Role of Saliva in Supply of Esophageal and Gastric Mucosa by Catecholamines

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Norepinephrine and epinephrine contents in oral, esophageal, and gastric mucosa are studied in rats by high-performance liquid chromatography 24 h, 3 days, and 7 days after removal of the main salivary glands. A 24-h deficiency of saliva leads to a sharp decrease in the norepinephrine contents in oral and esophageal mucosa. Three days after the surgery, norepinephrine content is normalized in the mucosa of the upper gastrointestinal tract. The most pronounced changes in the contents of both catecholamines in the mucosa of the upper gastrointestinal tract were observed on day 7. Severe insufficiency of salivation caused pronounced phasic changes in the catecholamine contents, indicating that the mucosa of the esophagus and lesser and greater curvatures of the stomach receive catecholamines from saliva. Insufficient supply of saliva leads to the development of inflammatory and dystrophic processes in esophageal and gastric mucosa.

Key Words: *catecholamines; sialadenectomy; esophageal and gastric mucosa*

Saliva secreted by the main salivary glands is the major source of catecholamines for oral mucosa [2-4]. It is unclear whether catecholamines from saliva supply esophageal and gastric mucosa. This study is an attempt to clarify this issue.

MATERIALS AND METHODS

Experiments were performed On 42 outbred male albino rats weighing 200±30 g. Submandibular and parotid salivary gland were extirpated under Nembutal anesthesia (40 mg/kg body weight). Sham-operated animals served as a control. Mucosa samples (10 g) from oral cavity, esophagus, and lesser and greater curvature of the stomach were collected under Nembutal anesthesia (40 mg/kg) 24 h, 3 days, and 7 days after the surgery. Function of salivary glands was synchronized by depriving the rats of food for 24 h with free access to water. The contents of epinephrine (EP) and norepinephrine (NEP) in the samples were determined by high-performance liquid chromatography with electrochemical detection [1]. The data were analyzed by Student's tests [5].

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RESULTS

In healthy rats, the contents of NEP and EP were maximal in esophageal mucosa and the content of EP in the lesser curvature of the stomach (Tables 1 and 3). This finding suggests that for normal functioning the esophagus requires higher concentration of NEP than oral mucosa and stomach. Twenty-four hours of after removal of the main salivary glands NEP contents sharply decreased in oral and esophageal mucosa and remained unchanged in lesser and greater curvatures of the stomach. Epinephrine content changed only in the greater curvature. Three days after the surgery, NEP concentration in the mucosa of the upper gastrointestinal tract was restored to the original level. The concentration of EP was increased in oral mucosa and decreased in esophagus and greater curvature of the stomach. These

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TABLE 1. Contents of Epinephrine and Norepinephrine in the Mucosa of Upper Gastrointestinal Tract 24 h after Sialectomy *(M±m)*

Tissue	NEP, ng/g tissue		EP, ng/g tissue	
	control	after sialectomy	control	after sialectomy
Oral mucosa	272±51.6 (9)	81.6±12.4 (10)***	40.2±7.5 (7)	51.3±11.4 (7)
Esophageal mucosa	431±86.7 (8)	130±26.5 (8)***	85±11.2 (8)	67.3±15 (8)
Mucosa of lesser curvature of stomach	302±50 (8)	303.4±51.0 (8)	105±18.3 (7)	44.2±22.1 (8)
Mucosa of greater curvature of stomach	376±60 (8)	236.7±59 (8)	70±9.3 (8)	44.9±7 (7)*

Note. Here and in Tables 2 and 3: *$p \le 0.05$, **$p \le 0.01$, ***$p \le 0.001$ compared with the control; number of rats a give in parentheses.

TABLE 2. Contents of Epinephrine and Norepinephrine in the Mucosa of Upper Gastrointestinal Tract 3 Days after Sialectomy *(M±m)*

Tissue	NEP, ng/g tissue		EP, ng/g tissue	
	control	after sialectomy	control	after sialectomy
Oral mucosa	272±51.6 (9)	244.7±60 (8)	40.2±7.5 (7)	67.7±12.8 (8)*
Esophageal mucosa	431±86.7 (8)	486±118 (7)	85±11.2 (8)	32±7.4 (9)***
Mucosa of lesser curvature of stomach	302±50 (8)	385±80 (9)	105±18.3 (7)	70.2±8.6 (9)
Mucosa of greater curvature of stomach	376±60 (8)	503±99 (8)	70±9.3 (8)	43±7.6 (7)**

TABLE 3. Contents of Epinephrine and Norepinephrine in the Mucosa of Upper Gastrointestinal Tract 7 Days after Sialectomy *(M±m)*

Tissue	NEP, ng/g tissue		EP, ng/g tissue	
	control	after sialectomy	control	after sialectomy
Oral mucosa	272±51.6 (9)	146.5±20.9 (10)**	40.2±7.5 (7)	31.7±6.9 (8)
Esophageal mucosa	431±86.7 (8)	215.8±18.3 (8)**	85±11.2 (8)	14.8±2 (8)***
Mucosa of lesser curvature of stomach	302±50 (8)	153.2±29 (9)**	105±18.3 (7)	26.8±3.9 (10)***
Mucosa of greater curvature of stomach	376±60 (8)	119.4±18.9 (9)***	70±9.3 (8)	45.6±7.1 (9)*

modifications of catecholamine contents were accompanied by dryness in the oral cavity and hyperemia of gastric mucosa associated with the development of inflammation. The most pronounced changes in the concentration of catecholamines were observed on day 7 after removal of main salivary glands. Norepinephrine contents decreased considerably in oral, esophageal, and gastric mucosa, while EP content dropped in esophagus and in the lesser and greater curvatures of the stomach and remained similar to the control in oral mucosa.

From our findings it can be concluded that severe insufficiency of salivation caused by removal of main salivary leads to changes in the contents of catecholamines (of NEP to a greater extent) in the mucosa of the upper gastrointestinal tract. On day 1 after the surgery, the concentration of NA drops in oral and esophageal mucosa. The concentration of EP decreases almost in the entire upper gastrointestinal tract. On day 7, the concentrations of both catecholamines decreases in oral, esophageal, and gastric mucosa, indicating that the esophagus and stomach receive catecholamines from saliva. Impaired salivation may be a factor determining the development of inflammatory-dystrophic processes in the mucosa of the upper gastrointestinal tract. It was demonstrated that catecholamine content is decreased in peptic ulcer in humans and animals [6,7].

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