EFFECT OF VAGUS NERVE STIMULATION ON COAGULABILITY OF THE BLOOD IN CATS

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UDC 612.115-06:612.819.911

Electrical stimulation of the vagus nerve in cats leads to the development of hypercoagulation, accompanied by an increase in the thromboplastic activity of the blood. Increased fibrinoloysis under these conditions is evidently protective in character and aimed at dissolving the clots that may be formed in the blood stream as a result of the development of hypercoagulation.

KEY WORDS: vagus nerve; hypercoagulation; fibrinolysis.

Different workers have given extremely contradictory accounts of the role of the parasympathetic nervous system in the regulation of homeostasis. Whereas some workers [4, 5, 18] consider that excitation of cholinergic structures leads to delay of blood clotting, according to others [2, 10] stimulation of the vagus nerve may be accompanied both by quickening and by slowing of blood clotting. In experiments on dogs the writers showed that vagus nerve stimulation, like administration of choline chloride, leads to the development of hypercoagulation and to increased fibrinolysis [7-9, 12]. The contradictory nature of the data in the literature is presumably explained by the fact that the experiments were carried out on different animals.

To investigate this problem experiments were performed in which the vagus nerve was stimulated in cats.

EXPERIMENTAL METHOD

Experiments were carried out on 16 cats. Under hexobarbital anesthesia the vagus nerve was exteriorized in the neck and stimulated by an electric current (frequency 8/min, pulse duration 3 msec, strength 5 mA) for 1 h. Blood for investigation was taken after stimulation for 30 and 60 min and again 30 min after the end of stimulation of the nerve. The clotting time [17], recalcification time [15], plasma heparin tolerance [1, 19], prothrombin time (Leningrad Blood-Transfusion Institute method), thrombin time, and free heparin [20], the fibrin concentration [11, 14], the retraction time [16], and the retraction of the blood clot and fibrinolysis [6] were determined in the blood sample.

EXPERIMENTAL RESULTS

In the experiments of series I (Table 1) the intact vagus nerve was stimulated. This resulted in shortening of the blood clotting and plasma recalcification times, an increase in the plasma heparin tolerance, and, during the first 30 min, a decrease in the prothrombin time. A slight decrease in the fibrin concentration was observed 30 min after stimulation but the changes in the other parameters were not significant ($P > 0.05$).

In three experiments slowing of blood clotting was observed 60 min after the beginning of stimulation. However, this reaction developed after preliminary hypercoagulation.

Department of Normal Physiology, Chita Medical Institute. (Presented by Academician V. N. Chernigovskii.) Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 78, No. 7, pp. 7-9, July, 1974. Original article submitted September 18, 1973.

TABLE 1. Effect of Vagus Nerve Stimulation on Coagulability of the Blood in Cats (M ± m)

Parameter studied	Control	During nerve stimulation		30 min after nerve stimulation
		30 min	60 min	
Blood clotting time (in sec)	178,0	110,0±30,0	124,0±29,0	121,0±21,0
Plasma recalcification time (in sec)	56,0	48,0±3,2	48,0±2,9	46,0±4,9
Prothrombin time (in sec)	18,0	16,7±0,4	17,4±0,4	18,0±1,0
Plasma heparin tolerance (in sec)	182,0	120,0±27,0	107,0±29,0	88,0±34,0
Thrombin time (in sec)	31,6	31,9±1,1	31,7±1,3	—
Free heparin (in sec)	8,6	9,0±0,7	8,8±0,6	—
Fibrin (in mg)	3,7	3,2±0,5	3,6±0,5	3,0±0,3
Retraction time (in min)	57,0	50,0±7,6	47,0±4,5	51,0±11,6
Retraction and fibrinolysis (in %)	68,0	72,0±2,2	72,0±2,3	65,0±3,6

In the experiments of series II the effect of division of the right vagus nerve on the blood clotting indices was studied. Unilateral division of the vagus nerve in cats had virtually no effect on blood clotting.

In the experiments of series III, after division of the vagus nerve the peripheral end was stimulated electrically. In these experiments shortening of the blood clotting and plasma recalcification times, a decrease in the prothrombin time, and an increase in the plasma heparin tolerance were observed.

The changes found are evidence of increased thromboplastic activity of the blood after stimulation of the peripheral end of the vagus nerve.

The results are similar in many respects with those of the analogous experiments carried out by the authors on dogs [8, 12, 13].

The statements in the literature that blood clotting in cats is delayed in response to stimulation of the vagus nerve [18] can probably be explained by the development of secondary hypocoagulation in this case. Numerous experiments performed on different animals in the writers' department have shown that the coagulability of the blood is always increased and fibrinolysis intensified initially during excitation of both the sympathetic and the parasympathetic divisions of the autonomic nervous system [3, 7-9, 12, 13]. These results suggested that primary hypocoagulation does not exist in man and higher animals under physiological conditions [7, 8, 12].

Stimulation of the vagus nerve in cats thus leads to acceleration of blood clotting. The increased fibrinolysis in these cases is protective in character and is aimed at dissolving the clots that may form in the blood stream as a result of the development of hypercoagulation.

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