

Effect of Hyperadrenalinemia on the Contents of Epinephrine and Norepinephrine in Rat Gastrointestinal Tissues

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The contents of epinephrine and norepinephrine in the salivary glands, oral, esophageal, and gastric mucosa, and in the blood after parenteral injection of epinephrine measured by high-performance liquid chromatography. It is shown that 1.5 h postinjection the content of epinephrine in all studied organs and in the blood considerably surpassed the initial level, while the content of norepinephrine sharply decreased in the mucosa and increased in the blood. It is suggested that under conditions of hyperadrenalinemia, receptor binding of epinephrine far surpasses that of norepinephrine, attesting to a competition between these catecholamines for receptors on epitheliocytes which depends on their concentration in different body fluids.

Key Words: catecholamines; salivary gland; oral, esophageal, and gastric mucosa

Stress reaction leads to a marked elevation of plasma the catecholamines and changes their concentration in internal organs that absorb catecholamines by endocytosis [3,4]. However, the competition between epinephrine (E) and norepinephrine (NE) during their translocation under conditions of selective elevation of plasma E has not been demonstrated. These relationships are of particular importance in the upper portion of the alimentary canal, since the content of catecholamines in these organs greatly varies in various pathologies [5,6]. In light of this we studied the effect of selective elevation of plasma E on the content of E and NE in the salivary gland and oral, esophageal, and gastric mucosa.

MATERIALS AND METHODS

Experiments were carried out on 24 male albino rats weighing 200 ± 20 g. The rats received parenteral injection of chemically pure crystalline E (40 μ g/kg,

Sigma). Intact rats served as the control. In order to synchronize the secretory function of gastrointestinal glands, the animals were deprived of food for 24 h prior to the experiments and had free access to water. Hour and a half later, when the external symptoms of hyperadrenalinemia (general excitation, tachycardia, etc.) disappeared, the animals were narcotized with Nembutal (40 mg/kg), the blood (1 ml) was sampled, and specimens (10 mg) of the left submaxillary salivary gland and mucosa from oral cavity, esophagus, greater and lesser curvature of the stomach were obtained. The content of E and NE in the samples was measured by high-performance liquid chromatography with electrochemical detection [1]. The data were processed statistically using the Student *t* test [2]

RESULTS

In intact rats, the content of NE in the blood and tissues considerably surpassed that of E. The maximum concentration of E was found in the salivary gland, which has abundant sympathetic innervation.

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TABLE 1. Content of Norepinephrine and Epinephrine (E) 95 min after Parenteral Injection of E ($M \pm m$)

Tissue	Norepinephrine		Epinephrine	
	control	after injection of E	control	after injection of E
Salivary gland, ng/g tissue	925 \pm 118 (9)	204.5 \pm 37.1 (11)**	69 \pm 15 (8)	331 \pm 66.2 (11)**
Oral mucosa, ng/g tissue	296 \pm 34.4 (8)	177 \pm 23.7 (10)*	67.7 \pm 15.7 (8)	216.4 \pm 32 (9)**
Esophageal mucosa, ng/g tissue	335 \pm 49.4 (8)	98.4 \pm 14 (9)*	52.6 \pm 9.7 (9)	95.3 \pm 16.6 (10)*
Gastric mucosa from the greater curvature, ng/g tissue	233 \pm 47.5 (8)	142.4 \pm 23.3 (10)	48.4 \pm 10.7 (8)	142.2 \pm 24.5 (9)**
Gastric mucosa from the lesser curvature, ng/g tissue	357.3 \pm 41.9 (8)	203.9 \pm 42.2 (10)*	85.8 \pm 20 (8)	151.6 \pm 20.1 (9)*
Blood, ng/ml	3.2 \pm 0.78 (8)	5.7 \pm 0.77 (10)*	0.33 \pm 0.05 (8)	4.1 \pm 0.73 (10)**

Note. * $p < 0.01$, ** $p < 0.001$ compared with the control. Number of experiments is shown in parentheses.

A lower content of E was observed in the oral, esophageal and gastric mucosa. Another distribution pattern was noted for NE produced by chromaffine cells: variations of its content in the studied tissues were inconsiderable.

Experimental selective elevation of plasma E markedly changed the catecholamine content in the studied organs. As seen from Table 1, 1.5 h post-injection the content of E in all studied organs and in the blood considerably surpassed its initial level. The concentration of NE decreased in tissues and increased in the blood. Blood concentration of NE increased less than 2-fold, while that of E rose more than 10-fold. In the salivary gland, oral, esophageal, and gastric mucosa the content of E increased only 1.5-fold, suggesting that variations of catecholamine content in the salivary glands and mucosa in response to parenteral injection of E depend primarily

on their plasma concentrations. Our findings suggest that under conditions of selective elevation of E in the plasma it more intensively binds to adrenoreceptors than NE. This implies that E and NE compete for adrenoreceptors and that adsorptive endocytosis of these catecholamines by epitheliocytes of the upper digestive tract depends on their concentration in the biological fluids of the organism.

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