

PATHOLOGICAL PHYSIOLOGY AND GENERAL PATHOLOGY

PHYSIOLOGIC CHARACTERISTICS OF FASTING GASTRIC SECRETION IN CERTAIN EXPERIMENTALLY-INDUCED PATHOLOGIC PROCESSES IN DOGS

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According to a series of authors [1, 2, 3, 6], and others, as well as to observations made in conjunction with clinicians [5, 7, 8], copious fasting gastric secretion occurs in a number of diseases, i.e., it takes place without the introduction of secretory stimuli. There is marked qualitative difference between fasting gastric juice in different pathologic processes.

In particular, gastric juice of mainly high acidity and digestive power is secreted in hyperacidic gastritis and gastric ulcer, as well as in certain intoxications. In suppurative, septic processes and silicosis a considerable amount of fluid of low acidity and digestive power is found in the stomachs of the patients, and at times complete absence of free hydrochloric acid is encountered. I. P. Razenkov and collaborators have shown [6] that patients with sepsis may secrete up to 400-600 ml of gastric juice, devoid of hydrochloric acid and enzymes, in the course of 3-4 hours.

The present experiments were concerned with the question of peculiarities of gastric secretion in various pathologic processes in dogs and mechanisms determining continuous gastric secretion in the fasting state.

Results of two series of experiments are given in the present communication; these experiments were performed on 8 dogs with gastric fistulas and isolated pouches (according to Pavlov and Klemensevich-Heidenhein).

In the first series of experiments a study was made of the prolonged, continuous fasting gastric secretion evoked by an experimentally produced cinchophen gastric ulcer. The experimental cinchophen ulcer described by I. V. Malkiman, M. A. Vasilevsky, and E. A. Rudik [4] was taken as model.

From the 8th to 21st day following daily administration of 0.1 g cinchophen in addition to other indications of the formation of an ulcer [7] the appearance of continuous gastric secretion in the fasting state was noted (sometimes this secretion continued for several months after the end of cinchophen administration); the juice was distinguished mainly by high acidity and digestive power (Table 1).

Taking as a basis the findings [5, 8] concerning the depressing effect of bromides on hypersecretion by gastric mucosa observed in man and animals in gastric ulcer, an attempt was made to discover the action of bromides on prolonged continuous gastric secretion in the fasting state in the experimental dogs. In all

* Deceased.

cases daily introduction (from 7 to 12 days) of 0.5 g bromide into the stomach by way of the fistula produced a sharp decrease of this secretion (Fig. 1), whereas administration of 1 mg atropine (from 7 to 10 days) did

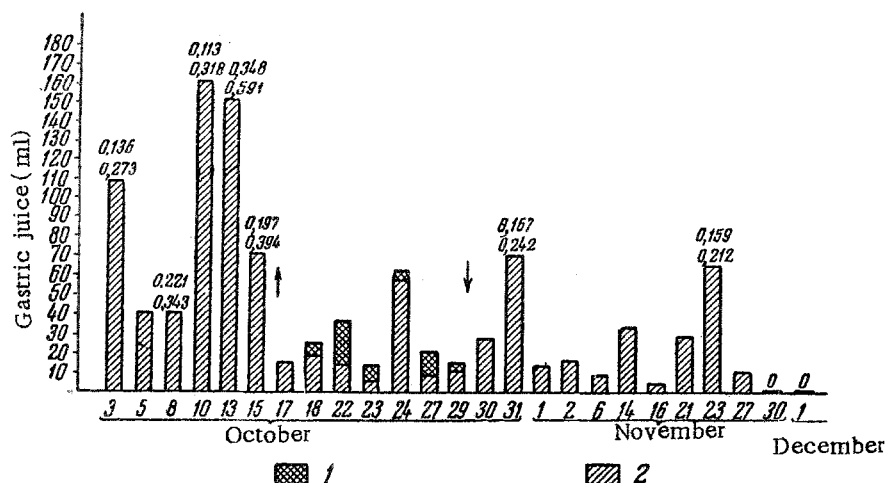


Fig. 1. The Effect of Bromide on Continuous Gastric Secretion in Experimental Gastric Ulcer. Dog Dick.

1) mucus of neutral reaction; 2) fasting gastric juice, \uparrow \downarrow period of bromide administration (0.5 g daily). Figures over the columns indicate acid values: lower - total, upper - free hydrochloric acid.

not produce such a definite and persistent lowering. In connection with this an attempt was made to determine more precisely the mechanism of the bromide effect and to discover the effect of NaBr on gastric secretion in the normal dog: the effect of NaBr in a given dose with varying methods of administration; and the ways in which this influence is exerted on the secretory process.

Control experiments performed on all dogs, showed that sodium bromide in the dose 0.5-1 g, given daily for 5-10 days by way of the gastric fistula and also per os and per rectum did not evoke gastric secretion and did not affect secretion produced by meat, bread, or alcohol.

