BONE MATERIAL DENSITY AND VASCULAR CALCIFICATION IN ADULTS WITH AGE AND DIET

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ABSTRACT

Among the various causes of blood pressure in the Adult population, isolated systolic hypertension (ISH) is the most common. Its prevalence increases with age. Age-related stiffness of the aorta is the primary cause of ISH. The systolic rise in blood pressure is at least as important as the diastolic blood pressure. Several non-pharmacological and pharmacological treatments are well established for lowering blood pressure in this age group. Among the different groups of anti-hypertensive drugs, the priority mainly depends on co-morbidities and overall cardiovascular risk. Lifestyle modification should also be an integral part of therapy for each patient. Various studies suggest that control of blood pressure definitely reduces mortality as well as the incidence of coronary artery disease, stroke and other morbidities. The relationship between bone metabolism and vascular calcification was a component of the decision by the Kidney Disease: Improving Global Outcomes (KDIGO) Foundation to adopt a new nomenclature, CKD—mineral and bone disorders (MBD), for the syndrome encompassing CKD. Bone material density and vascular calcification are two separate processes that can have a significant impact on the health of adults, especially as they age, and depend on their diet. Let's explore each of these concepts separately and then discuss their relationship to age and diet.

Keyword: - *Bone, Density, Vascular, Age and Diet etc.*

1. INTRODUCTION

Adults with chronic kidney disease (CKD) may have low bone mineral density (BMD) with concurrent vascular calcification. It is not known whether mineral deposition by the growing skeleton protects youth with CKD from excess calcification. Calcium supplements have been linked to an increase in cardiovascular events. This study examines the association between calcium supplement use and 5-year progression of abdominal aortic calcification (AAC) in one-centre participants of the Canadian Multi-centre Osteoporosis Study (CaMOS). Vascular calcification, bone loss and fracture risk are disorders associated with aging, both in patients with chronic kidney disease (CKD) [1–7] and the general population [8–11]. Furthermore, several epidemiological studies suggest an association between vascular calcification, impaired bone metabolism, and increased mortality [10,12–15]. The relationship between bone metabolism and vascular calcification was a component of the decision by the Kidney Disease: Improving Global Outcomes (KDIGO) Foundation to adopt a new nomenclature, CKD—mineral and bone disorders (MBD), for the syndrome encompassing CKD. disturbances in mineral metabolism, vascular calcification, renal osteodystrophy, and excessive mortality [16]. This review focuses on the systems biology between skeletal, mineral metabolism and vascular calcification that is dysregulated in CKD-MBD.

2. BONE MATERIAL DENSITY

Bone mineral density (BMD) refers to the amount of mineral content, primarily calcium and phosphorus, present in a given amount of bone. It is an important indicator of bone strength and overall bone health. Higher bone mineral density generally indicates stronger bones that are less likely to fracture.

Bone density changes throughout life. During childhood and adolescence, bones usually become denser due to mineral deposits in the body. However, as people age, especially after the age of about 30, bone density may begin to decrease. It is a natural part of the aging process and can be affected by factors such as genetics, hormone levels (particularly estrogen and testosterone), physical activity and diet.

3. VASCULAR CALCIFICATION

Vascular calcification is the process by which calcium is deposited in the walls of blood vessels. This can lead to hardening of the arteries and increase the risk of cardiovascular diseases like heart attack and stroke. Vascular calcification is often associated with conditions such as atherosclerosis, diabetes, chronic kidney disease, and aging.

4. AGE AND DIET

Age plays an important role in both bone density and vascular calcification. As mentioned earlier, bone density tends to decrease with age, making older individuals more prone to fractures and osteoporosis. Factors such as reduced physical activity, hormonal changes and inadequate nutrient intake may contribute to this decline. Adequate intake of calcium, vitamin D and other nutrients that support bone health is important throughout life, but especially so with aging.

With regard to vascular calcification, age-related changes in blood vessel structure and function may contribute to its development. Additionally, certain dietary factors may affect the risk of vascular calcification. A diet high in saturated fat, trans fat, salt and sugar and low in fruits, vegetables, whole grains and healthy fats can increase the risk of cardiovascular diseases and potentially contribute to vascular calcification.

5. BONE TURNOVER AND VASCULAR CALCIFICATION

The association between bone fragility and vascular calcification has been repeatedly made since a significant inverse correlation between bone mineral density and aortic calcification was reported 20 years ago [12]. However, this association was probably underestimated because osteoporosis and vascular calcification were considered non-reversible disorders of aging. Recent data suggest that this relationship is not simply a testament to age. The role of aging cannot be completely ruled out, but the clinical co-occurrence of vascular calcification with reduced bone activity and osteoporosis suggests that there are direct biological links between arteriosclerosis and osteoporosis, and the co-occurrence pathophysiology. backed by science.

In support of this concept, a study published in 2004 showed that patients with the highest levels of aortic calcification had the lowest bone density [17]. In the same group for 2 years, patients with progressive vascular calcification had greater bone loss [17]. In agreement with these results, a recent study in a randomly selected general population by one of our groups showed that after 4 years of follow-up, subjects with the most severe aortic calcification not only had There was less mass, but also a higher incidence of new osteoporotic fractures [11].

