SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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HIGH-RESOLUTION PERIPHERAL COMPUTED TOMOGRAPHY IN THE ASSESSMENT OF BONE LOSS AND RECOVERY DURING AND UP TO 2-YEARS AFTER 60D BED-REST

Abstract

Purpose: To assess the remodelling of bone at the distal tibia and radius during bed-rest and two-years recovery via high-resolution peripheral computed tomography (HR-pQCT).

Methods: Twenty-four male subjects as part of the 2nd Berlin Bed Rest Study (BBR2-2) performed high-load resistive exercise (RE; n=8), high-load resistive exercise with whole-body vibration (RVE; n=9) or no exercise (CTR, n=9) during 60-days head-down tilt bed rest. HR-pQCT measures of the distal tibia were performed before bed-rest, mid- and end-bed-rest, and then seven times in a two-year recovery follow-up period. Values are reported as mean[SD] percentage change versus pre-bed-rest.

Results: The greatest losses were seen in distal tibia cortical thickness (On day-3 after bed-rest: CTR:-2.7 [2.5]%, RE:-2.1[0.8]%, RVE:-1.9[1.7]%) and area (CTR:-2.4[2.1]%, RE:-2.0[0.9]%, RVE:-1.7[1.7]%). Total (CTR:-1.2[1.0]%, RE:-1.1[0.6]%, RVE:-1.2[1.2]%), cortical (CTR:-0.4[0.5]%, RE:-0.4[0.5]%, RVE:-0.4[0.6]%), and trabecular (CTR:-0.6[0.7]%, RE:-0.7[0.8]%, RVE:-0.9[1.8]%) density also reduced, but to a lesser extent. Increases in trabecular area and periosteal diameter were seen. Significant changes in trabecular number, separation and thickness were seen, but these effects were characterised by greater variability from one measurement day to the next. The greatest changes were seen between 3- to 28-days after bed-rest. Most of the changes were recovered by 180-days after bed-rest. A significant effect of the RVE (p=0.003), but not RE, countermeasure was seen on cortical area at the distal tibia, with few effects of the countermeasures seen on the remaining parameters.

Conclusion: Bone loss during bed-rest and remodelling afterwards can be particularly seen in the tibia cortex during bed-rest. This was seen the most in measures of cortical thickness and cortical area. HR-pQCT can be implemented in bed-rest to monitor changes at the distal tibia. The additional information gain in comparison to more conventional approaches (e.g. dual X-ray absorptiometry, conventional pQCT) still needs to be considered.