Our experiments show that ablation of the cerebral hemispheres of dogs leads to a fall in the value of the Congo red index, and to a lowering of the rate of elimination of the dye from the blood stream.

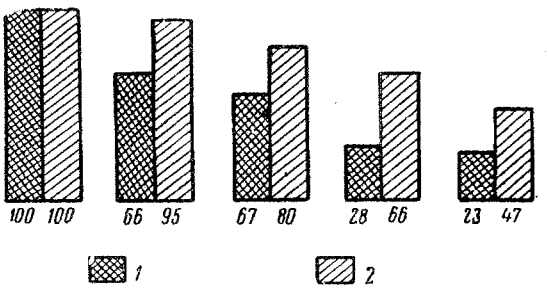

Fig. 2. Alterations in the Congo red content of the blood of normal and decerebrate dogs over 30 minutes after injection of the dye. The concentration of the dye in blood taken 4 minutes after injection was taken as 100%. 1) Unoperated dogs; 2) operated dogs.

This finding points to the existence of a direct or indirect influence of the cerebral cortex on the activity of the RES.

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REFLEX CHANGES IN THE INTRACARDIAL NERVOUS FORMATIONS ENCOUNTERED IN FOCAL EXPERIMENTAL MYOCARDITIS

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As we have shown in an earlier communication [4], focal myocarditis, produced in dogs and rabbits by application of heat to the apical myocardium, is associated with alteration in the response of the heart to electrical stimulation of the vagus nerves, whereas the response to stimulation of the sympathetics is unaffected.

* In Russian.

It was concluded, from an examination of the experimental material, that the effect was due to impulses proceeding from the pathological focus in the myocardium, leading to a parabiotic state, which, in the first place, affected the least labile nodes of the endocardial nerve formations, resulting in alterations in transmittance of impulses from the vagus to the heart.

Our experimental findings, and their interpretation, have been confirmed by other workers [1, 5, 6].

The experiments of these authors did not, however, exclude the possibility of the direct action of toxic substances on the intracardial nervous formations, and, indeed, assumed that such action took place. Moreover, no attempt was made to subject the intracardial nodes to thorough morphological examination.

In the present research we attempted to correlate the alterations in cardiac activity and in its paraysmpathetic regulation, due to myocarditis, with the myocardial alterations and with changes in the morphology of intracardial ganglionic formations. An essential feature of these experiments should be the exclusion of any possibility of direct damage to intracardial nervous formations by the traumatizing agent employed, and this would permit of an approach to the solution of the second objective of our research, viz., the elucidation of the role of reflex mechanisms in origination of morphologically discernable alterations in the intracardial nervous apparatus.

This condition was satisfied by the technique already applied by us for the production of focal myocarditis, and consisting in the injection, through a fine needle, of 1.0-2.5 ml of physiological saline at 85-95° into the apical myocardium, thus producing a circumscribed focus of necrosis, followed by hemorrhage and inflammation.

EXPERIMENTAL METHODS

The experiments were performed on dogs. The right vagus nerve of dogs under morphine-ether-chloroform anesthesia was cut in the cervical region, and the peripheral segment was placed on an electrode connected with the secondary coil of an inductor, fed from a 4 v accumulator. In each experiment we first determined the threshold for the reaction of the heart, during 10-15 minutes, involving 5-6 stimulations, each of 10 seconds duration. Hot saline was then injected into the myocardium (for this purpose, the thorax was opened at the level of the fifth rib, for 3-5 minutes, with artificial respiration, and an incision was made in the pericardium), and 8-10 determinations of the threshold current were again made, over a period of 40 minutes to 1 hour. Recordings of the action of the heart were made simultaneously with electrocardiographic and blood pressure recordings. The duration of each experiment varied from 1 hour to 1 hour 30 minutes. After conclusion of the experiment the dogs were killed with an ether-chloroform mixture.

Fragments of apical myocardial tissue, taken from the traumatized region, were subjected to histological examination, performed under the supervision of Prof. A. A. Solovev, Corresponding Member of the Academy of Medical Sciences USSR.

The tissue sections, prepared on a freezing microtome, were stained withhematoxylin-eosin, and with Sudan III for fat.

Intracardial nodes were taken from the region of the interauricular septum, and were examined by Nissl's method, and also by silver impregnation according to Kampos. The hearts of 4 experimental animals was subjected to histological examination. The control material for these examinations was taken from 2 dogs, previously subjected to a dummy operation, involving opening of the thorax, with incision of the pleural and pericardial sacs, without damaging the myocardium, followed by stimulation of the vagus, repeated 12-15 times at 3-5 minute intervals, for 60-70 minutes. Control material was also taken from 2 dogs which had been subjected to the dummy operation alone.

