

# THE EFFECT OF ISOHEMOTRANSFUSION ON THE METABOLISM OF ADRENERGIC SUBSTANCES IN THE BRAIN AND EFFECTOR ORGANS

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In 1957, we established that isohemotransfusion and primary transfusion of therapeutic serum (LSB) prepared by N. G. Belen'kii's method cause a pronounced and prolonged increase in the norepinephrine content of rabbit hearts. Further development of this research led us to study of isohemotransfusion on the metabolism of adrenergic substances in the brain, striated muscle (triceps brachii), and the spleen.

## METHOD

Rabbits were given a transfusion of freshly preserved (according to recipe No. 7 of the Order of Lenin Central Institute of Hematology and Blood Transfusion) rabbit's blood in a dose of 3-5 ml per kg of animal weight. Thirty minutes, 24, and 72 hours after the isohemotransfusion, the animals were decapitated, and the epinephrine-like substances in the brain, striated muscle (triceps brachii), and spleen were investigated by V. O. Osinskaya's method [11]. This method makes it possible to determine norepinephrine, epinephrine, compounds with the properties of oxidation products of epinephrine-like substances, and non-adrenal fluorescence. The experimental and control animals were killed on the same day. Changes in the metabolism of adrenergic substances were estimated by comparing the data obtained from the experimental and control animals in the course of one experimental day and also by comparison with the average level of the corresponding adrenergic substance in the control rabbits. Investigations were performed on 58 rabbits (30 experimental, 14 control, and 14 donors). The data were processed by the method of variable statistics ( $D=0.95-0.99$ ).

## RESULTS

The investigations conducted showed that isohemotransfusion is attended by a prolonged and pronounced increase in the norepinephrine content of the brain (Fig. 1, a, b). Even 72 hours after the transfusion, the norepinephrine content of the brain was greater than in the control rabbits.

Thirty minutes and twenty-four hours after the isohemotransfusion, the content of epinephrine-like substances was increased. After 72 hours, the content of these substances was the same as in the control rabbits in one animal and less than in the control in seven animals. Only in two cases was the content of epinephrine-like substances greater than in the control animals (Fig. 1, c, d). The fact that we hardly ever found epinephrine present in any of the experimental tissues is in accord with the literary data [14].

The changes in the metabolism of the striated muscle after isohemotransfusion (Fig. 2) followed the same course as those observed in the brain, although the changes observed in the content of epinephrine-like substances were more pronounced.

After isohemotransfusion, we also observed an increase in the content of norepinephrine and epinephrine-like substances [oxidation products (Fig. 3)] in the spleen. The metabolism of adrenergic substances in the brain, striated muscle, and spleen showed similar changes after primary transfusions of the heterogenic blood substitutes BK<sub>8</sub> [protein-blood substitute (protein hydrolyzate)] and LSB [13].

Norepinephrine is a total peripheral vasoconstrictor which exerts its action at its place of formation [15]. The increase in the content of adrenergic substances in the brain, heart, and main blood depots (striated muscle and spleen) is an extremely important part of the mechanism of the hemodynamic effect produced by various kinds of hemotherapy. It is no exaggeration to propose that pathology of the vascular tonus is pathology of the arterial pressure regulators. From the physiological viewpoint, therefore, one cannot concur with the opinion widely held that the mechanism of hemotherapy's hemodynamic effect is only the mechanical filling of the vascular system with blood colloids or plasma.

The data cited, together with the material we published earlier, show that different kinds of hemotherapy alter the functional condition of different sections of the corticovisceral reflex arc: the angioreceptors, the

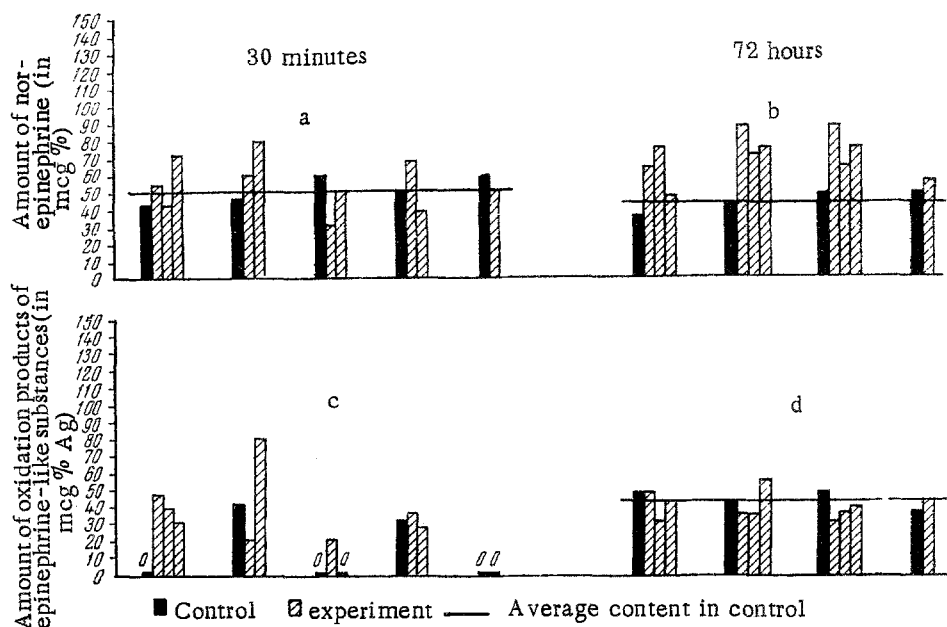


Fig. 1. Change in the amount of norepinephrine and epinephrine-like substances in the brain. Key: a, c—30 minutes; b, d—72 hours after isohemotransfusion.

