ably declines in old age. But, in spite of the diminished release of the hormone in the old animals, its effects may be involved in the development of harmful mechanisms which stem from the hypersensitivity of the vascular wall to VP in aging [1]. Thus, pronounced changes in VP regulation occur in aging, especially under stress, that may be of key importance the development of senile disorders and pathological processes. The role CSF plays in the VP regulation of brain functions is probably intensified in aging.

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Catecholamines in the Salivary Glands, Oral Mucosa, and Saliva of Rats with Acute Inflammation of Oral Soft Tissues

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Disordered secretory function of the salivary glands in sialadenitis frequently goes hand in hand with dystrophic changes in the oral mucosa. In aphthous stomatitis, on the other hand, not only is the secretory activity of these glands grossly impaired, but strongly marked changes occur in the excretion of catecholamines with the saliva [4]. Catecholamines are known to exert trophic influences on the mucosa [3]. The purpose of this study was to examine to what extent catecholamine levels are altered in the salivary glands, saliva, and oral mucosa of animals with inflammation of the oral soft tissues.

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MATERIALS AND METHODS

For the experiments, 69 random-bred rats of both sexes weighing 157.3±13.3 g were used. They were divided into six groups: *1*) intact rats with background (basal) saliva secretion; *2*) intact rats with saliva secretion stimulated by pilocarpine injected subcutaneously at 1 mg/kg body weight; *3* and *4*) rats with background saliva secretion at an early (2 h) and a late (24 h) stage, respectively, of acute inflammation of the oral soft tissues produced by injection, under sterile conditions, of a staphylo-

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TABLE 1. Catecholamine Levels (ng/g Tissue) in the Submandibular Gland and Oral Mucosa of Rats with Inflammation of Oral Soft Tissues. The Values are Means±SEM

Group	Submandibular glands:		Oral mucosa:	
	norepinephrine	epinephrine	norepinephrine	epinephrine
Intact rats with background saliva secretion	2524.7±197.8 (17)	99.5±9.6 (17)	251.3±39.1 (12)	60.1±8.3 (12)
Intact rats with stimulated saliva secretion	1800.0±213.7 (15) p^{*}	84.3±8.7 (15) p	109.3±10.6 (15) p^{***}	41.9±7.2 (15) p
Rats with background saliva secretion at the early stage (2 h) of inflammation	1213.2±160.9 (10) p^{***}	90.2±13.2 (10) p	199.4±22.8 (11) p	45.0±3.1 (10) p
Rats with stimulated saliva secretion at the early stage (2 h) of inflammation	2187.2±281.2 (8) $pp_1^{**}p_3$	77.1±18.2 (8) pp_1p_3	177.2±17.7 (8) $pp_1p_3^{***}$	42.6±8.4 (8) pp_1p_3
Rats with background saliva secretion at the late stage (24 h) of inflammation	1008.1±80.1 (8) $p^{***}p_1$	57.9±8.6 (8) $p^{**}p_1^{*}$	141.7±20.8 (11) $p^{*}p_1$	68.3±13.7 (10) pp_1
Rats with stimulated saliva secretion at the late stage (24 h) of inflammation	1733.2±267.8 (11) $p^{*}p_2^{*}p_3p_4$	99.2±12.0 (11) $pp_2^{***}p_3p_4$	128.7±27.1 (10) $p^{*}p_2p_3p_4$	27.8±5.1 (10) $p^{**}p_2^{***}p_3p_4$

Note. p is the significance of difference from intact rats with background secretion, p_1 from rats with background secretion at the early stage of inflammation, p_2 from rats with background secretion at the late stage of inflammation, p_3 from intact rats with stimulated secretion, and p_4 from rats with stimulated secretion at the early stage of inflammation. p without asterisk denotes an insignificant difference, while p with one, two, or three asterisks denotes a significant difference at <0.05, <0.01, or <0.001 level, respectively. Figures in parentheses indicate the number of rats.

coccal toxin (LH-0.18, series 33, manufactured at the Gamaleya Institute of Experimental Medicine), diluted 1:5 with physiological saline, into the submucosa of the left transitional fold of the vestibular maxillary aspect as the site corresponding to the location of the first molar; *5* and *6*) rats with pilocarpine-stimulated saliva secretion at the early (2 h) and late (24 h) stages, respectively, of the acute inflammation produced as indicated above.

