50 F with history of duodenal switch presenting for low BMD

Rajesh Jain MD
Endorama
HPI

• 50 F presenting with low BMD referred by PCP
• She has a history of malnutrition following duodenal switch procedure five years earlier
• Peak weight: 411 LB, current weight: 158 LB
• Previous fractures: Toe fracture (years ago)
• ROS: +Generalized muscle and joint pains
Extended History

**PMH:** Learning disability, morbid obesity

**Past surgical history:** Staged duodenal switch procedure
1. 6 years prior: Sleeve gastrectomy at BMI 70
2. 1.5 years after initial surgery: had weight loss of about 100 LB but plateaued, BMI at that time 51.7. Underwent duodenal switch procedure

“common channel”
Extended History

**PMH**: Learning disability, morbid obesity

**Past surgical history**: Staged duodenal switch procedure

6 years prior: Sleeve gastrectomy at BMI 70

-1.5 years after initial surgery, she had weight loss of about 100 LB but plateaued, BMI at that time 51.7. Underwent duodenal switch procedure

- Multiple vitamin deficiencies post-operatively, thought to be at least partially adherence related (learning disability & financial)

**Family history**: Negative for osteoporosis, breast cancer in mother, lung cancer in father

**Social history**: Quit smoking many years ago. Does not drink. She did graduate high school – special education. She lives with her parents. On disability due to cognitive impairment

**Medications**: Vitamin D 50,000 IU BID gel cap, iron, multivitamin, zinc, vitamin A, vitamin K, Allegra, Prilosec, selenium
Physical Exam

Vitals: Height 61 inches, Weight 158 LB (BMI 29.9), BP 114/62, HR 96
General: No distress
HEENT: Poor dentition, missing teeth. Thyroid exam, nodule on the left about 2 cm. Normal consistency of thyroid gland
Lungs: CTAB
CV: tachycardic, regular rhythm
Abd: Soft, non-tender.
Extremities: No edema
Skin: Pigmentations on the abdomen
Neuropsych: Decreased cognitive function
MSK: Unstable, antalgic gait
Initial BMD

L1-L4: BMD 0.632 g/cm², T-score -4.6, Z-score -5.1
Total hip: BMD 0.284 g/cm², T-score -5.7, Z-score -6.4
Bone loss after bariatric surgery

- Multiple etiologies: weight loss itself, vitamin D deficiency, calcium malabsorption, secondary hyperparathyroidism
- Vitamin D deficiency is common both before and after bariatric surgery
- Even with optimal vitamin D intake (>30 ng/mL), calcium absorption is significantly affected after surgery
  - One study of 33 patients after Roux-En-Y showed intestinal calcium absorption decreased from 32.7% pre-operatively to 6.9% post-operatively despite adequate 25-OH vitamin D. There were simultaneous increases in bone turnover markers

Extent of weight loss and bone loss

Longer follow up

![Graph showing BMD to 3 years Post-Op](image)

**Fig. 1.** BMD to 3 years Post-Op

What about fractures?

- One U.K. study looked at 2,079 patients and matched them to controls & followed them for mean 2.2 years
- Overall no significantly increased risk of fracture compared to controls (8.8 vs 8.2 per 1000 person years)
- However, in patients who were followed for 3-5 years, there was a trend towards increased fracture risk

Adjusted for age, sex, BMI, history of fracture, IBD, CVA, hx of falls, glucocorticoid use, calcium or vitamin D supplements, antiobesity drugs, anti hypertensive drugs, loop diuretics, organic nitrates, anxiolytics or hypnotics, bisphosphonates, opioids, PPIs.

With longer term follow up

- Study of 258 patients from Minnesota with mean BMI of 49 followed for median 7.7 years after surgery
- Most patients had undergone Roux-en-Y
- RR fracture was 2.3-fold compared to expected

Labs (1 month later)
Around the same time...

- Patient complaining of back pain x 2 weeks (no clear trauma) to PCP and underwent X-rays.
Around the same time...

- Patient complaining of back pain x 2 weeks (no clear trauma) to PCP and underwent X-rays

**Acute appearing non-displaced fractures of the right third and seventh ribs**

**Healing/healed nondisplaced fractures of multiple lower ribs**

Demineralized bones, which may indicate osteoporosis/osteopenia
Labs (1 month later)

25-OH Vitamin D 6
PTH 425
TSH 1.33
FT4 1.03
Pre-albumin 8
Vitamin A 10.6 (32.5-78)
Vitamin E 4.3 (5.5-17)

Diagnosis?
Osteomalacia

• Patients can present with diffuse bone and joint pain, muscle weakness, and difficulty walking
• Fractures may occur with little or no trauma, typically involving the ribs, vertebrae, and long bones
• Alkaline phosphatase usually elevated, PTH elevated
  • In one study of histologically confirmed osteomalacia and controls, elevated alkaline phosphatase had a 14% false negative and 8% false positive rate.
  • Our patient had consistently normal alkaline phosphatase – likely related to other nutritional deficiencies (particularly zinc, which is known to lower alkaline phosphatase and of which our patient had a chronic deficiency)
• Can occur from Vitamin D deficiency or resistance, as well as phosphate wasting syndromes

Absorption

**FIG. 1.** Serum 25OHD levels are unchanged despite a marked increase in vitamin D intake after RYGB. *, Change from preoperative baseline at $P < 0.05$.

