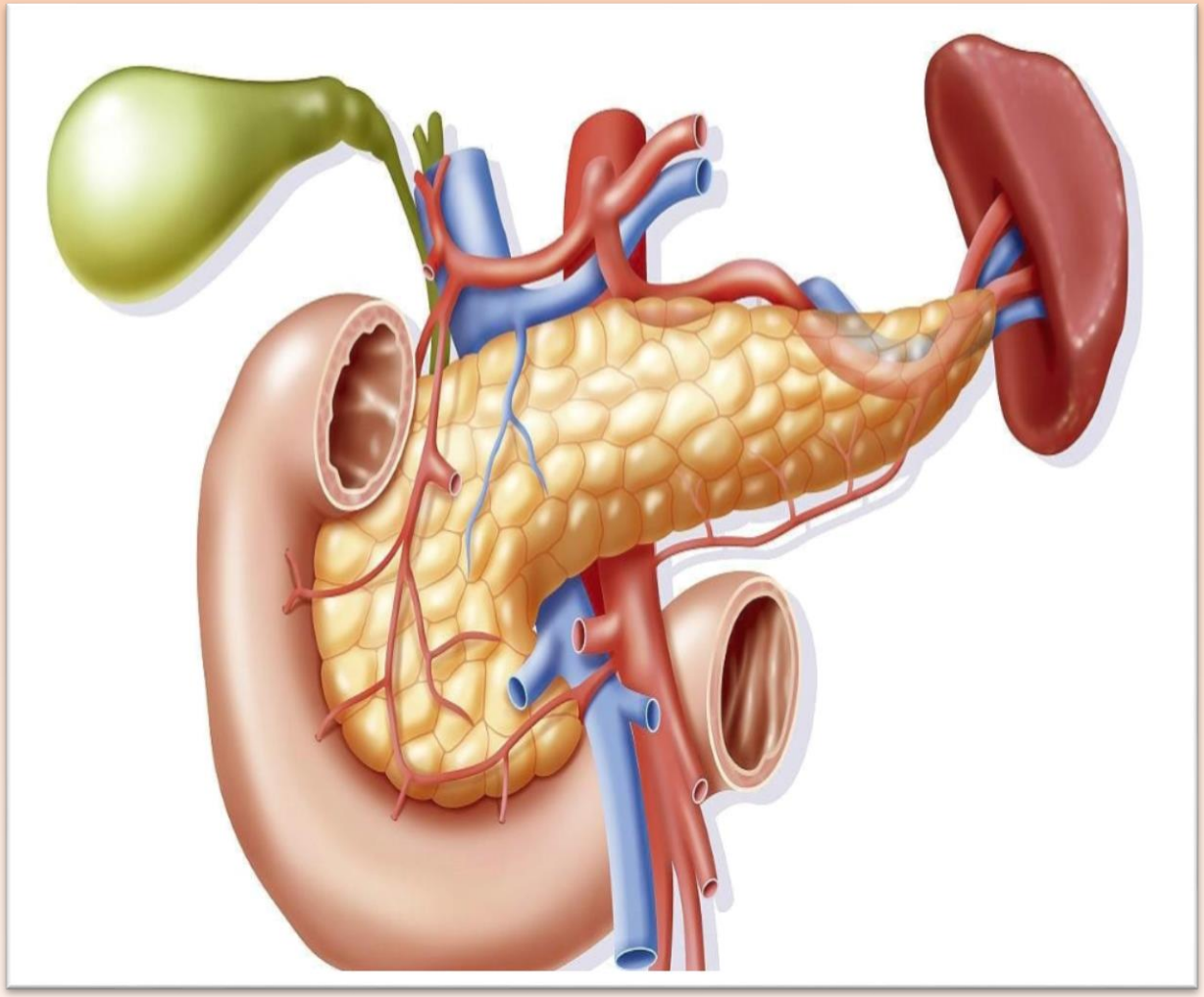
FERGANA MEDICAL INSTITUTE OF PUBLIC HEALTH

FUNCTIONAL VA CLINICAL ANATOMY OF THE PANCREAS

ISAQOVA NASIBA RAXMATJONOVNA

Monograph



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CONTENT

Introduction.

Pancreatitis is an acute or chronic inflammatory disease of the pancreas , which leads to profound morphological and functional changes in the body. This disease currently has a high incidence among gastroenterological diseases worldwide and poses a serious health problem in some regions. According to statistics , the annual incidence of acute pancreatitis worldwide is 5–80 cases per 100 thousand population, while chronic pancreatitis is recorded with an average of 10–20 cases.

In some developed countries, the incidence of chronic pancreatitis is increasing due to high alcohol consumption, while in developing countries, the form is more often associated with biliary tract diseases. For example, in Europe and North America, alcohol-related chronic pancreatitis occurs in 60–70% of cases, while in Asian and African countries, the etiology is related to the biliary tract in 30–50%. In addition, genetic factors, autoimmune mechanisms , and metabolic syndromes also play an important role.

many patients it disrupts not only the digestive system, but also the general metabolism, immunological balance and endocrine system. International studies show that more than 40% of patients with chronic pancreatitis have malabsorption syndrome, and up to 30% develop secondary diabetes mellitus. In acute forms of the disease, dangerous complications such as severe intoxication, multi-organ failure, sepsis can be observed. In chronic forms, it is characterized by impaired secretion of digestive enzymes, malabsorption, protein-energy malnutrition, hormonal imbalance and the development of secondary diabetes mellitus.

The prevalence of pancreatitis has been increasing in recent years. This is due to poor nutrition, excessive alcohol consumption, biliary tract diseases, genetic factors, and many other factors. According to statistics, the incidence of acute pancreatitis is increasing every year, and thousands of people around the world need treatment for this disease.

The main goal of the monograph is to comprehensively cover the anatomical, physiological, clinical, diagnostic and therapeutic aspects of pancreatitis, develop

preventive measures for the disease, and provide updated information based on modern scientific research. At the same time, it is intended to comprehensively cover the socio-economic consequences of the disease, the burden it places on the healthcare system, and issues related to the quality of life of patients. This material will be useful as a practical guide for medical students, physicians, gastroenterologists, surgeons, clinical residents , and research students, helping to deepen theoretical knowledge and make effective decisions in clinical practice.

comprehensive review of the medical relevance, clinical significance, and research findings of pancreatitis . It consistently covers the epidemiology, risk factors, pathophysiological mechanisms, key stages of clinical diagnosis , and treatment protocols. It also presents modern algorithms for diagnosis and treatment, international clinical recommendations, new endoscopic and minimally invasive technologies, and rehabilitation methods.

In addition, the monograph also extensively includes international scientific collaboration experiences, opportunities for implementing innovative technologies, and statistical data from large clinical trials published over the past five years. This not only enriches theoretical knowledge, but also substantiates new diagnostic and treatment approaches that can be applied in practice.

Purpose of the study

The main goal of this study is to provide an in-depth analysis of the clinical manifestations , etiopathogenesis, diagnostic methods, and treatment approaches of pancreatitis. It also considers the possibilities of implementing new treatment strategies through the analysis of modern scientific research and international clinical recommendations.

Objectives of the study:

1. Study of the epidemiology of pancreatitis, analysis of global and regional statistical data.

2. In-depth analysis of the etiological factors and pathogenesis mechanisms of the disease.
3. clinical manifestations , comparison of acute and chronic forms.
4. Evaluation of diagnostic methods: laboratory, instrumental and modern endoscopic technologies.
5. Study of treatment approaches: conservative, surgical and minimally invasive methods.
6. Develop rehabilitation and preventive measures, prepare recommendations to reduce the risk of relapse.
7. Analyze international experiences and develop scientifically based proposals for their implementation into national practice.

Scientific novelty of the research.

