ANALYSIS OF THE ACTION OF QUATERON ON THE ADRENALIN AND NORADRENALIN CONTENT IN DIFFERENT LAYERS OF THE STOMACH

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Data are given for the content of catecholamines (noradrenalin, adrenalin) in each separate layer of various parts of the stomach and of quantitative changes which they undergo under the influence of small (0.2-0.4 mg/kg) and large (1.5-2 mg/kg) doses of the ganglion-blocking agent quateron.

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In previous investigations Mirzoyan and co-workers [1, 3] showed that under physiological conditions the gastric mucosa secretes catecholamines. Different amounts of noradrenalin and adrenalin were found in different parts of the stomach. Secretion from the greater curvature contained more noradrenalin, and that of the lesser curvature more adrenalin. Only unconjugated noradrenalin is secreted with the gastric juice from the lesser and greater curvatures, while only a small part of the adrenalin is secreted in the bound state.

In the present investigation, to compare data for the content of catecholamines in the gastric juice with the presence of noradrenalin and adrenalin in the mucous membrane and muscular layers in different parts of the stomach, acute experiments were carried out on dogs. It was also considered necessary to study the effect of the ganglion-blocking drug quateron on changes in the content of catecholamines in the various layers of the stomach and to study more aspects of the mechanism of action of quateron on changes in the adrenalin/noradrenalin ratio in the stomach wall.

EXPERIMENTAL METHOD

Investigations of the content of catecholamines in the mucous membrane and muscular layer and changes in their content under the influence of quateron were carried out jointly with N. A. Esayan and E. K. Kazarova. The physiological and pharmacological part of the investigation was undertaken in the Department of Pharmacology, and the biochemical part in the Institute of Biochemistry, Academy of Sciences of the Armenian SSR. Spectrophotofluorometric determinations of noradrenalin and adrenalin in the extracts obtained from weighed samples of tissues from the mucous membrane and muscular part of the stomach by the method of Bertler and co-workers [4] were carried out on a "Farand" spectrofluorometer. For quantitative determination of acetylcholine, extraction with trichloroacetic acid was followed by testing on the eserinized frog rectus abdominis muscle by the method of Chang and Gaddum [6]. Cholinesterase activity was determined by a colorimetric method.

EXPERIMENTAL RESULTS

The results (Table 1) show that the content of catecholamines differs both absolutely and relatively in different parts of the stomach.

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TABLE 1. Effect of Various Doses of Quateron on Content of Catecholamines (in mμg/g fresh tissue) in Muscular and Serous Layers of Greater and Lesser Curvature of the Dog's Stomach

Dose of quateron (in mg/kg)	Lesser curvature				Greater curvature			
	muscle		mucosa		muscle		mucosa	
	NA	A	NA	A	NA	A	NA	A
Control	52,5±8,23 (10)	28,5±6,17 (10)	213,1±55,05 (6)	36,5±13,53 (6)	97±15,6 (9)	20±8,07 (9)	281,3±10,44 (9)	20,7±7,36 (9)
0,2–0,4	90±19,05 $P<0{,}01$ (7)	19±5,6 $P<0{,}05$ (7)	366±96,2 $P<0{,}02$ (6)	29±22,67 $P<0{,}5$ (6)	57,5±13,3 $P<0{,}001$ (6)	8,75±2,2 $P<0{,}01$ (8)	146,4±1,4 $P<0{,}01$ (8)	13,9±3,06 $P<0{,}01$ (8)
1,5–2	69,2±18,93 $P<0{,}02$ (5)	14,4±10,34 $P<0{,}02$ (5)	295,2±59,41 $P<0{,}01$ (5)	5,14±5,7 $P<0{,}01$ (5)	96±6,08 $P<0{,}05$ (3)	14,7±2,67 $P>0{,}05$ (3)	377,4±163,1 $P<0{,}001$ (5)	6,4±2,2 $P<0{,}02$ (5)

Note. Number of experiments in parentheses. NA) Noradrenalin, A) adrenalin.

A high content of noradrenalin was observed in those parts of the stomach in which sympathetic nerve fibers are more concentrated. According to data in the literature, sympathetic nerves running along blood vessels and participating in the formation of the submucosal plexuses are more clearly defined in the region of the greater than of the lesser curvature. The low adrenalin content is evidently connected with the presence of scattered chromaffin cells in the substance of the tissues, and the adrenalin which they contain is evidently not concerned with the mediator function of the sympathetic nervous system.

It was noted that small (0.2-0.4 mg/kg) and, in particular large (1.5-2 mg/kg) doses of quateron lowered the adrenalin level in the mucous membrane and muscular layer of the greater and lesser curvatures. The effect was more marked in the region of the lesser curvature (Table 1).

It might be assumed that the sharp decrease in the adrenalin content under the influence of quateron is connected with an increase in cholinergic mediator activity [5]. Accordingly, acute experiments were carried out on cats and rabbits to record the motor activity of different parts of the stomach, and at the same time, to determine the acetylcholine content and cholinesterase activity in weighed samples of the tissues. These experiments showed that intravenous injection of quateron in doses of 0.1-1 mg/kg was accompanied by an increase in tone, an increase in frequency and amplitude of the rhythmic waves of spontaneous gastric contractions, and by an increased intensity of acetylcholine metabolism, especially in the region of the lesser curvature.

In 11 experiments on rabbits it was found that quateron increases the acetylcholine content in weighed samples of tissues from the lesser curvature from 0.87 ± 0.352 to 1.38 ± 0.51 μg/g fresh tissue, i.e., by 55.5%. Under these conditions, cholinesterase activity was lowered by 41.1%. In the same experiments the content of acetylcholine in tissue taken from the greater curvature was 0.64 ± 0.224 μg/g fresh weight and the cholinesterase activity 25.45 ± 3.85% before administration of quateron, while after its administration the acetylcholine content increased to 1.059 ± 0.347 μg/g fresh tissue and the cholinesterase activity fell by 37.2%.

It thus seems justifiable to conclude that the liberation of adrenalin was due to the nicotine-like action of acetylcholine on the chromaffin cells scattered throughout the tissues of the stomach and capable of secreting adrenalin. The high acetylcholine content in the region of the lesser curvature favors the intensive liberation of adrenalin from the cytoplasm of the chromaffin cells in the mucous membrane and muscular layers of the lesser curvature. As Govyrin [2] suggests, the possibility is not ruled out that the synthesis of a certain quantity of catecholamines can also take the place extraneurally in the effector cells themselves, which have mediator function. The liberation of these catecholamines, especially adrenalin, can be facilitated by acetylcholine.

LITERATURE CITED

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