

ROLE OF THE DUODENAL CONTENTS IN THE MECHANISM OF DIGESTIVE DISTURBANCES IN ACUTE PANCREATITIS

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Injection of duodenal secretion obtained from dogs with acute pancreatitis into a duodenal fistula of healthy rabbits causes changes in the secretory and enzyme-forming function of the pancreas and duodenum of the recipients resembling in their general direction and dynamics the changes observed in rabbits with acute pancreatitis. Marked changes in the clinical condition of the animals develop simultaneously, and some of them die. It is concluded from the results that a toxic factor playing an important role in the pathogenesis of the general and local functional disturbances appears in the duodenal contents of animals with pancreatitis.

Besides their direct participation in food processing the digestive secretions also perform important functions in the maintenance of general homeostasis in the body and the regulation of the trophic state and interaction of the digestive organs [3-5]. In this connection the quantitative and qualitative changes in the digestive secretions in various pathological states may play a compensatory and adaptive role and may also be the cause of disturbances in the digestive tract and in the body as a whole.

Considerable disturbances in the content of pancreatic and intestinal enzymes in the mixed duodenal secretions have been detected in dogs with acute pancreatitis [2]. Allowing for the fact that the drainage of the duodenal contents through the fistula in dogs with acute pancreatitis alleviates its course and enables some of the animals to survive [7, 8], it can be postulated that interaction between the altered (pathological) duodenal contents and the duodenal mucosa plays an important role in the pathogenesis of the disturbances arising in acute pancreatitis.

This investigation was carried out to test this hypothesis.

EXPERIMENTAL METHOD

Experiments were carried out on 4 dogs and 36 rabbits with a duodenal fistula. The dogs acted as the donors of normal and pathological duodenal contents.

The rabbits were divided into three groups with 12 in each group: I) control animals receiving a duodenal mixture of secretions from normal dogs by injection into the duodenal fistula, II) animals with acute pancreatitis, and III) animals into whose fistula the pathological duodenal secretion, obtained on the 2nd-5th day of acute pancreatitis in the dogs, was injected. Acute pancreatitis was induced in the dogs and rabbits by injecting 0.2-0.5 ml/kg homologous bile into the pancreatic duct.

The pH and the content of trypsin, enterokinase, and alkaline phosphatase were determined in the duodenal mixture of secretions. The concentration of trypsin and amylase was determined in the blood serum. Throughout the experiment the animals' general clinical condition was assessed. The normal or pathological duodenal contents of the dogs were injected once daily into the rabbits in a dose of 4 ml for 3-4 days.

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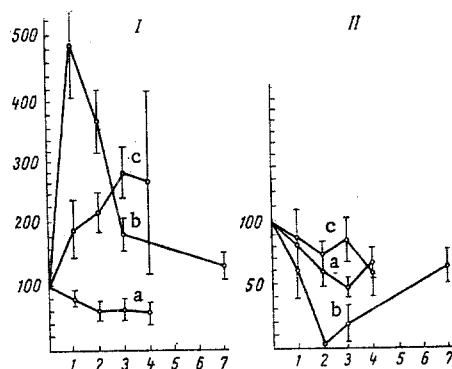


Fig. 1

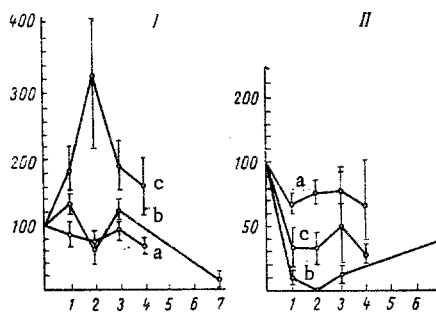


Fig. 2

Fig. 1. Changes in content ($M \pm m$) of amylase in blood serum (I) and in duodenal secretion (II) of rabbits after injections of normal duodenal contents of healthy dogs (a); in acute pancreatitis (b) and after injections of pathological secretion (c).

Fig. 2. Changes in trypsin content ($M \pm m$) in blood serum (I) and in duodenal secretion (II) of rabbits. Legend as in Fig. 1.

