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Radiation Fields, Effects and Risks in Human Space Missions (5)

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SERUM MICRORNAS AS NONINVASIVE INDICATORS FOR SPACE RADIATION

Abstract

Purpose: Space radiation including proton, electron and heavy ions is one of major barrier to human in long-term or deep-space exploration. Although physical dosimeters and some biomarkers have been developed to assess exposure risk, but there are still many limitations for current radiation monitoring methods. How to assess the risk of individuals who are exposed with the potential threat of health in early stage by a simple way is a challenge for traditional radiation dosimeters. Serum microRNAs (miRNAs) are ideal biomarkers because they are stable in responding to changes of environments, conservative in different species and easy to collection. The purpose of this study was to identify a set of serum miRNA which can serve as a universal indictor to indicate the exposure risk of different kinds of ionizing radiation. Methods: Eight-weeks-old male Kunming mice were whole-body exposed to different doses of X-rays, carbon ions and iron ions radiation (0, 0.5, 2Gy). Serum samples were collected and 374 miRNAs expression profiles have been detected by miRNA PCR array. The serum miRNA levels of mice exposed to different dose of X-rays, carbon ions and iron ions radiation were compared with controls for their relative as well as apparent changes. Then, miRNAs responded significantly to all three kinds of ionizing radiation were selected out to observe the dose and time dependent changes by quantitative-RT-PCR. Results: The miRNA expression profiles showed that 24 miRNAs for X-ray, 20 miRNAs for carbon ions radiation and 14 miRNAs for iron ions radiation were differently expressed. Among them, 5 miRNAs (miR-183-5p, miR-21-3p, miR-200b-5p, miR-34a-5p, miR-342-3p) responded to all three kinds of ionizing radiation simultaneously. Furthermore, A dose and time dependent increase in miR-21-3p, miR-200b-5p and decrease in miR-342-3p was observed. Those changes were detectable from 0.1 to 2 Gy and within hours up to a week. Conclusions: Our results have identified a set of serum miRNA which respond to different kinds of ionizing radiation with dose and time dependence. Those animal studies suggest that some specific serum miRNAs have potential of serving as novel noninvasive indicators for space radiation.