Nutritional deficiencies & vitamins after surgery. What needs to be monitored?

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Disclosures

- No financial disclosures
- Medical Director Bariatric program at Lourdes
Types of Surgery

- **Restrictive:**
  1. Gastric Banding.
  2. Sleeve gastrectomy.
  3. Gastric plication
  4. Gastric balloons.

- **Restriction and Malabsorption:**
  2. Biliopancreatic diversion.
  3. Duodenal switch.
Restriction & Malabsorption

**Mini gastric bypass**
- Single anastomosis

**Roux-en-Y gastric bypass**
- Esophagus
- Bypassed portion of stomach
- Proximal pouch of stomach
- "Short" intestinal Roux limb
- Upper anastomosis
- Pylorus
- Lower anastomosis
- Duodenum
 Restriction & Malabsorption

Original BPD

Modified with DS
Restrictive

Vertical Sleeve Gastrectomy

Intragastic Balloon: 2 Types

Type 1: Single Balloon
Type 2: Dual-Balloon

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Restrictive

Gastric Plication

Gastric Band
Optimizing postoperative patient outcomes and nutritional status begins pre-operatively.

Patients should be educated before and after weight loss surgery (WLS) on the expected nutrient deficiencies.

Screening is important because it is common for patients who present for WLS to have at least 1 vitamin or mineral deficiency preoperatively.

The role of the RD continues to be a vital component of the process.

All patients pursuing WLS undergo a preoperative clinical nutrition evaluation by an RD.

RD evaluation

- RD evaluation is necessary:
  1. to identify preoperative nutritional deficiencies
  2. To evaluate a patient’s ability to incorporate nutritional changes before and after WLS

- This should incorporate a systematic 4-step nutrition care process.
  1. nutrition assessment,
  2. diagnosis,
  3. intervention, and
  4. monitoring and evaluation

Is screening important?

- Even though surgery can exacerbate preexisting nutrient deficiencies, preoperative screening for vitamin deficiencies has not been the norm for the majority of WLS practices.

- Screening is important because it is common for patients presenting for WLS to have at least 1 vitamin or mineral deficiency preoperatively.

When does deficiencies happen: pre or post surgery
Recommendation formulation & grading

- Each recommendation has a corresponding graded level of evidence:
  - **Grade A**: Strong
  - **Grade B**: Intermediate
  - **Grade C**: Weak
  - **Grade D**: No evidence
## Pre-WLS Screening Recommendations

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommendation</th>
<th>Rationale &amp; prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiamine</td>
<td>Routine for all pts. Grade C</td>
<td>Prevalence pre-op reported as high as 29%</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Routine. Grade B. Serum MMA.</td>
<td>6-18% with obesity, 6-30% when on PPI</td>
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<tr>
<td>Folic acid</td>
<td>Routine. Grade B.</td>
<td>As high as 54% in pts with obesity.</td>
</tr>
<tr>
<td>Iron</td>
<td>Routine. Grade B. Screening based on symptoms. Serum iron, ferritin, TIBC. Grade B</td>
<td>As high as 45% in pts with obesity.</td>
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<tr>
<td>Vitamin D &amp; Calcium</td>
<td>Routine, Grade A.</td>
<td>Vit D def. as high as 90% with obesity.</td>
</tr>
<tr>
<td>Fat-soluble vitamins (A, E, K)</td>
<td>Grade C.</td>
<td>Preop: Vit A 14%, Vit E 2.2%, no data on Vit K.</td>
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<tr>
<td>Zinc</td>
<td>Before RYGB or BPD-DS</td>
<td>Prevalence 24% in WLS samples. 74% in pts seeking BPD-DS.</td>
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<tr>
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<td>Grade D. Repletion</td>
<td></td>
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<tr>
<td></td>
<td>indicated when signs &amp;</td>
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<tr>
<td></td>
<td>symptoms are evident.</td>
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<tr>
<td></td>
<td>and zinc assays are</td>
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</tr>
<tr>
<td></td>
<td>severely low.</td>
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<tr>
<td>Copper</td>
<td>Before RYGB or BPD-DS</td>
<td>As high as 70% in pre-BPD women.</td>
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<tr>
<td></td>
<td>Grade D. Erythrocyte</td>
<td></td>
</tr>
<tr>
<td></td>
<td>superoxide dismutase is</td>
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<td>the preferred assay &amp;</td>
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<td>precise when available &amp;</td>
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<td>affordable.</td>
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</table>
Correlation between BMI and peak serum vitamin D2 (ergocalciferol) concentrations in the control (•) and obese (□) groups after oral intake of vitamin D2 (50000 IU, 1.25 mg).
Vitamin D and Obesity

- As vitamin D is fat soluble and is readily stored in adipose tissue, it could be sequestered in the larger body pool of fat of obese individuals.