EXPERIMENTAL RESULTS

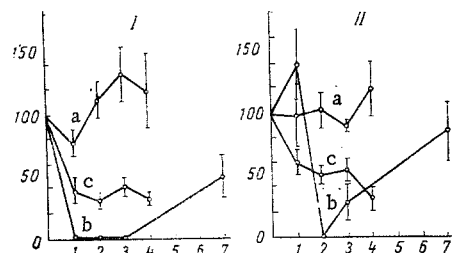


Fig. 3. Changes in content ($M \pm m$) of enterokinase (I) and alkaline phosphatase (II) in duodenal secretion of rabbits. Legend as in Fig. 1.

Injection of the duodenal mixture of juices of healthy dogs into the control rabbits caused no significant changes in the activity of the tested enzymes either in the duodenal secretion or in the blood serum, nor any changes in the animals' general condition (Figs. 1, 2, 3, curves a). In the rabbits with acute pancreatitis considerable changes were observed in the level of all three tested enzymes both in the duodenal contents and in the blood (Figs. 1, 2, 3, curves b). The general condition of the animals of this series was very serious during the first week of the disease (apathy, loss of weight). Two of the rabbits died on the 2nd-4th day. After injection of the pathological duodenal contents of the dogs into the rabbits, the recipients developed a picture of enzymic changes similar in many respects to that described previously, except for certain distinguishing features of their dynamics and severity (Figs. 1, 2, 3, curves c). The trypsin content in the blood serum of this group of rabbits showed a significant increase. By contrast with the first two groups, the clinical state of the rabbits of group III indicated the development of general disturbance in these animals; immediately after injection of the pathological secretion the rabbits behaved as if dead; this was followed by generalized excitation, giving way after 1-2 h to apathy. The volume of duodenal secretion from these animals fell, just as in rabbits with acute pancreatitis. Two rabbits of this group died after the first injection and four died after the third injection of the pathological juice.

These results demonstrate that the duodenal contents of dogs with acute pancreatitis differ considerably from the normal duodenal secretion of dogs in the effect on the general condition of rabbits and on the enzyme-forming function of the pancreas and duodenum. Despite some distinguishing features in the dynamics and severity of the changes in the rabbits with pancreatitis and the animals receiving pathological juice from the dogs, these changes were similar in direction. Allowing for the clinical effect of injections of the pathological juice and its effect on the survival rate of the animals, it can be concluded that the duodenal contents of dogs with acute pancreatitis contain a toxic factor with an important role to play in the pathogenesis of the general and local disturbances arising in these cases.

By contrast with the normal duodenal contents of dogs, with a relatively stable concentration of all the tested enzymes, the pathological secretion had a very low content of pancreatic and intestinal enzymes.

In acute pancreatitis and after injections of pathological juice changes developed both in the pancreas and in the duodenal mucosa, but it is not yet possible to estimate the relative importance of the reflex and

humoral influence in the mechanism of their production. Nor can it be stated with certainty what is the nature of the toxic factor discovered. Under pathological conditions the digestive secretions also acquire pathogenic properties with particular reference to the gastric juice, which becomes capable of producing ulcers on account of the appearance of isoenzymes in it in patients with peptic ulcer [1]. Further investigations will show whether the pathogenic properties of the duodenal contents in acute pancreatitis can be regarded as phenomena of the same order.

LITERATURE CITED

1. N. Sh. Amirov and Fernandez-Costa, in: *The Physiology and Pathology of Digestion* [in Russian], Moscow (1971), p. 230.
2. N. N. Lebedev, G. P. Abramova, and E. R. Cherkezova-Kinova, in: *Mechanisms of Regulation of the Activity of the Body under Pathological and Pathophysiological Conditions* [in Russian], Baku (1970), p. 462.
3. E. S. London, *The Physiology and Pathology of Digestion* [in Russian], Moscow-Petrograd (1924).
4. I. P. Pavlov, *Collected Works* [in Russian], Vol. 1 Moscow-Leningrad (1946).
5. V. D. Sukhodolo, N. M. Tikhonova, et al., in: *The Physiology and Pathology of Digestion* [in Russian], Moscow (1971), p. 40.
6. V. D. Sukhodolo, in: *Collected Transactions of the Third Scientific Conference of Physiologists, Biochemists, and Pharmacologists of the Western Siberian Union* [in Russian], Tomsk (1965), p. 166.
7. E. R. Cherkezova-Kinova, *Pat. Fiziol.*, No. 5, 51 (1962).
8. E. R. Cherkezova-Kinova, *Z. Ges. Inn. Med.*, 18, 1083 (1963).