

HISTOCHEMICAL, LUMINESCENCE, AND ELECTRON-MICROSCOPIC STUDY OF THE PANCREAS IN EXPERIMENTAL PERITONITIS

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Various forms of diffuse peritonitis in dogs are accompanied by the development of a secondary inflammatory-destructive process in the parenchyma of the pancreas with the typical vascular and enzyme disturbances, and inflammatory, necrobiotic, and local destructive changes of acute pancreatitis. These changes in the pancreas are evidently an important factor in the mortality from peritonitis.

KEY WORDS: peritonitis; pancreatitis; mortality.

Clinical and laboratory investigations have shown considerable disturbances of the external and internal secretion of the pancreas in peritonitis. However, the morphological changes in the pancreas in this condition have received little attention in the literature. Only a few papers have dealt with the submicroscopic changes in the pancreas in general [6-8].

The object of this investigation was to make a detailed morphological study of the pancreatic tissue in peritonitis, for lesions of this organ play an important role in the determination of the mortality from peritonitis.

EXPERIMENTAL METHOD

Twenty mongrel dogs weighing 10-15 kg were used. Peritonitis was induced by the intraperitoneal injection of a fecal suspension or a culture of the intestinal flora. In 12 dogs a high obstruction of the small intestine was produced by ligation. The animals were killed 3-16 days after the development of peritonitis. Ten dogs acted as the control.* Pieces of various parts of the pancreas were fixed and then stained with hematoxylin-eosin, picrofuchsin, fuchselin, Heidenhain's azan, and tested by the PAS reaction, by the method of Brachet and Feulgen, for acid and alkaline phosphatases. Serotonin was investigated by Falck's method, and material for electron-microscopic investigation (with the KEM-7A instrument) was prepared by the usual method.

EXPERIMENTAL RESULTS

In all cases the pancreas of the animals with peritonitis showed marked vasodilatation and evidence of stasis. The lumen of the interlobular veins, the capillaries of the acini, and the sinusoids of the islets of the pancreas were grossly dilated and congested with blood. The elastic membranes of the arteries were smoothed and the endothelium flattened. The vessel walls gave an intense PAS reaction and the endothelium showed alkaline phosphatase activity. The changes described were accompanied by the development of plas-morrhagia and local diapedetic hemorrhages. In sero-hemorrhagic peritonitis extensive focal hemorrhages

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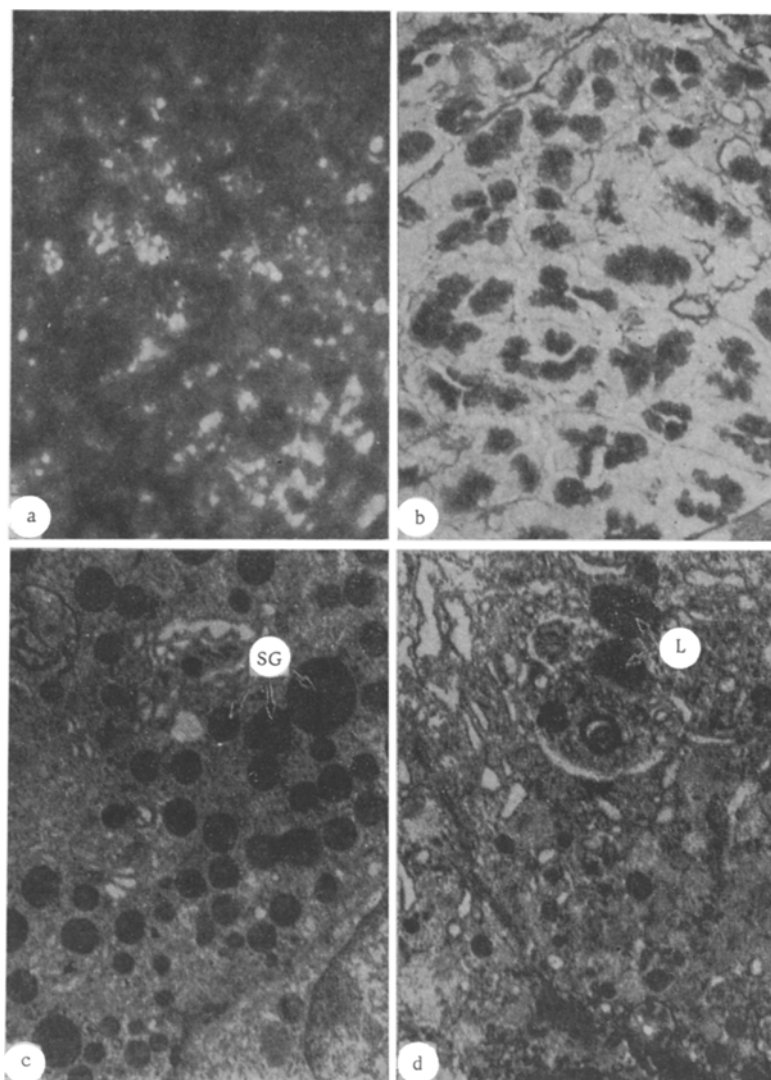


