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RESISTANCE OF RODENT BONE MARROW PROGENITORS TO SPACEFLIGHT FACTORS: BIOSATELLITE "BION-M1" AND GROUND-BASED EXPERIMENTS

Abstract

Elucidation of the space flight effects on the adult stem and progenitor cells is an important goal in space biology and medicine. A unique opportunity for this is provided by "BION-M1" project. We examined the effects of a 30-day flight on biosatellite and the subsequent 7-day recovery on mononuclears from murine tibia bone marrow. The S57black/6 mice were divided into groups: spaceflight, vivarium control, recovery after spaceflight and synchronous control. There were no differences between flight and control groups after 12 hrs and 7 days of recovery. The viability and CFU potential were high in all examined groups. Flow cytometric analysis showed no differences in the bone marrow cell immunophenotype, but the flight animals had more large-sized CD45+mononuclears, than the control. There was no difference in the CFU-F number between groups. After 7 days in vitro the MSC number in flight group was twice higher than in control, after 10 days – 4 times higher. These data may indicate a higher proliferative activity of MSCs after spaceflight. MSCs showed the same and high alkaline phosphatase activity, both in flight and in the control groups, suggesting no effect of spaceflight factors on early osteogenic potency of stromal cells. These results indicate that spaceflight factors had no significant damaging effects on the murine bone marrow progenitors. With the prospect of long interplanetary spaceflight becoming a real possibility there are some important questions regarding the combined effects of microgravity and gamma-irradiation. We evaluate the effects of 30-days unloading and fractional gamma-irradiation (6 doses with a source of 137Cs, total dose of 3 Gr) on rat bone marrow multipotent progenitors. It was shown a significant reduction in CFU-F in all experimental groups when compared to the control. The most significant decrease was observed in the group, which had been subjected to the combined unloading and irradiation. CD45 expression was increased in the groups exposed to radiation. At the same time a reduction in the expression of CD90 was observed during combination of radiation and unloading. The experimental groups showed smaller lipid drops and slow down in expression of alkaline phosphatase in MSCs. Hematopoietic CFU decreased only after irradiation and increased after recovery period. Granulocyte and macrophage progenitor changed in opposite manner. The results of experiments suggested

that the bone marrow progenitors showed moderate and reversible stress reaction on 30-day spaceflight factors. This work was supported by Program of IBMP RAS and grant NSc-371.2014.4