THE TARGET OF THE CHEMICAL STIMULUS DURING PERFUSION OF THE BLOOD VESSELS OF LYMPHATIC GLANDS

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The method of perfusion of an isolated organ through its blood vascular system, widely used in the study of chemoreceptors, gives no idea of the part played by the tissue receptors themselves of the perfused organ in the reactions. In other words, it remains unexplained whether the reflex changes in the arterial pressure and respiration observed during the passage of a chemical stimulus through an organ are caused by the action of the stimulus on the tissue receptors or only on the receptors of the blood vessels.

This problem, which was the subject of lively discussion a few years ago, still remains unsolved.

The possibility of interaction between the chemical stimuli usually used – nicotine, acetylcholine, potassium chloride, acetic acid and so on – and the tissue receptors was not in doubt. It remained uncertain, however, whether these substances could, by the use of this method, penetrate through the walls of the blood vessels and escape into the surrounding tissue.

In the present research an attempt was made to elucidate this problem.

EXPERIMENTAL METHOD

As an object for study we chose the chemoreceptor field of the lymphatic glands situated in a large cluster at the root of the mesentery of the small intestine, the so-called Aselli's pancreas, the anatomical features of which facilitated the carrying out of the work (Fig. 1).

The neurovascular bundle passing to Aselli's pancreas contains the mesenteric artery, mesenteric vein and mesenteric plexus. Directly beneath it, in the soft tissues, is situated the great efferent lymphatic duct, collecting the lymph from the whole of the abdominal cavity. There are no other lymphatic glands along its course to the thoracic duct.

As an analog of the stimulating substance, in our experiments we used the dye fluorescein $C_{20}H_{12}O_5$ (molecular weight 332), the molecule of which is larger than the molecules of the chemical stimuli usually used – nicotine, acetylcholine, etc.

The experiment was performed as follows. In a cat, under urethane anesthesia, through a laparotomy incision the mesentery was extracted and Aselli's pancreas isolated from the surrounding tissues, leaving only a bridge of tissue including the efferent lymphatic duct and the neurovascular bundle. The artery and vein were carefully dissected, ligated and divided. The lymphatic vessel was not divided. As a result of these manipulations Aselli's pancreas preserved its connection with the body only by means of the efferent lymphatic duct.

Ringer-Locke's fluid was perfused through the artery and emerged freely from the vein.

Into the perfusate was injected 1 ml of a 5% solution of fluorescein. After 10, 30 and 60 minutes, samples of blood were taken from the common carotid artery, into which a cannula had previously been inserted, the plasma was separated and examined in blue light from a lamp.

EXPERIMENTAL RESULTS

In all the samples the presence of fluorescein was detected by its characteristic greenish luminescence. It was found in greatest amount in the blood samples taken 30 minutes after injection of the dye.

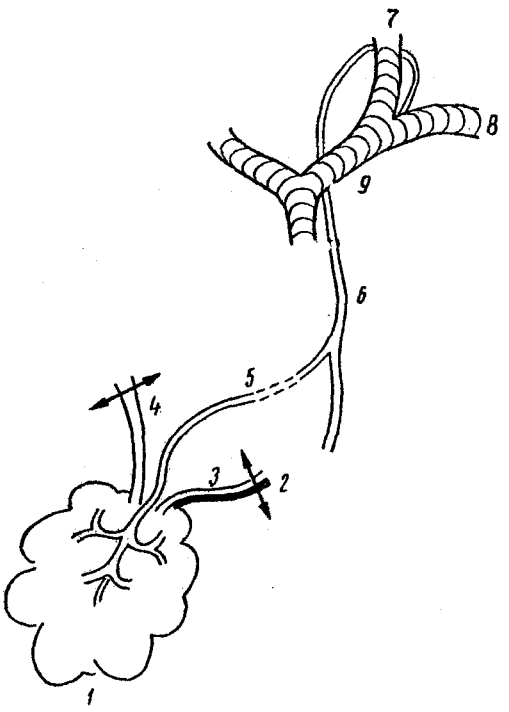

Fig. 1. Anatomical relations in the region of Aselli's pancreas (diagrammatic). 1) Lymphatic glands; 2) mesenteric plexus; 3) mesenteric artery; 4) mesenteric vein; 5) efferent lymphatic vessel; 6) thoracic duct; 7) jugular vein; 8) subclavian vein (left); 9) innominate vein (left) the site of division.

Hence fluorescein injected into an organ isolated from the general blood circulation, was found in the blood stream. It is clear that the dye must have entered the blood only through the efferent lymphatic duct, which means that the fluorescein had penetrated from the blood stream into the tissues of the lymphatic glands, thence through the efferent lymphatic duct and the thoracic duct into the general circulation of the blood. We obtained completely identical results in 8 experiments.

Since the penetration of a substance through a vessel wall depends mainly on the size of its molecule, it may be expected that substances having a smaller molecule, such as nicotine, acetylcholine, potassium chloride, acetic acid and so on, during perfusion of an isolated organ by the usual method, will also penetrate into the tissue of the organ examined, where they will interact with the tissue receptors.

We were able to show penetration of fluorescein through the vessel wall by the example of the lymphatic glands, but it must be assumed that this pehnomenon may also take place in other organs (spleen, intestine and so on). It is difficult, however, to perform an analogous experiment on these objects by virtue of the fact that the lymphatic vessels leading from them pass through regional lymphatic glands which hold up the fluorescein.

SUMMARY

With the isolated perfusion of the blood vessels supplying the lymph nodes the fluorescein, as shown experimentally, penetrates through the vascular walls into the tissue of the former.

LITERATURE CITED

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