

# EFFECT OF DAMAGE TO THE PREMOTOR REGION OF THE CEREBRAL CORTEX ON THE COLLATERAL CIRCULATION OF THE SMALL INTESTINE

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At the suggestion of M. G. Prives we studied the effect of damage to the cortex of the premotor region on the collateral circulation of the small intestine.

## EXPERIMENTAL METHOD

The studies were carried out on cats. The development of collateral circulation in the small intestine (25 cats) upon ligation of 2-3 neighboring branches of the mesenteric artery (according to the data of K. N. Fedorovich [2] and A. P. Bystrov [1], ligation of 2-3 contiguous arterial branches is not injurious to the intestine) was studied in the first series of experiments (control). Simultaneously, we also ligatured veins, which did not affect formation of collaterals and is favorable for the intestinal circulation.

At fixed periods (2, 3, 4, 5, 6, and 7 and more weeks) after the operation, the animals were killed (after each period no less than three cats) and a contrast medium was injected into the arterial channels with subsequent taking of X-ray photographs of the small intestine.

In the second series of experiments (25 cats) we examined the development of collateral circulation after damage to the premotor region of the cerebral cortex; in this group the animals were subjected to a double operation: in the first procedure, a 2 x 15 cm area of the premotor cortex was damaged, 10-17 days later, 2-3 branches of the mesenteric artery were ligatured. The animals were killed at intervals corresponding to those of the control series. The brains were removed and preserved in a 5% solution of formalin.

We subsequently investigated the region and extent of the damage to the cerebral cortex and took photographs.

## EXPERIMENTAL RESULTS

The peripheral and central ends of the sectioned arteries, filled with a roentgenopaque material, were clearly apparent upon examining the X-ray photographs of the arteries of the small intestine of the experimental animals killed within the first two weeks after the operation on the intestine.

A dilation was noted of the mesenteric branches bordering on the sectioned ones as well as of the arterial arcs, situated along the mesenteric margin of the section of intestine corresponding to the damaged vessels. In the adjoining sections of the mesentery, there stands out a clearly defined large-looped network of fine mesenteric arteries that is almost indiscernible on sections of the mesentery which were not operated on. The arteries themselves were dilated.

At the same time, there was noted in animals in which the premotor cortex was damaged the same chief effects, except that the vessels were less dilated and the fine arterial networks of mesenteric arteries were less dense.

