EFFECT OF RADIOSENSITIVITY OF THE ORGANISM ON VESTIBULAR FUNCTION CHANGES AFTER EXPOSURE TO IONIZING RADIATION

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When animals were irradiated in a dose of 600 R, those with no changes in vestibular function following exposure to small doses of radiation were least affected, and those with lowered excitability of the vestibular analyzer in response to small doses of radiation were affected most.

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Ionizing radiations, when acting on the body in doses of less than 100 R, unlike the same factor in larger doses, may increase or decrease excitability of the nonauditory part of the labyrinth [6, 7].

The object of the present investigation was to verify the hypothesis that this effect is connected with individual radiosensitivity of the organism.

TABLE 1. Character of Changes in Threshold of Sensitivity of Vestibular Analyzer to Adequate Stimulation After Whole-Body Irradiation in Dose of 50 R

Character of reaction	No. of animals	Threshold (in deg/sec)		
		initial value	after irradiation	P
Increase of thresholds	5	4,7±0,2	6,8±0,7	<0,02
Decrease of thresholds	9	7,1±0,7	4,9±0,5	<0,02
No change	12	6,3±0,6	5,3±0,4	—

TABLE 2. Mortality Among Experimental Animals from Radiation Sickness Compared with Character of Reaction of Vestibular Analyzer After Whole-Body Irradiation in Dose of 50 R

Character of reaction	No. of animals	Survival after irradiation in a dose of LD_{50}	
		no. surviving	no. dying
Increase of thresholds	5	1	4
Decrease of thresholds	9	5	4
No change	12	9	3

EXPERIMENTAL METHOD

Experiments were performed on 35 chinchilla rabbits of both sexes weighing 2.5-3 kg, 26 animals being experimental and 9 control. The state of vestibular function was assessed from the threshold of postnystagmus determined by the stop-stimulus method. Adequate stimulation of the vestibular analyzer was provided by a special rotating apparatus [2]. In every case rotation began clockwise with an angular acceleration of 0.5 deg/sec^2 up to an assigned angular velocity. Braking (the stop-stimulus) took place after 0.15 sec. The next stimulus, differing from its predecessor by 1 deg/sec, was applied 1.5 min later. The experimental animals were exposed to whole-body irradiation in a dose of 50 R from a cobalt source on a type ÉGO-2 γ-ray apparatus with a dose rate of 168-161 R/min [8]. The threshold of nystagmus was measured 1.5 h later, noting whether its value differed from initially by more than 1.96 σ. If not, the difference between them was considered not significant. In accordance with the object of the investigations, the radiosensitivity of the experimental animals was determined by irradiating them in a dose of LD_{50} (shown by our data to be 600 R) 2 h after exposure to a dose of 50 R.

The control animals were investigated in the same way as the experimenta, but were not irradiated.

EXPERIMENTAL RESULTS AND DISCUSSION

As a result of a single exposure to whole-body irradiation in a dose of 50 R, changes took place in the vestibular function of 14 of the 26 experimental animals (Table 1).

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It is clear from this table that the initial threshold of nystagmus differed in the animals from the three groups ($P < 0.05$).

The results of control observations showed that the threshold of nystagmus determined after mock irradiation was indistinguishable from the results of the 4 preceding investigations.

When the experimental animals were irradiated in a dose of LD_{50}, the highest mortality was observed among rabbits developing changes in vestibular function (8 of 14 animals died), while the mortality was much lower among rabbits showing no changes of statokinetic function (3 of 12 rabbits died). When considering the mortality among the animals of groups 1 and 2, it should be noted that it was highest among those whose thresholds of sensitivity were increased in response to irradiation in a dose of 50 R (Table 2). Assessed by the χ^2 criterion, the difference in survival rate among the three groups of animals ($P < 0.05$) is significant.

Our results are in agreement with those obtained by other authors, who found that definite changes in the threshold of sensitivity of the vestibular analyzer take place in some animals after whole-body irradiation in doses of less than 100 R [7]. The fact that the reaction of the nervous system to irradiation is determined by the initial level of excitability has been confirmed by a number of observations [1, 4, 5].

On the other hand, N. G. Darenskaya and A. B. Tsypin [3] found a definite relationship between the response of the central nervous sytem to irradiation in small doses and the radiosensitivity of the animal.

The results of this investigation show, in our opinion, that the character of the changes in threshold sensitivity of the vestibular analyzer after single whole-body irradiation in a dose of 50 R bears a definite relationship to the initial excitability of the analyzer.

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