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ON THE uptake



Holland Bloorview
Kids Rehabilitation Hospital



CEREBRAL PALSY: STRONG BONES, HEALTHY KIDS

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Children with cerebral palsy (CP) have low bone mineral density, which means their bones are weak and at increased risk for fragility fractures (broken bones). This is because children with CP spend less time doing weight-bearing activities (standing and walking), may have poor nutrition and decreased exposure to sunlight, and may require anti-seizure medication. Approximately 20% of children and young adults with CP who cannot walk independently develop fragility fractures, the most common site of fracture being the femur (large bone in the leg). Fractures cause significant pain and impairment and children usually require surgery and/or casting.

For these reasons, it is important for parents and health care providers to know how to improve bone mineral density and prevent fragility fractures in children with CP. A group of health care providers at Holland Bloorview Kids Rehabilitation

Hospital (Toronto), The Hospital for Sick Children (Toronto), Kluge Children's Rehabilitation Centre & Research Institute (Charlottesville), Glenrose Rehabilitation Hospital (Edmonton), and The Rehabilitation Institute of Chicago conducted a systematic review of the best available evidence and based on the results and expert opinion, developed a **clinical practice guideline (CPG)**. The review considered whether, in children and young people with CP with restricted mobility, the following interventions are effective in improving bone mineral density and/or decreasing fragility fractures: (1) weight-bearing activities; (2) vitamin D and calcium supplementation; and (3) bisphosphonates.

Weight-bearing activity

Overall, research does not provide enough evidence to say that weight-bearing activities (including standing frames, gait-trainers, vibration platforms, and physiotherapy) are effective for improving bone mineral density or for decreasing fragility fractures. In the studies, no specific activity stood out as being more or less effective. Fortunately there were no negative side effects of weight-bearing activities. It is important to note that

weight-bearing activities are beneficial for children with CP for reasons other than to improve bone mineral density or decrease fragility fractures (children may enjoy the activity; stretching; maintenance of range of motion etc). The review and CPG recommends further research be done to investigate the effect of weight-bearing activities on bone health.

Vitamin D and calcium supplementation

Calcium is found in many foods (such as milk, yogurt and salmon) and is essential for bone growth and integrity. Vitamin D helps your body absorb the calcium that comes from food. We get some vitamin D from foods, but mostly from exposure to the sun. Unfortunately, it can be difficult to get enough sun during the winter and in the summer while wearing sunscreen. People with darker skin need more sun time to get enough vitamin D.

Research shows vitamin D and calcium are possibly effective in improving bone mineral density. There is not enough evidence to say vitamin D and calcium prevent fragility fractures. Since vitamin D is safe, the review and CPG recommends taking a vitamin D2 or D3 supplement at a dose of 800-1000 IU per day. Baseline

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blood work should be taken and the dose of vitamin D should be adjusted to maintain a 25-OH-D level between 70-100nmol/L.

Recommended daily calcium intakes exist for healthy children and the same recommendations should be used for children with CP. In order to increase compliance and prevent constipation and drug interactions, the review and CPG recommend that, if possible, children get calcium through their diet as a first choice rather than using a calcium supplementation.

One potential side effect of vitamin D and calcium supplementation is increased calcium in the urine, which increases the risk of renal stones. To assess for this possible side effect, the review and CPG recommend a urine test (calcium/osmolality ratio) at baseline and 6-12 months after starting supplementation.

Bisphosphonates

Bisphosphonates are a family of drugs that

reduce the activity of cells that cause bone reabsorption (bone loss). When given with vitamin D and calcium, bisphosphonates are probably effective in improving bone mineral density in children with CP and possibly effective at reducing fragility fractures in children who have had fractures in the past. Unfortunately, there are adverse effects related to

bisphosphonate therapy including flu-like symptoms and hypocalcemia. Importantly, there is a general lack of information on the long-term impact

of bisphosphonates on growing bones. For these reasons, the benefits of bisphosphonates must be carefully weighed against the long-term results and potential risk of side effects. The review and CPG recommend consultation with a bone health specialist and consideration of bisphosphonates only after the child with CP sustains a fragility fracture. Bisphosphonates should not be used preventatively until more research is available.