As was noted in our previous papers, stimulation of the vagus nerves of animals with undamaged myocardium did not affect the threshold of the reaction of the heart.

EXPERIMENTAL RESULTS

The reactions of all the 4 dogs, whose hearts were later subjected to histological examination, to the injection of hot saline were of the same type.

During the first few minutes after damaging the myocardium the threshold for the reaction of the heart to vagus stimulation rose by 2-8 cm of the length of the induction coil, i.e., the transmission of impulses from the vagus nerves to the heart was considerably impeded. The frequency of the heart beat increased. Sporadic or grouped premature beats made their appearance. Brief attacks of paroxysmal ventricular tachycardia were seen less frequently, although alterations in the form of the ventricular complex of the sinus contractions of the heart were not noted. This is evidence that the necrotic foci produced in the myocardium were of small size. The blood pressure rose slightly in some cases, and fell slightly in others.

Histological examination showed the following.

In Dog No. 1 (experiment of February 25, 1951) the muscle fibers in the specimen taken from the region of injection of saline into the apical myocardium were separated. The space between them was filled with loose fibrous tissue, forming a more or less dense reticulum. This enclosed sporadic groups of erythrocytes, as well as sparsely scattered lymphoid cells, including some polymorphonuclears, either singly, or in small aggregates. In places, this reticulum resembles a fibrin network. Some of the meshes of the reticulum are formed from separated connective tissue fibers.

The muscle fibers at the margins of the lesion frequently contain pycnotic nuclei, and are in places converted into a homogeneous or finely granular mass (Figure 1).

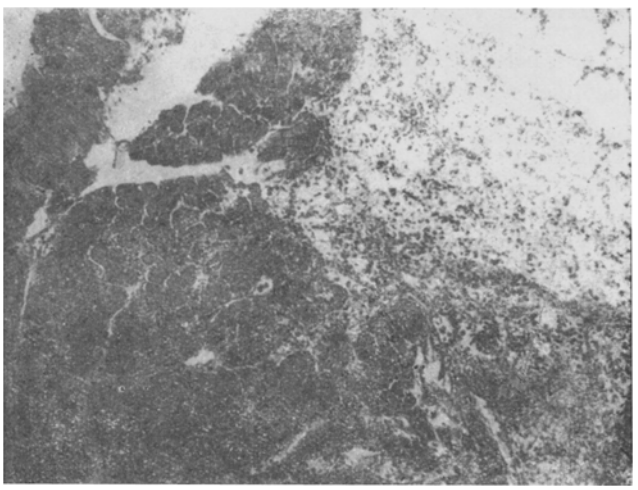

Fig. 1. Site of introduction of physiological saline into the apical region of the heart of Dog No. 1.

The blood vessels located in the immediate vicinity of the focus, as well as at a certain distance from it, were markedly engorged.

Staining for fat with Sudan III did not reveal fatty degeneration. The intracardial nodes contained nerve cells, with peripherally situated nuclei, and showing evidence of central chromatolysis. A few binuclear cells were seen.

Similar changes were seen in the other dogs (Nos. 2, 3, and 4).

Deviations from normal were not observed during the histological examination of heart muscle taken from dogs of the control series, subjected to the same operational trauma as the experimental group, and to vagus stimulation, but not given myocardial injections. The nerve cells of the intracardial nodes showed alterations characteristic of stimulation. These changes were not of uniform intensity for all the dogs of the control group.

Isolated nerve cells taken from dogs subjected to vagus stimulation contained peripherally situated chromatophilic substance, which formed a border around the margins of the cells, with peripheral displacement of the nucleus. Such cells were also encountered in dogs subjected to opening of the pleural and pericardial sacs only, without vagus stimulation, but the changes were of lesser degree.

A comparison of the nature of the alterations in the nerve cells of the experimental and the control animals shows that the differences are both quantitative and qualitative.

