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RESEARCH ARTICLE

JUVENILE OSTEOPOROSIS IN CHILDREN – A NURSING PERSPECTIVE

Geetha S*

Department of Child Health Nursing, Sree Balaji College of Nursing, Bharath University, Chrompet, Chennai

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ABSTRACT

Osteoporosis is being increasingly recognised in paediatric practice as a consequence of several factors.In addition, the improved medical and nursing care provided to children with chronic illness has led to many of them living long enough to develop osteoporosis. The availability of methods to assess bone density in children as a surrogate marker of bone strength and the possibility of medical treatment to increase bone density have also resulted in an increased awareness of groups of children who may be at risk of osteoporosis. Osteoporosis in children may be primary due to an intrinsic bone abnormality (usually genetic in origin) or secondary due to an underlying medical condition and/or its treatment.The effects of this disease can best be managed with early diagnosis and treatment. In secondary osteoporosis, treatment may include treating the underlying cause of the disease.

INTRODUCTION

In recent years it has become very common to see children with fractures. Pediatric casualty departments are occupied with children with complicated falls as common accidents. Osteoporosis is found to be a underlying pathology for such common accidents and fractures. It's easy to rectify osteoporosis in children who lay bone mass every day.

Osteoporosis literally means "Porous bone or brittle bone." This disease is characterized by too little bone formation, excessive bone loss, or a combination of both. People with osteoporosis have an increased risk of fractures. It is most common in older people, especially older women.

From birth through young adulthood, children steadily accumulate bone mass, which peaks sometime before age 30. The greater their peak bone mass, the lower their risk for osteoporosis later in life. Both heredity and lifestyle choices-especially the amount of calcium in the diet and the level of physical activity-influence the development of peak bone mass and the rate at which bone is lost later in life.

Idiopathic Juvenile Osteoporosis(IJO)

Idiopathic juvenile osteoporosis (IJO) is a primary condition with no known cause. It is diagnosed after the doctor has excluded other causes of juvenile osteoporosis, including primary diseases or medical therapies known to cause bone loss.

This rare form of osteoporosis typically occurs just before the onset of puberty in previously healthy children. The average age at onset is 7 years, with a range of 1 to 13 years. The good news is that most children experience complete recovery of bone.

Secondary Osteoporosis

Secondary osteoporosis, which can affect both adults and children, results from another primary disorder or therapy.

Causes of Osteoporosis in Children

Most fractures in children are caused by trauma. Children with fragile bones from osteoporosis may be fracture-prone. They are at increased risk of fracture from minor injuries. The most common bone break in children occurs in the forearm just above the wrist.

Common factors affecting bone mass include genetics and environment. Genes inherited from both parents is a major factor. Diet and exercise make up the bulk of the environmental factor. For girls and women, hormone levels are also a key factor. Corticosteroid treatment and chemotherapy are two other causes of osteoporosis in children.

Physical activity early in life builds bone mass. This must occur before the growth plates between the bones and the joints finish growing and close up. At the same time, getting enough calcium, vitamin D, and phosphorus is also important to bone growth and development.

Even with good genes, children must have a certain level of calcium. This is needed to reach peak bone mass that is preset by the genetic code. Higher levels of calcium in the diet during childhood and adolescence can build bone mass and prevent fractures.

Not getting enough vitamin D from diet or lack of sunshine can also contribute to the development of osteoporosis in children. Phosphate in soft drinks is a risk factor for low peak bone mass. This is true when soda pop replaces milk on a daily basis.

Disorders, Medications, and Behaviors That May Affect Bone Mass:*

Primary Disorders

- Juvenile rheumatoid arthritis
- Diabetes
- Osteogenesis imperfecta
- Hyperthyroidism
- Hyperparathyroidism
- Cushing's syndrome
- Malabsorption syndromes
- Anorexia nervosa
- Kidney disease

Medications

- Anticonvulsants (e.g., for epilepsy)
- Corticosteroids (e.g., for rheumatoid arthritis and asthma)
- Immunosuppressive agents (e.g., for cancer)

Behaviors

- Prolonged inactivity or immobility
- Inadequate nutrition (especially lack of calcium and vitamin D)
- Excessive exercise leading to amenorrhea (absence of menstrual periods)
- Smoking

Alcohol abuse

Clinical Features

The first sign of IJO is usually pain in the lower back, hips, and feet, often accompanied by difficulty walking. Knee and ankle pain and fractures of the lower extremities also may occur. Physical malformations include abnormal curvature of the upper spine (kyphosis), loss of height, a sunken chest, or a limp. These physical malformations are sometimes reversible after IJO has run its course.

X rays of children with IJO often show low bone density, fractures of weight-bearing bones, and collapsed or misshapen vertebrae. However, conventional x rays may not be able to detect osteoporosis until significant bone mass already has been lost. Newer methods such as dual energy x-ray absorptiometry (DXA), dual photon absorptiometry (DPA), and quantitative computed tomography (CAT scans) allow for earlier and more accurate diagnosis of low bone mass. These noninvasive, painless tests are a bit like x rays.

Diagnosis

An initial assessment for low bone density will include laboratory measurements of vitamin D, serum calcium, alkaline phosphatase (an enzyme that is involved in bone mineralization), and thyroid and parathyroid hormones, both of which, if elevated, can affect calcium absorption.

Osteoporosis is diagnosed in children with a clinically significant history of fractures and low bone mass. A clinically significant history would include use of any of the medications mentioned above, or having a bowel mal absorption disorder, reduced mobilization, and a history of more than one fracture or a low energy fracture.

