

Changes reflected in a lower curve were recorded 15 days after poisoning: a reduced vascular segment and a more prolonged maximum of accumulation of the radioactive colloid, exceeding 16-20 min (Fig. 3). The phenomenon described can be explained by disturbed functional activity of the reticuloendothelial cells as a result of their toxic damage by CCl_4 .

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EFFECT OF ACUPUNCTURE ON ACTIVITY OF EXPERIMENTAL

HIPPOCAMPAL EPILEPTOGENIC FOCI IN RABBITS

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Acupuncture is being used on an ever-widening scale in clinical practice as one of the most active methods of treatment of various diseases not involving the use of drugs [3, 4]. Acupuncture is used in particular for the treatment of epilepsy, but there are as yet no clinical or experimental data to confirm the antiepileptic effect of acupuncture and to justify its use in paroxysmal states.

The aim of this investigation was to study the effect of acupuncture on activity of experimental epileptogenic foci in model experiments on animals.

EXPERIMENTAL METHODS

Experiments were carried out on 32 chinchilla rabbits, mainly females, weighing 2700-3200 g, anesthetized with pentobarbital. Bipolar chemical electrodes were implanted into the dorsal hippocampus of the rabbits on the left and right sides, in accordance with stereotaxic coordinates. Each chemical electrode consisted of: 1) a cannula-needle 0.8 mm in diameter through which solutions of substance could be injected into the brain, and 2) a nichrome wire (0.25 mm in diameter), insulated with transplant plastic and glued to the cannula. Brain potentials were recorded on an ÉEG4P-02 4-channel electroencephalograph. The experiment in which the EEG was recorded the first time was carried out on the 6th day after the operation. All subsequent experiments with a particular rabbit were done at 2-day intervals. An epileptogenic focus was formed in the rabbit hippocampus by injection of 0.0001 ml (100 U) of a solution of the sodium salt of penicillin through the chemical electrode by

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TABLE 1. Changes in Activity of Epileptogenic Foci in Rabbit Hippocampus under the Influence of Acupuncture

Point of stimulation	No. of expts.	IED, %	ECS, %
Control	60	104,3	102,8
N _o 1	20	37,3*	12,8*
N _o 2	9	15,0*	0†
N _o 1 + N _o 2	8	2,7*	0†
N _o 3	8	57,5	74,6
N _o 4	9	265,8†	296,4†
N _o 5	9	138,3*	138,3*

Note. * and † not explained in Russian original — Consultants Bureau.

TABLE 2. Comparison of Effectiveness of First Two (A) and Next Two (B) Acupuncture Procedures on Epileptogenic Foci in Rabbit Hippocampus

Point of stimulation	IED, %		ECS, %	
	A	B	A	B
N _o 1	28,6	46,0*	1,7	24,0*
N _o 2	4,7	25,3*	0	0
Nos. 1 and 2 simultaneously	0	5,5*	0	0

Legend. *P < 0.05.

means of a 1- μ l chromatographic syringe. This dose of penicillin was the smallest capable of inducing an epileptogenic focus in the hippocampus of the rabbits in all experiments. In the course of 120 min after injection of penicillin the EEG was recorded, after which the number of single interictal epileptiform discharges (IED) per minute of the EEG record was calculated in each 10-min interval of the experiment and the mean number of electrographic correlates of seizures (ECS) was determined also per 10-min interval. The mean number of IED and ECS recorded on the first EEG trace obtained from the control and experimental animals was taken as 100%. Changes in the intensity of IED and ECS during repeated formation of epileptogenic foci in the same hippocampus of the same rabbit compared with the results obtained with the first focus formed were studied in ten control rabbits. In 22 experimental rabbits changes in the effect of acupuncture on activity of a subsequently created focus compared with the results obtained with the first focus in an individual rabbit not subjected to acupuncture were studied.

