FUNCTIONAL STATE OF THE SYMPATHICO-ADRENAL SYSTEM IN DIFFERENT PHASES OF THE THROMBOHEMORRHAGIC SYNDROME

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The functional state of the sympathico-adrenal system in various phases of the thrombohemorrhagic syndrome was studied in experiments on 98 albino rats. In the hypercoagulation phase increased function of the sympathico-adrenal system was found, while the opposite took place in the hypocoagulation phase; the results demonstrate the role of the sympathico-adrenal system in the genesis of the different phases of the thrombohemorrhagic syndrome.

The existence of a thrombohemorrhagic syndrome is now firmly established [5, 7, 8, 10], with a phase of hypercoagulation giving way to a phase of hypocoagulation as one of its features. The pathogenesis of this syndrome has been studied mainly with respect to the humoral component of the system for blood coagulation and fibrinolysis. The role of the regulatory systems has not received its due attention.

The functional state of the sympathico-adrenal system was studied in the different phases of the thrombohemorrhagic syndrome.

EXPERIMENTAL

Experiments were carried out on 98 albino rats. The thrombohemorrhagic syndrome was induced by intravenous injection of isogeneic hemolyzed erythrocytes in a dose of 1 ml/100 g body weight. Control animals received an equivalent volume of physiological saline. The various phases of the thrombohemorrhagic syndrome were tested by thromboelastography (ISK-2 thromboelastograph; blood from jugular vein; 26 rats).

Catecholamines were determined by Osinskaya's method [9] in the kidney, heart, and striped muscles. The animals were decapitated immediately after injection of the hemolyzed blood (14 rats) or physiological saline (12 rats), and also 15 min (10 rats from each group) and 24 h (13 rats from each group) after the injection.

EXPERIMENTAL RESULTS

Injection of isogeneic hemolyzed erythrocytes actually induced a thrombohemorrhagic syndrome which passed through different phases (Fig. 1). The coagulating activity of the blood was sharply increased 15 min after injection of the hemolyzed erythrocytes (decrease in the values of r, k, t, s, T; increase in the maximal amplitude ma and in the clot elasticity E, the coagulation index y, and the index of hypercoagulation rose particularly sharply). The coagulating activity of the blood was reduced 24 h after the onset of acute intravascular hemolysis (an increase in the time t, the specific coagulation constants, a sharp decrease in the maximal amplitude, and a decrease in the clot elasticity E, indicating utilization of fibrinogen and platelets for intravascular blood clotting). A phase of hypercoagulation thus developed 15 min after

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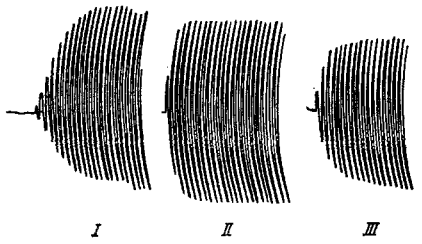

Fig. 1. Thromboelastograms of rats recorded at various times after injection of isogeneic hemolyzed erythrocytes: I) before injection; II) 15 min, and III) 24 h after injection of isogeneic hemolyzed erythrocytes.

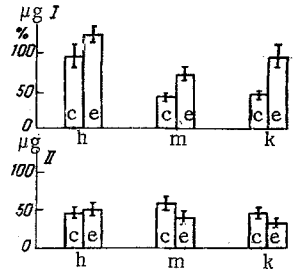

Fig. 2. Noradrenalin concentration in tissues in various phases of the thrombohemorrhagic syndrome: I) 15 min, and II) 24 h after injection of isogenic hemolyzed erythrocytes; c) control; e) experiment; h) heart; m) muscles; k) kidneys.

injection of the hemolyzed erythrocytes, and this was followed after 24 h by a phase of hypocoagulation, in agreement with observations in the literature [1, 5].

In the experiments of series I the noradrenalin concentration in the kidneys, heart, and striped muscles was studied immediately after injection of the isogeneic hemolyzed erythrocytes (as a rule, adrenalin is not found in these tissues).

Immediately after injection of the hemolyzed erythrocytes the noradrenalin concentration in the muscles was slightly increased. The catecholamine level in the kidneys and heart was unchanged.

In the experiments of series II these indices were studied 15 min after injection of the hemolyzed erythrocytes into the animals (Fig. 2). A marked increase in the noradrenalin concentration in the heart muscle, striped muscles, and kidneys was discovered at these times ($P < 0.01$). The thromboelastograms showed that marked hypercoagulation was present at this time.

A tendency toward a decrease in the noradrenalin concentration in the striped muscle and kidneys was observed 24 h after injection of the hemolyzed erythrocytes. Whereas the noradrenalin concentration in the muscle of the control group of animals was 56.5 ± 10.37 μg%, and in the kidneys it was 43.6 ± 7.30 μg%, in rats of the experimental group the noradrenalin concentration was 38.08 ± 7.07 and 31.92 ± 3.36 μg%, respectively.

Thromboelastography showed the development of hypocoagulation at this period.

These investigations suggest an essential role of the sympathico-adrenal system in the mechanism of development of the various phases of the thrombohemorrhagic syndrome. The increase in activity of this system was accompanied by signs of hypercoagulation in the tissue component of the mechanism of blood coagulation and fibrinolysis [2], by spasm of the blood vessels, by increased viscous metamorphosis of the platelets [3, 6], and by an increase in the activity of factor XII [4], which plays an important role in the development of the hypercoagulation phase of the thrombohemorrhagic syndrome. The opposite state of affairs is found during hypocoagulation.

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