A few days ago, I toured the rapidly-completing Golisano Children’s Hospital with one of the construction superintendents. Having spent years looking at floor plans and paint chips, I still was not prepared for what I saw in reality. The building is absolutely magnificent. The patient rooms are huge, and the public spaces are large, yet warm and inviting. The “treehouse,” of course, is the crowning glory of the hospital. Standing in the chapel/meditation space, I could look all the way to Onondaga Lake. Having a child hospitalized with a serious illness can never be a positive experience, but our new hospital and the programs we have planned for it will go a long way toward minimizing the impact of hospitalization on children and families.

There are two highlights to the current issue of KidStuff. Dr. Irene Sills provides a very comprehensive update on the use of bone density measurements in children. This is an area of great current interest, as skeletal integrity can be impaired in a wide variety of chronic conditions. Unfortunately, bone density measurements performed in centers without pediatric bone specialists can be misleading. Irene has received formal training in the interpretation of bone density studies, and along with the pediatric nephrologists makes up a core group of faculty with expertise in this important area. Please call us with any questions about this.

Brad Olson also introduces a new initiative for community education. The department has recently produced a series of superb online lectures, keyed to the Pediatric Online Curriculum. Thomas R. Welch, MD

Professor and Chair
Department of Pediatrics

Volume 8, No. 1 January 2009

Calendar

Pediatric Grand Rounds

WEDNESDAYS, 9:15 TO 10:30 A.M., ROOM 6500, UNIVERSITY HOSPITAL, SYRACUSE

JANUARY 21

Ajay Kraul, MBBS, MD, Department of Pediatrics, Division of Pediatric Gastroenterology and Nutrition, Cincinnati Children’s Hospital Medical Center

JANUARY 28

Wanda Fremont, MD, Department of Psychiatry, SUNY Upstate Medical University, College of Medicine

FEBRUARY 4

Success by Six speaker

FEBRUARY 11 TBA

FEBRUARY 18 TBA

FEBRUARY 25 TBA

MARCH 4

Roberta Moro, MD, Fellow, Division of Pediatric Infectious Disease, Department of Pediatrics, SUNY Upstate Medical University College of Medicine

MARCH 11

Frederick Roberts, MD, Clinical Professor Emeritus, Department of Pediatrics, SUNY Upstate Medical University College of Medicine

MARCH 18 TBA

MARCH 25

Theresa A. Nicklas, DrPh, Professor of Pediatrics, USDA/ARS Children’s Nutrition Research Center at Baylor College of Medicine, Department of Pediatrics

Questions? Comments? Contact Thomas Welch MD, Department of Pediatrics, 315-464-5451 or welcht@upstate.edu

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www.upstate.edu/peds/
Bone Densitometry Scanning in Children and Adolescents

The dilemma: A 13-year-old girl presents to you with her third fracture in three years, a recent forearm fracture sustained during a fall while playing basketball. Her first fracture was a wrist fracture which occurred when she was ice skating and tripped. The second fracture was a stress fracture in her foot detected after weeks of running long distances with her father. Her parents want her to have a bone densitometry scan (DXA) performed to see if she has osteoporosis. What do you recommend?

What is a DXA scan?

DXA scanning is the use of dual energy x-ray absorptiometry to determine the density of bone. It is a widely available technology and uses remarkably low doses of radiation which make it an attractive option for studying bone health. There are normative data for children. The areas scanned in children are the spine and total body less the head. The scan should be read in children based upon the Z-score (age adjusted score) and not a T-score (used for adults over 21 years). Low bone mineral density in children is defined as a Z-score of less than -2.

The diagnosis of osteoporosis in children should never be made on the basis of Z-score alone. The child should also have a clinically significant history of fractures: long bone fracture of the lower extremity, vertebral compression fracture, or two or more long bone fractures in the upper extremity.

Why is interpretation difficult in a child or adolescent?

The major limitation to DXA scanning is that it measures the density in an area (grams/cm2) of bone and is not a volumetric measurement. A shorter than average child of a particular age will have a lower Z-score even if the bone is normally mineralized. In the figure below you can see how two similarly dense bones will calculate out to have a lower density when area is measured and not volume.

Pubertal steroids increase bone density. Teens with constitutionally delayed puberty will have lower Z-scores because they have not yet started puberty. However, they may have perfectly healthy bones. Alternatively, teens with pathologic causes for delayed puberty, i.e. anorexia nervosa or inflammatory bowel disease, may have truly low bone mineral density even when adjusted for the pubertal delay.

What causes low bone mineral density in a child?

Some children have low bone mineral density due to primary bone disorders (osteogenesis imperfecta), chronic diseases that impair bone health (cancer, cystic fibrosis, celiac disease), immobilization, endocrine disorders (Turner syndrome, growth hormone deficiency, hyperthyroidism, hyperparathyroidism), or the use of bone “toxic” drugs (glucocorticoids and immune modulators). However, in the otherwise healthy child, vitamin D deficiency and inadequate calcium intake are often the culprits. The American Academy of Pediatrics is currently recommending that all children take 400 units of vitamin D daily.

What is not known about DXA scans in children and adolescents?

It is not known what bone mineral density is associated with the risk for fracture in children and adults. Studies are on-going, but it is not currently possible to determine a risk of bone fracture based upon Z-score in youth in the same manner that it is possible to assess risk of fracture in postmenopausal women who have DXA scans.

So, what is the “bottom line”? When is a DXA scan recommended in children?

There are no evidence-based recommendations at the current time. However, there is some expert opinion. DXA scanning is indicated in children with a history of fragility fractures. Providers who care for adults are familiar with the term “fragility fracture.” It refers to a fracture that occurs without the expected amount of force. Examples include vertebral compression and femoral neck fractures without trauma. Low-impact fractures of the forearm, ankle, or finger are considered fragility fractures, but such determinations depend upon accurate histories. In pediatrics, we have accepted the adult definition and are more concerned about low bone mineral density in children with fragility fractures. There is no accepted minimal number of “appropriate impact” fractures that should prompt a provider to suggest a DXA scan be done. Fractures are not uncommon in healthy, growing children. However, more than two episodes of fracture in the recent past may be a consideration for further investigation.

DXA scanning is indicated in children with the chronic illnesses and conditions listed above and for those who have taken medications that predispose them to poor bone mineralization.

Before ordering a DXA scan, providers must consider if the results of the DXA scanning will change the patient’s management. For instance, if steroid-type medications for asthma treatment are potentially causing bone demineralization, some thought may be given to alternate therapies. If a family is resistant to giving a child vitamin D, evidence of bone demineralization may motivate compliance.

Back to our patient… Do you order the DXA scan?

I want more information to include dietary habits, height, pubertal onset and progression, and prior medications she may have taken. Her long bone fractures are not fragility fractures, but I am concerned about the stress fracture in her foot being a “low impact” fracture depending upon the distances she has run. I would check her levels of 25 hydroxyvitamin D, calcium, alkaline phosphatase, phosphorous, intact PTH. I would also check liver function tests, kidney function tests and a CBC. I would obtain calcium-to-creatinine ratio in her urine and even ask her to collect a 24 hour urine calcium and creatinine. I would screen her for celiac disease.

Because she has had three fractures in three years, I would order a DXA scan. I would be sure that the bone densitometry scan is interpreted taking into account her pubertal stage and height, and not only her age.

—Irene N. Sills, MD