This study is distinguished by the introduction of modern approaches to the issue of pancreatitis. As a scientific innovation:

1. An in-depth comparative analysis of global and regional epidemiological indicators of pancreatitis is provided.
2. genetic and immune mechanisms in etiopathogenesis is more widely elucidated.
3. The effectiveness of modern endoscopic, minimally invasive and radiological diagnostic methods is evaluated. And new proposals are presented to improve rehabilitation and preventive measures.

In this way, the study contributes to the adaptation of advanced methods in the diagnosis and treatment of pancreatitis to national practice.

Methods used in the study

This study uses a comprehensive approach. The main methods are as follows:

1. **Literature review** – study of scientific articles and monographs published in the last 10–15 years, analysis of international clinical recommendations.
2. **Clinical observation and retrospective analysis** - study of the history, laboratory and instrumental parameters of patients hospitalized with acute and chronic pancreatitis.

3. **Laboratory tests** - blood and urine tests, determination of pancreatic enzymes (amylase, lipase), glucose levels, and inflammatory markers.

4. **Instrumental diagnostics** - analysis of the results of ultrasound (USG), computed tomography (CT), magnetic resonance imaging (MRI), endoscopic retrograde cholangiopancreatography (ERCP).

5. **Statistical methods** - mathematical and statistical processing of collected data, determination of epidemiological indicators, assessment of the level of reliability.

6. **Comparative analysis** - comparing international and national protocols, determining effectiveness in clinical practice.

combines theoretical and practical aspects, ensuring a comprehensive study of pancreatitis.

Scientific and practical significance of the research.

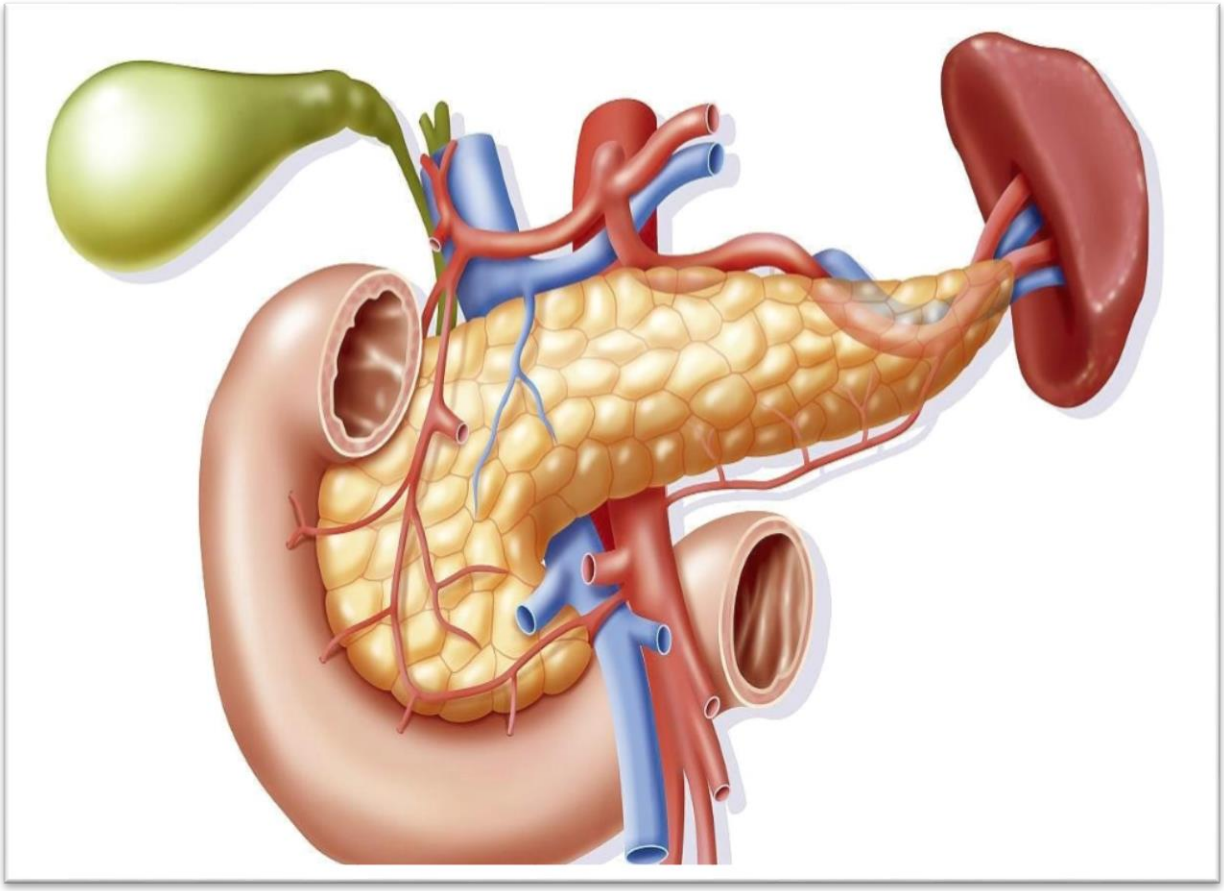
The scientific significance of this study is that it enriches existing knowledge through a comprehensive study of pancreatitis, evaluation of new diagnostic and treatment methods, and comparative analysis of global and regional epidemiological data. The scientific results expand the understanding of the pathogenesis and clinical processes of the disease and create a methodological basis for new scientific research.

The practical significance of the study is that the results of the study will serve to develop diagnostic algorithms, treatment protocols and preventive measures that can be applied in medical practice. It will provide practical assistance to clinicians, surgeons and gastroenterologists in early detection of the disease, selection of effective treatment and improvement of the quality of life of patients. It will also serve as a basis for developing specific strategies to reduce the morbidity and mortality associated with pancreatitis in the health system.

CHAPTER I. Morphological aspects of the pancreas

The morphology of the pancreas is characterized by its complex structure and two functional directions - exocrine and endocrine activities. The gland is elongated in shape, consists of a head, body and tail, and is located from the medial part of the duodenum to the spleen. Anatomically, it is located in the retroperitoneal region , and due to the presence of numerous blood vessels, lymphatic vessels and nerve fibers around it, its diseases affect not only local, but also the functions of the entire organism. Morphologically, the pancreas is a gland of the alveolar-tubular type , producing mainly serous secretion, and this secretion is an important component of the digestive process.

The results of morphological studies, when combined with clinical observations, more accurately indicate the diagnostic signs of the disease and allow for the selection of treatment strategies.



For example, microscopic examination of the distribution of fibrotic tissue can help determine surgical or conservative treatment approaches, while in-depth analysis of

the genetic and biochemical basis will pave the way for future individualized treatment and personalized medicine.

