

Functional activity of hematopoietic stem and progenitor cells under the acute and chronic exposure to ionizing radiation in different doses

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Background. The problem of ionizing radiation influence on the organism is rather significant due to the fact that radiation sources are widely spread in medicine, industry, and environment in general. Therefore, it is important to study the mechanisms, which underlie the radiation-induced processes in cell, as well as the consequences on the level of tissues, organs and systems.

Aim. The aim of the current study was investigation of functional properties of hematopoietic stem and progenitor cells of Balb/C mice under external acute and chronic exposure to irradiation in different doses.

Methods. The study was performed using original system of hematopoietic cells cultivation in diffusion chambers *in vivo*, which allows assessing their functional activity. Animals were divided into 5 groups: 1) acute irradiation in the sublethal dose of 5.95 Gy during 8.5 min; 2) acute irradiation in the dose of 0.19 Gy during 4 h; 3) chronic irradiation in the dose of 0.24 Gy during 6 months; 4) chronic irradiation in the dose of 1.5 Gy during 18 months; 5) control group. 25 mice were used as donors; their bone marrow was obtained from femoral bones and suspension for further cultivation was prepared based on cultural medium and semisolid agar. Suspension was injected in gel diffusion chambers, which were inserted into the intraperitoneal cavity of recipients (50 mice). After 11-day cultivation we performed the analysis of obtained cell aggregates.

Results. Assessment of the cell cultures allowed determining the essential differences between the investigated groups of animals. The most pronounced decrease in the functional activity of hematopoietic progenitor cells was revealed in the 1st group. We obtained only 17.1 ± 0.8 colony-forming units (CFU) per 1×10^5 explanted cells, comparing to 36.4 ± 1.8 in control group. In the 4th group we received 19.2 ± 0.9 CFU; the 2nd and the 3rd groups were less affected – 29.1 ± 1.4 and 25.6 ± 1.1 CFU, respectively.

The obtained results are the evidence of high radiosensitivity of hematopoietic system, first of all, stem and progenitor cells. Besides, chronic long-lasting exposure to ionizing radiation causes the injury of not only hematopoietic cells, but also of hematopoietic microenvironment, and, as a result, impaired haematopoiesis.

Conclusion. The comparative analysis of obtained data has shown a pronounced influence of ionizing radiation on the functional properties of hematopoietic cells, depending on the accumulated doses. These findings can provide the basis for further development of radiation injury criteria in case of human radiation exposure.

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