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Clinical Quiz

Hylonome

Development of osteomalacic myopathy in a morbidly obese woman following bariatric surgery

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Case

We report a case of a 55 year-old morbidly obese woman 150 kg (BMI 56) who underwent a biliopancreatic diversion (BPD) surgery in April 2008. Her past medical history includes hypothyroidism, diabetes mellitus and hypertension. BPD consists of a distal gastrectomy, a 250 cm alimentary channel, and a 50 cm common channel. Digestion and absorption of macronutrients and micronutrients are limited mostly to this 50-cm "common channel". Lipid status and glycemic control are improved in patients with dyslipidemia and diabetes following BPD. However, BPD may be associated with a variety of nutrient deficiencies and metabolic derangements, such as iron deficiency, anemia, deficiencies of the fat-soluble vitamins (A, D, E, K), and metabolic bone disease[1,2].

After BPD, the patient lost 65 kg (BMI 31) but exhibited deterioration of her general condition with back pain, progressive leg weakness, diffuse musculoskeletal pain and peripheral neuropathy associated with severe difficulty in climbing stairs and standing up from a sitting position.

On clinical examination (twelve months after BPD) she was unable to rise from a chair without assistance. She needed to push off with both hands in order to stand from a chair and she had a broad-based "waddling" gait. Her daily activities were compromised by severe weakness and musculoskeletal pain. Because of the diffuse and severe musculoskeletal pain the patient was under analgesics and nonsteroidal anti-inflammatory drugs at a daily basis.

Osteomalacic myopathy was diagnosed on the basis of her biochemical profile (increased ALP levels, hypocalcemia, hypophosphatemia, undetectable 25OHD, increased iPTH level) which was attributed to severe malabsorption after BPD. Femoral and lumbar-spine BMD were consistent with osteoporosis. T-score of lumbar spine BMD was -3.6 and of total hip -3.8 (Hologic QDR-4000).

The patient was treated with 400.000 IU ergocalciferol intramuscularly every month for 2 consecutive months. She also received dietary calcium supplementation (1,5 grams), cholecalciferol (1200 iu) and oral multivitamin supplements daily.

	Prior therapy	4 months later	Normal range
Ca	8.4 mg/dl	8.6 mg/dl	8.5-10.3
P	2.2 mg/dl	2.5 mg/dl	2.7-4.5
Mg	2.4 mg/dl	2.5 mg/dl	1,5-2,6
Creatinine	0.51 mg/dl	0.7 mg/dl	0,6-1,4
ALP	456 U/L	339 U/L	39-117
Osteocalcin	51 ng/ml	111.3 ng/ml	15-46
25(OH)D	9.1 ng/dl	10.3 ng/dl	30-46,5
PTH	182.2 pg/ml	178 pg/ml	10-65.2
Tot. protein	7.3 g/dl	7.34 g/dl	6,4-8,7
Serum albumin	4.1 g/dl	4.17 g/dl	3,0-5,0
Fe	83 μg/dl	79,3 μg/dl	37-145
Ferritin	166 ng/ml	68 ng/ml	22-322
Folic acid	6.7 ng/ml		3,0-17,0
Vit. B1	64 μg/l		28-85
Vit. B6	11.8 μg/l		8,7-27,2
Vit. B_{12}	779 ng/dl		225-1000
Ca urine 24h	32 mg/24h	112 mg/24h	100-300
P urine 24h	789 mg/24h	1316 mg/24h	350-1400
Creatinine urine 24h	837 mg/24h	1045 mg/24h	800-1800

Table 1. Biochemical tests prior and after treatment.

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Laboratory tests		Supplement	
1. CBC, RBC, platelets	6. Albumin and prealbumin	Multivitamin	1-2 daily
2. Glucose, Electrolytes	7. Vitamin B_{12}, folate	Calcium citrate with vitamin D	1200-2000 mg/d 400-800 U/d
3. Lipid profile	8. Fat-soluble vitamins (A,D,E,K)	Folic acid	400 μg/d in multivitamin
4. Iron studies, ferritin	9. Metabolic bone evaluation: Intact PTH, 24-hour urine calcium, Urine N-telopeptide	Elemental iron	40-65 mg/d
5. Liver function	10. Renal stone evaluation: ferritin 24-Hour urine calcium, citrate, uric acid and oxalate	Vitamin B_{12}	350 μg/d orally or 1000 g/mo i.m or 3000 μg every 6 mo i.m

Table 2. Recommended laboratory tests* (during the 1st year every 3 months, thereafter every 3-6 months depending on symptoms) and routine nutrient supplementation after malabsorptive bariatric surgical procedures[5].

The patient's muscle strength improved gradually within the next weeks. Four months later, a follow-up examination demonstrated significant improvement in strength and muscle bulk and functional abilities. She presented a notable improvement of musculoskeletal pain resulting in cessation of analgesics and non-steroidal anti-inflammatory drugs. Her serum calcium levels returned to normal whereas phosphate levels were still low. PTH and ALP levels were still mildly elevated (Table 1).

