

Research & Reviews: Journal of Botanical Sciences

The Radiobiological Effect of Low Dose Ionizing Radiation on Visual Organs

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Short Commentary

Received date: 22/07/2015

Accepted date: 02/09/2015

Published date: 04/09/2015

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Currently, nuclear power has indicated its positions as one of the main sources of energy in the world. Therefore, currently study of the influence of ionizing radiation on human body, evaluation of the possible risk of the development of the radiation-biological effects and provision of the radiological safety has a clear scientific-practical direction. In connection with this, the assessment of the threshold effect of the low-level radiation is the most disputable today. One of the key, national problems, such as the assessment of medical consequences in the visual organ, according to classical radiobiological doctrine of "dose-effects" relationship, was investigated by the author on the example of the 115 employees In the exposed group I we have selected 75 of the liquidators (LPA) of the consequences of the Chernobyl accident, residents in the Republic of Kazakhstan, Astana, aged 40 to 60 years, primary and posterior subcapsular cataract immature stage (PSC). Depending on the year of entry into the area of emergency work and the resulting mean radial load according to the Russian State Medical Dosimetry Registry, patients were divided into 3 podruppy: I (1986) - 39 ALP (18,9 ± radiation dose of 0, 6 cGy); II (1987) - 21 ALP (radiation dose cGy 8,4 ± 0,6); 1B (1988-1989) - 15 ALP (radiation dose cGy 3,3 ± 0,3)- Risk factors studied cataract development in each of the above groups. Exhibited group II accounted for 115 employees Stepnogorsk Mining-Chemical Complex of the Republic of Kazakhstan with the initial and posterior subcapsular cataract immature stage (PSC). Age in both groups ranged from 40 to 60 years. The dose of radiation - 39, 89 ± 20, 61 (mine Shantobe) - 61,16 ± 21,64 mSv (Stepogorsk city).

The non-exposed group (men without exposure to ionizing radiation): control group (group) -97 with different stages of cataracts; the control group (control group) - 99 without pathology of the lens 4.

With the aim of clarifying the cause-and-effect association of the detected pathology with radiation in persons, who were affected by the influence of short-term and prolonged low level of the ionizing radiation, it was detected by the results of the conducted investigations that in the structure of the eye pathology the dominant is cataract and retinal pathology (angiopathy, angiospasm, and angiosclerosis).

Clinical features of the ophtalmopathy under the influence of the low dose radiation were characterized by early involutinal changes, which were progressing by time span.

To assess the effect of low doses of radiation among the rank of ocular diseases after studying their structure (number of cases) (incidence), we studied population relative risks (Eng. Related risk (RR) in the pathology of the eye, depending on the average radiation exposure, multiplicity of irradiation, industrial experience. One of the important measures of the relationship is a measure of the relative risk, which demonstrates the strength of the relationship between the influence of the studied factors and disease, speaking as a measure of the influence of this factor on the development of the disorder. The relative risk indicates how many times the likelihood of developing the disorder above in individuals exposed to certain risk factors than non-exposed.

Relative risk greater than 1 indicates an increase in the probability of occurrence of the phenomenon in a group under the influence of the studied factors. Evaluation of the population relative risk ($RR > 1$), detected in the development of the priority radiation-induced cataract ($RR 1,1-6,7$) and retina pathology ($RR 1,1-3,3$), indicates to the main risk factor – radiation, which effects the high morbidity with this class of diseases among the above mentioned study groups.

In addition, with the aim to optimize the immunological response of the especially radiosensitive and immune-privileged lens on the influence of low dose radiation, diagnostic study was conducted. The special interest is presented by the improved methodic of detecting the specificity of the reaction of stimulated leukergy in the presence of the lens antigen in vitro during forecast of the cataract of radiation genesis in persons who were affected by the low dose ionizing radiation. In this study antigen lens was designed and studied. (Notice of the Institute of Intellectual Property of the Ministry of Education and Science of the Republic of Kazakhstan about the positive result of the preliminary examination for the grant of an innovative patent for the invention "Method for predicting radiation cataract genesis in patients who received low doses of ionizing radiation" was received on this study).

As antigen we used the lens extract obtained by standard techniques: extracapsular cataract extraction. Diagnosticum "lenticular antigen" obtained by biochemical methods the authors Osterman LA Uilms B. Wilson K. For the first time the authors set the reference limit of $1,03 \pm 0,05\%$ leykergii stimulated in patients in the control group. A sample was considered positive if experience index agglomeration in the presence of an antigen stimulator $\frac{1}{3}$ lens was higher than in the control. The advantage of our method, unlike the method of spontaneous leykergii is that this particular method due to the presence in the reaction of the lens antigen sensitizing leukocyte reaction Delayed-type, particularly to low molecular weight allergens, identifying intensification of oxidative metabolism in sensitized leukocytes in contact with the allergen, determining its informative value in the diagnosis of specific radiation cataract genesis.

Thus in the research work on the immunodiagnosics cataract genesis of radiation as a result of randomization general population by random selection of the following criteria:

The presence of pathology of the lens (cataract) - focus on the lens was made in connection with a dominant position in the structure of ophthalmic diseases as a result of exposure to radiation - pathology of the lens (cataract) and its properties

1. - High radiosensitivity of the lens
2. - The anatomical features of the lens
3. - Immune privilege.
4. The criterion for inclusion of the exhibited groups 1 and 2 in immunological research were:
5. - Gender - men
6. - Age 40 to 60 years
7. - The average dose of radiation
8. -The Presence of pathology of the lens - cataract with primary and immature stages.
9. Exclusion criteria:- Average age over 60 years
10. - The presence of diabetes mellitus
11. - Corticosteroids.

As antigen we used the lens extract obtained by standard techniques: extracapsular cataract extraction. Diagnosticum "lenticular antigen" obtained by biochemical methods the authors Osterman LA Uilms B. Wilson K. As a result of the given study there were detected referent limits of $1,03 \pm 0,05\%$ of the lens antigen stimulated leukergy for the study groups. A sample was considered positive if experience index agglomeration in the presence of an antigen stimulator $\frac{1}{3}$ lens was higher than in the

Control. It was proved for the first time that in persons who were affected by low dose radiation with cataract under the conditions of the lens antigen stimulated leukergy in vitro their adhesive qualities are increasing, this assumes the maintained high autoagression to lens antigens and intensity of cell immunity. The "dose-effect" relationship was detected in the level of autosensibilization: the higher the dose, the higher the level of sensibilization of leukocyte to lens antigens.

The results of the dissertational work have interdisciplinary character and can be used by radiologists, ophthalmologists, and immunologists.

The obtained results allow to assess the possible harm of radiation to human health in regard to eye pathology in persons, who were affected by low dose radiation, and which is important to specialists in the field of risk assessment during the establishment of the norms of radiation safety as a result of possible techno genic accidents and professional contact with radiation, and also for population, living in radiation contaminated territories.

Evaluation of the clinical forms of ophthalmopathy, most frequently met among persons under the influence of low dose

radiation, will allow ophthalmologists to develop algorithm of managerial decisions in diagnostic and treatment-preventive aspects, and also during medical check-up.

The inclusion of the reaction of stimulated leukergy in vitro into the plan of diagnostic examinations will allow to assess the work of effector mechanisms of immune system and the level of their compensation, which will facilitate adequate diagnostic assessment of a patient and competent treatment administration.