THE IMPACT OF EXPERIMENTAL CHRONIC RENAL FAILURE ON BIOMECHANICAL PROPERTIES OF FEMUR IN GROWING RATS

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Key words: *chronic renal failure, bone biomechanical properties, secondary hyperparathyroidism*

Objectives. Disruptions in mineral metabolism occur early in the course of chronic kidney disease (CKD) and result in alterations in bone mass, turnover, mineralization, and architecture that are the main elements of bone strength. Decreases in bone strength manifest clinically as fractures, and bone strength has been recognized as a key component of CKD-Mineral and Bone Disorder (CKD-MBD). Bone strength can be directly measured by a biomechanical analysis of the bone from animal experimental models, however, the information about bone biomechanical properties in CKD is scarce.

Aim. We used the experimental 5/6 nephrectomy model of chronic renal failure (CRF) to perform the comprehensive study explaining the impact of age, disease progression and secondary hyperparathyroidism on biomechanical properties of femurs in growing rats.

Materials 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 and 3 months of CFR progression the animals were sacrificed, serum samples were collected, and femurs were excised for three-point bending test.

Results. The mean body weights and serum calcium levels were lower, whereas creatinine, urea and parathyroid hormone (PTH) levels were higher in CRF in comparison with appropriate controls. After adjusting for body weight, the yield load (Fy) was significantly reduced in the early stage of CRF compared to controls, however, its values increased with the development of disease. The stiffness and work to fracture (W) were increased in CRF compared to control rats. Moreover, the part of femoral material properties – yield stress (σy) was significantly higher in CRF groups compared to controls. The positive relationship was between

the cross-sectional moment of inertia (CSMI) and femoral Fu, Fy, and stiffness. Serum PTH levels positively correlated with femoral Fy, Fu, stiffness and CSMI in CRF but not in the controls.

Conclusions. The femoral strength in growing rats with CRF were even better than those in age-matched controls. It is possible that an early adaptive response related to rapidly growth provided protection from the deleterious effects of CRF on bone. PTH levels seems to be one of the possible factors responsible for this protective mechanism.

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WPŁYW EKSPERYMENTALNEJ, PRZEWLEKŁEJ NIEWYDOLNOŚCI NEREK NA WŁAŚCIWOŚCI BIOMECHANICZNE KOŚCI UDOWEJ U ROSNĄCYCH SZCZURÓW

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Słowa kluczowe: *przewlekła niewydolność nerek, właściwości biomechaniczne kości, wtórna nadczynność przytarczyc*