal/snack
  
  - **Vitamin/Mineral Deficiency**
    - RD should monitor supplement intake at every visit, specifically timing of intake & dosages
    - Single format vit/min can be added to typical routine
    - Routine biochemical surveillance necessary
Long-Term post-op Complications

• Nutritional Complications
  ▫ Hair loss beyond 1-yr post op
    • Evaluate for deficiencies in protein, iron, zinc, selenium, biotin, essential fatty acids
  ▫ Reactive Hypoglycemia
    • Occurs 1-4 hours post-prandial in response to higher carbohydrate meal
      ▫ Symptoms: Perspiration, palpitations, hunger, weakness, syncope
      ▫ Treatment: Pair protein & fiber at meals/snacks, eat small frequent meals, avoid refined carbohydrates
Long-Term post-op Complications

• Nutritional Complications
  ▫ Weight Regain
    • Research from MBSC shows that patients typically regain 10-15% of loss between years 2 & 3 post-op
    • RD should evaluate behaviors at 2 year post-op visit
    • Why? Many reasons:
      ▫ Metabolism adapts to lower calorie intake
      ▫ Old behaviors creep back in
      ▫ Cravings return
      ▫ Lack of consistency with exercise
  ▫ Disordered Eating related to fear of Regain
Behavioral Modifications

• Prioritize protein
  ▫ Protein at every meal and snack
  ▫ Eat protein foods first, then fruits/vegetables, then anything else
  ▫ Spread protein throughout day
    • No more than 30 grams at any meal
• Avoid grain-based food items, especially bread, pasta, rice
  ▫ Filler foods that can cause pain/discomfort
• 4-6 small meals or snacks, No Grazing
  ▫ Greater than 7 eating occasions per day considered grazing
  ▫ In one study, 72% of patients who grazed regained weight compared to 11.7% without grazing habits (3)
Behavioral Modifications

- Separate fluids from foods by 30 minutes
  - Flushing foods through stomach too fast can lead to diarrhea
  - Causes hunger to come on sooner
  - Can cause discomfort, nausea, regurgitation

- Avoid carbonation & straws
  - These exacerbate acid reflux

- Avoid alcohol
  - Greater risk if alcoholism following bariatric surgery
  - Addiction transference happens
Behavioral Modifications

• Chew foods thoroughly & eat slowly
• Avoid overeating
• Avoid foods not well tolerated
  ▫ High-fat, high-sugar items
  ▫ Bread, Pasta, Rice and flour-based items
  ▫ Personal intolerances
• Limit caffeine
• Exercise!
  ▫ Cardio for calorie burn
  ▫ Strength training to prevent muscle wasting
Special Considerations

- Post-op patients who have:
  - Type 1 Diabetes
  - CKD and end-stage renal disease, on dialysis
  - Renal transplants
  - Kidney stones

- Pregnancy

- Cases that require a second surgery
  - Reversals (AGB/VGB, RYGB)
  - Revisions (any)
  - Conversions (SG → RYGB)
Questions?

Thank you!

Amy Lockwood, MPH, RDN - alockwoo@umich.edu
Darlene Bellers, MS, RDN - mdarlene@umich.edu
References:


