

**Morphological changes in the pancreatic vessels  
upon acute necrotizing pancreatitis in elderly and senile age**

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**Key words:** acute necrotic pancreatitis, elderly and senile age, pathomorphological changes of intra- and extrapancreatic vessels, pancreas, pathogenesis

Problem of diagnosis and treatment of acute pancreatitis (AP) is considered one of the most difficult in surgical gastroenterology [4, 7]. This is due, above all, the complexity and unpredictability of the pathogenesis of the disease. According to the literature, AP currently ranks second place in the structure of acute surgical diseases of the abdominal cavity, second only to acute appendicitis [2, 3]. In Ukraine, the incidence is 67 per 100 thousand of population [1, 5].

During the aging human body intensity of blood supply to the pancreas is reduced, the size and number of functioning acini and islets of Langerhans are reduced, there is a proliferation of fat and fibrous tissue between the lobes of the gland and within them. These involutive processes are accompanied by disorders of the immune system, hyporeactivity of organism, microorganism reduction reaction to the impact of external pathogenic factors, accumulation number of autoimmune reactions [8, 11].

In recent years, in elderly patients scholars point increase in so-called "ischemic AP", the frequency of which is 8-13% [8]. Its symptoms and severity are largely dependent on the degree of stenosis or occlusion of the abdominal aorta [8]. Extravasal stenosis causes compression of the abdominal aorta modified by fibrous ligament and medial curved legs aperture, ganglion and neuroganglion tissues of abdominal plexus. Intravasal occlusion of atherosclerotic lesions causes abdominal aorta, chronic thromboembolism or atheromatous masses. By severe necrotic changes in the parenchyma of the pancreas can cause diabetic angiopathy due to sclerotic vascular obliteration intraorhannyh [10, 12]. In acute necrotizing pancreatitis (ANP)

were detected changes in blood vessels not only intraorganic and peripancreatic arteries, but extrapancreatic, such as the superior mesenteric artery and its branches [12].

The **aim of study** is to learn basic morphological changes in extra- and intrapancreatic arteries and determine their probable role in the pathogenesis of ANP and its complications in elderly and senile age.

**Materials and methods.** There was a histological study of intra- and extrapancreatic arteries in 38 patients with ANP elderly who were treated during 2012-2016. At the age of 65-70 years were 23 (60.5%), 71-80 years — 9 (23.6%) over 80 years — 6 (16%) patients.

During the execution of studies used definitions of classification AP (Atlanta 1992) amended by the working group (2007) and the American College of Gastroenterology (2013) [9, 13]. Thus, the moderate ANP was diagnosed in 14 (36.5%), severe in 19 (50%), very severe form of disease (fulminant course) in 5 (13.2%) patients. To analyze the results of a CT scan with contrast enhancement clinical and morphological classification proposed by A.I. Dronov et al. was used (2013) [6]. Thus, subtotal superficial pancreatic necrosis was diagnosed in 14 (36.5%), subtotal transmural necrosis of pancreas — in 10 (26.3%), total superficial necrosis of pancreas — in 9 (23.6%), total transmural necrosis of pancreas — in 5 (13.2%) patients. In biological research material obtained during surgery-drainage puncture fluid formation in the omental bursa and retroperitoneal fat under, as well as isolated lumbotomy *E. coli*, *Ps. aeruginosa*, *Pr. mirabilis* in a concentration of  $6 \times 10^6$  microbial bodies in  $1 \text{ cm}^3$  established in 18 (47.3%) patients, *St. aureus* in the same concentration — in 5 (13.2%) patients, associations *Ps. aeruginosa* + *Pr. mirabilis* in 9 (23.6%) patients, 6 (15.7%) patients were found the growth of microorganisms.

All patients operated in "open" way through in 10-26 days after hospitalization with infected ANP and its complications when using puncture-drainage interventions or isolated lumbotomy was ineffective. The material for pathological study was removed sequesters and viable pieces of pancreas obtained during open surgery. Pathomorphological changes were studied in the walls of intra- and extrapancreatic

arteries, in particular transverse pancreatic artery and its branches, as well as a large pancreatic Geller artery and its branches. Also we studied changes in the walls of small veins of the body and tail of pancreas that provide blood flow from the left anatomic surgical segment pancreas. For staining of collagen fibers used for staining tryhromom Masons. For staining of elastic fibers used fuchsin by Hart. Histological preparations were studied by light-optical microscope «Leica DME» with increasing x40, x100, x200, x400.

**Results and discussion.** In 25 (65.7%) patients the primary indication for the implementation of open surgery was the presence of purulent septic complications. Laparotomy was completed by the formation of a closed omental bursa. After surgery, performed long drip irrigation of omental bursa by retroperitoneal antiseptic solutions ("Dekasan"), which contributed to a more complete blur elimination of necrotic tissue and pancreas manure and toxic products. After early laparotomy we performed laparotomy "on demand" in other hospitals, conducted in 13 (34.2%) of 38 patients. Indications for relaparotomy were erosive acute bleeding into the lumen of the gastrointestinal tract and abdominal cavity (4), the growing phenomena of multiple organ failure and progression of pancreatic necrosis (9). Postoperative complications occurred in 12 (31.5%) of 38 patients. 9 (24%) patients died.

The feature of vascular structure of pancreas with ANP in elderly and senile was primary lesion intrapancreatic branches of arteries. Marked narrowing of blood vessels, characteristic circular or focal intimal hyperplasia of arteries that formed unevenly folded hyalinized internal elastic membrane with a circular growth of collagen and elastic fibers in subendothelial space. Upon staining by Masons in the case of circular elastic fibrous intimal hyperplasia in subendothelial space visualized aniline positive collagen fibers. Between the connective fibers determined the presence of fibroblasts, fibrocytes, single smooth myocytes (Fig. 1).

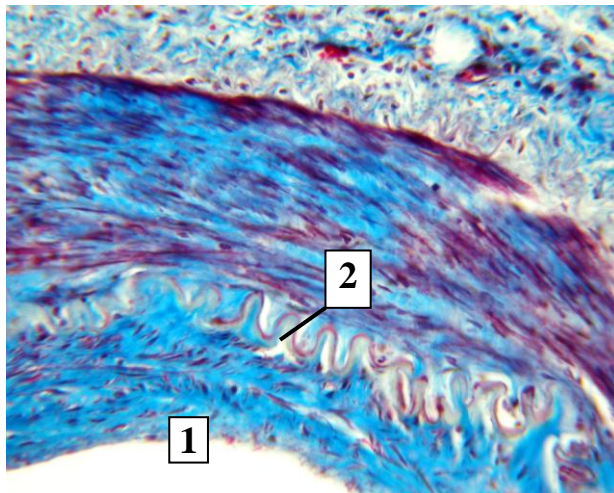


Fig. 1. Circular elastic fibrous intimal hyperplasia of intrapancreatic arteries.

1. Stenosis of lumen of the intrapancreatic artery.

2. Unevenly folded hyalinized internal elastic membrane (indicated by arrow).

Staining: Mason. MP: x400.

When staining by Hart with fuchsin elastic fibers selectively acquire a brownish gray color. They are loosely were mostly tortuous nature were thin in some places formed cavity in the form of "windows-like membranes" perhaps due to focal lysis of elastic fibers. Internal elastic membrane of intraorganic pancreatic arteries was clearly visualized and had signs of multiplication (Fig. 2).

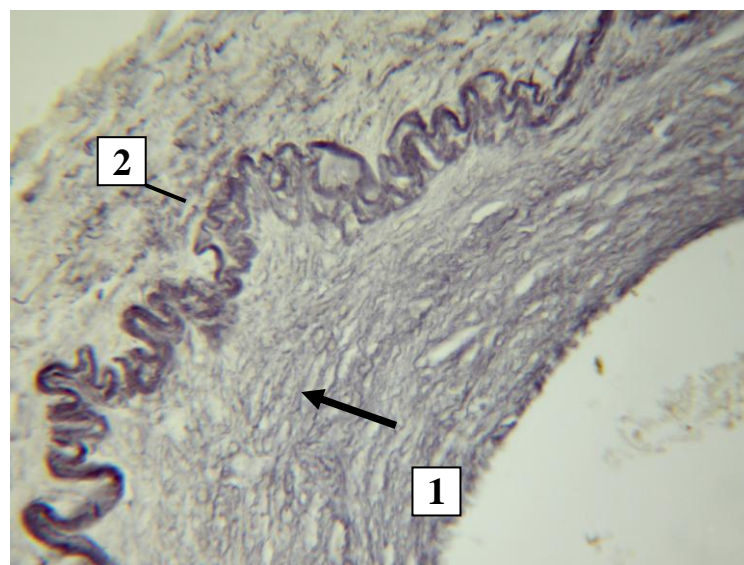


Fig. 2. Circular elastic fibrous intimal hyperplasia of intrapancreatic artery (the arrow).

1. Stenosis of intrapancreatic lumen of the artery.
  2. Unevenly folded inner elastic membrane with signs of multiplication.
- Staining: Hart. MP: x400.

In preparations often met focal fibrosis and intimal hyperplasia of intrapancreatic elastic arteries. However, in some cases, when a focal pancreatic necrosis were noted phenomenon focal compact arrangement of elastic fibers in the hyperplastic intima by type doubling newly internal elastic membrane. In some cases marked intimal thickening due to the proliferation of collagen fibers — the fibrous intimal hyperplasia. When staining by Hart this type of thickening of the intimal hyperplastic impossible to detect. At the same time, staining by Mason artery intima hyperplasia in this type of look compact. It visualized individual cellular elements such as fibrocytes and macrophages (Fig. 3).

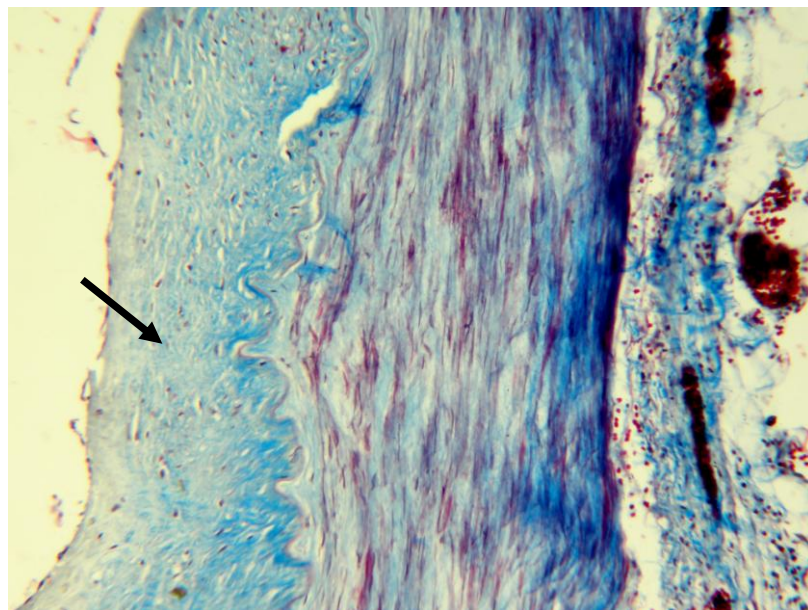


Fig. 3. The focal necrosis of the pancreas.

1. Fibrous intimal hyperplasia of artery (the arrow).
- Staining: Mason. MP: x200.

Along with the above intimal hyperplastic processes in pancreas of intraorganic arteries in patients with elderly at AP are characteristic phenomena

liposclerosis and atheromatosis of intima. The main part of atheromatous plaques is lipids that look discolored, as not coloured by hematoxylin and eosin, methods by Mason and Hart. Lipids can be located intracellularly and extracellularly. Cells containing lipids in the cytoplasm — xanthome cells. Between lipids displays intact (with liposclerosis) and fragmented (at atheromatosis) connective tissue fibers. The endothelium of focal fibrous plaques is desquamative. Liposclerosis can also coexist with intimal non-lipid hyperplasia. In some cases, we set fibro-muscular artery intima hyperplasia and focal liposclerosis. Liposclerosis and atheromatosis of intima of intrapancreatic vessels are represented by the presence of focal or circular fibro-lipid plaques (Fig. 4).



Fig. 4. Circular lipid fibrous plaque in the intrapancreatic arteries.

1. Stenosis of lumen of the artery.
2. Lipids contained in the plaque.
3. Collagen fibers.

Staining: hematoxylin and eosin. MP: x100.

A characteristic feature of pathological changes of extrapancreatic walls of arteries, including transverse pancreatic artery and its branches and great pancreatic artery and its branches Geller at ANP in elderly and senile patients were evident by

structural transformation of the internal elastic membrane (IEM). These structural changes IEM were both upon intimal hyperplasia, and in its absence. Most often, these changes were presented as a multiplication of IEM, that is, increase its ranks by formation of new elastic fibers membrane layers or splitting of existing fibers.

Sometimes IEM was considerably thickened by proliferation of collagen fibers. This collagen fibers penetrated from intimal hyperplastic artery shell in the middle, so crisp contours IEM were lost. IEM multiplied layers were thickened, in some cases hyalinized that manifested fuchsin staining by Mason (Fig. 5).

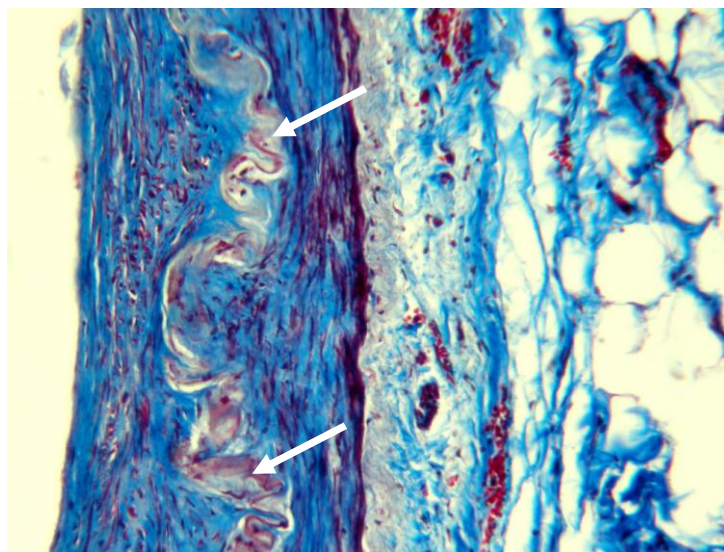


Fig. 5. Hyalinosis of the internal elastic membrane of extrapancreatic artery (indicated by arrows).

