TECHNIQUE OF EXPERIMENTAL PRODUCTION OF A VENOUS THROMBUS

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Methods have been reported in Russian and foreign publications, for the production of thrombi in living animals by chemical or mechanical agents, or using thromboplastin, staphylococcus toxin, ferric chloride, hypertonic sucrose solutions, and other substances.

These methods do not, however, fulfill their purpose of producing a thrombus in a live animal.

We have made use of the technique proposed by Hirsch and Lowe [1] with slight modifications.

The animal (a rabbit) was fastened to a board in a supine position. The skin was incised in the mid-cervical line. A 3-4 cm length of the jugular vein was dissected free. The proximal and distal ends of the vein were caught up in ligatures, so as to facilitate lifting it. The ligatures were not tightened. The flat handle of any instrument was inserted under the section of vein, and the vein was given 20-35 light taps with the flat of a scalpel handle. After 2-4 minutes the vein was seen to blanch, and a formed thrombus could be felt within it. The ligatures were then removed. Slight bleeding was readily stopped by pressure with a gauze plug.

EXPERIMENTAL RESULTS

We were able to produce thrombi in 15 veins (one in the iliac vein) of 8 rabbits. Histological examination, conductred under the direction of V. P. Teodorovich, confirmed the presence of a fresh thrombus in every case. It is obvious that the given method introduces all the factors needed for the formation of a thrombus: temporary stoppage of blood flow, injury of the intima, and release of thrombokinase.

The above-described method is simple and affords a convenient means of producing a model of thrombosis in rabbits, for the experimental study of anticoagulants.

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EFFECT OF ABLATION OF THE CEREBRAL CORTEX ON THE SECRETORY ACTIVITY OF THE SALIVARY GLANDS OF DOGS

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The first researches on the cortical control of salivation were reported by Lepine and Bochefontaine [15], over the years 1875-1888. V. M. Bekhterev and N. A. Mislavsky [2] found, in short experiments on dogs, that direct stimulation of certain cortical areas caused salivation on the side stimulated. G. P. Zelenyi, L. A. Klemenkova, and D. S. Fursikov [9, 10] observed a diminished flow of saliva in totally decerebrate dogs during

meat feeding or when acid solutions were placed in the mouth. D. A. Biryukov [3, 4] found that immediately after removal of one or "one and a half" hemispheres of dogs there was a certain increase in the unconditioned reflex secretion of saliva, but that with time the preoperational rate of secretion returned. Ya.M. Pressman [14] found that unconditioned reflex discrimination between various stimuli was coarser in decerebrate dogs than in normal ones.

The influence of the cerebral cortex on unconditioned reflex activity of the salivary glands has not yet, however, been fully elucidated.

EXPERIMENTAL METHODS

The experiments were performed on three dogs: Malchik , Ryzhik, and Tobik. Both parotid glands of the dogs Malchik and Ryzhik were provided with fistulae, while Tobik had one parotid and one submaxillary gland fistula.

Two series of experiments were performed. In the first series we measured the secretion from each gland during a short feed with dry food: 1 g portions of white rusks or of meat powder every 30 seconds for 15 minutes. Over this time, the saliva was collected in graduated cylinders, separately for each gland.

In the second series we followed salivation in response to stimulation of the buccal mucosa with hydrochloric acid of various concentrations (20 ml of 0.1, 0.3, and 0.5% acid per 30 seconds). The acid was introduced into the mouth by means of a special dispenser attached to the inner surface of the cheek, which allowed us to measure the secretion of each gland, depending on the side stimulated. The saliva was collected for 3 minutes after applying the stimulus.

After we had determined the amount of saliva secreted, and ascertained the relative activities of each of the paired glands in normal dogs, Prof. E. A. Asratyan performed the operation of removing the cortex of one cerebral hemisphere. The cortex of the left cerebral hemisphere was removed from Malchik and Ryzhik (21.5 g of brain was taken from Malchik, who weighed 8 kg, and 16. 5 g from Ryzhik, who weighed 6.5 kg). The right cerebral cortex, weighing 23.5 g, was taken from Tobik (weight 10 kg).

After recovery from the operation (13-17 days) the dogs fed themselves, and moved around freely; the experiments were then renewed. The techniques were identical with those applied before the operation.

In all, 78 experiments were performed on Tobik, 68 on Malchik, and 52 on Ryzhik. Tobik and Malchik were kept under observation for 18 months after the operation, and Ryzhik for 6 months.

EXPERIMENTAL RESULTS

An examination of the secretory function of the parotid glands showed that their activities were not uniform under normal conditions. The amount of saliva secreted by each gland varied from experiment to experiment.

Where the flow of saliva was stimulated by acid, the dependence of the amount secreted on which side was stimulated was evident – salivation was always greater on the side at which acid was introduced.

Our results are in accordance with those of other authors who had studied the activities of the parotid glands [1, 4, 5, 6, 14].

The differences between the secretory activities of the two glands are not, however, very great under normal conditions; the ratios of the mean values are 1 : 1 or 1 : 1.06 (Figure 1).

Removal of the cortex of one of the cerebral hemispheres resulted in a considerable alteration in the secretory function of the salivary glands. This alteration was of the same nature in all the dogs.