Fig. 2. Annual percentage normal and low serum.

Vitamin D formulations
Vitamin D after malabsorptive bariatric surgery

- Gel caps with oil or coated pills may be poorly absorbed in patients after malabsorptive bariatric surgery
- Dry powders, liquid, or chewables may be better absorbed, but no trials looking at this issue
  - U.S. guidelines recommend 3000 units daily initially in the early post-operative periods
- Patches may be options to bypass the GI tract but can be expensive over time. E.g. $20 or more per month with no insurance coverage

Patient course continued...

- Patient’s course complicated by financial difficulties (various forms of vitamin D are not covered by insurance) and difficulty with adherence (related to learning disability)
  - Mixing up different formulations of Vitamin D/Calcium so taking the wrong dose
  - Being unable to afford the Vitamin D (pills, patch)
  - Running out of her medications
  - Being told to mix dry vitamin D with apple sauce, running out of apple sauce, and then not realizing she can mix the dry vitamin D with other things
Patient course

- Follows up routinely, last visit in October 2015
- No further clinical fractures
- Current meds: Vitamin D 50,000 IU dry powder daily, Citracal chewables [calcium 250 mg each] TID (less than recommended), Centrum Silver daily [Calcium 500 mg]
BMD - 2015

**Height / Weight:** 60.7 in. 167.6 lbs.
**Sex / Ethnic:** Female Black

**Measured:**
- Date: 07/30/2015 9:20:06 AM
- Value: (13.50)

**Analyzed:**
- Date: 07/30/2015 9:21:57 AM
- Value: (13.50)

**Densitometry Ref: L1-L4 (BMD)**
- **BMD (g/cm²):**
  - L1: 0.556
  - L2: 0.595
  - L3: 0.522
  - L4: 0.635
  - L1-L4: 0.574
- **T-score:**
  - L1: -4.8
  - L2: -5.0
  - L3: -5.6
  - L4: -4.7
  - L1-L4: -5.1

**Trend: L1-L4 (BMD)**
- **%Change vs Baseline:**
  - L1: -2.2
  - L2: -8.5
  - L3: -8.5
  - L4: -8.5

**Trend: L1-L4**
- **Measured Date:**
  - 07/30/2015 54.3 0.574 -2.2
  - 06/20/2013 52.2 0.627 -0.4
  - 05/26/2011 50.2 0.632 baseline

**Comments:**
Reversal of surgery?

- Reversal of malabsorptive part of her surgery was recommended but she declined
- “I have had numerous and extensive prior discussions with her regarding her nutrition and specifically my recommendation that she undergo revision of her malabsorptive component of her duodenal switch and did so again today. Unfortunately, she continues to adamantly refuse to do so, as she is terrified of weight regain. I spent 20 minutes explaining the rationale for revision and the fact that her sleeve would remain undisturbed and would still provide her with a weight loss tool.” – Surgery attending
Reversal of Malabsorptive Surgery

- Malabsorption is related to the length of the common channel (shorter channel is associated with greater deficiencies)
- Our patient had a 100 cm common channel, which is a common length, with shorter length (e.g. 75 cm) showing higher rates of secondary hyperparathyroidism in 165 patients (38.9% versus 14.9%) compared to 100 cm
- In one large Portuguese series of 1,423 patients who had undergone duodenal switch, rate of revision due to malnutrition was 0.7% and total reversal was 0.2%

Clinical course

- Over the past 6 months or so, patient now is getting the dry vitamin D automatically sent to her home
- Last 25-OH Vitamin D level in November was 16
- Change in management?
An aside: what about GLP-1s?

- GLP-1s appear to reduce bone loss in the setting of weight loss

Screening

<table>
<thead>
<tr>
<th>Randomization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liraglutide 1.2 mg/d N=19</td>
</tr>
<tr>
<td>Control N=18</td>
</tr>
</tbody>
</table>

Very low calorie diet
Mean 12.1 kg loss

Weight Loss Phase 8 weeks
Weight maintenance Phase 52 weeks

- Total body BMD and bone turnover markers (CTX-1, P1NP, osteocalcin, BSAP) assessed at screening, randomization, and after 52 weeks

Iepsen et al. GLP-1 receptor agonist treatment increases bone formation and prevent bone loss in weight-reduced obese women. JCEM 2015;100:2909-17.
No significant difference in total body BMD, though BMC decrease was lower in the liraglutide group.

Higher P1NP (bone formation marker) in the liraglutide group.

Exact mechanisms of GLP-1 agonists on bone are unclear.
• Any final thoughts?
References

• Fleischer et al. Decline in hip bone density after gastric bypass surgery is associated with extent of weight loss. JCEM 2008; 93:3735-3740.
• Iepsen et al. GLP-1 receptor agonist treatment increases bone formation and prevent bone loss in weight-reduced obese women. JCEM 2015;100:2909-17.