

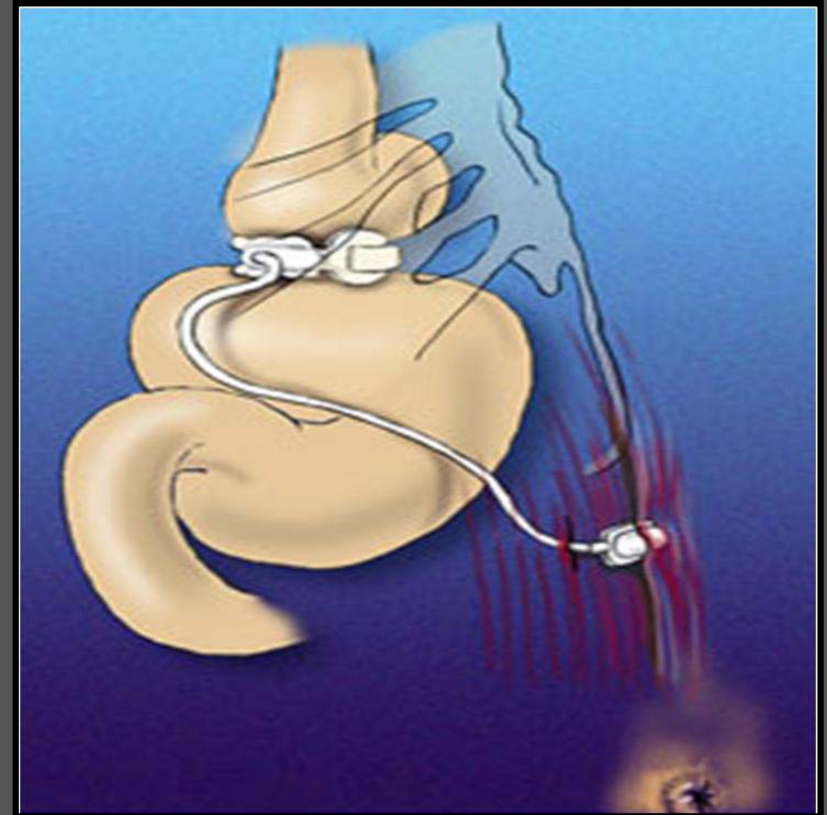
Monitoring the Blood: *Vitamins and Minerals*



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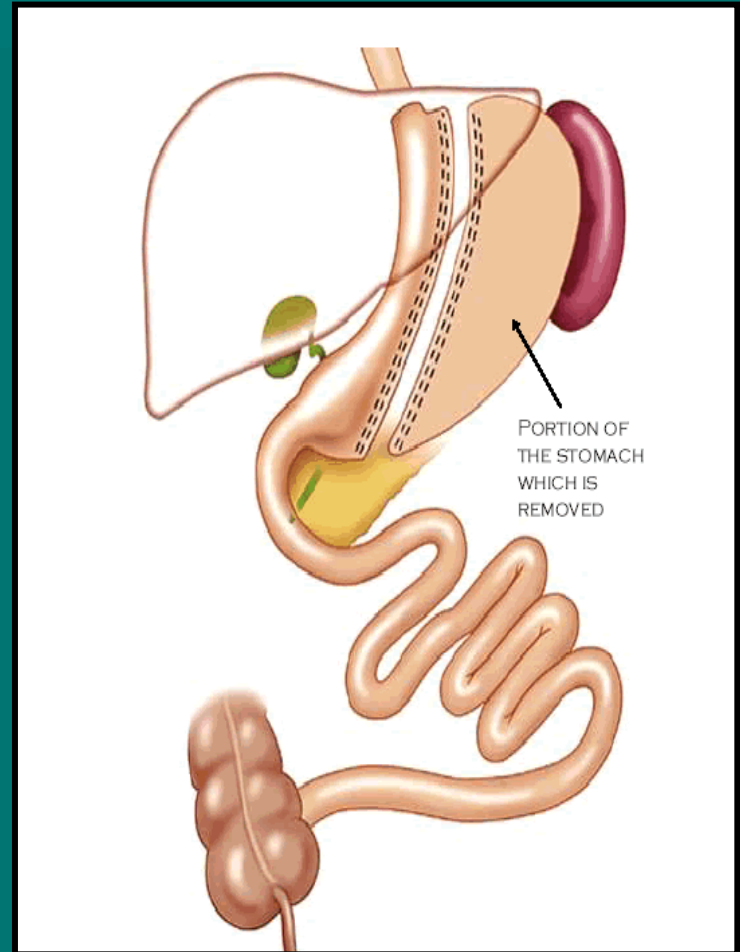
Gastric Banding