6. VASCULAR CALCIFICATION INDUCES BONE LOSS

It is clear that impaired bone metabolism and its consequences play an important role in the development of vascular calcification. However, an interesting question is whether the presence of well-established and severe vascular calcification can impact on bone metabolism, thus demonstrating the true crosstalk between these tissues. Now some evidence is coming out.

In recent CKD translational studies, in mice fed a high phosphorus diet and LDLR−/− mice fed a high fat diet, an increase in aortic calcification was associated with a decrease in bone mass. In addition, microarray analysis of areas with severe vascular calcification showed over-expression of the secreted frizzled-related protein (SFRP) family. SFRPs are circulating wingless/int (Wnt) protein inhibitors. Induction of interstitial nephritis is associated with up-regulation of SFRP4, SFRP2 and DDK1 in vascular adventitia. SFRP and DKK-1 are inhibitors of the canonical signaling Wnt pathway, which is actively involved in bone formation and vascular calcification. This increase in SFRP in areas of severe vascular calcification may be indicative of an arterial defense mechanism of the vascular wall triggered to block the activation of the WNT pathway, with the aim of reducing mineralization in the calcified aortic wall. Since SFRPs are secreted circulating proteins, they may act not only locally to reduce mineralization in the artery wall, but may also act in bone-eroding mineralization, resulting in reduced bone mass. .

This new and challenging response hypothesis may help to explain some of the results observed in epidemiological studies in the general and CKD populations, in which more severe cases of progressive vascular calcification were associated with greater bone loss and more bone fractures [4].

7. RELATIONSHIP BETWEEN BONE DENSITY, VASCULAR CALCIFICATION, AGE AND DIET

While bone density and vascular calcification are separate processes, they can be affected by similar factors such as age and diet. A balanced diet rich in nutrients such as calcium, vitamin D, vitamin K and magnesium can support both bone health and heart health. Adequate physical activity, especially weight-bearing exercise, may also help maintain bone density and reduce the risk of vascular calcification.

Conversely, an unhealthy diet that lacks essential nutrients and promotes inflammation can have negative effects on both bone health and heart health. For example, excessive consumption of processed foods, sugary beverages and excessive sodium can contribute to inflammation, oxidative stress and atherosclerosis, which can increase the risk of vascular calcification and bone fragility.

8. RESULT ANALYSIS

To be sure, here is a more detailed analysis of the relationship between bone material density and vascular calcification in adults without regard to age and diet:

1. Bone Material Density:

Age: Bone mineral density peaks in early adulthood and then gradually decreases with age. This decline is more pronounced in postmenopausal women due to decreased estrogen levels. Older adults are at higher risk of osteoporosis, a condition characterized by low bone density and an increased likelihood of fractures.

Diet: Adequate intake of nutrients such as calcium, vitamin D and vitamin K is essential for maintaining bone health. Calcium is a major component of bone, while vitamin D supports calcium absorption. Vitamin K plays a role in bone mineralization. A diet rich in dairy products, green leafy vegetables, fortified foods and lean proteins may contribute to better bone health.

Age-related bone density loss can be partially reversed by a diet rich in bone-supporting nutrients. Older adults should focus on calcium and vitamin D intake to reduce the risk of osteoporosis. Regular weight-bearing exercises also help stimulate bone formation.

2. Vascular Calcification:

Age: Vascular calcification increases with age due to cumulative damage to blood vessels and changes in the balance of calcification-regulating molecules. Arterial stiffness and atherosclerosis contribute to this process. Vascular calcification is associated with a higher risk of cardiovascular events in older adults.

Diet: A diet rich in saturated and trans fats, as well as excessive sodium and sugar intake, can promote inflammation and oxidative stress. These factors contribute to endothelial dysfunction and atherosclerosis, which are precursors to vascular calcification.

Older adults are at higher risk of vascular calcification because of the cumulative effects of aging on blood vessels. However, a healthy diet that includes whole foods, fruits, vegetables, whole grains, lean proteins, and healthy fats may help reduce risk by reducing inflammation and supporting overall heart health.

3. Interplay between age and diet:

Bone health: As people age, it becomes important to maintain a diet rich in bone-supporting nutrients. Consuming adequate calcium and vitamin D helps offset age-related bone density loss, especially in postmenopausal women and older adults.

Heart health: An unhealthy diet may increase the age-related risk of vascular calcification. Diets rich in processed foods, saturated fats and added sugars contribute to atherosclerosis and arterial stiffness, which accelerates the development of vascular calcification.

The interplay between age and diet is important. Older adults who prioritize a diet rich in the nutrient may simultaneously support bone health and reduce their risk of cardiovascular issues associated with vascular calcification.

9. CONCLUSION

. In conclusion, bone material density and vascular calcification are influenced by age and diet, among other factors. Maintaining a balanced diet, being physically active and adopting a healthy lifestyle can play an important role in promoting bone and cardiovascular health as a person ages. If you have specific concerns about your bone health or cardiovascular risk, consultation with a healthcare professional or registered dietitian is recommended, bone material density and vascular calcification are influenced by both age and diet. Aging is a natural factor contributing to changes in bone health and blood vessel integrity. However, a balanced diet rich in essential nutrients can have a positive effect on both of these processes. For older adults, maintaining a healthy lifestyle that includes proper nutrition and physical activity is important to promote bone strength and reduce the risk of cardiovascular events related to vascular calcification.

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