Commentary

Gastric bypass surgery procedures are a common practice for the treatment of morbid obesity. Metabolic bone disease is a well-documented long-term complication of obesity surgery. It is often undiagnosed, or misdiagnosed, because of lack of physician and patient awareness. Abnormalities in calcium and vitamin D metabolism begin shortly after gastrointestinal bypass operations; metabolic bone disease includes osteoporosis, osteomalacia, and secondary hyperparathyroidism. Secondary hyperparathyroidism, often precedes osteoporosis and osteomalacia[3].

The physiopathology of bone loss after bariatric surgery remains unclear. Several reports showed that obesity is associated with increased bone load at weight-bearing sites. The reduction in body weight may decrease the bone load and help to explain the decrease in BMD, especially at the location of the hip. Calcium and vitamin D malabsorption may also contribute to the increase in bone remodeling. Increased bone turnover seems to appear early after surgery, with peak turnover occurring in the first year, especially after procedures resulting in malabsorption[3,4].

In patients with BPD, bone density measurements with use of dual-energy x-ray absorptiometry may be indicated to monitor the development or presence of osteoporosis at baseline. In addition, a follow-up study at about 2 years, is in accordance with the recommendations from the International Society for Clinical Densitometry[4].

Patients who undergo bariatric surgery are at risk for long-term vitamin and mineral deficiencies and may develop a variety of neurological symptoms. Rapid weight loss, recurrent vomiting, and inadequate supplementation of key nutrients predispose to development of neurologic complications. The early complications of confusion or peripheral neuropathy may be due to deficiency of thiamine. The later complications are attributed to the involvement of the spinal cord and/or the peripheral nerves. This may be due to the deficiency of vitamin B_{12} or copper. Vitamin B_{12} deficiency can also affect the peripheral nerves without spinal cord involvement[2].

Long-term follow-up is necessary in all bariatric patients. They require laboratory tests to evaluate CBC, platelets, electrolytes, glucose, iron, ferritin, vitamin B_{12}, liver function, lipid profile, albumin, prealbumin, fat-soluble vitamins A, D, E, K, intact PTH, urine N-telopeptide, 24-hour urine calcium, citrate, uric acid and oxalate[5] (Table 2).

In patients who underwent a bariatric surgery, treatment with orally administered calcium, ergocalciferol or cholecalciferol is indicated to prevent or minimize secondary hyperparathyroidism. In cases of severe vitamin D malabsorption, oral doses of vitamin D_2 or D_3 may need to be as high as 50,000 to 150,000 IU daily, while more recalcitrant cases may require concurrent oral administration of calcitriol. All bariatric surgery patients should be provided with an oral multivitamin supplement that contains thiamine and folic acid (400 μg/d). Orally administered ferrous sulfate, fumarate, or gluconate (320 mg twice a day) may be needed to prevent iron deficiency in patients who have undergone a malabsorptive bariatric surgical procedure, especially in menstruating women. Parenteral supplementation with either 1000 μg of vitamin B_{12} monthly or 1000 to 3000 μg every 6 to 12 months is necessary if vitamin B_{12} sufficiency cannot be maintained by means of oral supplementation[5] (Table 2).

This case illustrates the importance of adequate follow-up for patients who have undergone these procedures. ALP, 25OHD and PTH levels need to be regularly monitored and there needs to be a low threshold for investigating any symptoms that may indicate bone pain. The risk of other fat-soluble vitamin and/or essential fatty acid deficiencies is also high. Protein levels need to be monitored closely especially during the phase of rapid weight loss.

Patients electing to have this form of bariatric surgical procedure should to be consulted for the regular need of a broad range of vitamin, mineral and possibly macronutrient supplementation, along with a careful nutritional monitoring. A thorough history and physical examination, a high index of clinical suspicion, and careful long-term follow-up, with specific laboratory testing, are needed to detect early metabolic bone disease in these patients.

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Questions

1. What is the most common complication in a patient following a biliopancreatic diversion (BPD) surgery

A. Hypercalciuria
B. Hypophosphatemia
C. Secondary hyperparathyroidism

Critique

The biliopancreatic diversion is associated with severe malabsorption of fat soluble vitamins, calcium, iron and protein. Urine calcium levels are expected very low. Hypophosphatemia isn't a very frequent complication, but if present, it is mainly due to the development of secondary hyperparathyroidism and less common due to malabsorption. Given the significant degree of malabsorption particularly of vitamin D and calcium in biliopancreatic diversion surgery, secondary hyperparathyroidism is the most frequent complication.
The correct answer is C.

2. Which is the most affidabile biochemical examination for the diagnosis of the osteomalacia?

A. Measurement of serum alkaline phosphatase levels
B. Vitamin D deficiency
C. N-telopeptide

Critique

Measurement of the bone resorption marker N-telopeptide is not specific for the diagnosis of the osteomalacia. 25OHD is important for its diagnosis but only very low levels (<8 ng/ml) are associated with a high incidence of osteomalacia. Alkaline phosphatase is the best single routine biochemical screening test for osteomalacia, being elevated in 80-90% of cases.
The correct answer is A.