

ABSORPTION OF SEROTONIN BY PLATELETS IN ACUTE RADIATION SICKNESS

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Experiments on 35 chinchilla rabbits irradiated in a dose of 600 R (Co^{60} γ rays, dose rate 140 R/min) showed that at the height of acute radiation sickness the ability of the platelets to absorb serotonin is reduced. The disturbance of this platelet function is considered to be a possible cause of the blood serotoninopenia in acute radiation sickness.

A disturbance of the ability of the platelets to absorb serotonin is considered to play an important role in the pathogenesis of the decrease in the blood serotonin concentration in acute radiation sickness [1, 2]. However, no special investigations have been carried out to confirm this hypothesis.

The ability of the platelets to absorb serotonin at the various stages of acute radiation sickness was studied.

EXPERIMENTAL METHOD

Experiments were carried out on 35 chinchilla rabbits of both sexes weighing 2.0-2.9 kg. Whole-body irradiation with Co^{60} γ rays was given to the animals as a single dose of 600 R (dose rate 140 R/min). A single blood sample (25-30 ml) was taken from the heart through a silicone-treated needle from the healthy animals and at various times after irradiation (1, 4, 7, 10, 15, and 21 days).

Platelet-enriched plasma was obtained by spinning the blood at 90 g for 10 min. Next, 1 ml platelet-enriched plasma was treated with 20-g serotonin (sample 1); the control consisted of plasma without added serotonin (sample 2). Two parallel samples were prepared from each rabbit. The platelet count in the plasma was determined in a Goryaev's chamber by the method of Brecher et al. [3]. The samples were incubated at 37°C for 90 min. After incubation the plasma was centrifuged at 700 g for 10 min to obtain a residue consisting of platelets. The serotonin concentration was determined in the platelets from both samples of each rabbit by the spectrofluorometric method of Weissbach [5]. Platelets from the same samples of the same rabbit were studied by electron microscopy. For this purpose the platelets were fixed in Karnovsky's solution, then dehydrated in alcohols of increasing concentration and embedded in Araldite. Sections were cut to a thickness of 200-500 Å on the LKB-4800A ultratome, stained with lead citrate by Reynold's method, and examined in the JEM-5y electron microscope. The number of 5-HT-organelles (granules containing serotonin [4]) in 100 sections of platelets from each sample was counted on the negatives.

The degree of sorption of serotonin by the platelets of each rabbit was determined from the difference: 1) in the serotonin concentration per 10^9 platelets from samples 1 and 2; 2) in the content of 5-HT-organelles per 100 sections of platelets from the same samples.

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TABLE 1. Serotonin-Binding Activity of Platelets of Rabbits with Acute Radiation Sickness (spectrofluorometric investigation)

Group of animals	No. of animals	A	B	C
Control (healthy)	6	4,08±0,71	5,83±0,79	1,75±0,21
Irradiated, investigated at different times:				
After 1 day	6	3,85±0,56	5,73±1,65	1,88±0,51
" 4 days	5	2,96±0,47 ¹	4,60±0,39 ¹	1,64±0,36
" 7 "	5	2,10±0,22 ¹	3,06±0,59 ¹	0,92±0,28 ¹
" 10 "	5	2,04±0,57 ¹	3,04±0,24 ¹	1,00±0,23 ¹
" 15 "	5	4,32±0,87	5,22±1,34	1,90±0,22
" 21 "	3	3,70±0,56	5,47±0,83	1,70±0,24

Note. Here and in Table 2: A) serotonin concentration in platelets from plasma without added serotonin, B) serotonin concentration in platelets from plasma with added serotonin, C) difference in serotonin concentrations in samples 2 and 1.

¹P < 0.05 compared with initial value.

TABLE 2. Serotonin-binding Activity of Platelets from Rabbits with Acute Radiation Sickness (results of electron-microscopic investigation)

Group of animals		A	B	C
Control (healthy)	6	146±7	187±7	41±7
Irradiated, investigated at different times:				
After 1 day	6	141±5	185±6	43±3
" 4 days	5	132±4 ¹	169±5	36±5
" 7 "	5	109±4 ¹	130±5 ¹	21±2 ¹
" 15 "	5	141±3	186±7	42±3

¹P < 0.05 compared with initial value.

particularly severe on the 7th and 10th days after irradiation. On the 15th and 21st days the ability of the platelets to absorb serotonin was restored. These observations indicated a decrease in the serotonin-binding activity of the platelets at the height of acute radiation sickness.

On electron-microscopic investigation of the platelets a decrease in the number of 5-HT-organelles was found. This indicates a disturbance of their ability to absorb serotonin at the height of acute radiation sickness (Table 2).

The spectrofluorometric and electron-microscopic investigations thus showed that at the height of acute radiation sickness the serotonin-binding activity of the blood platelets is reduced. This is evidently a cause of the decrease in the serotonin concentration in the platelets observed by Chernov and Raushenbakh [1] and also in the present investigation.

LITERATURE CITED

1. G. A. Chernov and M. O. Raushenbakh, *Probl. Gematol.*, No. 9, 3 (1960).
2. G. A. Chernov, *Radiobiol. (Berlin)*, 4, 139 (1963).
3. G. Brecher and E. P. Cronkite, *J. Appl. Physiol.*, 69, 365 (1950).
4. I. R. Tranzer, M. Da Prada, and A. Pletscher, *Nature*, 212, 1574 (1966).
5. H. Weissbach, *Methods in Medical Research*, 9, 178 (1961).