

EFFECT OF A CIRCUMSCRIBED FOCUS OF INFLAMMATION IN THE
BUCCAL CAVITY ON THE "PILOCARPINE" SECRETION OF
THE PAROTID GLANDS

A. P. Savinskaya

From the Experimental Pathology Laboratory (Director: Prof. S. I. Lebedinskaya),
Department of General Pathology (Director: Academician A. D. Speransky), Institute
of Normal and Pathol. Physiology, (Director: V. N. Chernigovsky, Member Acad. Med.
Sci. USSR), Acad. Med. Sci. USSR

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Up to the most recent date, textbooks on pharmacology maintain that the secretory effect of pilocarpine is due solely to its action on parasympathetic nerve endings [1, 3, 4, 7].

It was shown, however, by S. I. Gelperin and G. N. Pribytkova [2], and by V. N. Chernigovsky [10] as far back as 1937, that the effect of pilocarpine may vary in the presence of conditioned reflex stimuli, the nature of the alteration in secretion depending on the type of conditioned stimulus applied (negative or positive). O. S. Serebryannikov [9] found that painful stimuli applied during the period of action of pilocarpine may change the nature of the secretion. This finding was confirmed by V. A. Novi [8]. S. L. Levin [6] showed that pilocarpine-induced secretion may undergo alteration during sleep.

We found that when pilocarpine was injected subcutaneously in the mid-cervical line of normal dogs the flow of saliva from the right and the left parotid glands was not uniform.*

We noticed that the uneven secretion of the two parotid glands, in response to pilocarpine injections, was most pronounced in dogs of a "weak" type. The results of a study of pilocarpine-stimulated secretion in normal animals showed that its mechanism followed the same general laws as apply to the secretion of saliva by other unconditioned and conditioned reflex stimuli. The conclusion might hence have been drawn that changes in the functional state of the appropriate nerve centers might be significant factors in determining the nature of the response to introduction of pilocarpine.

In order to test the validity of this conclusion we made a study of the "pilocarpine" secretion of the two parotid glands, in the presence of a circumscribed area of inflammation of the buccal mucosa.

EXPERIMENTAL METHODS

The experiments were performed on two dogs, possessing different types of higher nervous activity, Sedoi being of the weak type, and Ryzhii of the strong.** Medium doses of pilocarpine hydrochloride solution (1.5 ml of 0.1% solution) were injected subcutaneously in the mid-cervical line. Saliva was collected in graduated vessels over the next two hours, the volume being read at 5 minute intervals during this time.

Background secretion was first measured for 9 days, after which we inflicted a burn on the mucous membrane of the gum of the left lower jaw, at the level of the 3rd molar, using a thermocauter with a spherical tip, diameter 0.8 mm.

The inflammatory reaction resulting from the cauterization took a similar course in both dogs. Immediately after inflicting the burn we saw a damaged area of mucous membrane, with detached shreds of membrane at the margins. During the following 2-4 days a considerable swelling arose around the burnt area, from which the membrane was separating. The mucous membrane around the swelling was of a reddish-purple color. During the following few days a scab formed in the center of the damaged area. The mucosal defect and the swelling gradually diminished, and after the wound had healed (on the 16-21st day) the only remaining effect was that the pigmentation was less than in the surrounding areas.

*Uneven secretory response to pilocarpine of the two submaxillary glands was noted by G. N. Kuzmenko [5] in 1940.

**Conditioned reflexes were developed in these animals, and the recognition of the typological peculiarities of their nervous systems was based on prolonged observation of their condition reflex activities, and also on the results of the application of special tests.

EXPERIMENTAL RESULTS

Experiments on the dog Sedoi

Secretion of saliva fell below the normal level on the day the gum was cauterized, from both parotid glands. By the following day secretion had increased considerably on the side of the lesion (left side), but had ceased altogether on the opposite side. On the third day the salivary response to pilocarpine had fallen somewhat on the left side, and had risen on the right. On the 4th day it was totally inhibited on the inflamed side, but again increased with time (on the 5-10th day); see Figure 1.

It thus appears that pilocarpine-stimulated secretion of saliva varied very widely during the first few days following the infliction of the burn. These variations were of a fluctuating nature, and consisted of augmentation or diminution of the flow of saliva, both from the gland on the same side as the inflammatory focus and from that on the opposite side.

Experiments on the dog Ryzhii

On the day the burn was inflicted there was a small rise in the salivary response to pilocarpine, on the same side as the lesion. On the next day secretion on this side had diminished considerably, while that from the opposite gland had fallen to zero. During the succeeding days there was a gradual rise in the response of both glands to pilocarpine injection, to the initial level (Figure 2).

