SERUM LEPTIN AFFECTS THE GEOMETRICAL BUT NOT BIOMECHANICAL PROPERTIES OF FEMORAL DIAPHYSIS IN YOUNG RATS WITH EXPERIMENTAL CHRONIC RENAL FAILURE

VI Środkowo Europejski Kongres Osteoporozy i Osteoartrozy oraz XVII Zjazd Polskiego Towarzystwa Osteoartrologii i Polskiej Fundacji Osteoporozy, Kraków 25-26.09.2015

P34

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Key words: *chronic renal failure, leptin, bone geometry, bone biomechanical properties*

Objectives. Patients with chronic kidney disease mineral and bone disorder (CKD-MBD)

suffer from bone disease characterized by decreased bone quantity and quality starting early during the course of CKD. CKD-MBD may also be characterized by impaired bone strength and geometry leading to an increased incidence of low-trauma fractures. Leptin is a small polypeptide hormone produced in fat tissue that plays an important role in controlling bone metabolism. It is a potent inhibitor of bone formation acting indirectly through the central nervous system. However, leptin also acts as a local factor produced by osteoblasts, with the ability to modulate bone resorption and formation through direct effects on bone cells.

Aim. We used the experimental 5/6 nephrectomy model of chronic renal failure (CRF) to explain, if serum leptin levels can affect bone geometrical and biomechanical properties in young, growing rats

Material and methods. Forty 4 weeks-old Wistar male rats were randomly allocated to sham-operation (Controls, n=16) or 5/6 nephrectomy (CRF, n=24). After one (CRF1) and three months (CRF3) of CFR development the animals were sacrificed, serum samples were collected and femurs were excised for three-point bending test.

Results. Serum leptin concentrations were significantly lower in CRF in comparison with controls after 1 month ($p<0.05$) and particularly after 3 months ($p<0.01$) of CRF development. After adjusting for body weight, the values of: femoral weight, length, the anterior-posterior periosteal and endosteal diameters, the medial-lateral periosteal and endosteal diameters, cortical wall thickness (WT), cortical index (CI), cross-sectional area (CSA), cross-sectional moment of inertia (CSMI) and mean relative wall thickness (MRWT) were significantly greater in femurs from the CRF rats compared to the controls. These differences were particularly seen in the third month of disease progression. Yield load (F_y) has been significantly decreased, whereas work to failure (W) and yield stress (σ_y) were increased in the femurs of CRF rats compared to controls. In controls, serum leptin was strongly and inversely associated with the majority of femoral geometrical parameters (except CSMI). In CRF, the inverse association was only observed between leptin and the femoral diameters. There was no association between leptin levels and biomechanical properties of femur in CRF as well as in control rats.

Conclusions. In young, rapidly growing rats serum leptin affects bone geometrical but not biomechanical properties in controls as well as in experimental chronic renal failure. However, in CRF rats with reduced leptin concentrations, this effect was less pronounced than in healthy animals.

P34

LEPTYNA MODYFIKUJE GEOMETRIĘ KOŚCI UDOWEJ BEZ WPŁYWU NA JEJ WŁAŚCIWOŚCI BIOMECHANICZNE W MODELU PRZEWLEKŁEJ NIEWYDOLNOŚCI NEREK U MŁODYCH SZCZURÓW

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Słowa kluczowe: *przewlekła niewydolność nerek, leptyna, geometria kości, właściwości biomechaniczne kości*