- Solely Restrictive Procedure – No malabsorptive elements
- Malnutrition tends to arise from poor dietary intake – particularly consumption of 'melting' foods
- Persistent vomiting can implicate Thiamine deficiency



Sleeve Gastrectomy

- Restrictive Procedure
- However, vitamin B12 implicated due to reduced gastric acid and intrinsic factor
- Vomiting and Thiamine
- Quality of intake implicating factor



Roux-en-Y Gastric Bypass

- Restrictive and Malabsorptive Procedure
- Nutrients absorbed in duodenum particularly indicated
 - Iron
 - Calcium
 - Vitamin D
 - Folate
- Poor dietary quality exacerbates malabsorptive element
- Lack of Intrinsic factor and gastric acid



Checking Bloods after RYGB

1st year – every 3-6m. Annual after this



- Full blood count
- Urea & Electrolytes
- B12 and Folate
- Iron Studies – Ferritin
- Liver Function Tests
- Bone Profile inc. Ca
- Vitamin D + PTH
- Lipid Profile
- Albumin
- Add if required:
 - Zinc
 - Selenium
 - Vitamin B1
 - BPD / DS – EFA's / Fat Soluble Vitamins
 - Magnesium

Iron Deficiency Anaemia



- Iron def common after RYGB, BPD, DS
- Affects 50% RYGB patients – Menorrhagic women ++
- **Causes:**
 - Decreased Intake – difficult textures
 - Decreased liberation (bypass stomach acid) and absorption (duodenum and upper jejunum)
 - Competition with Calcium (also supplemented). 300-600mg has direct dose-related inhibition on Iron absorption.
- **Prevention:**
 - Prophylactic Iron supplementation – 40-65mg/day elemental Iron
- **Management:**
 - Ferrous fumarate, sulfate, or gluconate
 - Up to 150–300 mg elemental iron daily
 - Add vitamin C and folic acid
 - Severe = Intravenous Iron infusion. Monitor due to anaphylactic risk

Fe Def Anaemia Case Study

- 23 yr old female
- History of
 - Obesity – BMI 60.4 kg m sq
 - Anaemia – Gastroscopy NAD apart from HH
 - haemoglobin of 11.5 with a MCV of 68.4. Haematocrit (0.36), MCH (22.1) low as well.
 - PCOS, Type 2 DM
- Pre-operative high iron advice provided
- Uncomplicated RYGB
- 3/12 post – presented with Menorrhagia – 8 week intervals with 1 week break
- 6/12 post op: Hb dropped to 9HB 9.6, MCV 73.4, Hct 0.30, MCH 23.2, Ferritin 3.1
- 7/12 post op – normal colonoscopy

- Anaemia continued despite 30ml Liquid iron (270mg elemental iron)
- 11/12 post op –
 - Ferritin 1.5ug/L* (ref 15-200ug/L)
 - Vitamin B12 162ng/L* (ref: 170-900)
 - Hb 8.7* (ref: 11.5-16.5)
 - MCV 67.5* (ref: 78-98)
- 1 year post-op – Iron transfusion carried out in day treatment centre
 - Max dose per infusion is 20mg/kg (based on IBW).
 - IBW of 72kg = max dose of cosmofer infused in 1 dose for each Hb target:

12: 1100mg
12.5: 1150mg
13: 1250mg
13.5: 1300mg
14: 1400mg

- So far, anaemia resolved.....

NOTE!



“Nutritional Anaemias resulting from Malabsorptive procedures might involve deficiencies in protein, copper, and selenium, necessitating evaluation of these nutrients when routine screening for iron, B12, and folic acid deficiencies is negative”

AACE/TOS/ASMBS
Guidelines 2009

Vitamin D

- High incidence in pre-op (40-68.1%) and post-op (50-63%) patients
 - decreased bioavailability fat soluble vitamins
 - enhanced uptake and clearance by adipose tissue
 - negative feedback control on hepatic synthesis vitamin D

- **Prevention**
 - 400-800IU/day cholecalciferol / ergocalciferol
- **Treatment**
 - 50,000 units 1-3 times per week of ergocalciferol orally or intramuscularly for 8 weeks.
 - **Severe = 50,000-150,000 IU / day**
 - **7.5mg Ergocalciferol (300,000u) once only**
- Mild to moderate hypophosphatemia (1.5–2.5 mg/dl), usually due to vitamin D deficiency can be treated with oral phosphate supplementation



