Micronutrients and Gastric Bypass

256,000 bariatric surgeries were performed in the U.S., 17.8% were RYGB. It is well established that these patients are at high risk for micronutrient deficiency and many patients are noncompliant with recommended vitamin and mineral supplementation. Updated clinical guidelines were published 2019 regarding specific recommendations for assessing, testing and supplementing micronutrients.

Bariatric surgery is recognized as the most effective treatment for severe obesity. In 2019, an estimated

Routine supplementation guideline;

B12- oral 350-1000 mcg daily or IM- 1000 mcg per month.

Vitamin D- 3000 IU daily until serum 25(OH)-vitamin D is >30 ng/ml

Calcium- 1200-1500 mg calcium daily in divided doses

Thiamine- 12 mg daily

Iron- menstruating females; 45-60 mg daily of elemental iron, includes what is in MVI, take in divided doses and separate from calcium, acid reducing medications

Common signs of Deficiency;

B12- Megaloblastic anemia, numbness, ataxia, ams, dementia, paralysis

B6- Seborrheic dermatitis, glossitis, cheilitis, peripheral neuropathy

B2- Angular and lip cheilitis, glossitis, nasolabial dermatitis, peripheral neuropathy

B3- Pellegra, weakness, 4d's, dermatitis, dementia, diarrhea, death

Vitamin C- scurvy, perifollicular hemorrhages, ecchymosis, bleeding gums

B1- Ataxia, confusion, nystagmus, weakness to LE

Vitamin D- Osteopenia, osteoporosis, muscle weakness, tetany

Vitamin A- Night blindness, Bitots spots, poor wound healing

Vitamin E- Spinocellular ataxia, peripheral neuropathy, impaired immune response, gait disturbance

Copper- Peripheral neuropathy, myelopathy, ataxia, neutropenia

Zinc- Alopecia, change in taste, white spots on nails, diarrhea

Iron- Microcytic anemia, spoon-shaped nails

Lab Assessment and Repletion

B12 *

Lab- Serum B12 or MMA (Methylmalonic acid) sometimes serum will be normal but B12 in tissue is depleted.

Repletion: 1000 mcg/day until normal serum B12 is achieved, then return to normal supplementation.

B-6 *

Lab- Plasma, erythrocyte or urinary pyridoxal-5-phosphate.

Repletion: 100 mg pyridoxine daily or 25-600 mg daily depending on severity of sx. Consider IV supplementation for severe symptoms (ie seizures). **Caution with high dose supplementation long term, a toxic dose is defined as 1000 mcg/day and is associated w/sensory neuropathy.**

B-2 (order under miscellaneous-vitb2)

Lab- Erythrocyte glutathione reductase activity coefficient (EGRAC). Should be performed after a 12 hour fast.

Repletion; 10-60 mg oral daily. **Caution w/high dose supplementation (>100mg/day), may lead to damage to the ocular lens proteins in retina.**

B-3 (order under miscellaneous –vitb3)

Lab- Urinary N1-methylniconatinamide and N1-methyl-2-pyridone-5-carboxamide

Repletion; 250-500 mg oral nicotinamide daily, 500 mg nicotinic acid daily or 100-300 mg subq in 3 doses for pellagra.

Vitamin C (order under miscellaneous-vit c)

Lab- Serum or leukocyte vitamin c, treat if deficiency suspected.

Repletion; 1-2 gms vitamin C daily for 2-3 days, followed by 500 mg daily for 1 week, followed by 100 mg daily for 1-3 months.

B-1 (don't check, just give supplement)

Lab- Thiamine pyrophosphate (TPP), from whole blood. Treat if deficiency suspected and do not need to wait in lab value.

Repletion; 100-500 mg 2-3 x per day.

Vitamin D *

Lab- 25(OH)-vitamin D

Repletion; 3000-6000 IU Vitamin D3 daily or 50,000 IU for Vitamin D2 1-3 x week.

Vitamin A (order under miscellaneous vit a)

Lab- Plasma retinol and carotenoid

Repletion: Without corneal changes- 10,000-25,000 IU daily orally. With corneal changes- 50,000 to 100,00 IU IM for 3 days followed by 50,000 IU daily for 2 weeks. **Toxicity can occur w/long term use or with a single dose of >660,000 IU.**

Vitamin E (order under miscellaneous vit e)

Lab- Serum alpha-tocopherol when serum lipids are normal.

Repletion; 100-400 IU daily. **Optimal dose not clearly defined.**

Copper *

Lab- Serum copper or ceruloplasmin

Repletion; Dose is based on severity of symptoms; 3-8 mg/day oral or 2-4 mg/day IV. If symptoms persist; 8 mg oral x 1 week, 6 mg oral for the next week, 4 mg oral the third week, 2 mg thereafter.

Zinc

Lab- Plasma or serum level

Repletion; 2-3 mg/kg day of elemental zinc. IV-7-10 mg daily.

Iron *

Lab- serum iron, TIBC, transferrin

Repletion; 100-200 mg elemental iron up to 300 mg 2-3 times per day. Add a source of Vitamin C to improve absorption. Consider taking a single dose 2 times per day.

Case Study

A 60 y.o. man was admitted to the hospital for g-tube placement into his remnant stomach 14 months after Roux-en-Y gastric bypass (RYGB) d/t persistent poor intake, weakness and an approximate 200 lb wt loss. His diet hx indicates he consumes <500 calories per day and 20 grams of protein and was non adherent to his vitamin and mineral regimen. Since surgery, he has become wheel chair bound because of lower extremity weakness, ataxia, neuropathy and regular falls. Prior to gastric bypass, he walked independently except on uneven surfaces to which he required a cane. Several micronutrient deficiencies are suspected including Vitamin B12, copper, Vitamin E, thiamine, Vitamin B6 and niacin.

This patient's serum copper level was found to be low at 57 mcg/dl (normal 75-145 mcg/dl). The pt was anemic but not neutropenic. He was treated w/ 2 mg/day of oral copper gluconate. He also received 0.5 mg of copper in the mvi and 1.92 mg in his tube feeding for a total of 4.42 mg/d of copper. Copper levels returned to normal 1.5 months after supplementation began. In addition, the patient did not experience any more falls after Cu initiation and TF. His ambulation improved, but remains wheel chair dependent outside of home. Cu levels continued to rise, and supplementation was discontinued after 7 months. Levels were checked regularly every 3 months.

Test

1. True or False;
   Patients who undergo bariatric surgery are at high risk for nutritional deficiency d/t the nature of the surgery and because of non-compliance with vitamin and mineral supplementation.

2. A patient that has had bariatric surgery and now has night blindness could be suspected as having a deficiency in
   a. **Vitamin A**
   b. **Vitamin B12**
   c. **Vitamin C**
   d. **Iron**

3. True or False;
   When replenishing vitamins and minerals for a known deficiency, you should take into account how much of the nutrient is in the MVI they are taking and any other form of nutrition they are receiving such as enteral tube feeding and TPN.

4. True or False;
   Sometimes it may take many months to replenish vitamin and mineral deficiencies.

Bariatric surgery is recognized as the most effective treatment for severe obesity. In 2019, an estimated 256,000 bariatric surgeries were performed in the U.S., 17.8% were RYGB. It is well established that these patients are at high risk for micronutrient deficiency and many patients are noncompliant with recommended vitamin and mineral supplementation. Updated clinical guidelines were published 2019 regarding specific recommendations for assessing, testing and supplementing micronutrients.

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