

EFFECT OF EXOGENOUS SEROTONIN ON AGGREGATION  
OF BLOOD PLATELETS AND SOME BLOOD CLOTTING  
INDICES IN ACUTE EXPERIMENTAL RADIATION SICKNESS

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Exogenous serotonin has no significant effect on aggregation of the blood platelets or on some indices of blood clotting in acute experimental radiation sickness.

An important role in the pathogenesis of the radiation hemorrhagic diathesis is played by the thrombocytopenia and disturbances of the functional properties of the platelets [4, 5]. However, the mechanism of disturbance of the functional properties of the platelets in acute radiation sickness has not been adequately explained. Some workers consider that serotonin participates in the aggregation of platelets and in blood clotting [7, 15, 16]. The blood serotonin level is lowered in acute radiation sickness, and the aggregation of the platelets is disturbed [9]. It may be postulated that the disturbance of the aggregation properties of the platelets in acute radiation sickness is associated with the lowering of the blood serotonin concentration.

This paper gives data concerning the effect of exogenous serotonin on aggregation of platelets and some indices of blood clotting in acute experimental radiation sickness.

EXPERIMENTAL METHOD

Acute radiation sickness was produced in 38 Wistar rats of both sexes, weighing 200-400 g, by irradiation with  $\text{Co}^{60}$   $\gamma$ -rays in a dose of 600 R, dose rate 66 R/sec. On the 7th day after irradiation, the rats were anesthetized with nembutal (30 mg/kg), and 2-3 min before blood was taken, an injection of serotonin creatine sulfate (Lawson, England) in a dose of 0.1 mg/kg was given into a subcutaneous vein. After injection of serotonin into the blood stream, the serotonin concentration was determined by a spectrofluorimetric method [18], and the activity of factor XIII [2], tolerance of the fibrin clot to plasmin [3], the plasma recalcification time [10], the thrombotest [6], and the aggregation properties of the platelets [11] as revealed by the FEK-M photoelectric colorimeter were estimated. For determination of aggregation, the platelet count in the plasma was  $10 \cdot 10^4$ - $15 \cdot 10^4/\text{mm}^3$ . Observations on aggregation of the platelets were conducted for 20 min.

All determinations were made in blood taken from the jugular vein of the rats by a silicone-treated syringe, and the blood was mixed with 3.1% sodium citrate solution in the ratio 9:1.

EXPERIMENTAL RESULTS

The tests showed that injection of serotonin in a dose of 0.1 mg/kg body weight increased its concentration in the blood of the irradiated animals to its level in healthy rats. In healthy rats, for instance, the mean blood serotonin concentration was  $0.34 \pm 0.02 \mu\text{g/ml}$ , in rats of the control irradiated group it was  $0.13 \pm 0.04 \mu\text{g/ml}$ , and after injection of serotonin into the irradiated rats its level was  $0.42 \pm 0.1 \mu\text{g/ml}$ .

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TABLE 1. Effect of Serotonin on Aggregation of Platelets and on Some Blood Clotting Indices in Irradiated Rats ( $M \pm m$ )

Index	Irradiation	Irradiation + serotonin
Aggregation of platelets (in mV)	$0.37 \pm 0.07$	$0.36 \pm 0.05$
Activity of factor XIII (in sec)	$37 \pm 1.7$	$39 \pm 1.7$
Tolerance of fibrin clot to plasmin (in min)	$144 \pm 13$	$146 \pm 14$
Plasma recalcification time (in sec)	$91 \pm 4.6$	$99 \pm 3.4$
Thrombotest (degree)	$4.1 \pm 0.6$	$3.2 \pm 0.5$

Restoration of the blood serotonin level to the normal values had no effect on aggregation of platelets in irradiated rats (Table 1). In the experimental animals the activity of factor XIII, tolerance of the fibrin clot to plasmin, the plasma recalcification time, and the thrombotest were essentially indistinguishable from the corresponding blood indices in the control, irradiated rats.

Injection of serotonin into irradiated animals in doses restoring its normal blood concentration thus has no effect on the aggregation properties of the platelets. These results are in agreement with those obtained by other workers [14], who found no aggregation of platelets in the mesenteric vessels of irradiated rats after injection of serotonin. Disturbance of the aggregation properties of the platelets in acute radiation sickness is probably not connected with the decrease in the blood serotonin concentration.

In the doses indicated above, serotonin had no effect on blood clotting indices of the irradiated rats. Other workers also have previously observed no significant changes in blood clotting in animals and man under the influence of serotonin injections [1, 12, 17]. The results now obtained and analysis of data in the literature suggest that serotonin, in physiological doses, has no significant role in blood clotting.

However, it has been observed [8, 13] that injection of serotonin into irradiated animals reduces the intensity of the hemorrhagic diathesis and leads to a higher percentage of survival of the irradiated animals. When serotonin is injected against the background of acute radiation sickness, it can evidently help to arrest the bleeding through its effect on the microcirculation and on the resistance of the vessel walls. However, these hypotheses require experimental verification.

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