

PATHOLOGICAL PHYSIOLOGY AND GENERAL PATHOLOGY

CHANGES IN THE EXCITABILITY OF THE VASOMOTOR CENTER DURING SURGICAL OPERATIONS ON THE AURICLE

K. A. Sergeeva

Physiological Laboratory of the A. A. Vishnevsky Institute of Surgery of the
USSR Academy of Medical Sciences (Dir., Active Member

P. K. Anokhin), Moscow

(Presented by Active Member Prof. P. K. Anokhin

Received December 15, 1956.)

During operations on patients with stenosis of the left atrioventricular foramen there are recorded definite changes in pulse, electrocardiogram, and vascular tone, which arise at the moment the auricle is manipulated.

V. I. Proznina [3], B. S. Kulaev [1], and others showed that irritation of the pericardium is attended by considerable changes in blood pressure and vascular reflexes, i.e., changes in the vasomotor center.

The present work was devoted to the study of the excitability of the vasomotor center during surgical operations on the auricle.

METHODS

The excitability of the vasomotor center was investigated by stimulating the baroreceptors of the carotid sinus reflexogenic zone. The experiments were carried out on rabbits. Twenty-four experiments in all were carried out.

Under urethane anesthesia, we secured the animals to the bench on their backs. We isolated the carotid arteries, one of which we arranged for blood pressure recording via mercury manometer and to obtain the pressor reflexes of the carotid sinus every 5-10 minutes, we put a Dieffenbach clamp on the other carotid. The pressure on the common carotid lasted 20 seconds. We determined the initial magnitude of the carotid sinus pressor reflex before the start of the operation.

Operation procedure: In the operation we exposed the ribs and sternum with a long skin-muscle incision. From the second to third ribs we cut the costal cartilages and removed part of the sternum. By blunt dissection we exposed the pericardium and made a medium sized incision in it; through the opening we grasped the auricle and drew it through the incision. Then we applied a ligature to the auricle as a preliminary to suturing it.

The ligatured auricle retreated into the incision, which we sewed up tightly.

We recorded the carotid sinus reflex after cutting into the costal cartilages and removing the sternum, after cutting into the pericardium, after grasping and suturing the auricle, and during the 2-3 hours after the operation.

RESULTS

In all the experiments, immediately after the ligation of the auricle, there was a decrease in the pressor reflex, up to the point of its complete disappearance at the end of the first or the beginning of the second hour. The latent period of the reflex was notably prolonged.

The blood pressure level remained the same or fell a very little. In some experiments, when the common carotid was squeezed, inverted (depressor) reflexes were observed (Fig. 1).

Thus ligation or suturing of the auricle is reflected in the excitability of the vasomotor center. Definite diminution of, or inversion of, pressor reflexes, observed after the operation, testifies to a lowering of the excitability of the vasomotor center.

To investigate the mechanism of the effect observed, a number of experiments were carried out.

In the first series, before the experiment or soon after it, we cut the vagus nerves, or blocked them with novocaine.

In all 4 experiments neither section nor blocking of the vagus nerves exhibited any influence on the dynamics of the change in reflexes following the operation.

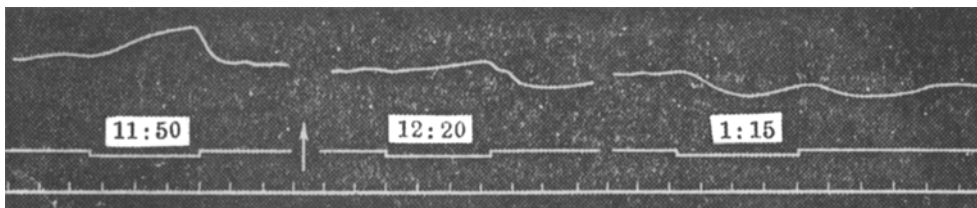


Fig. 1. Change in the pressor reflex of the carotid sinus following ligation of the auricle. Meaning of curves (from top to bottom): blood pressure, records of stimuli, time signals (5 second intervals), \uparrow -ligature of auricle.