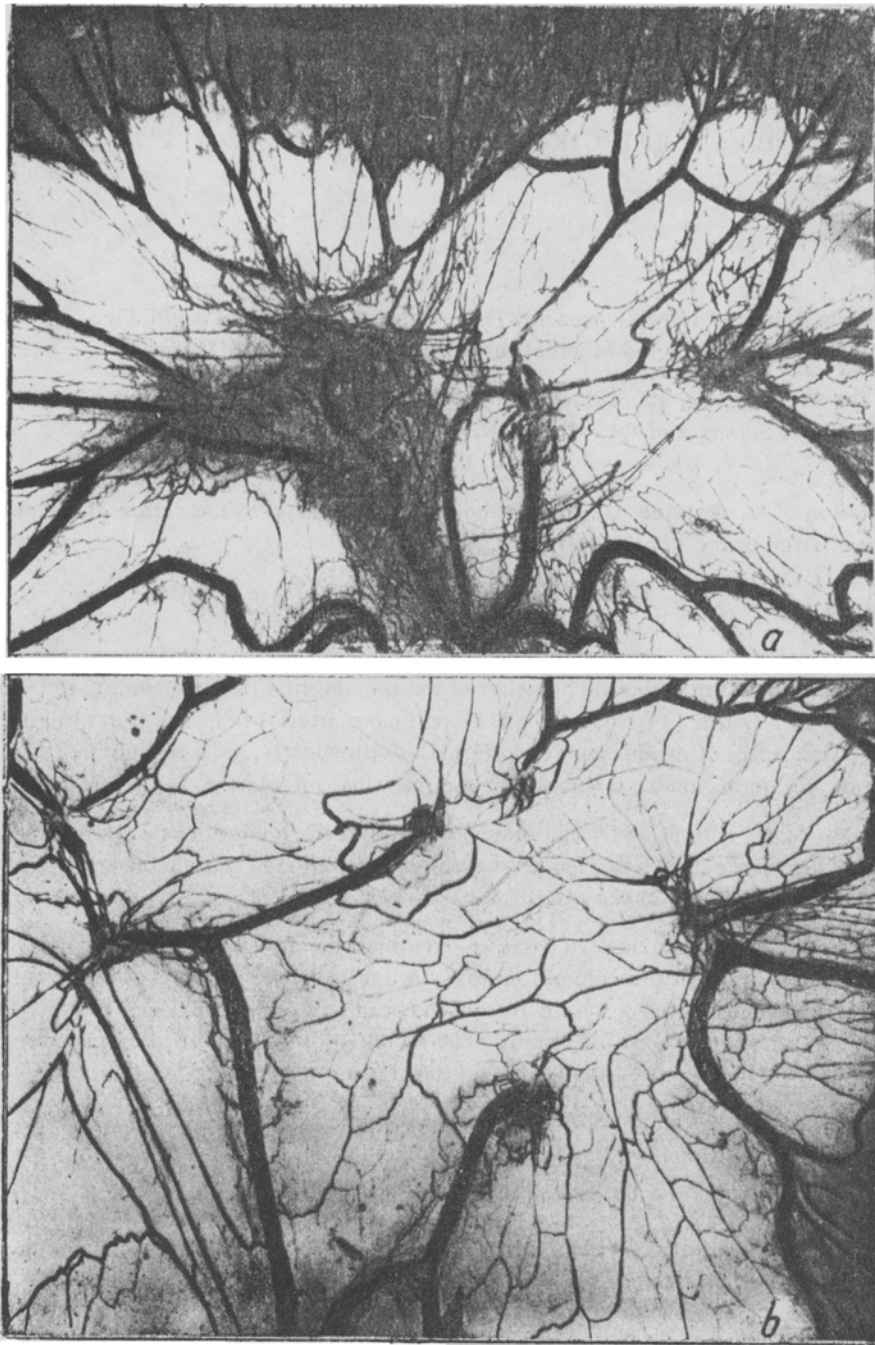


Figure 1. The vascular network in the wall of a cat's intestine 4-5 weeks after ligation of the branches of the mesenteric arteries (a, control) and upon preliminary damage to the premotor region of the cerebral cortex (b).

In the case of the control animals (first series), within three weeks there was clearly seen in the region of the sectioned arteries a network of dilated and tortuous mesenteric arteries.

The separate tortuous vessels of this network join the ends of the sectioned arteries to each other and to contiguous unsectioned branches of the mesenteric artery.

In the wall of the intestine in the area of the operation, the vascular network of the intraorganic arteries was more dense and the vessels were tortuous and dilated.



Figure 2. The vascular network in the wall of a cat's intestine 6-7 weeks after ligation of the branches of the mesenteric arteries (a; control) and upon preliminary damage to the premotor region of the cerebral cortex (b).

The picture obtained in the second series of experiments in the same period was very similar as a whole.

Within 4 to 5 weeks, a dense network of very fine vessels, joining the peripheral and central ends of sectioned arteries and neighboring vessels, was noted in the animals of the first series. From this network, larger vessels began to develop, joining the remnants of the sectioned arteries. This can be seen quite readily by enlargement of the X-ray photograph taken in the region of the sectioned arteries (Figure 1, a).

In the same period, animals of the second experimental group exhibited a similar but less dense network of anastomoses between the peripheral and central segments of the sectioned arteries (Figure 1, b).

Within 6-7 weeks and later in the first experimental series, the network of vessels joining the neighboring arteries no longer appears and exists only in the region of the sectioned arteries (Figure 2, a).

In the second series the vascular network was less dense (Figure 2, b).

On the basis of the data obtained, it is possible to conclude that upon damage to the premotor region of the cerebral cortex, the character of the development of collaterals remained the same as in the experimental series. However, the quantity of vessels participating in collateral circulations is less and the entire vascular network is less dense.

Anastomoses, joining the peripheral and central ends of sectioned arteries, develop later and the entire vascular reaction proceeds more sluggishly.

The data of our investigation indicate that there is a retardation of the regenerative processes upon damage to the cerebral cortex.

#### BIBLIOGRAPHY

[1] A. P. Bystrov, Collection of Works dedicated to the 40th Anniversary of V. N. Tonkov's Work, pp. 94-104, Leningrad, 1937.

[2] K. N. Fedorovich., Intestinal Changes in Relation to Disturbances of the Mesenteric Circulation (Experimental Study). Dissertation, St. Petersburg, 1910.