Staining: Mason. MP: x200.

Regardless of the presence or absence of multiplication, IEM tortuosity was uneven, leading to the formation of intimal cushion protrusion into the lumen of the vessel. In some cases, along IEM branches of extrapancreatic arteries visualized stores of calcium, which were basophilic staining with hematoxylin and eosin, staining for fuchsin by Mason and fuchsin negative staining by Hart. These petrificates of calcium lead to the violation of the integrity of the development IEM fragmentation with lysis and reactive perifocal hyperelastosis, both from the inner and middle membranes arteries.

Along with IEM petrification, calcification of arteries of secondary membrane in a circular focal and large deposits of calcium was detected (Fig. 6).

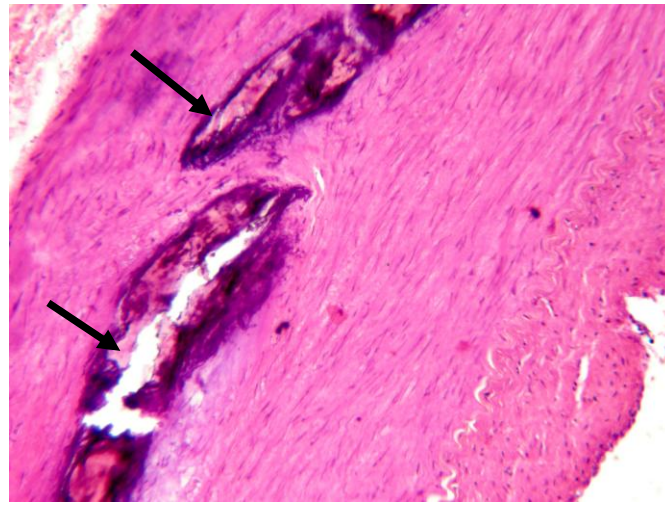


Fig. 6. Mediocalcification of artery (indicated by arrows).

Changes in walls of small veins of the body and tail of pancreas, that provide blood flow from the left anatomic surgical part of the pancreatic segment in elderly patients with ANP, were manifested intimal hyperplasia, mainly fibro-elastic type.

In arterial microvasculature of the pancreas identified characteristic manifestations of disorders of blood circulation in a plethora, sludge, stasis, a number of vessels were found red and hyaline thrombi that caused obturation of the lumen of blood vessels. In arterioles and small arteries of muscular type dominated and features a circular focal hyalinosis vessel walls.

Thus, the study of pathological arterial branches of intraorganic pancreatic vessels in patients with ANP in elderly and senile age found that major structural changes were most pronounced in the inner membrane of arteries of muscular type. They are characterized by circular or lobular hyperplasia of intima, mostly fibro-elastic type, less common fibrous muscle and fibrous hyperplasia. Along with hyperplastic processes in the intima of intrapancreatic artery branches frequently met phenomenon of liposclerosis and atheromatosis as a focal or circular fibro-lipid plaques.



Extrapancreatic medium caliber arteries IEM had uneven tortuosity characterized by intimal hyperplasia presence. Locally along with IEM we often visualized deposits of calcium, leading to breach its integrity with the development of fragmentation and lysis, perifocal reactive hyperelastosis.

In the middle membrane of certain extrapancreatic medium caliber arteries signs of fibrosis prevailed. Often calcification occurred, rarely detected hyperelastosis of average shell arteries.

**Conclusions.** The revealed changes in the walls of intra- and extrapancreatic vessels in elderly patients with acute necrotizing pancreatitis cause the substantial decline of intensity of splanhnic blood stream, being the promoting factors of developing necrotic changes in the pancreatic parenchyma and parapancreatic fiber which should be considered in the treatment of these patients.

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Pathomorphological changes in the walls of intra- and extrapancreatic vessels are studied in the 38 patients of elderly and senile age with acute necrotic pancreatitis, in particular, transversal pancreatic artery and great pancreatic artery of Heller and their branches. All patients underwent «opened» surgery in 10–26 days from hospitalization concerning festering-septic complications of pancreatic necrosis. 9 (24%) patients died. The revealed changes in the walls of intra- and extrapancreatic vessels cause the substantial decline of intensity of splanchnic blood stream, being the promoting factors of developing necrotic changes in the pancreatic parenchyma and parapancreatic fiber.