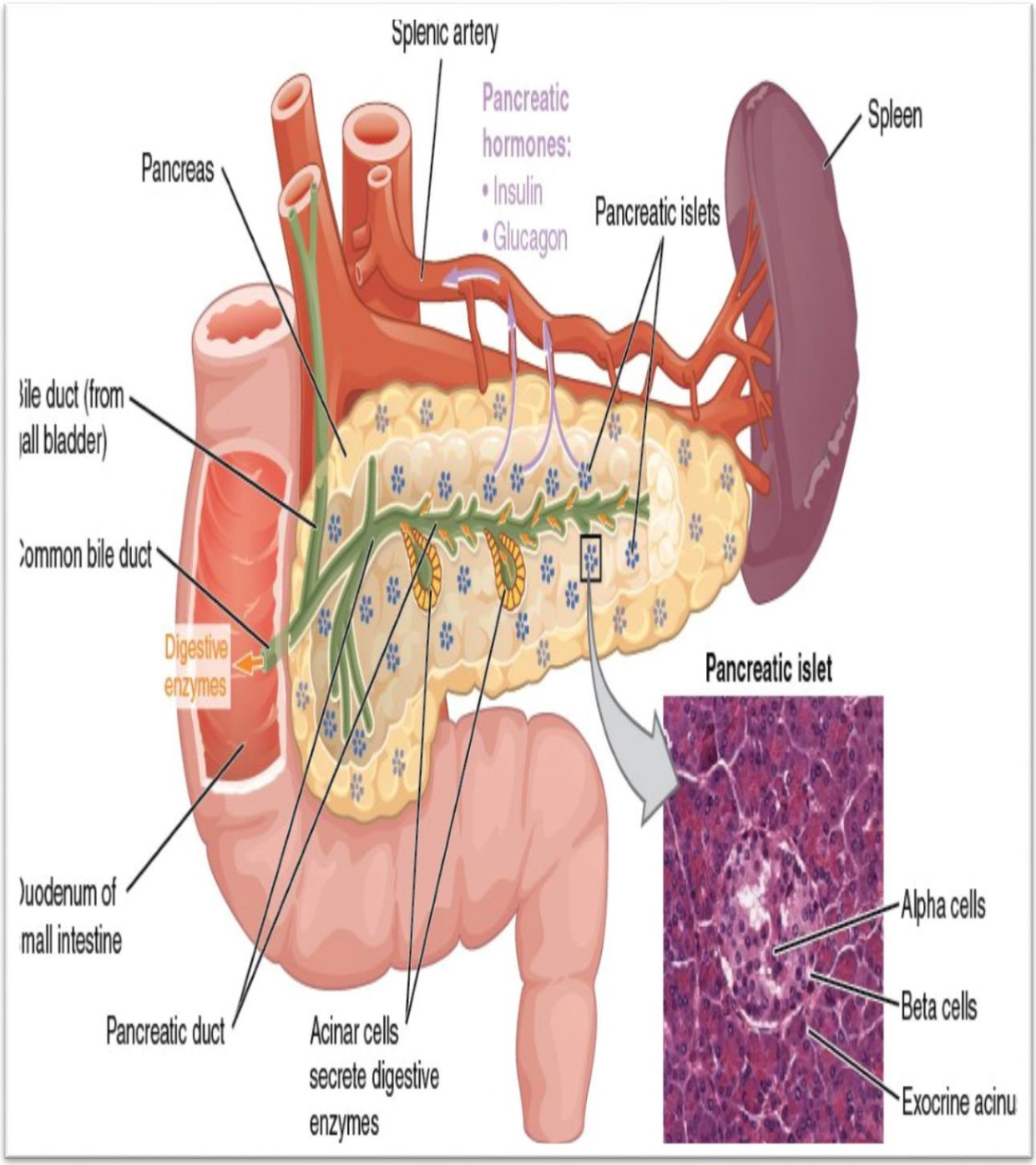
Thus, a deep and systematic study of the morphological aspects of the pancreas is of exceptional importance for scientifically understanding the origin, mechanisms of development, and consequences of pancreatitis. Morphological research helps to assess not only the structure of the organ but also its functional capacities. This, in turn, is of great significance in clinical practice for early diagnosis, determining effective treatment strategies, and improving patients' quality of life.

1.1. Anatomy of the pancreas

The pancreas is anatomically located on the posterior wall of the abdominal cavity , in the retroperitoneal region, extending from the C-shaped opening of the duodenum to the spleen. The average length of the gland is 14–18 cm and weighs 70–90 g , but some sources state that it can be up to 20 cm in size and weigh more than 100 g. Scientific morphometric studies have shown that the size of the pancreas varies widely , with males usually being larger and females being smaller.

However, clinical anatomical sources note that the longer and heavier pancreas of men may be due to a slightly higher enzyme production capacity, while the smaller size in women is explained by differences in metabolic needs. Some morphometric studies have shown that the pancreas of men is on average 16–18 cm long and weighs 80–100 g, while in women it is 14–16 cm long and weighs 60–80 g.

In addition, histological studies, which confirm morphological changes, also show age and sex-related differences in cell density, stroma development, and the ratio of exocrine acini to islets of Langerhans. For example, it has been noted that young men have a higher density of acinar cells , while women have a relatively higher proportion of islets. These differences are important in understanding the morphofunctional activity of the pancreas and in clinical assessment.



In some extensive anatomo-histological studies, it has been noted that the mass of the pancreas also varies significantly with age: in young people it has a relatively greater mass, while in the elderly it decreases in weight due to atrophic processes. Also, in fetuses and infants, the morphology of the pancreas is not sufficiently formed, and in the first years after birth, active growth phases are

observed. This indicates that the age factor must be taken into account when evaluating the results of morphological analysis .

There are also some differences in pancreatic length and mass between ethnic groups . For example, Asians have a smaller pancreas on average, while Europeans have slightly larger ones. These differences indicate the need for individualized use of normative parameters in clinical and diagnostic procedures.

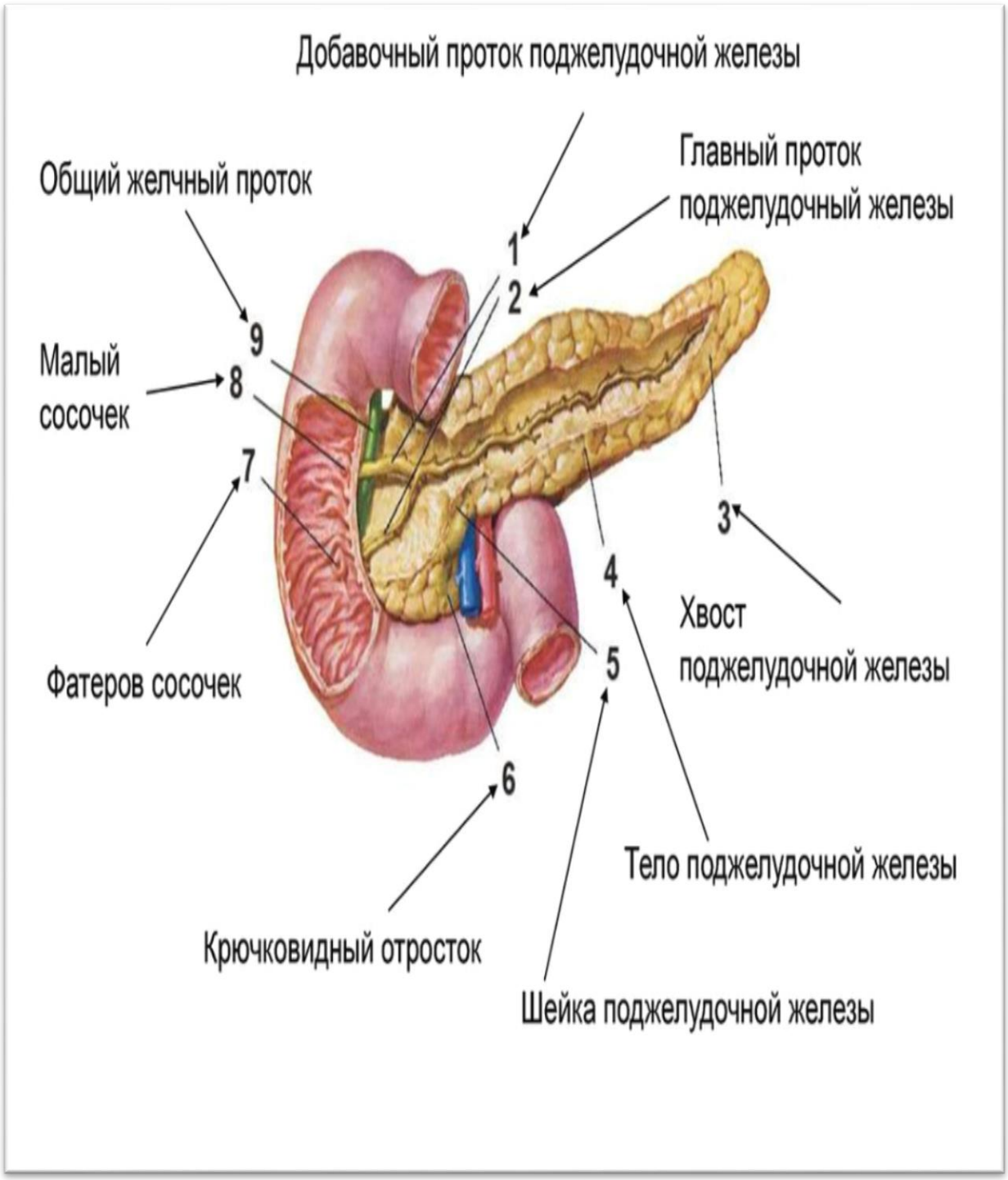
Some anatomical atlases and scientific sources also indicate that its length can be less than 12 cm or up to 22 cm. Also, the size of the pancreas can vary depending on age, gender , and individual constitutional characteristics.

