Life support Challenges for Human Space Exploration (10)
Supporting Crews for Exploration Missions (2)

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AN EXPERT SYSTEM TO FORECAST AND CONTROL THE BONE LOSS IN LONG LASTING SPACEFLIGHT

Abstract

We propose a specific electronic algorithm (expert system) to control bone loss, taking into account the effect of physical exercise, suggesting the use of anti osteoporotic drugs (Teriparatide and Alendronate) and controlling their effects. Starting from the level of specific bone bio-markers, in urine and blood, this algorithm is able to make an evaluation of the bone turnover, to suggest when to begin a drug treatment and to control the effect of such a treatment, modulating the dosage of the drug. As there is no experience on the effects of Teriparatide and Alendronate treatment on astronauts during their stay in microgravity, we studied a computerized model to foresee the changing of bone turnover markers provoked by the therapy and we tested it to verify its efficacy as an expert system. Considering the qualitative effects of anti osteoporotic drugs, in normal patients and volunteers, and the mutual interactions of different markers, a model to codify such a knowledge using fuzzy numbers was developed. We used the algorithm to forecast the status of bone mineralization in 80 patients, over a period of 6 months. The real data, bone turnover markers and quantitative CT (Computed Tomography) bone density values, of the same patients were used to control the effectiveness of the expert system. The simulations were concordant with the real data in 74 patients only for osteocalcin, bone alkaline phosphatase and serum C-terminal telopeptides of type I collagen. Considering the very short period of observation, that is not the optimal one for anti osteoporotic drugs, the results conferming that the expert system is ready to be used to forecast and control the astronaut bone loss during long lasting spaceflight.