

## EFFECT OF LIGATION OF THE PANCREATIC DUCTS ON DISTRIBUTION OF ENDOGENOUS SEROTONIN IN ORGANS OF THE GASTROINTESTINAL TRACT

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During the 12 months after ligation of the pancreatic ducts in dogs the concentration of endogenous serotonin (5-HT) was studied in the mucous membrane of different parts of the stomach and small intestine, and also in homogenates of pancreatic tissue and in peripheral blood. Considerable and prolonged disturbances of the deposition of endogenous 5-HT were found. The disturbances were characterized by definite patterns for each tissue studied and were connected with changes in the relative constancy of the enteral medium as a result of absence of the pancreatic secretion in the lumen of the alimentary canal.

KEY WORDS: *serotonin, pancreas*

The relative constancy of the enteral medium is determined by the components of the chyme and the digestive secretions, including biologically active substances of mediator or hormonal nature produced with the digestive secretions. It is an important condition of normal activity of organs of the gastrointestinal tract (GIT).

Substantial changes in the enteral medium following ligation of the pancreatic ducts lead to modification of the activity of GIT organs in the direction of adaptation and compensation [6, 7]. The distinguishing features of this modification are disturbances of the balance between the processes of luminal and contact digestion and considerable changes in the incretion of pancreatic enzymes.

Considering the data in the literature on the liberation of serotonin (5-HT) as a component of the pancreatic secretion and its important role in the regulation of digestive functions [1, 3-5, 8, 9], it was decided to study the changes in deposition of endogenous 5-HT in the GIT organs after ligation of the pancreatic ducts. No information could be found in the literature on possible changes in metabolism and deposition of biologically active substances under those conditions.

### EXPERIMENTAL METHODS

Experiments were carried out on 40 dogs, 15 of which served as the control. The remaining dogs were killed 3, 7, 14, 21, 60, 180, 270, and 360 days after ligation of the pancreatic ducts (in groups of 3 animals at each time). The 5-HT concentration in the tissues of the mucous membrane of four parts of the stomach and six parts of the small intestine and in homogenates of pancreatic tissue was determined in each animal by a fluorometric method [2]. The 5-HT concentration in whole blood also was determined regularly. The results were subjected to statistical analysis.

### EXPERIMENTAL RESULTS

The 5-HT concentration in samples of peripheral whole blood was increased 8- to 10-fold as early as 3 days after the operation and it remained at that level until the end of the first week. By the end of the 3rd week the 5-HT concentration fell and was then only 2-2.5 times higher than the control level. Later this decrease continued, but even at the end of the period of observation (12 months) the blood 5-HT level still remained higher than in the

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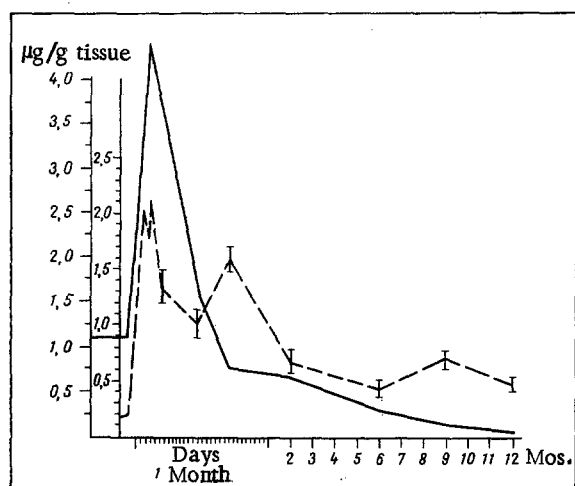


Fig. 1. Dynamics of 5-HT concentration in peripheral whole blood (broken line) and in homogenates of pancreatic tissue (continuous line) after ligation of pancreatic ducts.

control (Fig. 1).

Similar changes were found in the 5-HT concentration in pancreatic homogenates: Soon after ligation of the ducts it was increased by 2-3 times, and this was followed by a progressive decrease. The 5-HT level in homogenates of pancreatic tissue was very low 6 and 9 months and, in particular, 12 months after ligation of the ducts (Fig. 1).