- >50% decreased bioavailability of cutaneously synthesized vitamin D$_3$ in the obese subjects could account for the consistent observation, that obesity is associated with vitamin D deficiency.

- Oral vitamin D should be able to correct the vitamin D deficiency associated with obesity, but larger than usual doses may be required for very obese patients.
### Thiamine

**Early**: Dry beriberi (without edema): brisk tendon reflexes, peripheral neuropathy polyneuritis, muscle weakness/or pain, gait ataxia, convulsions  
Wet beriberi: heart failure with high cardiac output, edema, tachycardia or bradycardia, lactic acidosis, dyspnea, hypertrophy and dilation of right ventricle, resp. distress, venous HTN, bounding arterial pulsations  
GI: slow gastric emptying, jejunal dilation or megacolon, constipation  
**Advanced**: Wernicke’s encephalopathy: polyneuropathy, ataxia, ophthalmoplegia, nystagmus, confabulation, short-term memory loss  
If psychosis and/or hallucinations present, Korsakoff psychosis and/or Wernicke-Korsakoff syndrome

### B12

**Early**: Pernicious anemia (due to absence of intrinsic factor)/ Meagloblastic anemia: pale with slightly icteric skin & eyes glossitis (magenta or “beefy red”), fatigue, anorexia, diarrhea paresthesia (prickly feeling), ataxia, demyelination and axonal degeneration, especially of peripheral nerves, spinal cord, and cerebrum, vertigo, tinnitus, palpitations.  
**Advanced**: Angina or symptoms of CHF, Altered mental status ranging from mild irritability and forgetfulness to severe dementia or frank psychosis
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<th><strong>Folate</strong></th>
<th>changes in pigmentation or ulceration of skin, nails, or oral mucosa</th>
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<td><strong>Iron</strong></td>
<td>Fatigue, Microcytic anemia, Decreased immune function, enteropathy, Glossitis, dysphagia, koilonychias, vertical ridges on nails, palpitations</td>
</tr>
<tr>
<td><strong>Vit D.</strong></td>
<td>Hypocalcemia, tetany, tingling, cramping, Metabolic bone disease, rachitic tetany</td>
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TELL ME AGAIN THAT WEIGHT-LOSS SURGERY IS THE EASY WAY OUT...
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<td>Thiamine</td>
<td>High risk groups : Gr B Females, blacks, pts not having F/U, CHF on lasix, GI symptoms.</td>
<td>Prevalence ranges from 1% to 49% and varies by type of WLS and post-WLS timeframe.</td>
<td>increases with: malnutrition, excessive and/or rapid weight loss, excessive alcohol use</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Grade B. Frequent in first yr, then annually or as clinically indicated for patients who chronically use: metformin, colchicine, PPI, seizure meds</td>
<td>Prevalence at 2–5 yrs &lt;20% in RYGB and 4–20% in SG.</td>
<td>Can occur due to food intolerances or restricted intake of protein and B12-containing foods.</td>
</tr>
<tr>
<td>Folate</td>
<td>Grade B: mainly women in childbearing age</td>
<td>Prevalence up to 65%</td>
<td>Nonadherence with multivitamin will contribute to folate deficiency</td>
</tr>
<tr>
<td>Iron</td>
<td>Within 3 mo, then every 3–6 mo, until 12 mo, and annually for all pts</td>
<td>3mo to 10 yr: AGB 14%, SG 18%, RYGB 20–55%, BPD 13–62%, DS 8–50</td>
<td>can occur after any WLS</td>
</tr>
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# Post WLS screening recommendations

