PROLIFERATION ABILITY OF BONE MARROW CELLS OF HUMAN IN LATE PERIODS AFTER CHRONIC RADIATION INFLUENCE

V.S. Pesternikova

Branch No. 1 of Russian Federation State Scientific Centre Biophysics Institute
456780, Ozersk (Chelyabinsk-65), Russia

The ionizing radiation influence on human causes damage of hemopoiesis, that is one of the most radio-sensitive systems. Long-term chronic exposure leads quickly to changing the peripheral blood content, and therefore cytopenia (leucopenia and thrombocytopenia) of different degrees of its expressions depending from the value of exposure doses is being observed(1). The picture of peripheral blood and bone marrow has been fully studied in period of exposure and in period after the radiation influence end, when the gradual recovery of blood indexes was occurring to level that was observed during primary examination (2). The initial thrombocyte level recovered by 5th year of observation, but the leukocyte level recovery occurred later, and approached to the initial indexes in exposed persons by only 10th year. Despite the long-term period after the exposure end (25-30 years), the persons exposed to chronic γ-radiation doses, which exceeded the maximum permissible dose more that at 10 times, had the leukopenia, and in some cases the hypoplastic state of hemopoietic.

There are different interpretations of the leucopenia genesis in the literature for persons exposed, and the number of researchers believes that leucopenia in these patients is the consequence of decreasing the granulocyte production by bone marrow (3, 4). The important significance in changing of production of these cells may be the damage of proliferation processes of granulopoietic elements in bone marrow. There are a few works in literature which indicating to the damage of proliferative ability of hemopoietic cells under chronic exposure. The decreasing of mitotic activity of bone marrow cells occurred in persons who worked during long time period having the contact with the ionizing radiation sources (3). Basing on the experimental data (5, 6), the increase of proliferative ability of bone marrow cells was observed during the processes of the chronic and fractionation exposures, however, for long time exposures (1.5-2 years) it was shown the significant decrease of the proliferation processes with lengthening of cell cycle time by 2-2.5 times (6).

It was conducted the study of morphology and proliferative ability of the bone marrow cells in 46 persons, who were exposed to occupational external γ-radiation, in 25-30 years after end of contact with the ionizing radiation sources. The total doses of external γ-radiation were 2.0 Gy for 12 persons, 2.1-4.0 Gy for 23 persons, and > 4 Gy for 11 persons. The group of the practically healthy persons (9 individuals), who had not contact with ionizing radiation sources, was taken as the control group according to the age-sex content of main group. The proliferative ability of the bone marrow elements was evaluated by mitotic index, and by the degree of incorporation of the specific labeled predecessor of DNA (tritium-thymidine) into nuclei of the bone marrow cell under conditions of the short-term cultivation of bone marrow cells. The bone marrow preparations were made in 0.5, 1, and 2 hours, then they were fixed and treated by autoradiography. Percentage of labeled elements was estimated in preparations for each type of the proliferating cells (the label index). The label intensity was determined by number of silver granules under the nuclei of labeled cells.

The number of erythrocytes and thrombocytes was on the level of norm in the blood of examined patients. For 20 persons, the leucopenia of the different degrees of

expression was found out, and the decrease of number of cells which having nucleus was indicated in punctates of bone marrow because of decreasing of all types of cells or only granulopoietic elements.

The evaluation of proliferative ability of bone marrow elements shown that there is the decreased number of mitoses of both the proliferating granulocytes and erythronormoblasts in persons with hypoplasia. The number of mitoses of proliferating bone marrow elements was on level of norm in patient with normal hemopoiesis.

The values of tritium-thymidine incorporation into nuclei of bone marrow cells differed also in persons with different content of leukocytes in blood. The increase of incorporation of labeled predecessor of DNA into young granulo- and erythro-poietic elements was found for persons with normal content of leukocytes. The significant decrease of index and label intensity of bone marrow cells was in patient with long and stable leucopenia and hypoplasia, this evidences that the proliferation rate of granulopoietic cells decreases when cell cycle and its separate phases have become more long at 1.5-2 times. Apparently, the rate reducing of proliferation of these elements influences greatly on the content of granulopoietic elements in the bone marrow and in production of mature granulocytes as well as its content in peripheral blood. In some cases with expressed hypoplasia of hemopoiesis it was found only single labeled granulopoetic elements. In comparison with granulopoietic elements, the damage of proliferative activity of erythronormoblasts do not significantly influence on the content of erythrocytes in blood, it may be because of the compensatory reactions in the erythropoiesis system: a) the possible change of differentiation direction of the stem pool cells mainly to erythropoietic-sensitive elements (3); b) the significant addition of erythrocyte production may be waited under changing the ratio of elements of early and late generations of erythronormoblasts, i.e., increasing the erythroblast content, pronormoblas and basophilic normoblasts (elements with more high proliferative potential in comparison with polychromatophilic normoblasts); and c) in some cases, it was found out activating of the erythropoiesis (together with the leuco-erythro-blast ratio), that causes the additional erythrocyte production.

Thus, the proliferative process rates in bone marrow elements are significantly lower in persons exposed to chronic γ-radiation and having the hypoplasia of bone marrow, and leucopenia.

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