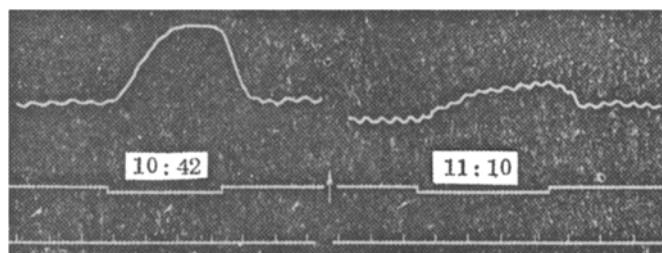


Fig. 2. Changes in the carotid sinus pressor reflex on suturing the auricle after section of the vagus nerves. Meaning of curves same as in Fig. 1.

In rabbits with cut vagi, ligation of the auricle led to lowering of the excitability of the vasomotor center, which was expressed as a decrease, disappearance, or inversion of the carotid sinus reflexes (Fig. 2).

The morphological investigations of B. M. Erez [4], E. K. Plechkova [2] and others demonstrated the role of depressor fibers in the innervation of various regions of the heart.

In this connection we carried out the following experiments, in which we cut the depressor nerves about 1-1½ hours after operation on the auricle, i.e., when the reflexes were already sharply decreased.

In 4 experiments, immediately after section of the depressor nerves, the carotid sinus reflexes were completely restored. In one experiment the magnitude of the reflexes after section of the depressor nerves was increased, reaching values higher than the initial values.

In the subsequent 7 experiments we performed the ligation of the auricle on animals whose depressor nerves

had already been cut. Section of the depressor nerves before the operation had little effect on the magnitude and character of the carotid sinus pressor reflexes; in the majority of cases the reflex level was not changed by section of these nerves. In all cases, ligation of the auricle, in animals whose depressor nerves had already been cut, was not reflected in the state of the carotid sinus reflexes; their magnitude and period of inhibition during the first 2 hours after operation remained as before (Fig. 3), and only at the end of the 2nd or the beginning of the 3rd hour, along with a gradual fall in blood pressure in two experiments, did the carotid sinus reflexes decrease.

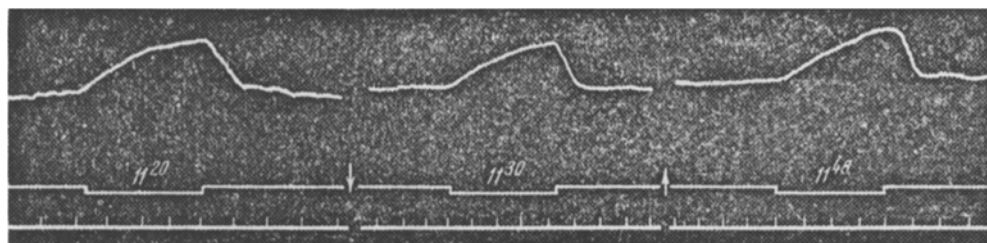


Fig. 3. Carotid sinus pressor reflex before and after ligation of the auricle on a background of a section of depressor nerves. Meaning of curve as Fig. 1. ↓ section of depressor nerves; ↑ ligation of auricle.

Consistency of the carotid sinus reflexes was observed only if both depressor nerves were cut. After section of only one depressor nerve, suture of the auricle led to a decrease in the reflexes, as before.

Thus, section of the depressor nerves completely eliminated the change in the state of excitability of the vasomotor center which was observed when the auricle was operated on. This fact allows us to suppose that in operative manipulation of the auricle, afferent impulses reach the vasomotor center, through the depressor nerves leading to a diminution of its excitability, which may be one of the reasons for disturbances in hemodynamics during operations on the heart.

SUMMARY

The excitability of the vasomotor center was investigated by stimulating the baroreceptors of the carotid sinus zones of 24 rabbits, anesthetized with urethane, during operations on their auricles. Ligation of the auricle caused a decrease in the excitability of the vasomotor center, which was expressed as inhibition, which could even be complete, of the pressor reflexes. Section of both vagi did not abolish this effect. Section of both depressor nerves completely abolished these reactions.

LITERATURE CITED

- [1] Kulaev B. S., Role of the Chemoreceptors of the Pericardium in the Regulation of Circulation and Respiration.* Author's abstract, Diss., Moscow, 1954.
- [2] Plechkova E. K. *Klin. Med.* 1941, Vol. 19, No. 9.
- [3] Prozhiga V. I., *Vestnik Khirurg.*, 1955, 6, 71-78.
- [4] Erez B. M., The Nerves of the Human Heart and those of Certain other Vertebrates, Author's abstract,* Diss. Leningrad, 1956.

* In Russian.