All rats were deprived of food for 24 h before the acute experiment, while being allowed to drink water *ad libitum*. Tissue pieces were taken from the left submandibular gland and oral mucosa under Nembutal anesthesia (40 mg/kg). In rats with stimulated saliva secretion, mixed saliva (oral fluid) was collected during 40 min prior to tissue sampling.

In the biological material collected, norepinephrine (NE) and epinephrine (E) were determined by means of HPLC with electrochemical detection [1]. The results were treated statistically by Student's t test [2].

RESULTS

In rats with background saliva secretion, the NE levels in the submandibular glandular tissue were greatly reduced 2 h after the staphylococcal toxin injection into the submucosa, while the E levels remained within normal limits. In the oral mucosa of these rats, the NE and E levels were normal at that time, although the oral soft tissues were markedly edematous. In rats with stimulated saliva secretion, NE was appreciably elevated in the salivary gland, and both NE and E were increased in the secreted saliva, although their secretion with the saliva was near the control level. In the oral mucosa, the levels of both NE and E differed greatly from those in the corresponding controls (Table 1).

Twenty-four hours after the toxin injection, rats with background saliva secretion had reduced levels of both NE and E in the salivary glands, and they also exhibited lowered NA levels in the oral mucosa. Rats with stimulated saliva secretion had slightly more E and much more NE in the salivary glands than did such rats at 2 h, while having the same levels of NE and lower levels of E in the oral mucosa (Table 1). In the secreted saliva, the E and NE levels returned to normal (Table 2).

The present results show that gross disturbances of background and stimulated saliva secre-

TABLE 2. Catecholamine Concentrations in and Excretion with Saliva in Rats with Inflammation of Oral Soft Tissues. The Values are Means±SEM

Group	Amount of saliva (ml/40 min)	Concentration (mg/ml) of		Secretion (ng/40 min) of:	
		norepinephrine	epinephrine	norepinephrine	epinephrine
Intact rats with stimulated saliva secretion	0.58±0.08 (11)	0.96±0.17 (13)	0.49±0.12 (13)	0.43±0.10 (13)	0.20±0.05 (13)
Rats with stimu lated saliva secretion at the early (2 h) stage of inflammation	0.28±0.05 (11) p_3^{**}	1.95±0.45 (12) p_3^{*}	1.19±0.28 (13) p_3^{*}	0.26±0.05 (12) p_3	0.22±0.03 (13) p_3
Rats with stimulated saliva secretion at the late (24 h) stage of inflammation	0.78±0.10 (12) $p_3p_4^{***}$	0.72±0.15 (10) $p_3p_4^{***}$	0.44±0.11 (11) $p_3p_4^{*}$	0.43±0.11 (10) p_3p_4	0.28±0.04 (11) p_3p_4

Notes. p_3 is the significance of difference from intact rats with stimulated saliva secretion and p_4 from rats with stimulated saliva secretion at the early stage of inflammation. p without asterisk denotes an insignificant difference, while p with one, two, or three asterisks denotes a significance at <0.05, <0.01, or <0.001 level, respectively.

tion occur in rats when an inflammatory focus is set up in their oral soft tissues. Whereas the activation of salivation with pilocarpine in intact rats led to considerable reductions of only NE in the glandular tissue and oral mucosa, both E and NE were lowered in the oral mucosa of rats with the inflammatory focus in the oral soft tissues, as compared to control rats with background saliva secretion. At 24 h after the staphylococcal toxin injection, rats with stimulated secretion contained more NE in the glandular tissue than did rats with inflammation at 2 h, while having normal levels of E in this tissue and lowered levels of both catecholamines in the oral mucosa, which may be taken as evidence for a vasodilatory effect exerted by pilocarpine on the vascular system of the salivary glands and on the M-cholinoreceptors of adrenergic neurons. The resultant increase in blood flow through the glandular tissue in the presence of lowered catecholamine levels there promoted the replenishment of the catecholamine reserves in the salivary glands, with a consequent return toward normal of E and NE concentrations in, and excretion with, the saliva. This, however, did not affect the E and NE concentrations in the oral mucosa, which may be explained by the rapid flow of saliva and the short duration of its contact with the oral mucosa in rats with stimulated secretion.

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