In children, this gland, although smaller , works relatively more actively; in this case, the secretory activity of the cells is high, and the production of digestive enzymes is intensive. The production of pancreatic enzymes in childhood is one of the main factors for the full functioning of the digestive system. Therefore, in pediatrics, the specificity of pancreatic activity is constantly monitored. In adults, with age, due to atrophic processes, the gland becomes slightly smaller and its weight decreases, which leads to a decrease in secretory activity, slowing down digestion, the occurrence of malabsorption syndrome, and in some cases, the development of enzyme deficiency. In addition, in the elderly, due to degenerative changes in pancreatic cells, endocrine activity also weakens, increasing the risk of developing secondary diabetes.

Also, morphological changes are observed in the islets of Langerhans during old age, which can lead to a decrease in insulin production and impaired glucose metabolism. Therefore, when assessing morphological indicators , it is a scientifically sound approach to compare age-specific normative parameters with individual normative indicators in children, adolescents, adults and the elderly.

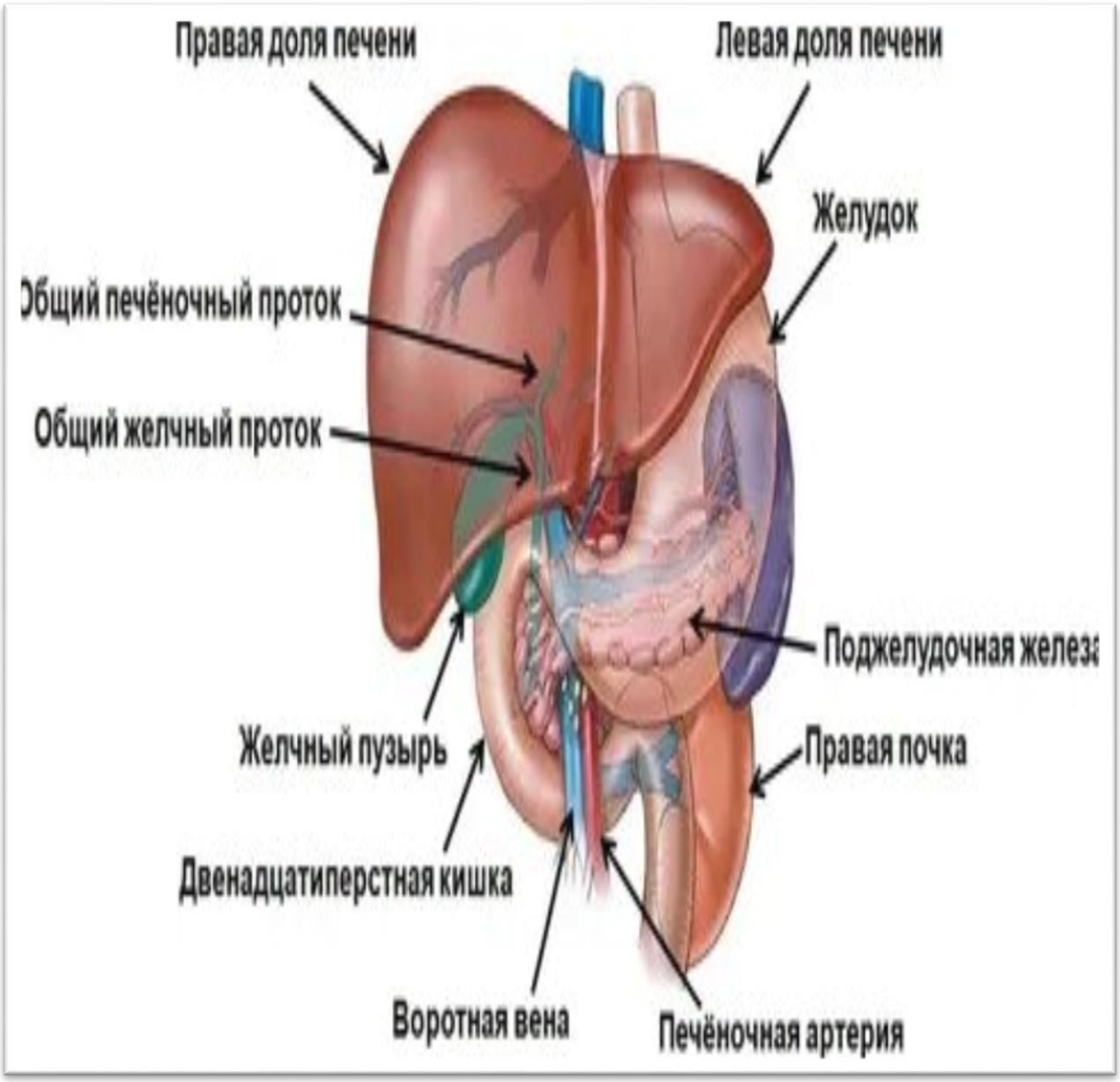
The organ consists of a head, body and tail, the head is located on the medial side of the duodenal curve and is often in direct anatomical communication with the common bile duct. The body passes in front of the aorta, inferior vena cava and left renal vein, and its posterior surface is close to the abdominal aorta and left adrenal gland. The tail ends under the left rib , in the area close to the spleen and is adjacent

to the hilum of the spleen. This anatomical location makes the pancreas a clinically important organ in gastroenterological and surgical pathologies, since pathologies occurring in its various parts can directly affect the function of the surrounding blood vessels, bile ducts and adjacent organs.



The anterior surface of the pancreas is adjacent to the stomach, while its posterior surface is in contact with the abdominal aorta, inferior vena cava, left adrenal gland, and left kidney.

