THE BONE-KIDNEY-AXIS: INVESTIGATING A NEW MEDIATOR OF CKD-INDUCED BONE DYSTROPHIE

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Introduction

Mineral bone disease (MBD) and cardiovascular disease in patients suffering from chronic kidney disease (CKD) are a prime example of organ cross-talk [1]. Kidney impairments lead to hyperphosphatemia and uremia, promoting vascular calcification as well as bone disorders like osteoporosis [2]. The complex interplay between CKD, MBD, and the vascular system is thus labeled CKD-MBD. The chromogranin A derived calcification blocking factor (CBF) has already been established as an inhibitor of vascular calcification, but nothing is known of its effect on bone health [3].
In this project MBD was investigated in animal models of vascular calcification and atherosclerosis as well as the mediating effect of CBF on the bone.

Methods

To investigate the effect of CKD on bone quality, vascular calcification was induced in rats via vitamin D_3 and nicotine treatment (VDN). The structure and bone mineral density of tibia from VDN rats with and without CBF treatment were analyzed via micro-computed tomography (micro-CT) scans. In detail, the bone mineral density of the trabecular and cortical bone, as well as the trabecular thickness, number, porosity, cortical thickness and medullary volume were analyzed.

Results

VDN animals without additional treatment showed significant changes in bone structure and bone mineral density of the tibia. The mineral density of the trabecular bone was increased by 86 % in VDN rats compared to control animals ($p=0.01$). The trabecular number of VDN rats increased by 128 % ($p=0.0009$), while the trabecular porosity decreased by 15 % ($p=0.0055$). The mineral density of the cortical bone decreased by 8 % ($p=0.005$), while the cortical porosity was increased by 10 % ($p=0.0068$) and cortical thickness decreased by 22 % ($p=0.0048$). Conversely, the medullary volume increased by 47 % ($p\leq0.0001$). These changes were in all cases negated to non-significance compared to the control, when the rats were additionally treated with CBF.

Discussion

In our study, we were able to comprehensively show the changes in bone mineral density and bone structure in the tibia of rats suffering from vascular calcification. In addition, preventive treatment with CBF proved to inhibit any changes in bone structure and mineral # density, effectively preserving the healthy state of the bone. Based on these results, CBF presents a novel mediator of not only vascular calcification but also MBD, highlighting it as a possible treatment target in CKD-MBD.

References

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