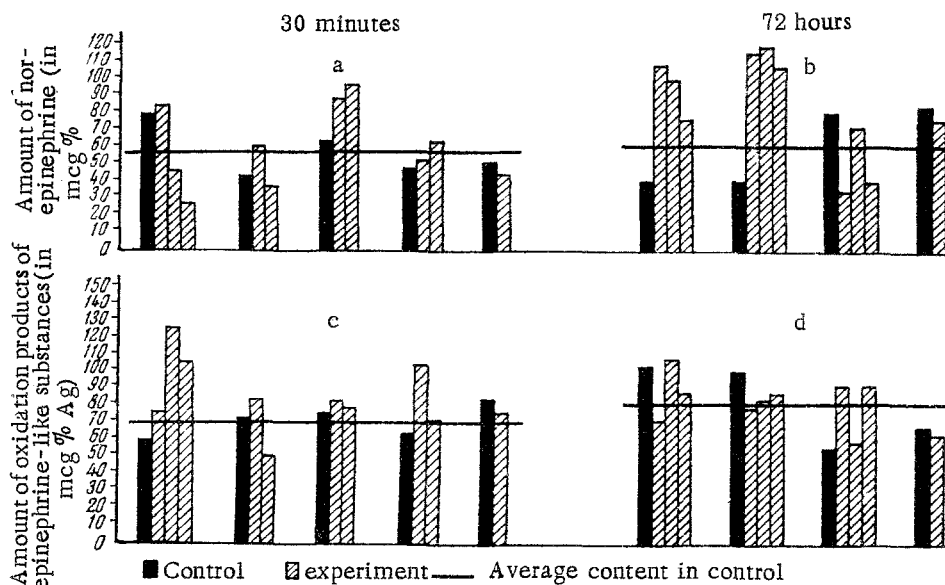


Fig. 2. Change in the amount of norepinephrine and epinephrine-like substances in the striated muscle. Symbols the same as in Fig. 1.

cerebral cortex, sections of the autonomic nervous system, and the endocrine glands. One can consider it established [1-10, 12, 13] that isohemotransfusion and transfusion of heterogenic blood substitutes are attended by a decrease in the epinephrine content of the adrenal glands, an increase in the content of epinephrine-like substances in the blood, an increase in the content of norepinephrine and oxidation products of epinephrine-like substances in the brain and effector organs (heart, striated muscle and spleen), change in the function of the anterior lobe of the hypophysis, increased excretion of corticoids into the blood by the cortical part of the adrenal glands, and intensification of the function of the

posterior lobe of the hypophysis, attended by an increased amount of vasopressin in the blood.

Therefore, the different types of hemotherapy have a very substantial effect on the function of the main regulators of vascular tonus, and this, one must suppose, is the foundation of the mechanism of their hemodynamic effect.

Our data indicate that one must approach the action mechanism of transfused blood or blood substitutes from the standpoint that the transfused blood interacts with the organism, so that the organism plays a definite part in the effect of transfused blood. This, of course, also applies to heterogenic blood substitutes.

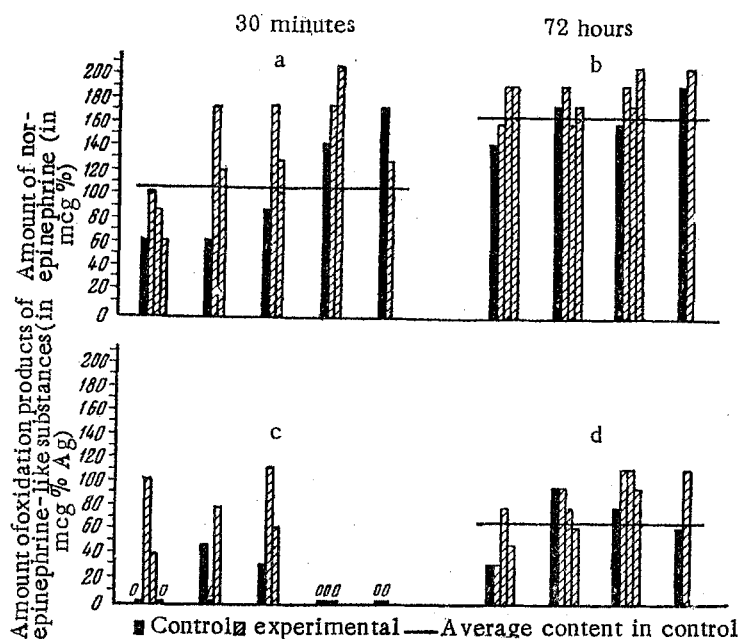


Fig. 3. Change in the amount of norepinephrine and epinephrine-like substances in the spleen. Symbols the same as in Fig. 1.

#### SUMMARY

The author studied the effect of isohemotransfusion on the content of norepinephrine, epinephrine, and compounds possessing the properties of the oxidation products of epinephrine-like substances in the brain and the main blood depots (the striated muscle triceps brachii, and the spleen).

As established, isohemotransfusion is attended by an increase in the amount of norepinephrine and oxidation products in all the tissues investigated. The main feature in the hemodynamic action of various types of hemotherapy is the effect on the functional condition of the systems controlling the arterial blood pressure, i.e., the nervous and the endocrine.

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\*Original Russian pagination. See C. B. translation.