At the same time further experiments showed that administration of NaBr for 5-7 days by way of gastric fistula as well as per os and per rectum either lowered or completely inhibited continuous fasting gastric secretion in dogs with gastric fistulas or Pavlov pouches. The identical effect obtained with the different methods of administration indicates that the mechanism of this bromide effect is not connected with local action on gastric mucosa.

It should be noted that the optimal dose of bromide is individual and depends on the type of nervous system of the animal.

Different results were obtained in experiments on dogs with Klemensevich-Heidenhein pouches. The appearance of experimentally-induced gastric ulcer in these animals was also accompanied by continuous secretion in the pouch, but it was not as copious as in the case of dogs with Pavlov pouches; it only appeared 3 weeks after the beginning of cinchophen administration, and the gastric juice was of low acidity. Administration of NaBr (from 0.5 to 2 g) did not affect the secretion (Table 2). Therefore, the influence of bromide is only exerted when parasympathetic innervation is preserved.

The results of the experiments provide an experimental basis for the use of bromides as substances which inhibit continuous gastric secretion in the fasting state observed in some pathologic processes. At the same time the question concerning the optimal dose of bromide requires further investigation and clinical trials.

The second series of experiments was performed on dogs with experimentally induced aseptic abscesses.

Single or multiple abscesses were produced by subcutaneous administration of 2-3 ml of turpentine in the upper third of the thigh. In some cases turpentine administration was repeated after several days to ensure a longer course of the process. The suppurative process continued in different dogs from 7 to 20 days, and in one dog - up to 5 weeks.

TABLE 1

Fasting Gastric Juice Secretion in the Dog Dick With Gastric Fistula in Gastric Ulcer and a Suppurative Process

Date	Gastric ulcer				Suppurative process				Remarks	
	Amount of juice (ml)	Acidity		Digestive power (mm)	Date	Amount of juice (ml)	Acidity			Digestive power (mm)
		Free HCl	Total				Free HCl	Total		
8/V	0			Cinchophen administered from 10/V to 23/VI	13/VI	5.0	Mucus		3 ml turpentine introduced on 18/XI	
16/V	93	53/106			20/XI	51	86/135	2.4		
29/V	77	49/102			21/XI	80	78/111	2.0		
30/V	72	55/119			22/XI	36.2	0/32	0		
1/VI	90	86/121			24/XI	80.1	0/39	2.1		
5/VI	125	94/125			25/XI	23.0	0/16	0		
26/VI	22.8	82/102			26/XI	32.0	0/16	0		
3/X	110	37/65		Continuous	28/XI	9.0	9/8	0		
8/X	42	61/94		fasting secretion of	29/XI	2.5	0	-		
10/X	165	30/86								
13/X	160	94/162		juice from						
15/X	89	53/108		26/VI to 1/X						

TABLE 2

Influence of Bromide on Fasting Gastric Secretion in Experimental Gastric Ulcer in the Dog Mishka with a Pavlov Pouch and the Dog Dunai with a Heidenhein Pouch

Date	Amount of juice in 3 hours (ml)	Acidity		Remarks	Date	Amount of juice in 3 hours (ml)	Acidity		Remarks	
		Free HCl	Total				Free HCl	Total		
3/III	0	Mishka —		Cinchophen administered from 5/III to 20/III 18/III blood in stool and gastric juice, vomiting	3/I	0	Dunai —		Cinchophen administered from 5/I to 28/I 28/I blood in stool and gastric juice (x-ray examination data)	
3/III	0	—			5/I	0	—			
18/III	2.0	0/16			7/I	0.5	Mucus			
20/III	3.2	24/36			15/I	0.5	"			
					28/I	1.2	0/16			
22/III	4.5	24/36		30/I	2.0	0/16		NaBr 0.5-2.0 g daily administered from 7/II to 15/II		
24/III	3.8			58/96		2/II	1.5		8/16	
27/III	5.7			72/96		4/II	3.8		20/32	
29/III	7.8			72/102		27/II	3.5		20/32	
1/IV	2.3	16/32		NaBr 0.5 g daily administered from 30/III to 9/IV Mucus	10/II	4.0	28/40			
3/IV	1.2	0/16			15/II	3.2	20/32			
5/IV	0.5	0			17/II	3.5	20/32			
7/IV	0	—			19/II	2.8	16/28			
9/IV	0	—			23/II	2.0	16/32			

During the period of development of the abscess, usually 2-3 days after the beginning of its formation, secretion of gastric juice in the fasting state began, and the juice showed extremely low acidity and digestive power. The secretion usually ceased during resolution of the abscess and the subsequent period, as distinct from observations in experimental ulcer (Table 1).

Taking into account the previous findings concerning the effect of bromide on continuous gastric secretion in experimental ulcer, an analogous series of experiments was performed on the dogs with suppurative processes. NaBr was administered in the same doses and for the same time as in experimental ulcer.

The experiments showed that in this pathologic condition too some decrease of secretion followed directly the introduction of NaBr, but it was less persistent and much less pronounced than in cases of experimental gastric ulcer. Fig. 2 shows the results of NaBr action on fasting gastric secretion during the formation of an abscess in the dog Dick.

