

INFLUENCE OF VARIOUS ZONES OF THE HYPOTHALAMUS ON THE BLOOD CLOTTING SYSTEM

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Stimulation of the anterior zone of the hypothalamus by pulses of current (2 V, 1 msec, 8 Hz) for 1 min caused hypocoagulation in the blood clotting system, reflected in prolongation of the recalcification time and a decrease in the concentrations of factor VIII and heparin. During stimulation of the same zone at 100 Hz hypercoagulation was obtained: the recalcification time and the time of Quick's test were shortened and the concentrations of factor VIII and heparin increased. Electrical stimulation of the posterior zone of the hypothalamus at frequencies of both 8 and 100 Hz gave rise to hypercoagulation.

The hypothalamus, the highest autonomic center, has an influence on the blood clotting system [2, 3, 11]. However, whereas some investigators have observed a purely stimulant effect on the blood clotting system after stimulation of the hypothalamus [2, 8], others have observed hypocoagulation in response to stimulation of the anterior hypothalamus and hypercoagulation in response to stimulation of the posterior hypothalamus [4]. Other investigations have shown that the effect of the hypothalamus on autonomic functions depends not only on the localization but also on the strength, frequency, and duration of the stimulation [1, 6, 10].

It was therefore decided to study the effect of electrical stimulation of the anterior and posterior zones of the hypothalamus by pulses of different frequencies on the blood clotting system.

EXPERIMENTAL METHOD

Experiments were carried out on rabbits weighing 2.5-3 kg. The hypothalamus was stimulated through bipolar nichrome electrodes, 0.1 mm in diameter, inserted with the aid of a stereotaxic apparatus into the posterior and anterior zones of the hypothalamus by reference to the skeletal coordinates of Fifikova and Maršala. Square pulses (2 V, 8 and 100 Hz, 1 msec) were applied for a period of 1 min.

The state of the blood clotting system was investigated by determining the recalcification time [9], the concentrations of factor VIII and of free heparin [5], and the prothrombin time [12]. All these parameters were determined before and 5, 30, and 60 min after stimulation.

At the end of the experiment the location of the stimulating electrodes was verified histologically.

EXPERIMENTAL RESULTS

Stimulation of the anterior zone of the hypothalamus at a frequency of 100 Hz was accompanied by hypercoagulation of the blood (Fig. 1A). This was reflected in shortening of the recalcification time by 38.8% after 5 min ($P < 0.001$) and a decrease in the Quick's prothrombin time by 12.4% ($P < 0.02$). The concentration of factor VIII was increased ($P < 0.001$). The changes in the heparin concentration were not significant.

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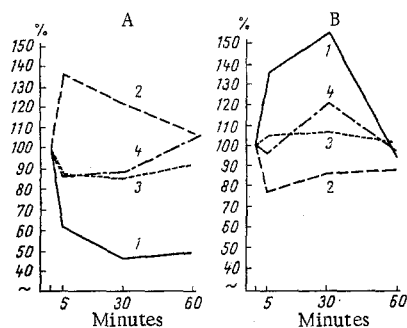


Fig. 1

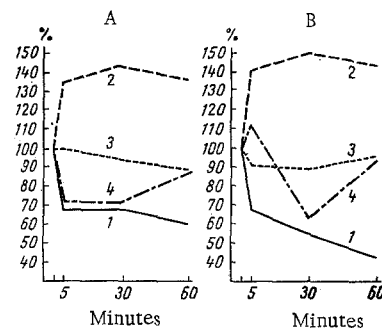


Fig. 2

Fig. 1. Changes in parameters of blood clotting system during stimulation of anterior hypothalamus at 100 Hz (A) and 8 Hz (B): 1) recalcification time; 2) concentration of factor VIII; 3) prothrombin by Quick's method; 4) free heparin concentration. Abscissa, deviation of parameter from normal, taken as 100%; ordinate, time of investigation after stimulation (in min).

Fig. 2. Changes in parameters of blood clotting system during stimulation of posterior hypothalamus at 100 Hz (A) and 8 Hz (B). Legend as in Fig. 1.

Electrical stimulation of the same region of the anterior hypothalamus at 8 Hz (Fig. 1B) gave a completely opposite effect: hypocoagulation of the blood was observed. The recalcification time was increased by 34.2% ($P < 0.05$) after 5 min, and it reached a maximum (152.2%; $P < 0.02$) after 30 min. The maximal increase in the concentration of factor VIII (by 12.1%) was recorded after 5 min ($P < 0.001$). The heparin concentration was increased by 19.78% ($P < 0.02$) after 30 min. The increase in the prothrombin time by Quick's method was not significant. All these parameters except factor VIII, the concentration of which remained low, returned to their original level after 1 h.

Stimulation of the posterior hypothalamus at frequencies of both 100 Hz and 8 Hz induced changes of a similar type in the blood clotting system. In response to stimulation at 100 Hz (Fig. 2A) the recalcification time was shortened by 40.74% ($P < 0.01$), the concentration of factor VIII was increased by 46.85% ($P < 0.001$), the Quick's prothrombin time was reduced by 7.44% ($P < 0.05$) with effect from 30 min, and the heparin concentration was reduced by 29% ($P < 0.001$) with effect from 5 min.

Stimulation of the same region at 8 Hz (Fig. 2B) shortened the recalcification time by 57.22% ($P < 0.001$) and increased the concentration of factor VIII by 50% ($P < 0.001$). After 30 min the Quick's prothrombin time was reduced by 10.6% ($P < 0.05$) and the heparin concentration was reduced by 36.5% ($P < 0.01$).

These results show that the hypothalamus participates in the regulation of the blood clotting system. The stimulant influence of the anterior hypothalamus on blood clotting must be attributed to stimulation of adrenergic elements, while the inhibitory influence, correspondingly, is attributed to stimulation of cholinergic structures [4]. These structures are evidently diffusely distributed in the anterior hypothalamus, and since they vary in their excitability, stimulation may give rise to an adrenergic or cholinergic effect depending on its parameters [7].

In response to electrical stimulation of the posterior hypothalamus hypercoagulation was observed whatever the frequency of stimulation. This may be explained by predominance of adrenergic structures in this region.

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