

CONTENT OF CATECHOLAMINES IN THE ORGANS OF ANIMALS DYING FROM ACUTE RADIATION SICKNESS

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The changes in the content of catecholamines in the organs of rabbits and monkeys dying from acute radiation sickness are different [2]. These differences may be associated with species differences both in catecholamine metabolism and in the course of radiation sickness.

In the present investigation the content of catecholamines was studied in the organs of guinea pigs, biologically close to rabbits, but in their sensitivity to radiation closer to monkeys.

EXPERIMENTAL METHOD

Experiments were carried out on 35 guinea pigs of both sexes weighing 500-900 g. Nine animals were used as controls and 26 guinea pigs received whole-body irradiation in a single dose of 500 R, in the following conditions: voltage 196 kV, filters 0.5 mm Cu + 1 mm Al, skin-focus distance 65 cm, dose rate 10.2 R/min; the evenness of distribution of the irradiation throughout the field was within limits of 8%. The guinea pigs developed a severe form of radiation sickness (mortality 88% in the period of 8-17 days after irradiation). The catecholamines were determined by the trihydroxyindole method [3, 4]. Differences were considered significant if $P < 0.05$.

EXPERIMENTAL RESULTS

The content of catecholamines in the organs of surviving guinea pigs, sacrificed in a satisfactory state 3.5 months after irradiation was as a rule close to normal. In the animals which died the adrenalin level was lowered on the average by 67%. The content of noradrenalin in the adrenals was increased by 85%, but in the heart, spleen, cerebral hemispheres, and brain stem it was reduced on the average by 50-60%. When extensive hemorrhages developed into the body cavities the adrenalin content in the heart rose sharply (on the average by 2.7x). This phenomenon was not observed in animals with local hematomas in organs (even in the heart tissue itself).

The adrenalin content in the adrenals and the adrenalin and noradrenalin content in the heart of the dying guinea pigs bore an inverse linear relationship to the time of death, while the content of noradrenalin in the cerebral hemisphere and its relative content in the adrenals were directly dependent on this time. The content of noradrenalin in the heart and spleen could be correlated with the relative loss of body weight (the coefficients of correlation in all cases were 0.4-0.6). The relationship between the noradrenalin content in the spleen and its weight did not reach the level of significance.

The decrease in the content of adrenalin in the adrenals and of noradrenalin in the other organs of the guinea pigs dying from radiation sickness corresponded to the analogous phenomenon in other species of animals [1, 2, 5-7] and indicated the functional insufficiency of the sympathetic-adrenal system, progressing to a lethal issue. Comparison of the results of the present investigation with the authors' previous findings [2] showed that the degree of decrease of the adrenalin content in the adrenals and noradrenalin content in the heart and spleen was less (and approximately equal) in the guinea pigs and monkeys, and much greater in the rabbits. The accumulation of noradrenalin (the precursor of adrenalin in biosynthesis) in the adrenals took place in the rodents but not in the monkeys, characterized by a high intensity of their hormone-forming processes [3].

Accumulation of adrenalin in the heart was also found in monkeys with severe hemorrhages; in rabbits, in which a hemorrhagic syndrome is not characteristic, this phenomenon was not observed. Probably acute excitation

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of the adrenal medulla by massive blood loss leads to the accumulation of adrenalin in the heart, and this may seriously disturb the activity of this organ [8].

The changes in the content of the catecholamines in animals dying from acute radiation sickness thus exhibit important species differences, determined mainly by radiobiological differences. However, in the case of some indices (the content of noradrenalin in the adrenals), species differences in the catecholamine metabolism may be more important.

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