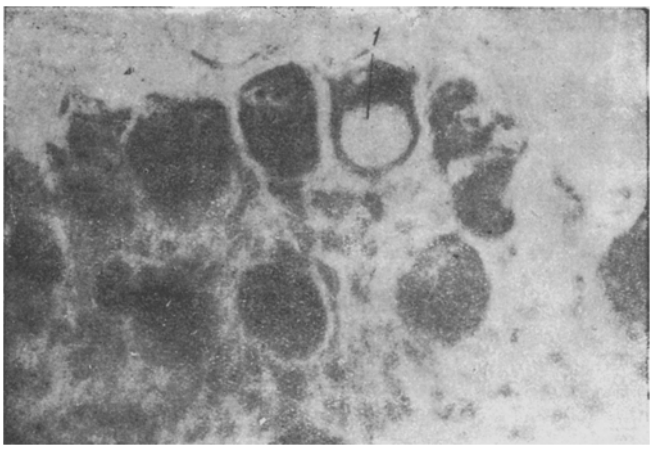

Fig. 2. A nervous node from the interauricular septum. 1) vacuolized nerve cell (Dog No. 1).

Whereas stimulation of the vagus, and opening of the thoracic cavity, are followed by appearance of evidences of stimulation of isolated neurones only, the superimposition of additional stimulation by inflicting circumscribed trauma to the myocardium is followed by the appearance of vacuolized nerve cells, and at hyperplasia of their processes, i.e., to more serious structural alterations (Figure 3).

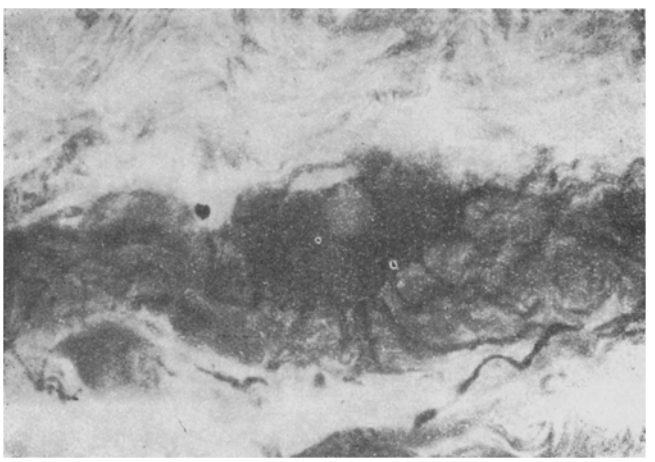

Fig. 3. A node from the interauricular septum. Hyperplasia of processes of a nerve cell (Dog No. 2).

Similar alterations in intracardial nodes were described by Yu. M. Lazovsky [3] in certain myocardial diseases, in particular in myocardial infarct.

The disturbances in transmission of impulses from the vagus nerves to the heart may to a large extent be attributed to these pathological dystrophic changes in nerve cell morphology, which are only encountered in the presence of lesions of the heart.

It may be concluded from the electrocardiographic findings, from the morphological study of the thermal lesions, which are seen to be sharply demarcated, and to be remote from the locations of the intracardial nervous apparatus, and from the rapid development of the changes in this apparatus, that these alterations are not ascribable to the direct action of the traumatizing agent, but that they arise reflexively, as a result of the powerful additional stimuli proceeding from the focal lesion.

The stimuli from the focal lesion may reach the intracardial nervous apparatus through existing reflex arcs, involving the second, intact vagus nerve, the intervertebral ganglions, and the sympathetic nerve. Of equal importance may be links of the axon reflex type, and this view is supported by A. A. Zubkov's comparative morphological studies [2]. Phenomena of the type of perielectrotonic remote action may also be of some significance [7].

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ALTERATIONS IN PHAGOCYTIC ACTIVITY OF THE LEUCOCYTES OF HUMAN BLOOD DURING ANESTHESIA

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Numerous papers have been published over the past few years on the effect of the nervous system on immunobiological processes, and, in particular, on the phagocytic reaction of leucocytes [5, 10, 11, 12, 13]. Most of the researches were performed on animals, and only a few [4, 9, 11] are based on observations of human subjects.

The present paper presents the results of observations of phagocytic activity of the leucocytes of 127 patients under ether or nitrous oxide anesthesia. The complement activity of the blood was also studied for some of the patients.

EXPERIMENTAL METHODS

Phagocytic activity and complement titer were determined in 110 patients before administration of the narcotic, during the stage of unconsciousness preceding the operation, and on the day following the operation. Of these patients, 81 underwent surgical operations for conditions such as contractures, ankyloses and skin defects, i.e., they were not suffering from inflammatory or septic conditions. The complement titer of the blood was determined by the same method as is used in the Wasserman reaction. The phagocytic activity of the leucocytes was assessed with respect to Staphylococcus aureus, strain 209. To a mixture of 0.02 ml of 3.8% sodium

* In Russian.