REFLEX EFFECT OF HYDROCHLORIC ACID ON INTESTINAL SECRETION

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N. V. Maevskaya

Department of Physiology (Head, Prof. A. B. Feldman)
Donets Medical Institute
Presented by Active Member AMN SSSR V. V. Parin
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Local chemical and mechanical stimulations of the intestinal mucosa are undoubtedly two of the factors which normally promote secretion of the fluid part of the intestinal juice. Chemical stimulation is accompanied by a pronounced after-effect. While there is evidence [4, 5] that the effect of mechanical stimulation is the result of a local reflex, even in the denervated intestine [7], the mechanism whereby chemical stimuli affect intestinal secretion has not been discovered. Suggested mechanisms [1] have not been confirmed. Reduction of calomel hypersecretion when the mucosa is anesthetized [4] is not a convincing proof of the reflex nature of intestinal secretion in response to local application of a chemical stimulus as the reduction may be linked with inhibition of the mechanical component in calomel hypersecretion.

An attempt was therefore made to determine the mechanism whereby hydrochloric acid influenced secretion of the fluid part of the gastric juice, by pharmacological intervention in the reflex arc at various points.

METHOD

Altogether, 121 experiments were carried out on 8 dogs with segments of the proximal part of the jejunum isolated either by the Thiry or the Thiry-Vella method. Secretion was induced by irrigation of the mucosa for 5 min with 20 ml 0.25% hydrochloric acid, the mucosa being washed with normal saline at the end of the period. Intestinal juice was collected every 15 min for 2 h. In some experiments the mucosa was first irrigated with 0.5 or 1.0% dicaine solution or 0.5 or 3.0% novocain; in others the animals were given subcutaneous injections of hexamethonium (6 mg/kg) or atropine (1 ml of 0.1% solution).

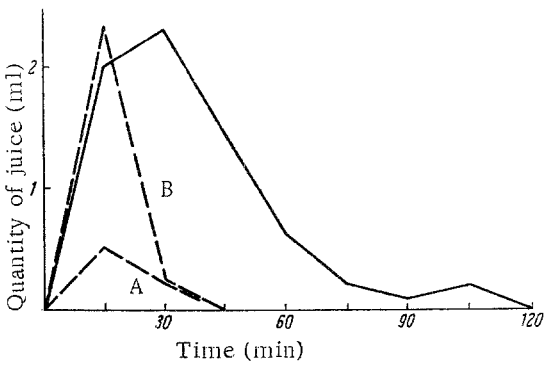
Effects of Dicaine and Hexamethonium on Intestinal Juice Secretion (ml/2 h) in Relation to Introduction of Hydrochloric Acid into Small Intestine

Statistical index	Control (HCl)	Dicaine 0.5% before HCl	Hexamethonium (6 mg/kg)	
			Before HCl	15 min after HCl
M±m	5.92±0.18	3.56±0.24	1.58±0.08	3.14±0.10
n	12	9	9	9
t		7.9	22.2	10.7
P		<0.001	<0.001	<0.001

RESULTS

Preliminary irrigation of the mucosa with 0.5% dicaine immediately before irrigation with acid reduced the quantity of juice and, in most cases, the period of secretion (see table).

The results with 0.5% and, more particularly, 3.0% novocain were very similar.



Effect of atropine on intestinal secretion in dog Renat in response to introduction of HCl into intestine. Continuous line - control experiment. Interrupted line - atropine experiment. A) Injection of atropine 15 min before irrigation of intestinal mucosa with HCl. B) Injection of atropine 15 min after irrigation.

In the strengths employed, these anesthesia-producing substances had no effect on periodic secretion and it could therefore be inferred that they had no direct effect on the intestinal glands. Receptor depression would therefore appear to be the factor responsible for the reduced secretion in response to acid after prior irrigation of the mucous membrane with anesthetic solutions.

Anesthetic substances have been found to have this suppressing effect on chemoreceptors in the mucosa of the small intestine in both chronic and acute experiments [2, 3, 8].

It was found, however, in the present experiments that juice secretion was unaffected by irrigation of the mucosa with 0.5% dicaine if "acid" secretion was already occurring and it could therefore be assumed that the solution had no effect on the other parts of the reflex arc.

In the case of chemical stimulation of secretion, dicaine and novocain did not produce the phase of hypersecretion seen with secretion induced by mechanical stimulation [7].

Autonomic ganglia were then blockaded in an attempt to obtain further information on the mechanism of the secretion-inducing effect of hydrochloric acid. Hexamethonium (6 mg/kg), injected subcutaneously 10 min before irrigation of the mucosa with acid began, inhibited secretion to a considerable extent (table). This effect was apparently connected with blockade of intramural ganglia as it is known that complete denervation of the intestine does not affect the reaction of intestinal glands to local stimulation. It should be noted that, in experiments on the same dogs, secretion in response to acid was depressed by the ganglion-blocking agent in about the same degree as secretion in response to mechanical stimulation, which would suggest a single mechanism common to the 2 forms of stimulation. Intestinal juice secretion was also reduced by hexamethonium administered when acid-induced secretion was already developed (table). This would suggest that continued activity of intestinal glands after the mucosa has been exposed to the action of hydrochloric acid for a short period is connected with sustained excitation in ganglia.

Atropine administered subcutaneously to the animal 15 min before an experiment or 15 min after the introduction of acid into the intestine inhibited secretion to a considerable degree (Fig. 1). This inhibitory effect of atropine both before and after the establishment of secretion confirms this explanation of the mechanism of continued activity of the intestinal glands.

These experiments are thought to prove that secretion of the fluid part of the intestinal juice in response to chemical stimulation of the mucosa is effected through a local reflex mechanism. They do not, however, exclude the possible inclusion of a humoral factor such as enterocrinin in the local reflex process [10] although there is no evidence [1, 6, 9, 11] that this substance is concerned in the secretory reaction of intestinal glands to local stimulation when the nerve supply is intact.

SUMMARY

A conclusion was drawn on the local reflex mechanism of intestinal secretion in response to stimulation of the mucous membrane with a 0.25% hydrochloric acid solution. This conclusion was based on the inhibition of secretion in the isolated intestinal portion of a dog under the effect of anesthetics, hexamethonium and atropine.

The after-effect of the intestinal glands reaction to chemical stimulation is associated with prolonged stimulation of the intramural ganglia.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