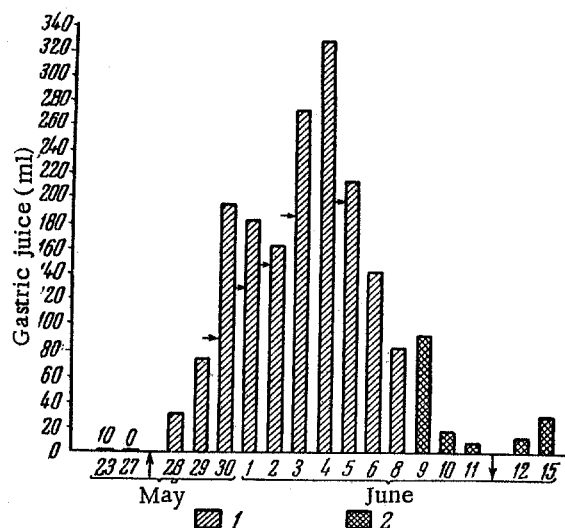


Fig. 2. Fasting gastric secretion during daily administration of bromide during the formation and resolution of an abscess. Dog Dick.

1) acid juice; 2) mucus → administration of bromide;
 ↑ — administration of turpentine and beginning of abscess formation; ↓ — end of suppuration.

In control experiments that subcutaneous injection of 0.2 mg adrenaline (usually producing vasoconstriction) did not affect the amount of secretion appearing in response to meat, bread, and alcohol.

The experimental results presented indicate a nervous mechanism of gastric secretion in the given pathologic process, and, apparently, local nervous formations play a definite part in its appearance. At the same time the possibility of the importance of vascular changes is not excluded—this question requires further study.

The results of the present experiments permit the conclusion that fasting gastric secretion in dogs subjected to the influences under investigation has different origins and significance.

While continuous fasting secretion of highly acid juice with high digestive power arising in experimental gastric ulcer is predominantly pathologic in character, since it favors ulceration and relapses, and evidently results from functional disturbance of central regulatory mechanisms, the fasting secretion in experimental abscess can be regarded chiefly as a manifestation of a peculiar defensive reaction of the organism which appears when breakdown products from suppurative foci circulate in the blood.

Despite daily administration of bromide, considerable fasting gastric secretion was observed during the development and resolution of the abscess; this secretion decreased a little after bromide only on the day of the experiment.

Somewhat different results were obtained in the case of dogs with Heidenhein pouches (Dunai, Valet).

Administration of bromide to these dogs produced no effect on gastric secretion. Administration of atropine, however, completely inhibited secretion on the day of the experiment (Fig. 3). It follows from this that the mechanism of the appearance of this secretion is connected with cholinergic nervous factors, but is also possible when parasympathetic pathways are interrupted.

In trying to discover the nature of this secretion, an attempt was made to discover its relation to carbocholine and adrenaline, using these substances in small doses. Carbocholine was shown to increase secretion in suppurative conditions without changing the qualitative composition of the juice, while adrenaline, although not as severely, still inhibited this secretion (Fig. 3). It had been previously established

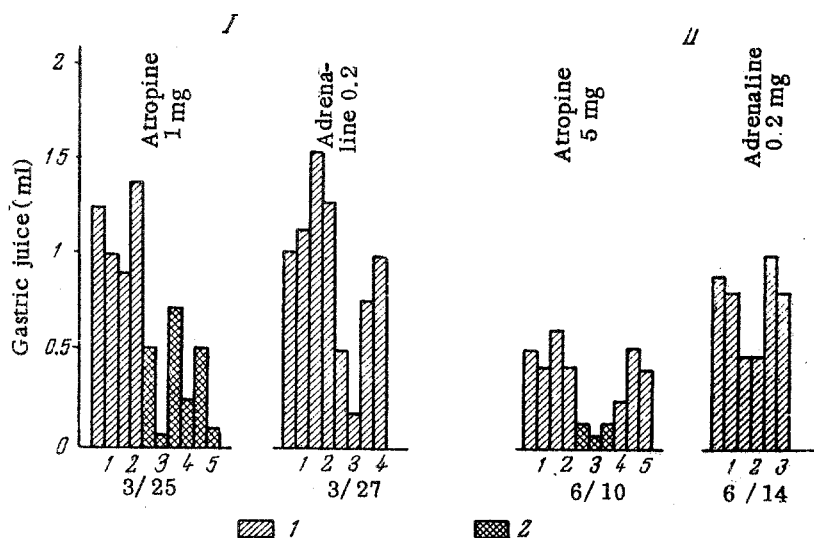


Fig. 3. Influence of atropine and adrenaline on fasting gastric secretion during suppurative process in the dog Ryabchik with a Pavlov pouch (I) and Valet with a Heidenhein pouch (II).

1) acid gastric juice, 2) mucus of neutral reaction.

The gastric juice in these cases has very weak digestive activity. In connection with this arises the need to check the expediency of using, both experimentally and clinically, intravenous and subcutaneous administration of various substances for the analysis of digestive activity of gastric glands, in particular in order to characterise the second phase of gastric secretion.

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* In Russian