



# A Case of a Pre-Adolescent Female with a Triad of Bone Diseases

Cynthia Gordner, MSN, RN<sup>1</sup>, M. Rose D’Arcangelo, MD<sup>1, 2</sup>

Penn State Hershey Medical Center<sup>1</sup>, Penn State University College of Medicine<sup>2</sup>

## Demographics

12-year, 8-month old Caucasian female

## Clinical Presentation

CM initially presented to the endocrinology clinic at age 10 years 3 months for evaluation for possible Cushing’s disease. She was referred from the orthopedic clinic for endocrine evaluation of 6-months history of back pain, vertebral compression fractures, and osteoporosis. Spine x-rays and MRI indicated severe osteopenia. Compression deformities were present in the lower thoracic vertebrae with more than 75% loss of vertebral height. Compression deformities were also present in the lumbar spine with greater than 50% loss of vertebral body height. There is nearly complete loss of height in T12. She is obese, with excessive thoracic kyphosis and mild thoracolumbar kyphosis.

## Past History

- Product of fraternal twin gestation, with birth weight of 5 pounds 11 ounces
- Previous fractures of clavicle and finger
- Central obesity with BMI 26.6 kg/m<sup>2</sup> (>97%)
- Minimal dairy intake, does not take vitamins
- Participates in age-appropriate activities
- The twin is unaffected, and has a lean body build
- Unilateral hearing loss

## References

1. Bowden, S.A., Robinson, R.F., Carr, R., & Mahan, J.D. (2008). Prevalence of vitamin D deficiency and insufficiency in children with osteopenia or osteoporosis referred to a pediatric metabolic bone clinic. *Pediatrics*, 121(6), e1585-e1590. doi: 10.1542/peds.2007-2011
2. Hogler, W. & Shaw, N. (2010). Childhood growth hormone deficiency, bone density, structures and fractures: Scrutinizing the evidence. *Clinical endocrinology*, 72, 281-289.
3. Osteogenesis Imperfecta Foundation. (2012). Types of OI. Retrieved from [http://www.oif.org/site/PageServer?pagename=AOI\\_Types](http://www.oif.org/site/PageServer?pagename=AOI_Types)
4. Vertebral compression fracture. Retrieved from <http://www.joelgarrismd.com/vcf-overview.html>

## Evaluation

### Growth parameters:

- 135 cm (10-25 %ile)
- 48.4 kg (75-90%ile)

### Physical exam:

- buffalo hump on upper back
- no abdominal striae
- Tanner 1 development

### Laboratory assessment:

- IGF-1 171 (117-771 ng/mL)
- 25-hydroxyvitamin D 20 ng/mL
- alkaline phosphatase 216 (80-240 units/L)
- Thyroid function studies normal
- Parathyroid hormone normal
- AM cortisol 19.0 (2.9-19.4 µg/mL)
- Urinary free cortisol 10.3 (1.0-45.0 µg/24 hrs)
- Growth hormone<sub>max</sub> (GH) with arginine and insulin 0.8 ng/mL

### Radiologic assessment:

- Bone age 11 years 10 months
- DEXA scan -3.2 in right hip, and -3.6 in left hip and spine
- Pituitary MRI normal with small pineal cyst

### Genetic testing

- Collagen mutation COL1A2 consistent with osteogenesis imperfecta (OI) type IV

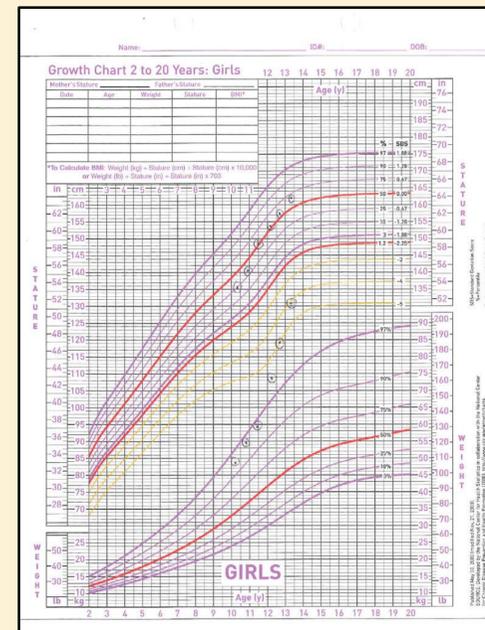
## Interventions

### Vitamin D supplementation

- 2000 IU/day

### Growth hormone therapy

- Initiated at dose of 0.3 mg/kg/week
- Significant improvement in BMD: -2.3 in both hips and spine after two years of therapy (35% improvement)
- Complete reconstitution of compressed vertebrae after two years



Vertebral compression fracture (4)

## Discussion

The differential diagnoses for this patient include: Cushing’s disease, skeletal dysplasia, idiopathic juvenile osteoporosis, vitamin D deficiency, OI, and growth hormone deficiency (GHD). CM was diagnosed with severe GHD, OI, and vitamin D deficiency as contributing factors for her osteoporosis.

Both OI and GHD can contribute to loss of bone integrity, resulting in osteopenia or osteoporosis. Structurally deficient collagen contributes to the bone fragility in OI type IV, which may lead to long bone and vertebral compression fractures (3). Vitamin D insufficiency is a common occurrence in children with osteopenia or osteoporosis caused by primary or secondary bone disease (1).

Consideration of the use of bisphosphonates was given dependent upon the effectiveness of GH therapy. As improvement was noted with GH and vitamin D supplementation, the use of bisphosphonates was not implemented. GH is a potent anabolic agent, with the ability to maximize muscle and bone mass (2). In the case of CM, GH was sufficient to facilitate complete reconstitution of the vertebral compression fractures, with resolution of back pain, and minimization of fractures.