Substantial changes were observed in the gradients of 5-HT distributions in the mucous membrane of the different parts of the GIT. By the end of the 1st week, although the 5-HT level in the mucous membrane of four parts of the stomach remained unchanged, its concentration in the mucous membrane of the duodenum and other parts of the small intestine was appreciably lowered. From the end of the 2nd week until the end of the 2nd month the 5-HT level in all parts of the GIT was sharply reduced, to not more than 40-50% of the initial value. The relative decrease was maximal in the mucous membrane of the stomach and duodenum.

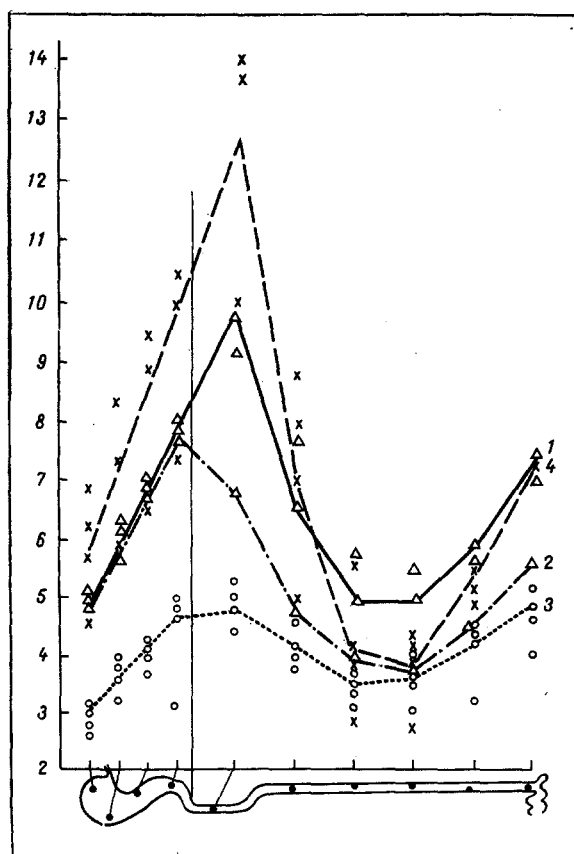


Fig. 2. Dynamics of serotonin concentration in mucous membrane of stomach and small intestine after ligation of pancreatic ducts. Abscissa) regions of GIT in which 5-HT concentration was determined; ordinate) 5-HT concentration (in  $\mu\text{g/g wet weight of tissue}$ ). 1) Control; 2) after 1 week; 3) after 14-60 days; 4) after 6-12 months.

The 5-HT concentration in these parts of the GIT 6 and 9 months after ligation of the pancreatic ducts rose to its initial level, and by the end of the 12th month exceeded it. In the terminal ileum the 5-HT level also rose to the control value. Meanwhile, in the middle part of the small intestine, the 5-HT concentration continued to remain at the particularly low level at which it began to be observed as early as by the end of the 2nd month (Fig. 2).

Ligation of the pancreatic ducts, by preventing the entry of pancreatic secretion into the intestine, thus leads to considerable and prolonged disturbances of the deposition of endogenous 5-HT in the mucous membrane of the different parts of the GIT and also to changes in its concentration in the peripheral blood and in pancreatic tissue homogenates. The similarity between the character of the changes in the 5-HT concentration in the blood and the dynamics of the changes in its amylase activity under these conditions, familiar from the literature [7], will be noted. This similarity is evidence of an increase in the outflow of secretion. The complex dynamics of the changes in deposition of endogenous ST in the different parts of the GIT at different times after ligation — the general decrease between the 7th day until the end of the 2nd month, the sharp and longest decrease in deposition in the middle part of the small intestine and, finally, the marked increase in the 5-HT level to exceed the control in the stomach and duodenum by the end of the 12th month after ligation — is evidently connected with disturbances of the enteral medium arising through the cessation of entry of pancreatic juice into the lumen of the intestine.

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