ROLE OF ACETYLCHOLINE IN THE PATHOGENESIS OF STRESS ULCERS OF THE GASTRO-INTESTINAL TRACT

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The development of ulcers in the gastric mucosa following immobilization and cooling of rats to a temperature of 4°C for 2 h is accompanied by an increase of 2.5 times in the acetylcholine concentration and a decrease of 14% in the cholinesterase activity in the tissues of the glandular part of the stomach.

Previous investigations showed that injection of hydrocortisone into rats increases the acetylcholine concentration and reduces the cholinesterase activity in the tissues of the intestine. Injection of deoxycorticosterone reduces the acetylcholine concentration [3].

After comparing these results with those obtained by Al'pern et al. [1], who demonstrated the role of acetylcholine and cholinesterase in the pathogenesis of gastric and duodenal ulcer, the writer put forward the hypothesis that the acetylcholine–cholinesterase system plays an important role in the mechanism of origin of "stress" and "steroid" ulcers of the gastro-intestinal tract [2, 4].

To test this hypothesis, in the present investigation the concentration of acetylcholine and its enzymic hydrolysis were determined in the stomach tissues during the formation of ulcers under the influence of stress.

EXPERIMENTAL METHOD

Experiments were carried out on 32 noninbred albino mice of both sexes weighing 100-170 g.

To produce stress, the animals were immobilized at a temperature of 4° for 2 h in wire cages large enough for a rat. The animals were deprived of food for the previous 24 h, but had free access to water.

The acetylcholine concentration was determined and its enzymic hydrolysis studied immediately after immobilization.

To determine the total acetylcholine, the glandular part of the rat's stomach was taken. The organ was quickly washed, dried on filter paper, weighed, and homogenized in bicarbonate Ringer's solution acidified with hydrochloric acid (pH 3.8), cooled to 0°C, and containing eserine ($6 \cdot 10^{-5}$). The homogenate was then placed for 5 min in a boiling water bath extracted for 2 h at room temperature, and centrifuged for 30 min. The acetylcholine concentration in the extract was determined on the frog rectus abdominis muscle. The muscles were sensitized with acetone [5].

To prepare standard solutions, acetylcholine was dissolved in the same extract from which the acetylcholine had previously been removed by boiling with alkali. The acetylcholine concentration was expressed in $\mu g/g$ tissue.

Enzymic hydrolysis of acetylcholine was determined by Ammon's manometric method. A 1.5-ml sample of the homogenate, diluted twice with Krebs–Ringer bicarbonate solution, was placed in the main compartment of a Warburg's apparatus, and 0.5 ml of a 1% solution of acetylcholine chloride was placed in

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TABLE 1. Effect of Stress on Acetylcholine Concentration and Cholinesterase Activity in Tissues of Glandular Part of Rat Stomach (M ± m)

Animals	No. of animals	Acetylcholine	No. of animals	Cholinesterase
Control	6	0,32±0,05	10	7,64±0,29
Exposed to stress	6	1,11±0,21	10	6,57±0,21
P		<0,01		<0,01

Note. The units in which the acetylcholine concentration and cholinesterase activity are expressed and discussed in the section "Experimental Method."

the side tube. Hydrolysis took place in a gas mixture containing 25% N_2 and 5% CO_2. Activity of the enzyme was expressed in milligrams acetylcholine hydrolyzed by 1 g tissue in 1 h at 38°C.

The results show that the development of ulcers in the gastric mucosa of the rats was accompanied by an increase in the acetylcholine concentration in the stomach tissues. This was evidently due to a decrease in the enzymic hydrolysis of acetylcholine. The results confirm the writer's hypothesis regarding the role of cholinergic mechanisms in the development of "stress" ulcers of the stomach.

LITERATURE CITED

1. D. E. Al'pern, É. N. Berger, and T. F. Fesenko, Arkh. Pat., No. 3, 19 (1946).
2. É. N. Berger and Yu. I. Bondarenko, Vrach. Delo, No. 8, 38 (1968).
3. Yu. N. Bondarenko, Probl. Endokrinol., No. 4, 68 (1967).
4. Yu. I. Bondarenko, Some Aspects of Acetylcholine Metabolism during Experimental Disturbances of Adrenal Function. Author's Abstract of Candidate's Dissertation, Ivano-Frankovsk (1968).
5. J. E. Davis, Am. J. Physiol., 162, 616 (1950).