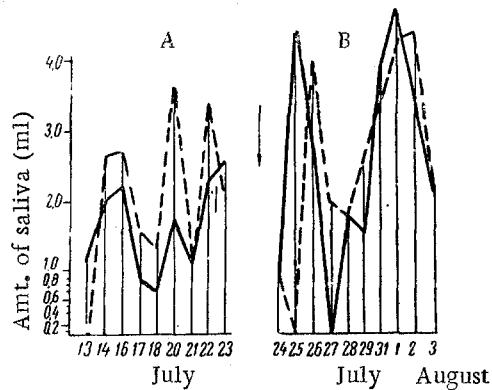


Fig. 1. Flow of saliva, in response to pilocarpine, from the left (continuous line) and right (broken line) parotid glands of the dog Sedoi before (A) and after (B) infliction of a burn (↓) on the gum of the left lower jaw.

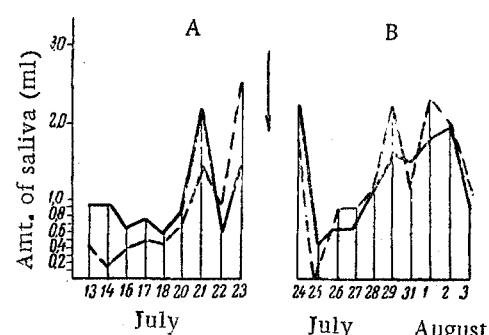


Fig. 2. Flow of saliva, in response to pilocarpine, from the left (continuous line) and right (broken line) parotid glands of the dog Ryzhii before (A) and after (B) infliction of a burn (↓) on the gum of the left lower jaw.

We thus see that the presence of a circumscribed inflammatory focus in the dog Ryzhii caused alteration of the salivary response to pilocarpine of both the parotid glands. These alterations differed, however, from those found for Sedoi, in that they were of short duration, and there was a rapid return to normality.

It is noteworthy that the presence of the inflammatory focus in the buccal mucosa of Ryzhii did not lead to any pronounced asymmetry in the response of the two parotid glands to pilocarpine. The variations in the flow of saliva were in the same direction in the left and the right glands, and any differences observed were of a quantitative nature only. With Sedoi, on the other hand, the secretory action of the two glands was quite unsymmetrical in the presence of the lesion. The maximum rise in secretion by the gland on the same side as the inflammatory focus coincided in time with its total inhibition on the opposite side. Later on, these effects were reversed. Only from the 6th day on did we observe parallel variations in the responses of the two glands, although they still differed considerably in magnitude.

For purposes of comparison, we performed similar experiments on the same dogs, in which the unconditioned reflex stimulus to parotid gland secretion was a meat-biscuit powder meal, instead of pilocarpine.

In these experiments, we waited until the effect on secretion of pilocarpine had ceased (about 2 hours after its injection), and then fed the dogs with a meat-biscuit powder meal (15 g).

The results of these experiments are represented in Figure 3.

The experiments showed that in dogs of a weak type (Sedoii) a circumscribed inflammatory lesion had the same effect on the response to feeding as it did on that to pilocarpine. The changes in secretion in response to a meal were also of a fluctuating nature, and the fluctuations appeared on the same days as did those in response to pilocarpine.

In dogs of a strong type (Ryzhii) the changes in flow of saliva in response to the meat-biscuit powder meal in the presence of a circumscribed inflammatory lesion were restricted to a slight depression of secretion on the opposite side to the lesion.

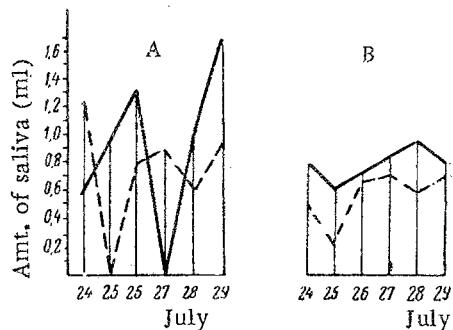


Fig. 3. Flow of saliva, in response to a meat-biscuit powder meal, from the left (continuous line) and right (broken line) parotid glands of the dogs Sedoi (A) and Ryzhii (B), in the presence of an inflammatory lesion of the gum.

It may be concluded that a circumscribed inflammatory lesion of the buccal mucosa affects both reflex secretion of saliva and secretion due to pilocarpine, and the nature of the changes in both types of secretion is in many respects similar. The degree and the nature of these changes are dependent on the typological peculiarities of the nervous system of the subjects.

Our experimental results indicate that the effect produced by pilocarpine is to a considerable extent determined by the functional state of the appropriate nerve centers. This finding merits special attention, inasmuch as up until the present investigations of the action of pilocarpine on secretion have been concentrated chiefly on its effects on the peripheral parts of the nervous system, without taking into account the significance of the initial functional state of the relevant nerve centers.

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* In Russian.