RESPONSE OF THE ENTEROCHROMAFFIN SYSTEM OF ALBINO RATS AND GUINEA PIGS TO IRRADIATION

G. G. Pankratova and G. A. Chernov

UDC 612.497.014.481

In rats, in contrast to guinea pigs, the number of enterochromaffin cells is increased at the height of radiation sickness. At the same periods, abnormal, large enterochromaffin cells of the giant-cell type appear in rats.

* * *

A few investigations of the effect of irradiation on enterochromaffin cells of the intestinal mucous membrane has been published. Most of this work has been done on guinea pigs [1, 3, 7].

Because of differences in the distribution of enterochromaffin cells in guinea pigs and rats, and also of differences in their radioresistance, it was decided to compare the response of enterochromaffin cells of these animals to irradiation.

EXPERIMENTAL METHOD

Experiments were carried out on 40 male albino rats weighing 150-200 g and 40 male guinea pigs weighing 250-300 g. The animals received a single exposure to γ-ray irradiation in a minimal absolutely lethal dose: 700 R for guinea pigs and 900 R for rats. The control and irradiated animals were sacrificed by decapitation after 1, 3, 5, 7, 9, and 14 days. A histological study was made of pieces of duodenum fixed in 10% acid formalin, embedded in paraffin wax, and cut into sections 10 μ in thickness. Enterochromaffin cells were detected by the Masson–Hamperl argentaffin reaction. Cells were counted throughout the cross section of the duodenum.

EXPERIMENTAL RESULTS

A gradual decrease in the number of enterochromaffin cells was observed in guinea pigs irradiated in a minimal absolutely lethal dose in the course of development of radiation sickness (Fig. 1). At the height of the disease, signs of increasing mortality were observed among the enterochromaffin cells. Normally, large cells with very abundant granules predominate in the mucous membrane (from 450 to 600 cells per section). On the 3rd day after irradiation, cells with pycnotic nuclei, with granules caked together, and with a varying degree of degranulation appeared in the sections. On the 7th day, most cells remaining in the crypts were in a stage of destruction (260±23.6; $P < 0.01$).

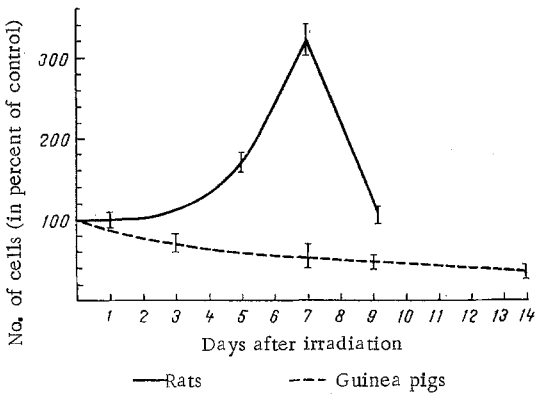

Fig. 1. Dynamics of changes in number of enterochromaffin cells in irradiated rats and guinea pigs.

In rats under normal conditions the number of enterochromaffin cells is much smaller than in guinea pigs (80±5 cells per section) and their granules are smaller and not so abundant. After irradiation of rats in a minimal absolutely lethal dose, in contrast to guinea pigs, the number of enterochromaffin cells was increased at the height of radiation sickness (7th day). The number of cells was 3-4 times greater (Fig. 1) than in the control (257±17.5; $P < 0.001$). At this time, cells of large size with more

(Presented by Academician of the Academy of Medical Sciences of the USSR P. D. Gorizontov.)
Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 67, No. 6, pp. 115-117, June, 1969.
Original article submitted June 21, 1968.

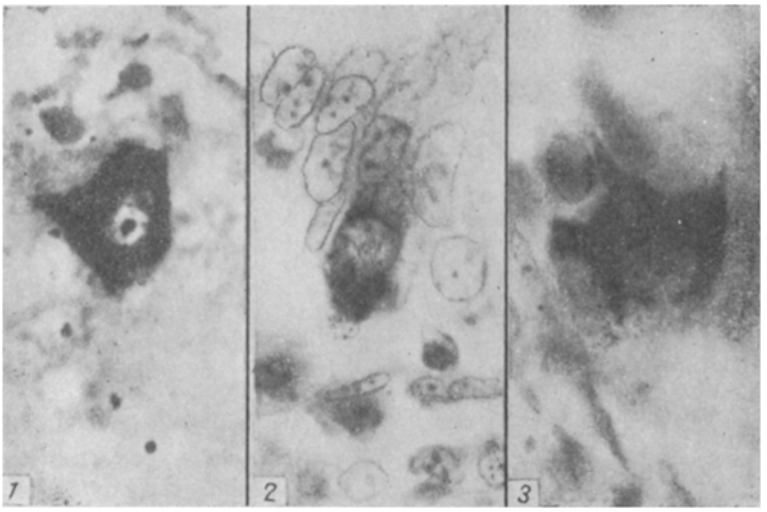

Fig. 2. "Giant" enterochromaffin cells (1 and 3) found in rats on 7th day after irradiation; enterochromaffin cell of control rat (2).

intensive and coarse granulation and also cells with vacuoles in their cytoplasm appeared in the mucous membrane. Very large, highly granulated cells of curious shape were found in some preparations. These were two or three times larger than the ordinary cells and were of the giant-cell type (Fig. 2).

Since mitoses have not hitherto been found in enterochromaffin cells, and amitoses only in isolated cases, the increase in number of cells on the 7th day discovered in these experiments was probably due to transformation, i.e., to maturation of preenterochromaffin cells. Further study of this problem is required.

Near the time of death of the animals (9th-10th day) the number of enterochromaffin cells showed a decrease (90±4.9).

The character of the response of enterochromaffin cells to irradiation thus depends on the species of animal. It is interesting to note that enterochromaffin cells of guinea pigs and rats react differently to various pharmacological agents also [5, 6]. From data in the literature on the importance of serotonin in the regulation of the hemostatic system of the body [2, 4] it is possible that the lower intensity of the hemorrhagic syndrome in rats with radiation sickness than in guinea pigs is due to differences in the response of the serotonin system in the animals of this species to irradiation, as the present investigation demonstrated.

LITERATURE CITED

1. N. M. Nemenova, V. M. Manteifel', and G. A. Chernov, Byull. Éksperim. Biol. i Med., No. 3, 109 (1962).
2. M. O. Raushenbakh and I. L. Chertkov, Pathogenetic Basis of Hemotherapy and Myelotherapy on Acute Radiation Sickness [in Russian], Moscow (1965).
3. A. M. Rusanov, G. N. Alekseeva, L. V. Solilova, et al., Abstracts of Proceedings of a Scientific Conference on "Regenerative and Compensatory Processes in Radiation Sickness" [in Russian], Leningrad (1963), p. 72.
4. G. A. Chernov, Radiobiol. Radiother., (Berlin), 4, 117 (1963).
5. S. Hallier, Z. Zellforsch., 27, 52 (1937).
6. E. Klemm, Z. Zellforsch., 26, 387 (1937).
7. J. Staszyc, Z. Mikr.-Anat. Forsch., 73, 351 (1965).