

CHANGES IN SECRETION OF PANCREATIC JUICE DURING STIMULATION OF THE GALL BLADDER IN DOGS

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Experiments on dogs with pancreatic and biliary fistulas showed that reflex stimulation from the gall bladder leads to significant changes in the secretion of pancreatic juice. These changes may take the form of inhibition or potentiation.

Clinical and experimental studies have shown that the gall bladder and pancreas are frequently involved concurrently in disease. The question of reflex connections between these organs has received less study. Experiments have shown that the secretion of pancreatic juice in response to feeding in dogs with biliary and pancreatic fistulas is inhibited after stretching the gall bladder for 3 min by a rubber balloon [3] or if the gall bladder is irrigated with water at 35-40°C [2].

Results of the writer's earlier experiments confirmed these findings and demonstrated inhibitory effects from the gall bladder on the secretion of pancreatic juice [1]. However, further experiments then showed that the pancreas may respond differently to stimulation of the mechanoreceptors of the gall bladder, namely by an increase in the secretion of pancreatic juice. The present investigation was carried out to study this phenomenon.

TABLE 1. Inhibition of Secretion of Pancreatic Juice in Dogs During Stimulation of Gall Bladder Mechanoreceptors (B) Compared with Changes in Secretion of Juice in Experiments Without Stimulation (A)

Dog's Name	A			B			
	exp. no.	fluctuations in secretion of juice (in ml) in exp. without stimulation	difference	exp. no.	secretion of juice (in ml)		difference
					without stimulation	with stimulation	
Mishka:	1	42—46	—4	1	46	34	—12
	2	8—12	—4	2	58	8	—50
Bobik	3	28—79	+51	3	43	10	—33
	4	52—89	+37	4	79	69	—10
	5	62—87	+25	5	89	29	—60
	6	58—39	—19	6	87	56	—31
	7	99—51	—48	7	39	21	—18
				8	51	52	+1
$M \pm m$ P		49—57	8 13 >0,5		61	34	27 8 <0,02

EXPERIMENTAL METHOD

Long-term experiments were carried out on four dogs with a Pavlov pancreatic fistula and a Schiff fistula of the gall bladder. The gall bladder fistula was formed first in two of the dogs (called Mishka and Bobik), and a fistula of the pancreatic duct was formed 6 months later. In two other dogs (called Fomka and Norka) the two fistulas were formed simultaneously.

Pancreatic secretion was determined during the 4 h before feeding (the meal consisted of 1 liter milk, 100 g stewed meat, 200 g biscuit). Stimulation of the gall bladder by a balloon in which the pressure was 30-35 cm water began 30 min before feeding, and continued throughout the period of observation (4 h). In three experiments, before the gall bladder was stimulated its receptors were blocked by irrigation of the mucus membrane with 1% cocaine hydrochloride solution for 6 min. Statistical analysis of the results was carried out by the method of direct differences [4].

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TABLE 2. Increase in Secretion of Pancreatic Juice in Dogs in Response to Stimulation of Gall Bladder Mechanoreceptors (B) Compared with Changes in Secretion of Juice in Experiments Without Stimulation (A)

Dog's name	A			B			
	exp. no.	fluctuations in secretion of juice (in ml) in exp. without stimulation	difference	exp. no.	secretion of juice (in ml)		difference
					without stimulation	with stimulation	
Norka	1	111—78	—33	1	41	85	+44
Fomka	2	78—41	—37	2	60	70	+10
	3	36—22	—14	3	22	22	0
	4	36—76	+40	4	65	26	—39
	5	21—11	—10	5	76	118	+42
	6	21—28	+7	6	11	80	+69
Bobik	7	56—81	+25	7	28	57	+29
				8	81	123	+42
	8	51—83	+32	9	83	123	+40
	9	88—88	0	10	38	36	—2
	10	104—100	—4	11	100	115	+15
	11	54—35	—19	12	111	142	+31
	12	35—33	—2	13	25	100	+75
	13	33—64	—31	14	85	107	+22
	14	64—85	+21				
M		56—59	3		59	86	27
± m			7				7.7
P			0,7				<0.01

The mean difference was 27 ml and was statistically significant ($P < 0.01$). Meanwhile, in the experiments without stimulation of the gall bladder, just as in the first series of observations, there was no significant difference between the direction of the changes in juice secretion (Table 2A). Consequently, in response to stimulation of the gall bladder the secretion of pancreatic juice may be either reduced or increased.

The reflex nature of these responses is shown by preliminary results of three experiments in which the gall bladder was anesthetized. No significant difference was found in the secretion of pancreatic juice with and without stimulation of the gall bladder after it had been anesthetized. The changes in secretion of pancreatic juice in response to stimulation of the gall bladder mechanoreceptors are thus reflex in origin; the direction of these changes depends on the functional state of the gall bladder.

In the animals in which the gall bladder fistula was formed 6 months before the pancreatic fistula stimulation of the gall bladder by the balloon induced a significant decrease in the secretion of pancreatic juice. However, with the course of time the response of one of the dogs of this series was reversed: inhibition of secretion of juice was followed by potentiation. This evidently took place under the influence of more frequent stimulation of the gall bladder and reflected changes in its functional state. The increase in the secretion of pancreatic juice evoked by stimulation of the gall bladder mechanoreceptors occurred also in dogs in which both fistulas were formed simultaneously and, consequently, the difference in the functional state of the gall bladder could have been due to the shorter time elapsing after formation of the fistula.

LITERATURE CITED

1. A. A. Anoshina, in: The Physiology of Digestion [in Russian], Part 1, Odessa (1967), p. 9.
2. L. P. Volkova, in: The Physiology and Pathology of Digestion [in Russian], L'vov (1965), p. 34.
3. N. L. Gol'dfarb, in: Problems in Corticovisceral Relationships [in Russian], Vol. 1, Minsk (1956), p. 56.
4. E. A. Montsevichyute-Éringene, Pat. Fiziол., No. 4, 71 (1964).

EXPERIMENTAL RESULTS

The first series of experiments was carried out on the two dogs in which the fistula of the gall bladder was formed before exteriorization of the pancreatic duct.

It is clear from Table 1 (B) that during mechanical stimulation of the gall bladder in the dogs Mishka and Bobik the secretion of pancreatic juice was reduced by comparison with that observed on the previous (control) day when no stimulation was applied. The mean difference was 27 ml and was statistically significant ($P < 0.02$). During the same period fluctuations in the secretion of juice were, of course, observed in the control experiments, but they were not consistent in character (Table 1A).

These results demonstrate that stimulation of the gall bladder mechanoreceptors causes inhibition of the external secretory function of the pancreas. However, the results of the next experiments showed that effects of an opposite nature could take place. These effects were seen in experiments carried out on the two dogs in which the fistulas were formed simultaneously, and also on one of the dogs of the first series, in which experiments with stimulation of the gall bladder mechanoreceptors were carried out over a long period of time, and were performed twice as often during this second period. As Table 2B shows, in these dogs the secretion of pancreatic juice was not inhibited, but was clearly intensified by stimulation of the gall bladder mechanoreceptors.