

THE EFFECT OF TRANSFUSION OF HOMOLOGOUS BLOOD AND OF BELEN'KII'S  
THERAPEUTIC SERUM (BTS) ON THE CONTENT OF ADRENALIN-LIKE  
SUBSTANCES IN THE HEART OF RABBITS

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The most characteristic and important feature of the mechanism of the stimulating action of various forms of blood transfusion is their effect on metabolism. We have postulated [2-8] that this effect is due to the action of different forms of blood transfusion on the trophic function of the nervous system and the glands of endocrine secretion. In previous reports [2-8] it was shown that transfusion of homologous blood and the primary transfusion of BTS alter the functional condition of the cerebral cortex, of all divisions of the vegetative nervous system and of the glands of internal secretion. These findings to some extent demonstrate the influence of various forms of blood transfusion on the trophic function of the nervous system and, consequently, its role in the changes in metabolism during various forms of hemotherapy.

In view of the importance of the problem we deemed it necessary to study it in the heart. Under these circumstances we set out from the following assumptions: the intensifying trophic nerve of I. P. Pavlov is sympathetic; the sympathetic nervous system possesses, according to L. A. Orbeli and others, adaptational and trophic functions; adrenalin-like substances are the mediators of sympathetic impulses. In accordance with the above we studied the influence of transfusions of homologous blood on the content of adrenalin-like substances in the heart of rabbits.

EXPERIMENTAL METHOD

Rabbits were transfused with freshly preserved (by formula 7 of the Central Institute of Blood Transfusion) rabbit blood in a volume of 7-10 ml per 1 kg body weight. At intervals of 30 minutes, 24 and 72 hours after the blood transfusion the animals were decapitated and the adrenalin-like substances in the hearts of the animals estimated by V. O. Osinskaia's method [11], as worked out in A. M. Utevskii's laboratory. This method makes it possible to estimate the noradrenalin (NAD), the adrenalin (AD) compounds with certain properties of oxidation products of adrenalin-like substances (OP) and "nonadrenalin fluorescence."

EXPERIMENTAL RESULTS

Observations were made on 60 rabbits (30 experimental, 15 control and 15 donors). Our investigations confirmed the findings of V. O. Osinskaia [11] that in the heart of the normal rabbit noradrenalin is present but not adrenalin. It was found that transfusion of homologous blood is accompanied by an increase in the noradrenalin in the heart of rabbits. This increase was observed 30 minutes, 24 hours (Fig. 1) and even 72 hours after the transfusion, when the noradrenalin content of the heart of the experimental animals was greater than that of the controls.

It is interesting to compare the findings with the results of investigations into the effect of transfusion of homologous blood on the heart. The method of electrocardiography is known to give very contradictory results.

Meanwhile clinical observations on the use of blood transfusion in patients with posthemorrhagic anemia have shown the extremely favorable influence of transfusion of homologous blood on the activity of the heart.

E. R. Gesse [1] pointed out: "Zeifert, Vedergake, Tseler et al. stress the importance of blood transfusion as a means of stimulating the activity of the heart to a much greater extent than any drug." What is responsible for this action of blood transfusion? In the opinion of the author, "the transfused blood acts as a replacement of the blood which has been lost, the nerve centers and cardiac ganglia emerge from their state of anoxemia, and the blood vessels are filled with fluid" [1].

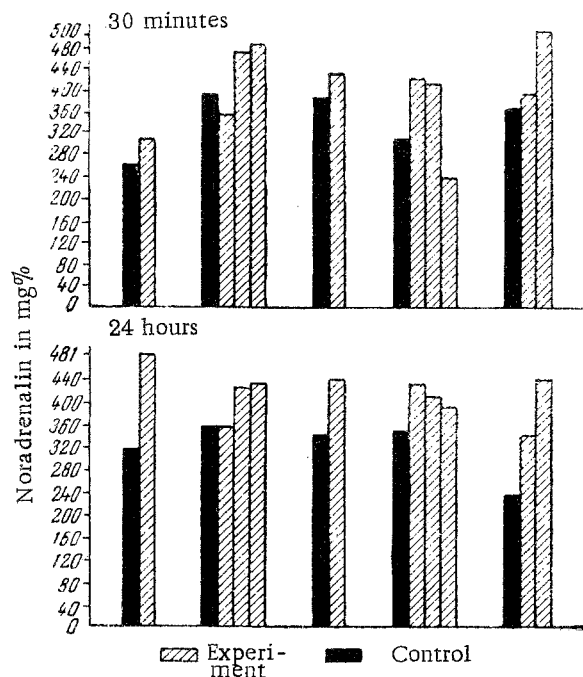


Fig. 1. The effect of transfusion of homologous blood on the noradrenalin content of the rabbit's heart.