In the first place, there was a considerable diminution in secretion from the gland on the operated side. Thus, the average secretion of the left parotid gland of the dog Malchik fell by 41.7% after ablation of the left cerebral cortex. That of the right parotid gland of the dog Tobik fell by 34% after removal of the right cerebral cortex (Figure 2).

In the second place, secretion slightly increased on the side opposite to the operated one. Thus the average secretion of the right parotid gland of the dog Malchik rose by 28%.

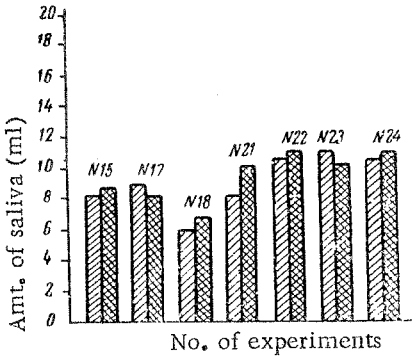

Fig. 1. Flow of saliva, in ml, from the left and the right parotid glands of the dog Ryzhik, under normal conditions.

In the third place, owing to the changes in the relative activities of each of the paired glands, there was a striking change in the ratio of their activities, from 1 : 1 preoperational to 1 :1.7, 1 :2, and even 1 : 3.

Apart from this, we noticed that more saliva was secreted by the left gland of normal dogs on some occasions, and by the right gland on others, whereas after operation the flow was always less on the operated side (Figure 3).

In the experiments involving introduction of acid, excess of secretion on the side at which the acid was put in was no longer the rule; the flow of saliva was always less on the operated side.

The changes in the secretory function of the glands appeared soon after the operation (the experiments on Ryzhik were commenced on the 13th, and on Malchik on the 17th day after the operation), and persisted over a year or more. During the second year after the operation a certain increase in the flow of saliva in response to meat powder was observed for the dog the average flow rising from 12 to 15 ml from the right gland, and from 7 to 8.8 ml from the left. The ratio of the secretions remained constant, however.

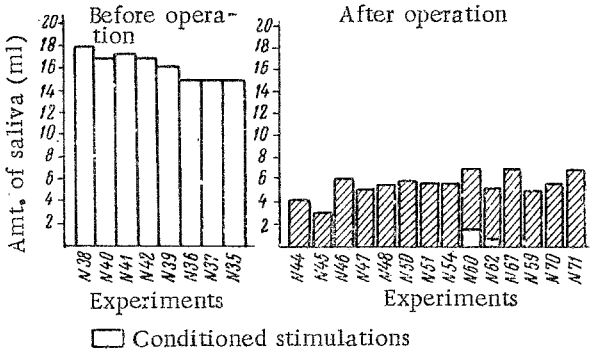

Fig. 2. Flow of saliva, in ml, from the right submaxillary gland of the dog Tobik before and after removal of the right cerebral cortex.

In some of the experiments with operated dogs we investigated the natural conditioned reflexes to the smell and sight of food. We found that the conditioned reflex flow of saliva had altered in the same way as had unconditioned reflex flow, viz., the gland on the operated side secreted much less than on the intact side. Thus over 6 minutes during which Malchik was exposed to the sight and smell of meat powder his left gland (operated side) secreted 0.2 ml of saliva, and his right gland 1 ml. Similarly, Ryzhik's left gland secreted 0.1 ml of saliva, and his right gland 1 ml.

The results of our experiments are in accord with the observations of S. L. Levin [12], who studied unconditioned reflex secretion of saliva in patients suffering from cerebral tumors and brain injuries.

Paired organs are particularly valuable for experiments designed to elucidate the influence of the cerebral cortex on the activity of these organs.

In our experiments one gland served as a control for the other. This was of assitance in enabling us to find the causes for the changes in the functions of the organ after decortication. The impairment of the function of the salivary gland on the operated side might be explained as resulting from the severe trauma inflicted on the central nervous system by the operation. However, the unfavorable effects on the organism of so serious an operation as unilateral decortication would be expected to affect the functional state of both glands equally. Yet

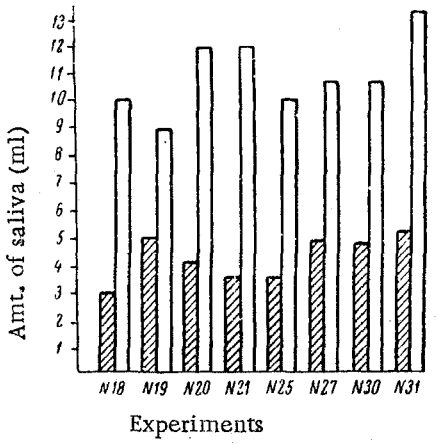

Fig. 3. Flow of saliva, in ml, from the left and right parotid glands of the dog Malchik, after removal of the cortex of the left cerebral hemisphere. Shaded columns--flow of saliva from the operated side; unshaded columns —flow of saliva from the intact side.

our experiments showed that the secretory function of the gland on the unoperated side is not only not diminished, but is greater than it was before the operation. The general condition of the dogs also gave no evidence of any severe remote sequelae of the operation —the dogs gained weight, and their behavior did not differ from that of normal dogs.

We think that the alterations in the secretory function of the glands can be related to change in their central control following removal of the cortex of one of the cerebral hemispheres. It is noteworthy that unilateral decortication causes the greatest changes in the gland on the operated side, which may be of assistance in locating the cortical areas concerned in the regulation of the secretory function of the salivary glands.

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