A note on measuring bone mineral density

Dual energy X-ray absorptiometry (DXA) is the most common and preferred way to evaluate bone health. A distal femur regional scan is a preferred assessment for children with CP as this is the area they frequently fracture. Based on expert opinion, the review and CPG recommend a DXA scan following a fragility fracture.

Glossary of Terms

Bone mineral density: referring to the amount of mineral matter per square centimeter of bone. Low bone mineral density leads to weak and fragile bones.

Fragility fractures: a broken bone that occurs as a result of normal activities. In children with CP, the femur is the most common site of a fragility fracture.

Systematic review: A rigorous and thorough summary of research evidence on a particular topic.

Clinical practice guideline: guidelines for clinical practice, developed by systematically reviewing the best available evidence and using an expert panel that includes clinicians to interpret and inform the guideline development.

Weight-bearing activities: use of standing frames, gait-trainers, vibration platforms, and physiotherapy.

Calcium: a mineral that is found in many foods (such as milk, yogurt and salmon) and is essential for bone growth and integrity.

Vitamin D: a vitamin that helps your body absorb the calcium that comes from food.

Bisphosphonates: a family of drugs that reduce the activity of cells that cause bone reabsorption (bone loss).

DXA scans: used to evaluate bone health by measuring the transmission of two different photon energies with different attenuation profiles through the body.

Take away points

- Children with cerebral palsy (CP) have low **bone mineral density**, which means their bones are weak and at increased risk for **fragility fractures**.
- In order to learn more about how to improve bone mineral density and prevent fragility fractures, a group of researchers from Canada and the USA conducted a **systematic review** and created a **clinical practice guideline** for parents and health care providers.
- There is insufficient evidence to say that **weight bearing activities** improve bone mineral density or prevent fractures. Still, given the safety and other benefits of these activities, a physiotherapy consult is indicated in children with CP.
- **Calcium** and **vitamin D** are possibly effective in improving bone mineral density, but there is not enough evidence to say vitamin D and calcium prevent fragility fractures. Recommended daily intakes of calcium are available for children and can be used in children with CP as well. Vitamin D supplementation is recommended at doses of 800-1000IU daily. Bloodwork and urine tests should be done at baseline and at 6-12 months.
- **Bisphosphonates** are probably effective in improving bone mineral density in children with CP and reducing fragility fractures in children who have had fractures in the past. Given the risk of adverse effects and lack of information on the long term impact of bisphosphonates, consultation with a bone health specialist and consideration of bisphosphonates is recommended only after the child with CP sustains a fragility fracture.
- **DXA scans** are recommended only following a fragility fracture.

Future **research** that evaluates osteoporosis interventions that are appropriately powered for fragility fractures as a primary outcome is critically important to inform practice. Population based studies are also required to obtain more accurate information on prevalence rates of low bone mineral density and fragility fracture in children with CP, as well as their impact on pain and quality of life.

References and Useful Links

Systematic Review and Clinical Practice Guideline:

Fehlings, D., Switzer, L., Agarwal, P., Wong, C., Sochett, E., Stevenson, R., Sonnenberg, L., Smile, S., Young, E., Huber, J., Milo-Manson, G., Kuwaik, G.A., Gaebler, D. (2012) Informing evidence-based clinical practice guidelines for children with cerebral palsy at risk of osteoporosis: a systematic review. *Dev Med Child Neurol*; 54(2), 106 – 116.

Recommended Calcium Intakes:

Vitamin D and Calcium: Updated Dietary Reference Intakes. Health Canada.
<http://www.hc-sc.gc.ca/fn-an/nutrition/vitamin/vita-d-eng.php>

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