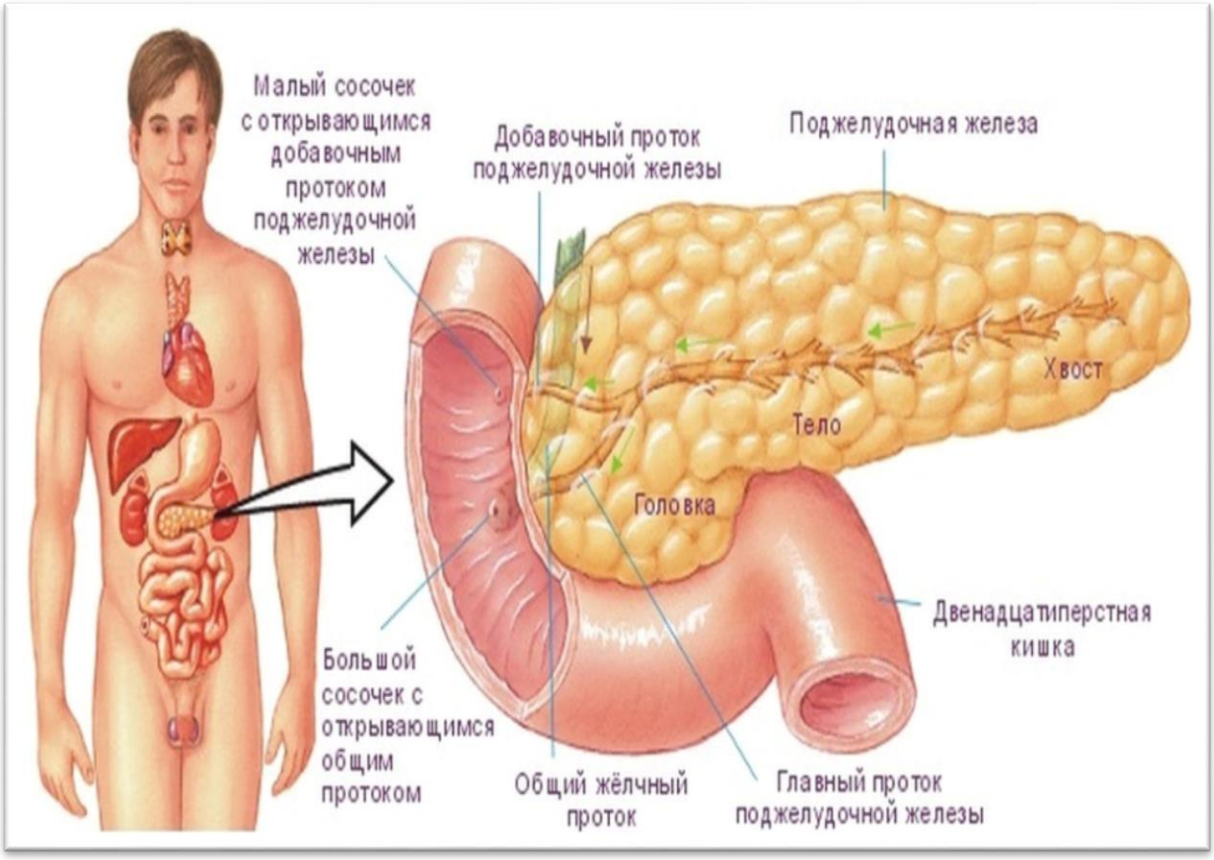
This close anatomical relationship is clinically important, as pancreatic pathologies can have a significant negative impact not only on the functional activity of the gland itself, but also on neighboring organs. For example, pancreatic inflammatory processes can cause reactive changes in the gastric wall, compress the abdominal aorta and inferior vena cava, disrupting hemodynamic flow, and limit the function of the left adrenal gland and left kidney.



Therefore, such close anatomical location of the pancreas requires special attention in clinical diagnostics and surgical practice.

For example, when pancreatitis or pancreatic tumors develop, there is a feeling of pressure and squeezing in the stomach, impaired outflow of the inferior vena cava, or impaired function of the left adrenal gland. Therefore, when studying the morphology of the pancreas, the relationship with neighboring organs is always taken into account.

The head has close anatomical connections with the bile duct , which explains the mechanism by which biliary tract diseases can cause pancreatitis.



Specifically, the common bile duct and the duct of Wirsung often open into the duodenum through the same papilla. Therefore, the formation of stones or inflammatory processes in the bile ducts leads to increased pressure in the pancreatic ducts, impaired secretion flow, and, as a result, premature activation of pancreatic enzymes. Clinical observations also confirm the high percentage of cases of pancreatitis associated with gallstone disease.

The main excretory duct of the pancreas is the duct of Wirsung , which often merges with the common bile duct and opens into the major papilla of the duodenum. This anatomy is of particular clinical importance, since the merging of bile and

pancreatic secretions at one point complicates their outflow and creates a predisposition to pathological processes.

In some cases, an additional outlet called the Santorini duct is also found, which often opens into the duodenum through the minor papilla. The presence of the Santorini duct is an individual anatomical variant and is detected in clinical practice using ERCP (endoscopic retrograde cholangiopancreatography), MRCP (magnetic resonance cholangiopancreatography) or high-resolution CT scans . In recent years, endoscopic ultrasound (EUS) has also been used as an additional effective method for detecting this duct. The frequency of the Santorini duct is reported in the scientific literature to be between 5–15% , and the presence of this variant is considered an anatomico-functional factor that increases the susceptibility to pancreatitis.

According to scientific sources , the Santorini tract occurs in 5–10% of the population, and in some populations this figure can reach up to 15%. Clinical observations show that patients with this anatomical variant have a relatively high risk of developing pancreatitis. In particular, the distribution of the secretion flow through the two papillae accelerates the premature activation of enzymes and can enhance autolysis processes in pancreatic tissue. According to international statistics, the frequency of acute pancreatitis in patients with the Santorini tract is 1.4–1.8 times higher than in the general population . Therefore, this anatomical variant is considered a separate risk factor in clinical practice.

Also, scientific sources note that in cases where the Santorini tract is present, the tendency to pancreatitis is higher. Because the distribution of the secretory flow and differences in the anatomy of the papilla increase the risk of premature activation of enzymes. According to clinical statistical observations, the frequency of pancreatitis in patients with the Santorini tract is 1.5–2 times higher , and this anatomical variant is considered an additional risk factor for pathological processes. Therefore, early diagnosis and regular monitoring are important in such patients.

The Wirsung and Santorini tracts are important in the pathogenesis of pancreatitis, since disruption or obstruction of the flow of secretion can lead to

increased pressure within the gland, premature activation of enzymes, and the onset of the inflammatory process.

Blood supply is mainly provided by the splenic artery, superior mesenteric artery, and common hepatic artery. Venous blood flows into the portal vein system. Lymphatic flow is directed to the regional lymph nodes. Innervation is provided by sympathetic and parasympathetic nerve fibers, keeping the secretion processes under neurohumoral control.

The anatomical location and structure of the pancreas are of great importance in clinical practice. Because it is surrounded by the bile ducts, duodenum, stomach, spleen, and large blood vessels, and the anatomical relationships with these structures play an important role in pancreatitis and other pathological processes. For example, inflammation or tumors developing in the head of the pancreas can compress the common bile duct, causing mechanical jaundice. Pathologies in the body or tail can compress the splenic vein, causing portal hypertension syndrome. Therefore, a thorough study of anatomical and topographic relationships is of great importance both in surgical practice and in gastroenterological diagnosis.

1.2. Histomorphological structure of the pancreas

The pancreas has a histomorphologically complex structure , and its main parenchyma consists of two functional components: exocrine and endocrine departments.

The exocrine part is composed of glandular tissue of the alveolar–acinus type, with numerous zymogen granules located in the apical portion of the acinar cells. These granules contain inactive forms of proteolytic enzymes (trypsinogen, chymotrypsinogen, proelastase, precursors of carboxypeptidases), as well as precursors of other enzymes such as lipase, amylase, ribonuclease, and deoxyribonuclease. The granules are formed in the Golgi apparatus and are released through a calcium-dependent exocytosis mechanism. The secretory pathways of the cells are polarized: secretion occurs through the apical part, while the basal part, rich in rough endoplasmic reticulum, is adapted for protein synthesis.

In addition, centroacinar cells are closely associated with the intercalary tubules and actively participate in the formation of the main composition of pancreatic juice. These cells play an important role in the regulation of bicarbonate secretion and ion transport. The secretion is gradually collected -through the system of intercalary, intralobular and interlobular tubules , eventually joining the Wirsung and Santorini ducts. In tubular epithelial cells, bicarbonate ions and water are secreted with the help of CFTR and SLC26 proteins, which ensures the maintenance of the pH of pancreatic juice in the range of 7.8–8.4 .

This environment is necessary not only for the optimal activation of digestive enzymes, but also for neutralizing the acidic medium of the duodenum and protecting the mucosal lining. Scientific literature notes that disruption of CFTR function, as occurs in diseases such as cystic fibrosis, leads to impaired pancreatic secretion and, as a result, an increased risk of developing pancreatitis. Therefore, the proper functioning of this mechanism is of great clinical and scientific importance, not only in physiological digestion, but also in the prevention of pathological conditions.