Calcium

- Post-op loss of BMD
- Deficiency in 25-48% at 4 years (malabsorptive procedure)
- **Causes:**
 - Decrease in intake of calcium rich foods
 - Bypass of duodenum and proximal jejunum where calcium preferentially absorbed
 - Malabsorption of Vitamin D
- Difficult to monitor as serum levels often normal
- **Prevention**
 - 1,200-2000mg/day Calcium citrate (absorbed without gastric acid). Otherwise take with meal
- **Treatment**
 - DEXA at baseline and 2 years / fractures
 - Calcium and vitamin D supplementation
 - Check PTH – replace if appropriate
 - Consider biphosphonates



Vitamin B12 Deficiency

- **Incidence:**
 - 30% RYGB after 1 yr if only receiving multivitamin
 - 5–29% Pre-operative
- **Causes:**
 - Bypassing lower portion of stomach
 - Decreased digestion of protein-bound cobalamins
 - Impaired formation of intrinsic factor
- **Implications:**
 - Anaemia
 - Neuropathy
- **Prevention:**
 - $\geq 350\mu\text{g/day}$ orally
 - 1000 μg intramuscularly x4 /yr
- **Treatment**
 - If above unsuccessful, can use 1000 μg / month.



ZINC

- Plasma Zn represents $<0.1\%$ whole body Zn – poor biomarker
- Incidence – 10-50% BPD/DS
- **Causes**
 - Diarrhoea as risk factor – Zn lost in Faeces
 - Absorption occurs in proximal duodenum
- **Clinical Manifestations**
 - Immune disorders and susceptibility to infections, Anorexia, lethargy, diarrhoea Alopecia, dermatitis, paronychia, Impaired wound healing
- **Prevention**
 - Not supplemented as prevention as known to cause copper def.
 - Copper deficiency anaemia often treated with Iron = Organ Damage
 - Advise high dietary Zn sources
- **Treatment**
 - Solvazinc 45mg tds

Thiamine (Vitamin B1)

■ Causes:

- Duodenal Absorption and Protracted vomiting

■ Clinical Manifestations:

- Peripheral - Beri-Beri – weakness, ataxia, numbness, elevation of RBC transketolase
- Central - Wernicke's Encephalopathy – memory loss, confusion, paralysis, coma, death

■ Prevention:

- Daily multivitamin preparation containing thiamine

■ Treatment:

- Persistent vomiting after *any* bariatric procedure = aggressive supplementation; intravenous glucose provided as aggravates thiamine deficiency
- Presentation of neurologic symptoms = aggressive parenteral supplementation with 100 mg/day, administered for 7–14 days
- Subsequent oral thiamine (100 mg/day) continued until symptoms resolve

Folate

- 10–35% after RYGB and BPD or BPD/DS
- Clinical Manifestations:
 - Megaloblastic Anaemia
 - Peripheral neuropathy and neuropsychiatric disorders
 - Thrombocytopenia
 - Neural Tube defects
 - Glossitis
- Prevention:
 - Complete multivitamin and mineral should contain folate.
Aim for 800–1,000 $\mu\text{g}/\text{day}$ of folate
- Treatment:
 - Folic Acid 5mg od for 4 months

Rare Nutrient Deficiencies

- Selenium
- Copper
- Magnesium
- Vitamin A, E, K

Rare nutrient deficiency: Case Study

- 32yr old female
 - Morbid Obesity (BMI – 51 kg/m sq)
 - Renal failure with haemodialysis
 - PCOS, IGT, HT, CHOL
- Uncomplicated RYGB - 80cm limb lengths

- 3 months post-op, numbness over left hand - ?neuropraxia
- 6 months – A+E weakness and numbness in legs
- Next day, admitted to Renal Hosp. Unable to stand from numbness, ataxia + bilateral leg weakness
- Ceruloplasmin (0.1gm/L)(ref = 0.2-0.5 gm/L) and copper (6.9 umol/L)(ref 11-22umol/L)
- Also showed low vitamin A, D, Iron and Folate (mild)
- Copper supplements provided during haemodialysis with IV Additrace, resulting in her serum copper concentrations returning to normal.
- It took 8 weeks to walk unaided and a degree of weakness persists.

Final Note

- Compliance, Compliance, Compliance
- External Data suggests only 30-35% compliance with vitamin Supplementation
- Anecdotally, compliance variable despite education.
- Supplements often stopped when weight loss stops.
- Reinforces need for life-long follow up

Thank you for Listening

AACE/TOS/ASMBS Guidelines (2009)