To measure bone mineral density, the pediatric orthopaedist uses dual x-ray asborptiometery (DXA), in which two x-ray beams of differing energy are directed at the site being measured. In children, the site is restricted to the spine, which is thought to yield the most useful information. Once this image is obtained it is compared to an “ideal” standard, the mean BMD (Bone Mass Density) value in healthy age peers. However, this means of measuring bone mass in children is not regarded as completely reliable. In addition, ideally, each child’s BMD would be compared to that of healthy children not only of similar age, but also sex and level of skeletal maturity, data that is not yet readily available.

Additional information can be derived from Peripheral Quantitative Computed Tomography (pQCT) which distinguishes between intramedullary (inner, spongy) bone and cortical bone (the tissue forming the surface of the bone), which is much denser. This measurement is taken at the wrist or tibia.

Conventional x-rays of a fracture are not reliable to yield information on the quality of the bone.

Treatment and Prevention

In the management of children who have sustained osteoporotic fractures, are bisphosphonates. These are chemical analogues of pyrophosphate, a natural inhibitor of bone mineralisation. The more recent nitrogen-containing bisphosphonates inhibit the enzyme farnesyl diphosphate synthase within the mevalonate pathway resulting in impairment of osteoclast-induced bone resorption.

Intravascular bisphosphonates such as pamidronate are also effective at relieving pain associated with vertebral compression fractures.

Although this article has focused on the medical management of a child with osteoporosis, it is important to recognise that a multi-disciplinary approach is often required. In addition to a paediatrician who is familiar with paediatric bone disease, there is a need for radiographers who are experienced in undertaking and interpreting bone density scans in children. Physiotherapists and occupational therapists are necessary for rehabilitation following surgery or fractures. Liaison with an orthopaedic surgeon is often important for elective surgery to correct limb deformity or the placement of intramedullary rods in children with OI to provide internal strength to bones that are frequently fracturing. A specialist nurse is another important member of the team to provide education about the condition and treatments and to liaise with schools as to the appropriate management of a child with osteoporosis.

Treatment for low bone density in children usually begins with a nutritional approach. While most families are aware that their children should be getting enough calcium and vitamin D in their diet, they may not know how much is needed and that the requirement for calcium changes with age. At age nine for

example, the requirement increases by 500 milligrams - to 1300 milligrams a day, from that required at age eight, and continues at the new level until the child turns 19 and peak bone mass is achieved. The goal is to make sure the patient's potential for laying down new bone is optimized during those years.

Daily Calcium Requirements

Birth - 6 months	6 - 12 months	1 - 3 years	4 - 8 years	9 - 18 years
210mg	270mg	500mg	800mg	1300mg

Avoid more than 2500mg of calcium daily

In addition to milk, there are a variety of foods that contain calcium and can help children get sufficient levels of calcium in their daily diet. Some examples include:

Food	Examples
Dairy Foods	Milk, yogurt, cheese
Leafy green vegetables	Broccoli, kale, spinach
Fruits	Oranges
Beans and peas	Tofu, peanuts, peas, black beans, baked beans
Fish	Salmon, sardines
Miscellaneous	Sesame seeds, blackstrap molasses, corn tortillas, almonds, brown sugar

Raising the child's vitamin D level can rarely be achieved by nutritional choices alone. Moreover, with more people avoiding sun exposure, supplements are usually necessary.

Nursing Implication

- Explain all treatments, tests, and procedures. For example, if the patient is undergoing surgery, explain all preoperative and postoperative procedures and treatments to the patient and her family.
- Make sure the child and her family clearly understand the prescribed drug regimen. Tell them how to recognize significant adverse reactions. Instruct them to report them immediately.
- If the patient takes a calcium supplement, encourage liberal fluid intake to help maintain adequate urine output and thereby avoid renal calculi, hypercalcemia, and hypercalciuria.
- Advise the patient to sleep on a firm mattress and to avoid excessive bed rest.
- Teach the patient how to use a back brace properly, if appropriate.
- Thoroughly explain osteoporosis to the child and her family. If they don't understand the disease process, they may feel needless guilt, thinking that they could have acted to prevent bone fractures.
- Demonstrate proper body mechanics. Show the patient how to stoop before lifting anything and how to avoid twisting movements and prolonged bending.
- Encourage the patient to install safety devices, such as grab bars and railings, at home.
- Advise the patient to eat a diet rich in calcium. Give her a list of calcium-rich foods. Explain that type II osteoporosis may be prevented by adequate dietary calcium intake and regular exercise. Hormonal and fluoride treatments also may help prevent osteoporosis.
- Explain that secondary osteoporosis may be prevented by effectively treating underlying disease, early mobilization after surgery or trauma, decreased alcohol consumption, careful observation for signs of malabsorption, and prompt treatment of hyperthyroidism.
- Reinforce the patient's efforts to adapt, and show her how her condition is improving or stabilizing. As necessary, refer her to an occupational therapist or a home health nurse to help her cope with ADLs.
- Focus on careful positioning, ambulation, and prescribed exercises.
- Administer analgesics and heat to relieve pain as ordered.
- Include the patient and his family in all phases of care.
- Encourage the patient to perform as much self-care as her immobility and pain allow.
- Provide the patient activities that involve mild exercise.
- Check the patient's skin daily for redness, warmth, and new painsites.
- Monitor the patient's pain level, and assess her response to analgesic's, heat therapy, and diversional activities.
- Explain all treatments, tests, and procedure to the patient.
- Make sure the patient and her family clearly understand the prescribed drug regiman.
- Tell the patient to report any new pain sites immediately, especially after trauma.
- Provide emotional support and reassurance to help the patient cope with limited mobility.

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