These zymogens are activated stepwise under physiological conditions only in the intestinal lumen by enterokinase (enteropeptidase) and bile acids -. Enterokinase converts trypsinogen into trypsin, which in turn activates other proenzymes through a proteolytic cascade. According to scientific observations , the orderly functioning of this cascade not only ensures optimal digestion of proteins, fats, and carbohydrates during digestion, but -also serves as a major mechanism protecting pancreatic tissue from self-digestion.

This mechanism ensures the complete breakdown of proteins, -fats and carbohydrates during digestion and protects pancreatic tissue from self-digestion. In addition, specific protease inhibitors within the cell, including pancreatic secretory trypsin inhibitor (SPINK1/PSTI), are an important protective factor that prevents the development of pancreatitis by limiting the premature activation of zymogens. Scientific studies have shown that mutations in the SPINK1 gene are directly associated with the development of hereditary and idiopathic pancreatitis, which

indicates the genetic basis of this protective mechanism. Therefore, these inhibitors are considered important biomarkers for clinical diagnostics and prognostic assessment not only in physiological processes, but also in pathological conditions.

Scientific studies show that this process occurs on the basis of a physiologically complex proteolytic cascade: enterokinase acts on trypsinogen, converting it into trypsin, and trypsin sequentially activates other zymogens. In this way, the complete breakdown of proteins, fats , and carbohydrates is ensured.

In addition, specific intracellular protease inhibitors, in particular pancreatic secretory trypsin inhibitor (PSTI), prevent premature activation of enzymes and protect the glandular tissue from autolysis. Therefore, a thorough study of the histomorphology of the exocrine department is of great importance for a scientifically sound understanding not only of normal physiology, but also of the pathogenesis of acute and chronic pancreatitis.

Scientific studies have shown that this process occurs through a multi-step proteolytic cascade: enterokinase acts on trypsinogen, converting it to trypsin, which in turn activates other zymogens. This mechanism ensures the complete breakdown of proteins, fats, and carbohydrates during digestion and protects pancreatic cells from autolysis under physiological conditions.

Scientific studies have shown that this mechanism is one of the main factors protecting pancreatic tissue from self-digestion. Also, intracellular protease inhibitors (for example, pancreatic secretory trypsin inhibitor - PSTI) prevent premature activation of enzymes. Thus, the histomorphological characteristics of the exocrine department are of particular scientific importance in understanding the pathogenesis of acute and chronic pancreatitis in clinical practice.

This mechanism protects the pancreas from autolysis. Also, the intercalary ducts and excretory ducts form a complex network, delivering the secretion of the gland to the duodenum. The epithelium of the ducts contains special cells that secrete bicarbonate ions , which play an important role in neutralizing the pH of the pancreatic fluid entering the intestine and maintaining the activity of enzymes at an optimal level.

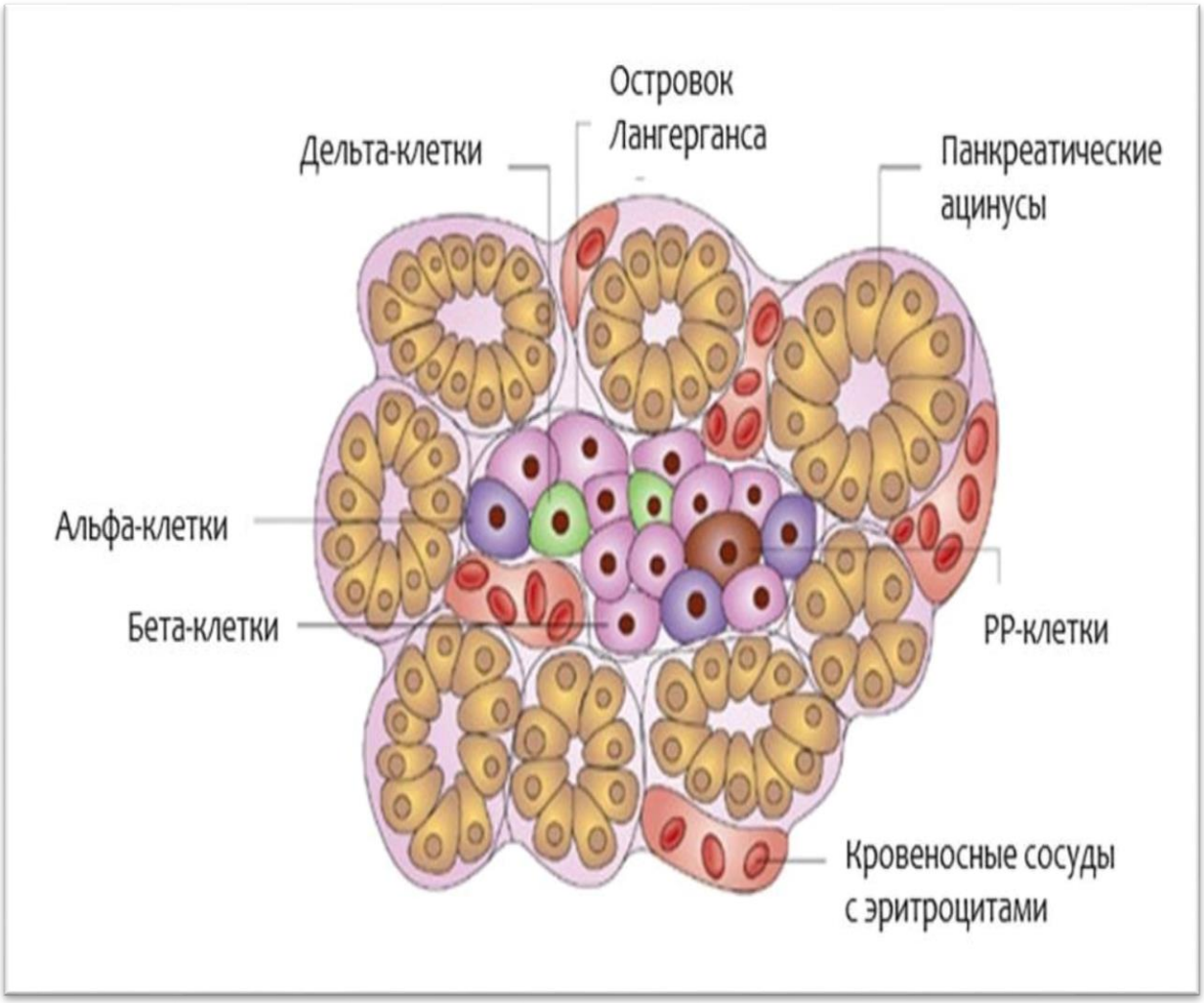
The endocrine part consists of the islets of Langerhans , which are morphologically distinct from the surrounding exocrine tissue. Several types of cells are identified in the islets: β -cells (producing insulin), α- cells (glucagon), δ -cells (somatostatin), PP-cells (pancreatic polypeptide), and ε- cells (ghrelin). These cells are densely surrounded by capillary sinusoids , which ensure the rapid passage of hormones into the bloodstream.

The stroma consists of dense connective tissue , in which blood vessels, lymphatic vessels and nerve fibers are located. The degree of development of the stroma varies depending on age, sex, individual constitution and pathological conditions. In young individuals, the stroma is relatively poorly developed , while in the elderly, fibrous elements increase, which leads to a decrease in the elasticity and secretory activity of the gland.

Fibrosis processes are mainly aggravated in chronic pancreatitis, cystic fibrosis and autoimmune inflammations, disrupting the functioning of the exocrine and endocrine departments. At the same time, changes in the microcirculatory vessels and lymphatic channels located in the stroma can significantly disrupt organ trophism. Nerve fibers provide pain sensations and vegetative regulation, therefore, pathological remodeling of the stroma is also one of the main mechanisms in the formation of clinical symptoms of pancreatitis.