Fig. 1. Pancreas of dogs with experimental peritonitis: a) increase in concentration and intensity of fluorescence of serotonin in parenchyma of pancreas (Falck's luminescence-fluorescence method 250 \times); b) increased acid phosphatase activity in acinar cells (Gomori's method 250 \times); c) numerous specific secretory granules in cytoplasm of acinar cells (12, 000 \times); d) marked lysosomal activity against the background of intracellular reorganization (12, 000 \times). SG - secretory granules; L - lysosomes.

were found, sometimes mainly in the subcapsular zone of the gland. Meanwhile, marked interstitial edema of the organ was observed. The interlobular, intralobular, periductal, and perivascular connective tissue was swollen, its fibers were loosely arranged and gave a strongly positive PAS reaction, resistant to the action of amylase but maintaining orthochromasia on staining with toluidine blue. In many cases massive suppurative infiltration of the interstitial tissue was observed, especially in the superficial areas of the gland. Clusters of cocci and bacilli of the microbial flora were found in the zones of diffuse leukocytic infiltrations of the parenchyma of the organ and the surrounding cellular tissue. In individual cases the leukocytic infiltration extended to the insular system of the organ. The lumen of the terminal and intralobular ducts of the glands was considerably dilated and packed with PAS-positive and pyroninophilic material. The interlobular efferent ducts had their usual appearance, but in some parts they showed dilatation or dystonia with invagination of the walls. In some ducts the epithelium was severely swollen, with evidence of vacuolation and focal desquamation. The efferent ducts were packed with homogeneous masses mixed with leukocytes. Marked signs of focal disintegration of the acini, with loss of their complex structure, and

degenerative and necrobiotic changes in their cells. These zones contained many cells with evidence of hyaline-droplet and vacuolar degeneration and with increased hydrophilicity of the cytoplasm. In certain cases the development of fine focal necrosis was observed in the acini, especially in the subcapsular zones of the gland, with the appearance of karyorrhexis, marked vacuolation of the cytoplasm, and cytolysis. Infiltration with tiny droplets of fat and the accumulation of PAS-positive material, accompanied by a marked decrease in the pyroninophilia of the cells, were observed in the foci of necrobiosis and degeneration.

The content and localization of ribonucleoproteins in the cells were modified considerably. Heterogeneity in the distribution of the pyroninophilic material was observed in the cytoplasm of many of the cells. In some cells, while the RNA retained its granular appearance, it was localized in a narrow rim around the nucleus or near the basement membrane, whereas in others it appeared as a compact homogeneous mass. In every case of diffuse peritonitis a marked decrease in the cystine content and a sharp increase in the concentration and intensity of luminescence of serotonin were observed in the cytoplasm of the exocrine cells (Fig. 1a). A marked increase in the activity of acid and alkaline phosphatases also was observed in these cells (Fig. 1b).

On electron-microscopic investigation the smooth ergastoplasmic reticulum in most of the cells had strongly dilated and emptied cisterns, indicating disturbance of their drainage function. This was confirmed also by a large increase in the number of specific secretory granules in the cytoplasm of the cells (Fig. 1c). In many cells lysosomes were numerous against the background of a marked intracellular reorganization (Fig. 1d).

Different forms of diffuse peritonitis are thus accompanied by the development of a secondary inflammatory-degenerative process in the parenchyma of the pancreas, with disturbances of vascular tone and enzyme activity and inflammatory, necrobiotic, and local changes in the organ typical of acute pancreatitis. Structural and functional changes of this type in the pancreas are evidently an important factor in the mortality from peritonitis [1]. The toxic action of breakdown products of the gland tissue on the myocardium and parenchymatous organ must be taken into consideration from this standpoint [2-5].

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