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<tr>
<td>Vit D &amp; calcium</td>
<td>Grade B. Research is on to find vitamin D binding assays as additional tool.</td>
<td>100%</td>
<td>25(OH)D preferred assay.</td>
</tr>
<tr>
<td>Vit A,E &amp; K</td>
<td>First year for BPD/DS: Gr B In RYGB if there is protein-cal. Malnutrition.</td>
<td>70% in 4 yrs in BPD-DS, possible RYGB. E &amp;K Def. unlikely.</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>RYGB &amp; BPD/DS atleast annually Grade C. when the patient is symptomatic for iron deficiency anemia but screening for iron neg.</td>
<td>70% post-BPD/DS; 40% post-RYGB; 19% post-SG; 34% post-AGB.</td>
<td>Def.is possible, even if taking zinc supplements especially if primary sites of absorption (duodenum &amp; proximal jejunum) are bypassed</td>
</tr>
<tr>
<td>Copper</td>
<td>Grade C.</td>
<td>90% post-BPD/DS, 10–20% post-RYGB.</td>
<td></td>
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</table>
Supplement recommendations post surgery

**Thiamine**
- All pts should receive at least 12 mg daily – Grade C
- and preferable 50 mg daily from a B-complex supplement or MVI once or twice daily- Grade D

**Vitamin B12**
- All pts should receive supplementation- Grade B
- Varies based on route of administration
  1. Orally by disintegrating tablet, sublingual, or liquid: 350–500 mg daily
  2. Nasal spray as directed by manufacturer
  3. Parenteral (IM or SQ): 1000 mg monthly
Folic acid

- Should take 400–800 mg oral folate daily from their multivitamin- Grade B
- Women of childbearing age should take 800–1000 mg oral folate daily- Grade B.

Iron

- Low risk -males and patients without history of anemia should receive at least 18 mg of iron from MVI- Grade C.
- Menstruating females and patients who have undergone RYGB, SG, or BPD/DS should take at least 45–60 mg of elemental iron daily cumulatively- Grade C.
Vitamin D & Calcium

- All pts should take calcium supplementation - Grade C
- Dose of daily calcium from all sources varies by procedure: BPD/DS: 1800–2400 mg/d LAGB, SG, RYGB: 1200–1500 mg/d.
- Recommended preventative dose of vitamin D is based on serum levels: vitamin D3 dose is 3000 IU daily, until blood levels of 25(OH)D are greater than sufficient (30 ng/mL)- Grade D.
- A 70–90% lower vitamin D3 bolus dose is needed (compared to vitamin D2) to achieve the same effects as those produced in healthy non-bariatric surgical patients-Grade A.

To enhance calcium absorption - Grade C

- Calcium should be given in divided doses.
- Calcium carbonate should be taken with meals.
- Calcium citrate may be taken with or without meals.
**Vitamins A, E, and K**

- **LAGB**: Vitamin A 5000 IU/d and vitamin K 90–120 ug/d Grade C.
- **RYGB and SG**: Vitamin A 5000–10,000 IU/d and vitamin K 90–120 ug/d- Grade D.
- **LAGB, SG, RYGB, BPD/DS**: Vitamin E 15 mg/d-Grade D.
- **DS**: Vitamin A (10,000 IU/d) and vitamin K (300 mg/d) Grade B.
- Special attention should be paid to supplementation of vitamin A and K in pregnant women-Grade D.

**Zinc**

- Grade C.
- **BPD/DS**: MVI with minerals containing 200% of the RDA (16–22 mg/d)
- **RYGB**: MVI with minerals containing 100–200% of the RDA (8–22 mg/d)
- **SG/LAGB**: MVI with minerals containing 100% of the RDA (8–11 mg/d)
Copper

- Grade C.
- BPD/DS or RYGB: 200% of the RDA (2 mg/d) SG or LAGB: 100% of the RDA (1 mg/d)
- Copper gluconate or sulfate is the recommended source of copper for supplementation.
Current follow up in our program

Follow the Grade A and B recommendations.

- Vitamin D
- Serum iron, ferritin, TIBC
- Thiamine
- Vitamin B12
- Folic acid.

- These labs are checked preoperatively,
- After surgery: 6 months, 1 year and yearly after.
Questions?