

MECHANISM OF PLATELET PARTICIPATION IN MAINTENANCE OF RESISTANCE OF VASCULAR WALLS

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Intravenous injection of a suspension of platelets in plasma into irradiated rats increases the resistance of the skin capillaries to a greater degree than injection of washed or disintegrated platelets in 0.85% NaCl solution.

The function of the platelets in maintaining resistance of the walls of blood vessel is connected, in the opinion of some workers [6, 7], with the formation of platelet plugs, sealing off entire or damaged areas of blood vessels, while others [5, 8] attribute this function to the liberation of certain platelet substances, notably platelet lipoproteins or mucopolysaccharides, from the platelets of the blood and their incorporation into the endothelium.

In this investigation a further study was made of the mechanism of platelet participation in maintenance of the resistance of the vascular wall.

EXPERIMENTAL METHOD

Experiments were carried out on 61 Wistar rats of both sexes weighing 160-280 g. To reduce the resistance of their vascular walls, the animals received whole-body irradiation with Co^{60} γ -rays in a total dose of 600 R and at a dose rate of 50 R/sec. The rats were used in the experiments on the 7th day after irradiation, when according to clinical and laboratory data acute radiation sickness of moderate severity had developed. The resistance of the skin capillaries and the platelet count in blood taken from the caudal vein were determined initially and 10 and 60 min after injection of a suspension of intact or disintegrated platelets in 1 ml fresh plasma or 0.85% NaCl solution into the jugular vein. The platelet suspension was obtained by differential centrifugation [1] of heparinized (3 units/ml blood) venous blood of healthy rats. In the series with disintegrated platelets, a suspension of washed platelets was frozen 3 times at -20° and thawed at 18° . A hemolysate of erythrocytes was obtained by Baluda's method [2]. Platelets were counted by the method of Brecher and Cronkite [4]. The resistance of the skin capillaries was determined in the hypogastric region by the Hecht - Nesterov method; negative pressure -450 mm Hg, exposure 6 min, diameter of jar 0.5 cm. The resistance was expressed in degrees: 0) absence of petechiae, I) isolated small petechiae; II) small petechiae and 1-2 larger ones, III) mainly large petechiae, IV) continuous hemorrhage.

EXPERIMENTAL RESULTS

It is clear from the results given in Table 1 that injection of a suspension of platelets in fresh plasma causes an increase in resistance of the blood vessel walls. The resistance was higher 60 min, than 10 min after injection. The number of circulating platelets was the same after 10 and 60 min. Injection of the same number of washed platelets in 0.85% NaCl solution had no effect on resistance. In series II, washed platelets suspended in 0.85% NaCl solution were injected deliberately in a larger quantity than in series I. Under these circumstances, the number of platelets in the circulating blood of the animals was doubled, but after 10 min the resistance was unchanged, and it was increased only to degree II after 60 min. Intravenous injection of a mixture of disintegrated platelets caused a slight increase in resistance, to the same

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TABLE 1. Effect of Intravenous Injection of Suspension of Intact and Disintegrated Platelets on Resistance of Capillary Walls of Irradiated Rats (12 rats used in each series of experiments)

Property	Injection of suspension														
	platelets in plasma (1.23 billion)			washed platelets in 0.85% NaCl solution (3.26 billion)			disintegrated platelets in 0.85% NaCl solution (2.63 billion)			hemolysate of erythrocytes (0.9 billion)			0.85% NaCl solution		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
No. of platelets per mm ³ blood ($\times 10^3$)	150	198 ¹	212 ¹	134	417 ¹	388 ¹	170	160	160	140	—	113	144	130	150
Resistance (degree)	IV	III ¹	I ²	III	III	II ¹	III	II ¹	II ¹	II	—	II	IV	IV	IV

3) Legend: 1) before injection of suspension, 2) 10 min and 3) 60 min after injection.

4) Values differing significantly from original ($P < 0.05$).

5) Values differing significantly from preceding index ($P < 0.05$).

degree after 10 and 60 min. Injection of hemolysate of erythrocytes or 0.85% NaCl solution had no effect either on the platelet count or on the resistance of the vessel walls.

The results indicate that the mechanism by which platelets participate in maintaining the resistance of blood vessel walls is unconnected with plug formation: if the negative reaction on the resistance of blood vessel walls were due to the fact that platelets, acting as plugs, block the lumen of vessels ruptured during the test, in that case the test of resistance would have given identical results 10 and 60 min after injection of the platelets, while after injection of disintegrated platelets, because of the impossibility of formation of platelet thrombi, the resistance in general would not have increased.

The investigations showed that platelets washed to remove plasma and suspended in 0.85% NaCl solution had a less marked action on the resistance of the vessel walls than intact platelets suspended in plasma. These results, and also other investigations [3] showing that injection of platelet-free plasma increases the resistance of blood vessel walls in acute radiation sickness, suggest that plasma factors play a part in the mechanism of maintenance of resistance of the blood vessel walls by the blood platelets.

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