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

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IDENTIFICATION OF NOVEL BIOMARKERS IN SERUM FOR HEAVY ION RADIATION: PROTEINS, MIRNAS AND TRNA-DERIVED FRAGMENTS

Abstract

Space radiation is a major concern for manned spaceflight, especially, heavy ion in cosmic rays can result in more DNA double strand breaks and serious consequences in carcinogenesis. New minimally invasive biomarkers that can be easily and quickly detected at an early stage are valuable for risk assessment of space radiation. Serum molecules originating from tissues and blood cells are ideal biomarkers because they are easy for collection and detection, however, the molecules that respond to low dose of heavy ion radiation which are common in galactic cosmic rays have not been reported. We sought to observe serum proteins and small non-coding RNAs which can serve as the potential biomarkers for heavy ions in space radiation. Here, eight-weeks-old male Kunming mice were whole-body exposed to different doses of carbon ion radiation from 0Gy to 1Gy with linear energy transfer (LET) of 30keV/m. We performed Mouse Antibody Array and RNA sequencing to detect expression profiles of serum proteins and small RNAs at 24h post-irradiation. After conditional screening, 51 proteins, 81 microRNAs (miRNAs) and 26 tRNA-derived fragments were differently expressed compared with control group (0 Gy). Further, the signature proteins and small RNAs with higher expression levels were detected by enzyme-linked immunosorbent assay (ELISA) and quantitative real time polymerase chain reaction (qRT-PCR) to validate their dose dependent changes. After validation, the expression levels of 2 proteins (IGFBP-1 and IGFBP-3), 3 miRNAs (miR-183-5p, miR-200b-5p, miR-342-3p) and 5 tRNA-derived fragments showed obvious increase or decrease with increased doses. In this study, we preliminarily identified some new proteins, miRNAs and tRNA-derived fragments in serum which respond to low dose of carbon ion radiation. These serum molecules have potential of serving as minimally invasive biomarkers for risk assessment of space radiation in future.