Bone Health in Children: Guidelines for Vitamin D and Calcium Intake

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The evil men do lives after them, the good is often interred with their bones.
—William Shakespeare

Learning Objectives:
1. Review vitamin D metabolism, specifically as it relates to calcium homeostasis
2. Discuss recommendations regarding vitamin D and calcium intake by the American Academy of Pediatrics (AAP) and the Institute of Medicine (IOM)
3. Identify situations in which screening for vitamin D deficiency is necessary
4. Understand the implications and controversies surrounding vitamin D deficiency and its treatment

Primary References:

CASE ONE:

Mindy Vita is a 2-month-old infant who is coming in for a well visit on a cold winter day. This adorable infant is breastfeeding well, but her mother hasn’t yet given the multivitamins you prescribed at the two week visit.

1. What is the metabolism of vitamin D, and what are its effects on bone growth?

2. What are the recommendations for vitamin D intake for healthy children?

CASE TWO:

The next patient on your schedule is Ricky Otts, a 9-month-old male whom you sent for admission for several days of coughing and wheezing; you were concerned because he had had multiple episodes of bronchiolitis and had recently not gained weight for several months, leading to a weight at less than the 5th percentile for age. During the admission, a chest radiograph showed normal heart size with several areas of atelectasis. The radiologist noted that the proximal humerus had a widened metaphysis, with cupped, hazy and indistinct edges. His biochemical evaluation in the hospital revealed a serum calcium of 7.0 mg/dl, phosphorus of 3.4 mg/dl, alkaline phosphatase activity of 750 U/L, a PTH of 65 nIEq/ml (moderately elevated), and a 25-OHD of 12 ng/ml. Due to the history of failure to thrive, and multiple respiratory infections, a sweat test was ordered. The sweat test results were >60 meq/L, indicating the likely diagnosis of cystic fibrosis, which predisposed Ricky to vitamin D deficiency due to malabsorption of fat soluble vitamins.
3. What signs and symptoms would make you suspect vitamin D deficiency? What other risk factors besides CF might predispose Ricky to nutritional vitamin D deficiency?

4. Identify situations in which measurement of markers of bone health is useful. What testing should be performed?

5. How is vitamin D deficiency defined? What levels necessitate therapy?

CASE THREE:

Still in your office, you see Noah Dairy, a 16-year-old who was recently treated in the Emergency Department for a wrist fracture and has come for follow-up. He tells you that he fell on the ice in his driveway. Looking in his chart, you note that he has had 2 other fractures over the last 2 years; he fractured his right arm after wrestling with his brother and fractured his left tibia after he was tripped by another player while playing soccer. On further review of systems, he tells you he used to get stomachaches after eating pizza. He thought he was lactose intolerant and so has been avoiding dairy products for the last 3 years. He does not take any vitamin or mineral supplements. Biochemical evaluation reveals a serum Ca of 9.1 mg/dl, phosphorus of 3.1 mg/dl, a PTH of 28 nEq/ml (10-25) and a 25-OHD of 17 ng/ml.

6. How would you advise this patient regarding his lactose intolerance with respect to his dietary calcium intake?

CASE continued:

Noah’s father is concerned about all these fractures. He asks, “My mother was told by her doctor that she has osteoporosis, and was told to have a DXA scan to evaluate her bone density, should Noah should have one too?”
7. What is the utility of DXA scans in children? Are there any precautions to interpretation?

CASE continued:

Noah’s mom has heard that vitamin D can prevent autoimmune diseases like type 1 diabetes, multiple sclerosis, and cancer. She wants to know if she should give Noah extra vitamin D to prevent these diseases.

8. What is the relationship between vitamin D and health, other than that related to bone and calcium?

Additional References:


Resources:
1. Links to handouts and guidelines regarding vitamin D from the AAP: http://www.aap.org/healthtopics/vitamind.cfm
3. Link to Bone Mineral Density in Childhood Study (BMDCS) and height-adjusted BMD Z-score calculator: https://www.nichd.nih.gov/research/supported/bmdcs

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