Therefore, histomorphological analyses are of great scientific and practical importance in pancreatic diseases, especially in the deep and systematic understanding of the pathogenesis of acute and chronic pancreatitis, as well as diabetes. In addition, such analyses are of great importance in identifying the early stages of malignant neoplasms, fibrosis and autoimmune processes, and in assessing the degree of their spread.

The scientific literature emphasizes the possibility of differential diagnosis, disease prognosis , and individual treatment strategies based on histomorphological markers. Therefore, histomorphological analyses are an integral part of modern pathomorphology and acquire even greater scientific and clinical value when combined with molecular biology, immunohistochemistry, and genetic studies.



Microscopic observations allow clinical diagnosis to be combined with molecular genetic and biochemical tests by detecting inflammatory infiltrates, the degree of stromal fibrosis, and changes in the ratio of islets to acini. This process is further improved by the use of histopathological and immunohistochemical markers, which expands the possibility of determining the stage, duration, and prognosis of the disease process.

Therefore, histomorphological analyses serve as an important scientific basis not only in traditional pathology, but also in modern personalized medicine , as they are one of the main sources for developing individual treatment approaches and making clinical decisions.

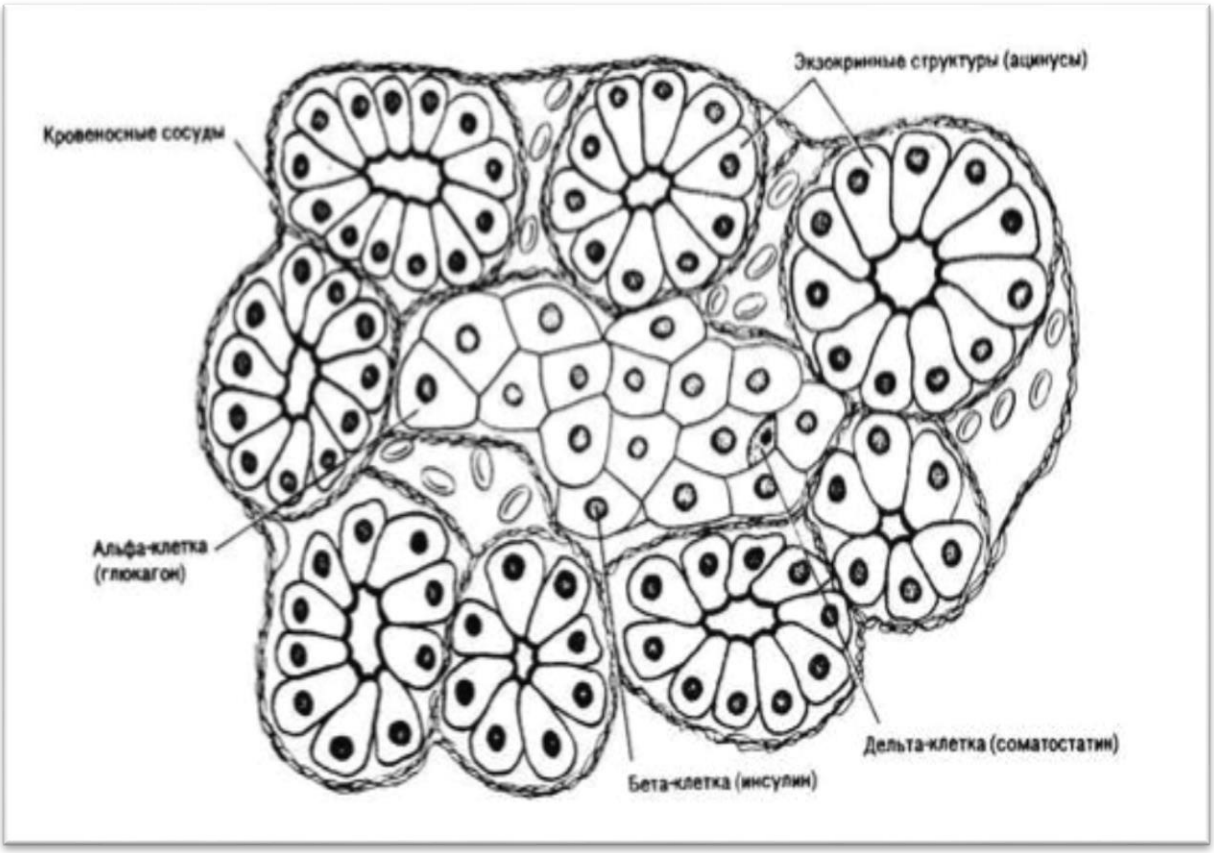
1.3. Exocrine and endocrine functions of the pancreas

The functional activity of the pancreas is carried out in two main directions: exocrine and endocrine. Exocrine activity is mainly associated with the production

of digestive enzymes and bicarbonate, while endocrine activity is carried out through the secretion of hormones that provide metabolic homeostasis. The close relationship between these two systems allows for integrated control of pancreatic activity. Scientific sources emphasize that the interaction of these two systems is also clinically important: for example, when exocrine activity is impaired, digestive processes in the intestine slow down, and this indirectly affects the secretion of endocrine hormones; on the contrary, when insulin secretion is impaired, glucose metabolism is disrupted, and the energy supply of the exocrine part also deteriorates. Therefore, a joint assessment of pancreatic activity in both directions more fully reveals the complex clinical picture of pathological processes.

Scientific literature shows that the interaction between these two systems is so strong that exocrine insufficiency is often accompanied by endocrine imbalance, and endocrine disorders, in turn, disrupt the digestive processes. Therefore, the joint study of both areas in assessing the functional activity of the pancreas is of high diagnostic and prognostic importance in clinical practice.

The exocrine part is mainly associated with the production of digestive enzymes and their release into the duodenum. In the zymogen granules of the acinar cells, inactive forms of enzymes such as trypsinogen, chymotrypsinogen, proelastase, precursors of carboxypeptidases, lipase, amylase, ribonuclease and deoxyribonuclease are stored. These enzymes play a central role in the breakdown of protein, fat and carbohydrate components of food digestion. For example, trypsin and chymotrypsin break down proteins into polypeptides, lipase breaks down fats into glycerol and fatty acids , and amylase breaks down polysaccharides into disaccharides and monosaccharides. Ribonuclease and deoxyribonuclease break down nucleic acids, which leads to the breakdown of DNA and RNA into mononucleotides, which ensures nucleotide exchange. Therefore, the activity of enzymes in zymogen granules is important not only in the digestive process, but also in ensuring the continuity of general metabolism.



Scientific studies show that the production and storage of enzymes are under a high degree of morphofunctional control, and disruption of the secretory cycle can lead to pancreatic insufficiency. According to clinical observations, an imbalance in enzyme production is manifested by syndromes such as steatorrhea, malabsorption, and protein deficiency. Therefore, zymogen granules of acinar cells are considered an important morphological indicator not only in the physiological digestive process, but also in the early diagnosis of pathological conditions .

According to scientific sources , the production and maintenance of these enzymes is under hormonal (secretin, cholecystokinin) and nervous (vagus nerve) control. For example, secretin enhances bicarbonate secretion from ductal cells, while cholecystokinin stimulates the release of enzymes from acinar cells. Parasympathetic impulses coming through the vagus nerve activate secretory activity. At the same time, hormones such as gastrin, motilin , and neuropeptide Y are also considered as additional regulatory factors of pancreatic secretion. The scientific literature emphasizes that the consistent operation of these multi- level

control mechanisms, in addition to ensuring the continuity and efficiency of the digestive process, is also of clinical importance, and their disruption is associated with the risk of secretory dysfunction, steatorrhea, and pancreatitis.

