

PHYSIOLOGY

PAROTID GLAND SECRETION AFTER EXTIRPATION OF THE SUPERIOR CERVICAL SYMPATHETIC GANGLION

COMMUNICATION I. UNCONDITIONED AND NATURALLY CONDITIONED SECRETION OF THE PAROTID GLANDS AFTER REMOVAL OF THE SUPERIOR CERVICAL SYMPATHETIC GANGLION.

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(Received June 24, 1955. Presented by V. N. Chernigovskii, Member of the Academy
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We have made a study of the role of the sympathetic nervous system in transmission of impulses from the higher levels of the central nervous system influencing the parotid glands. In this paper we present data referring to these influences on unconditioned and naturally conditioned reflex secretion of the parotid glands. Our experiments were performed on three dogs with bilateral parotid fistulae.

The magnitude of the unconditioned reflex activity was determined 4 times for each side and the mean value calculated by feeding the dogs 15 g portions of small rye flour rusks for 30 seconds and measuring secretion for an additional minute thereafter. The magnitude of the natural conditioned reflex activity was determined 4 times at 5 minute intervals and the mean value calculated by displaying 15 g portions of rusks in flat dishes to hungry dogs and not allowing them to eat for 30 seconds; cylinders containing saliva were then removed and the dogs allowed to eat the rusks.

The magnitudes of the unconditioned and conditioned reflexes were identical for the right and the left glands of two of the dogs (Jack and Nalet), while for the other dog (Piratka) the response of the right parotid was always slightly greater than of the left, by the same amount in different experiments (see table).

After determining the initial activity levels of the parotid glands, we removed one of the superior cervical sympathetic ganglia from each dog. Following this, the magnitude of the unconditioned reflex became greater than normal on the operated side and less than normal on the opposite side. The total volume collected from both sides over a given period remained practically the same as in unoperated dogs (see table).

The strength of the naturally acquired conditioned reflex also rose on the operated side and fell on the opposite side, and the total amount secreted from both sides did not differ significantly from that found before ganglionectomy (see table).

The observation that in unoperated animals the volume of unconditioned reflex secretion is the same on both sides is in agreement with published data [6]. The different reflex secretion of the right and the left glands of the dog Piratka is also not in contradiction to published observations. D. A. Biryukov [3], I. V. Vvedenskaya [4], and K. S. Abuladze [1] have shown that more saliva is secreted on the side which receives the more intense stimulation; since Piratka suffered from a defect of the jaw, she chewed her food mainly on the right side, and the more intense stimulation of buccal receptors on that side led to greater secretion from the corresponding gland.

*This work was done under the guidance of M. A. Usievich.

TABLE

Strength of Unconditioned and Natural Conditioned Reflexes Before and After Removal of a Superior Cervical Sympathetic Ganglion

Name of dog	Reflex	Volume of saliva secreted by parotids (in ml)					
		before operation			after operation		
		left	right	total	left	right	total
Jack	unconditioned	1.0	1.0	2.0	operation on right		
	conditioned	0.4	0.4	0.8	0.9	1.2	2.1
Piratka	unconditioned	0.9	1.0	1.9	operation on left		
	conditioned	0.4	0.5	0.9	0.5	0.2	0.7
Nalet	unconditioned	1.4	1.4	2.8	operation on left		
	conditioned	0.5	0.5	1.0	0.7	1.3	2.8
					0.4	0.4	1.1

The changes in salivary output following excision of one of the superior cervical sympathetic ganglia cannot be ascribed to change in exteroceptor influences from the buccal receptors, which were virtually unaffected by the operation. It is more probable that these changes were due to the fact that removal of one ganglion involved abolition of part of the efferent sympathetic impulses proceeding from the lateral horns of the upper thoracic segments of the spinal cord, both to the parotid glands and to the brain [5], with consequent impairment of secretory regulation.

Increased salivation following section of both cervical sympathetic nerves has been reported by E. A. Asratyan [2], who explained the effect as being due to interruption of paths connecting with the central nervous system. Our results with unilaterally operated dogs provide evidence of diminution in the correcting influence of cortical and subcortical regulation of the parotid gland on the operated side, i. e. a weakening of inhibitory action leading to increased unconditioned reflex secretion. Impairment of corrective action on the sympathectomized gland is compensated by intensification of inhibitory influences regulating the activity of the intact gland, resulting in diminished salivation. It may be supposed that this compensatory effect is due to change in the inductive interrelations between the corresponding symmetrical regions of the central nervous system. The development of these new relations between symmetrical centers is probably a result of changes in interoceptive connections between the parts of the central nervous system concerned in the regulation of the functions of the glands, following unilateral extirpation of the superior cervical ganglia.

It thus appears that removal of one of the superior cervical ganglia leads to enhancement of unconditioned reflex secretion of the ipsilateral parotid gland, and to lowering of secretion from the contralateral gland, the total volume secreted remaining constant, and the same as in unoperated animals. The strength of the natural conditioned reflex rises on the sympathectomized side, and falls on the opposite side, total secretion remaining unchanged.

LITERATURE CITED

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