Acupuncture was given by means of steel acupuncture needles during the 20 min after injection of penicillin into the hippocampus; the needle was left *in situ* throughout the 120 min of the experiment. The following acupuncture points were used: No. 1 (20 experiments), corresponding to the Yao Yang Kuan point (3.XIII according to the French meridional system of nomenclature of human points [3]), located between the spinous processes of the 4th and 5th lumbar vertebrae; No. 2 (9 experiments), corresponding to the Ming Mên point (5.XIII) in man, located between the spinous processes of the 2nd and 3rd lumbar vertebrae; points Nos. 1 and 2 simultaneously (8 experiments); No. 3 (8 experiments), corresponding to the Ta Ling point (7.IX) in man, located in the middle of the proximal fold of the radiocarpal joint; No. 4 (9 experiments), a knowingly inactive point located between the spinous processes of the 3rd and 4th lumbar vertebrae; No. 5 (9 experiments), also a knowingly inactive point, located on the posterolateral surface of the animal's thigh. The reasons for choosing these acupuncture points were, first, data in the literature indicating that stimulation of the Ming Mên point lead to an antiepileptic action [2, 3] and that stimulation of this point potentiates the effects of stimulation of the Yao Yang Kuan point, and second, the simplicity and reliability of their identification in animals, for the locations of these points are determined by anatomical structures which exist in both man and animals. The Ta Ling point, belonging to a different meridian from the Yao Yang Kuan and Min Mên points, was chosen to monitor com-

parison of the effects of its stimulation with those of stimulation of the Yao Yang Kuan and Ming Men points. The two knowingly inactive points were used for the same purpose. Acupuncture was accompanied by the appearance of characteristic behavior of the animal: The rabbit became quiet, responded weakly to external stimuli, and its corneal reflex was depressed. The experimental results were subjected to statistical analysis by the Wilcoxon-Mann-Whitney nonparametric U test.

EXPERIMENTAL RESULTS

The results given in Table 1 demonstrate the marked and significant decrease in the number of IED and ECS on the EEG, depending on the point of insertion of the needles.

Comparison of the results of acupuncture stimulation of points Nos. 1 and 2 showed that stimulation of point No. 2 was more effective. The most significant, and almost total inhibition of interictal activity (by 97.3%) and of seizures (by 100%) occurred during simultaneous stimulation of points Nos. 1 and 2. Stimulation of point No. 3, belonging to the "pericardial" meridian, had a much weaker effect, which was not significant, on epileptiform activity. Stimulation of knowingly inactive points (especially point No. 4), on the other hand, led to a significant increase in activity of the epileptogenic foci.

The results of the first two stimulations of the acupuncture points are compared with those of the 3rd and 4th acupuncture procedures in Table 2.

The results in Table 2 show that with an increase in the number of acupuncture procedures, the antiepileptic effect of each procedure diminished significantly.

The first experimental proof was thus obtained that acupuncture stimulation has a marked inhibitory effect on excitability of epileptized neurons of the rabbit hippocampus. The significance of the experimental evidence thus obtained for the value of acupuncture in the treatment of epilepsy is confirmed, in the writers' view, not only by the results of statistical analysis of the data, but also by the following facts: 1) the unequal intensity of the antiepileptic effect of stimulation of points Nos. 1 and 2 (stimulation of point No. 2 was more effective); 2) potentiation of the antiepileptic effect by combined stimulation of points Nos. 1 and 2; 3) the absence of an antiepileptic effect in control animals, into which acupuncture needles were inserted at knowingly inactive points. Further investigations are needed to explain the observed increase in activity of epileptogenic foci in response to insertion of needles at the points known not to be acupuncture points.

The mechanism of realization of the antiepileptic action of acupuncture has not been studied. Existing published data are evidence that acupuncture is accompanied by a change in activity of various neurotransmitter systems of the brain: cholinergic, GABA-ergic, serotonergic, and enkephalinergic [1, 7]. It can be postulated that the antiepileptic action of acupuncture also is due to functional changes arising in the various neurotransmitter systems and, in particular, the enkephalinergic system. The possible role of endogenous morphinelike polypeptides in the antiepileptic action of acupuncture is indirectly confirmed by the results of the present investigation, which reveal a fall in the effectiveness of acupuncture during repeated applications, possibly due to the development of tolerance to endogenous opiate substances [8]. Enkephalins have also been shown to have both proepileptic [5, 6] and antiepileptic [9, 10] activity.

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