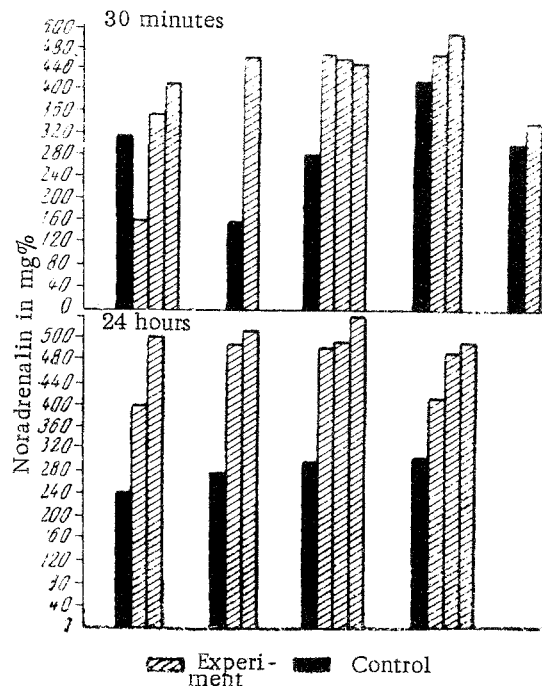


Fig. 2. The effect of primary transfusion of the heterogenic blood substitute BTS on the content of adrenalin-like substances in the heart of a rabbit.

In the literature to which we had access we could find no evidence for this assumption, and we decided to subject it to experimental analysis. If the increase which we found in the noradrenalin in the heart is brought about by some function of the transfused red cells, it must be absent after transfusion of plasma or serum; on the other hand, if it appears the effect which is produced must be due not to the replacement action of the red cells but to the stimulating action of the transfusion itself. For this reason in other experiments we studied the effect of primary transfusion of the heterogenic blood substitute BTS on the content of adrenalin-like substances in the heart of rabbits. Investigations carried out on 42 rabbits (30 experimental and 12 control) gave the same results in principle as with blood transfusion (Fig. 2).

The results described indicate that various forms of transfusion (blood, BTS) bring about an increase in the adrenalin-like substances in the heart of rabbits; this is new evidence of their influence on the trophic function of the nervous system and confirmation of the hypothesis which we have put forward previously of the single mechanism of action of the various forms of transfusion.

In the antishock effect of transfusions of blood and various blood substitutes the important role of the colloidal nature of the substance used may justly be pointed out. However to explain the whole affect on the grounds of colloidal properties would obviously be incorrect. Our findings demonstrate the importance of a cardiac factor which, as we know, plays an essential role in the maintenance of the level of the blood pressure. In this connection it is important to take note of findings which demonstrate the effectiveness of noradrenalin in the treatment of shock. There are grounds for assuming that the increase in the noradrenalin in the heart may to some extent

have a beneficial effect during intra-arterial transfusions of blood in cases of agony and clinical death, particularly if the possibility of automatic stimulation of the function of the sympathetic ganglion by blood transfusion, as we have pointed out, is remembered.

Finally the results obtained enable us to put forward for discussion the question of rational transfusion during dystrophic conditions of the myocardium. In this respect the following comparison appears to be of some interest: V. O. Osinskaia [11] showed that in animals with severe experimental thyrotoxicosis the content of noradrenalin in the heart is sharply reduced. V. A. Oppel' [9] with his co-workers and other investigators observed the beneficial effect of transfusion of homologous blood on the cardiac activity of patients with a severe form of Basedow's disease (blood transfusion was given to these patients as a preoperative measure). Our results show that blood transfusion is accompanied by an increase in the noradrenalin in the heart. In other words, an increase in the noradrenalin content of the heart may coincide with an improvement in its functional condition.

#### SUMMARY

The author established that isohemotransfusion and transfusion of Belenskii's therapeutic serum is associated with a pronounced and prolonged increase of the noradrenalin concentration in the rabbit's heart. This confirms the author's hypothesis on the single mechanism in the action of various types of hemotherapy and the role of the trophic function of the nervous system in the mechanism of their action. On the basis of the above data it is recommended to employ hemotherapy in dystrophic processes of the myocardium.

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\* In Russian.

\*\* See English translation.