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To Study Bone Tissue Mineral Density and its Disorders in Patients with Celiac Disease

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Abstract: This article analyzes decreased bone tissue mineral density and its disorders in patients with celiac disease. Celiac disease causes autoimmune inflammation of the intestinal mucosa, causing impaired absorption of calcium and vitamin D. This increases the risk of developing osteopenia and osteoporosis. The study discusses methods for assessing bone density, the effects of the disease on bone metabolism, and preventive measures. It also discusses the importance of dietetics and the positive effects of a gluten-free diet on bone health.

Keywords: Seliacia, bone mineral density, osteoporosis, osteopenia, calcium deficiency, vitamin D, gluten-free diet, bone metabolism.

Bone tissue is a connective tissue that contains calcified intercellular substances and is the main structural component of the bone skeleton. It differs from other connective tissues according to its mechanical functions, as it forms the skeleton of vertebrate animals (including humans), shapes body structure, and facilitates movement functions (since they are transversely connected). Chemically and biologically, bone tissue maintains the balance of mineral substance exchange in the organism. Its intercellular substances contain a large amount of calcium salts and fluoride. 97% of the calcium in the body is found in bone tissue. The amount of mineral elements in the bone tissue of a living organism is constantly changing. Such changes are usually caused by, firstly, the aging of the organism, the composition of the food consumed daily, and secondly, the influence of the internal secretion glands of the nervous system. Bone tissue, like other connective tissues, mainly consists of bone cells and intercellular substances.[1; 345,354-b]

According to the physiological functions performed by bone tissue cells and their morphological structure, they are divided into three groups: osteoblasts, osteocytes, and osteoclasts.

1. Osteoblast cells are poorly differentiated, single-nucleated bone-forming cells that synthesize the necessary substances for the main substance with the intercellular substance of bone tissue. Osteoblast cells are found in large numbers in stratified bone tissue, in its fractured or repaired areas. They are always present in the periosteum covering the surface of all skeletal bones. They are cubic or angular in shape. In the posterior part of the cytoplasm there is a round or oval nucleus. Each cell nucleus has one or more nucleoli. When viewed under an electron microscope, the mitochondria, endoplasmic reticulum and Golgi complex are clearly visible from the organoids contained in it. In addition, a lot of RNA and highly active alkaline phosphatase are found in the cytoplasm. These are involved in the metabolism of mineral salts in the tissue. During the embryonic development of the organism, osteoblast cells are formed from mesenchymal cells, and then take an active part in the development of the embryonic skeleton. At the same time, it also ensures the physiological and regenerative regeneration processes that occur in the tissue.

2. Osteocytes are mature, highly differentiated cells that form the basis of bone tissue. They are surrounded by extracellular matrix. Each cell is located in the spaces formed in the extracellular matrix. Osteocytes are flattened round or oval in shape, and several canal-like processes are produced from their periphery. The adjacent cell processes are connected to each other, giving the tissue a mesh-like shape. The cell processes are located in the extracellular matrix, through which nutrients enter the interior of the tissue. Nutrients are not visible in the tubules of the tissue that have become dysfunctional or old. The intercellular substance on the walls of the spaces where osteocytes are located usually does not accumulate salts. In the old literature, it was called the capsule of a bone cell, likening it to the capsule of cartilage cells, and it was understood that it had a unique solid structure. However, electron microscopy studies have shown that the capsule does not actually contain mineral salts. That is why the capsule appears shiny under the microscope. In the center of the lighter cytoplasm of the osteocyte, there is usually a single darkly stained nucleus. Of the organoids, mitochondria are most common. The Golgi complex is also underdeveloped. Osteocytes are cells that do not actively participate in tissue activity and are located in a stable state in the tissue. Some young osteocytes have the property of proliferating.

3. Osteoclast cells have the property of destroying cartilage and bone cells. They are much larger (50-90 nm) than other bone cells, irregular in shape, and are multinucleated cells. They can contain up to 3-10 nuclei. On their outer membrane, which is in contact with the extracellular matrix, they have numerous outgrowths resembling cytoplasmic outgrowths of the small intestinal epithelium. Inside the outgrowths, there are numerous vacuoles resembling lysosomes. They protrude through the cell membrane into the extracellular matrix and rapidly dissolve it. In this way, osteoclast cells ensure the growth and restoration of tissue development. The center of the cytoplasm of osteoclast cells is predominantly basophilic, i.e., it stains darkly, while the peripheral parts are oxyphilic, i.e., it stains lighter. Lysosomes inside cell membranes contain many hydrolytic enzymes.

There are also many mitochondria. The rough endoplasmic reticulum is less than the rough endoplasmic reticulum. There are many lysosomes and vacuoles. Small gaps are formed at the junction of osteoclast cells with the extracellular matrix.

$CO2+H2O=H2CO3$

As a result, calcium salts dissolve and the organic structure of the matrix is destroyed. It is clear that osteoclast cells perform important functions during the embryonic and postembryonic development of bone tissue and in the processes of regeneration.

Celiac disease is an autoimmune disease that damages the lining of the small intestine as a result of an inappropriate immune response to the gluten protein. This leads to inadequate absorption of nutrients, especially calcium and vitamin D. As a result, bone mineral density decreases, increasing the risk of developing diseases such as osteopenia and osteoporosis. In this article, we will look at changes in bone mineral density in celiac disease and measures to prevent them.

As a result of damage to the intestinal mucosa in celiac disease, a deficiency of important nutrients, especially calcium, phosphorus and vitamin D, which are necessary for bone health, occurs. This can lead to the following processes:

1. Calcium deficiency - the damaged part of the intestine cannot absorb calcium normally, which leads to a decrease in bone density.

2. Vitamin D deficiency - impaired absorption of vitamin D reduces the absorption of calcium from the intestine, resulting in brittle bones.

3. Secondary hypoparathyroidism – Vitamin D deficiency can lead to impaired production of parathyroid hormone, which increases bone mineral loss.

4. Bone metabolism disorders – The inflammatory process of the immune system can increase the activity of osteoclasts (bone-breaking cells) and decrease the activity of osteoblasts (bone-forming cells).

The following methods are used to assess bone status in patients with celiac disease:

Dual-Energy X-ray Absorptiometry (DXA) is the gold standard for determining bone density.

Blood tests are performed to assess calcium, phosphorus, vitamin D, and parathyroid hormone levels.

X-rays are used to detect bone fractures caused by osteoporosis.

Maintaining bone health is important for patients with celiac disease. The following measures can help maintain bone strength:

1. Adherence to a gluten-free diet - Strict adherence to a gluten-free diet is essential to restore the intestinal mucosa and ensure normal absorption of nutrients.

2. Adequate calcium and vitamin D intake - It is important to include dairy products, green leafy vegetables, and foods rich in vitamin D in your daily diet.

3. Exposure to sunlight – It is recommended to spend at least 15-20 minutes a day in the sun to stimulate the synthesis of vitamin D.

4. Physical activity – Weight-bearing exercise, running and walking are useful for increasing bone density and strengthening bones.

5. Medical supervision – As recommended by a doctor, it is necessary to regularly undergo the necessary tests and monitor bone density.[4; 785, 795-b]

In conclusion, decreased bone mineral density is a common complication in patients with celiac disease. Damage to the intestinal mucosa leads to calcium and vitamin D deficiency, increasing the risk of osteopenia and osteoporosis. To maintain bone health, it is important to follow a gluten-free diet, consume sufficient calcium and vitamin D, engage in physical activity, and undergo regular medical monitoring.

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