In recent years, scientific studies have shown that, in addition to secretin and cholecystokinin, gastrin and motilin also have an effect on pancreatic secretion. At the same time, neurotransmitters such as neuropeptide Y and acetylcholine are also considered as factors that enhance the activity of the gland. These multi- layered control mechanisms ensure the continuity, efficiency and clinical significance of the enzyme production process.

In addition, clinical observations show that continuous stimulation of secretin can increase bicarbonate secretion by 40–60%, and cholecystokinin can increase the secretion of digestive enzymes by 2–3 times. Also, a significant decrease in pancreatic secretion has been noted as a result of vagotomy. These data clearly confirm the scientific and clinical importance of neurohormonal control of exocrine activity.

In addition, hormones such as gastrin and motilin also participate as additional regulators that coordinate pancreatic secretion. It is noted in the scientific literature that the consistent functioning of these neuro-hormonal control mechanisms ensures spatial and temporal synchrony of enzyme production, which increases the efficiency of digestion. Conversely, disorders in these mechanisms can be accompanied by secretory dysfunction, enzyme deficiency and, clinically, steatorrhea, malabsorption, and an increased risk of pancreatitis.

In clinical practice, the secretin test is of diagnostic value in the assessment of pancreatic exocrine activity , while the decrease in secretory activity after vagotomy surgery indicates the extent to which this process is dependent on nervous control. In this way, exocrine activity is controlled in an integrated manner by the central nervous system and endocrine mechanisms, which ensures the coherence, efficiency and clinical control of the digestive process.

For example, trypsin and chymotrypsin break down proteins into polypeptides, lipase breaks down fats into glycerol and fatty acids , and amylase

breaks down starch and glycogen into disaccharides and monosaccharides, enabling absorption in the intestine. Therefore, the zymogenic granules of acinar cells are considered the main morphofunctional substrate for the continuity and efficiency of the digestive process.

These granules are formed in the Golgi apparatus and released by calcium-dependent exocytosis. The release of granules is closely related to cell polarization, ion channels, energy-dependent mechanisms, and the actin-myosin cytoskeleton , and this process is coordinated by SNARE-complex proteins. Thus, the morphofunctional mechanisms of the exocrine part at the cellular level are considered a key scientific factor not only in digestion, but also in understanding the pathogenesis of pancreatitis.

According to scientific studies , cell polarization, ion channels (in particular, Ca^{2+} and Cl^{-} channels), mitochondrial energy production, and the active participation of the actin-myosin cytoskeleton play an important role in the process of granule release. The fusion of granules with the apical membrane occurs through calcium-dependent exocytosis, in which SNARE-complex proteins also participate. At the same time, the activation of zymogens under physiological conditions occurs stepwise only in the duodenal lumen under the influence of enterokinase (enteropeptidase) and bile acids.

Enterokinase converts trypsinogen into trypsin, which in turn activates other proenzymes through a proteolytic cascade. This process is considered the main physiological mechanism that ensures the complete breakdown of proteins, fats , and carbohydrates, as well as protecting pancreatic tissue from self-digestion. According to scientific sources, the consistent and balanced functioning of this cascade increases energy efficiency during digestion , optimizes enteral metabolism, and protects pancreatic cells from autolysis. When this mechanism is disrupted, proteolytic enzymes are activated prematurely, which can lead to damage at the cellular level, inflammatory reactions, and ultimately the development of acute or chronic pancreatitis.

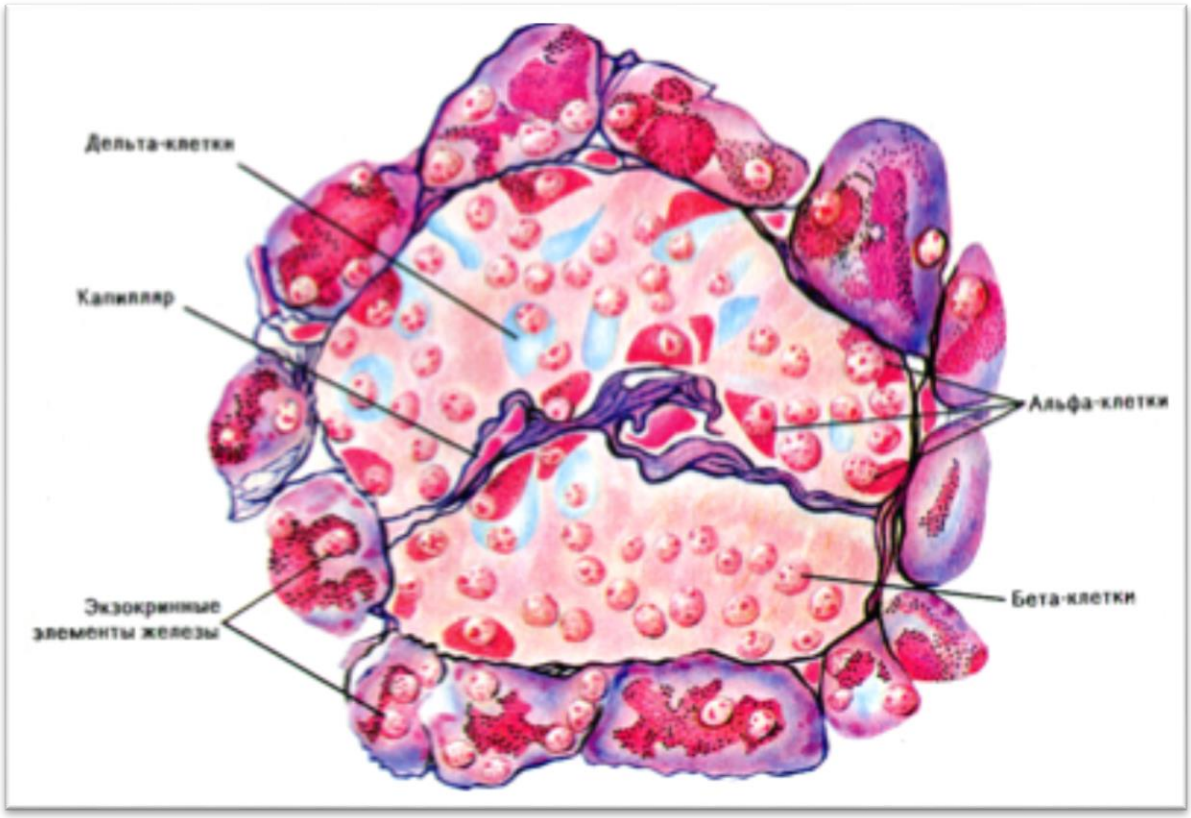
The scientific literature indicates that disruption of this mechanism, in particular premature activation of trypsinogen or deficiency of inhibitors such as SPINK1, plays a central role in the pathogenesis of acute and chronic pancreatitis. Clinical studies have shown that SPINK1 mutations are directly associated with early onset of pancreatitis, frequency of relapses , and severe clinical outcomes in patients with the disease.

Therefore, this mechanism is of great scientific and practical importance not only in explaining molecular pathogenesis, but also in prognostic assessment and development of individual treatment strategies. In particular, in clinical practice, this mechanism allows for the assessment of the severity of pancreatitis , the classification of patients into risk groups, and monitoring of treatment effectiveness. Therefore, it is considered one of the main scientific foundations for the formation of personalized approaches in modern gastroenterology.

Clinical and molecular genetic studies conducted in recent years have shown that this mechanism can be used to assess the severity of the disease, determine the long-term prognosis of patients, and develop genetic screening programs. This is the main scientific foundation for implementing the principles of personalized medicine and creating individual treatment algorithms for patients with pancreatitis.

They are activated in the lumen of the duodenum under the influence of enterokinase and bile acids, ensuring the breakdown of proteins, fats, and carbohydrates during the digestive process. Ductal cells, through bicarbonate secretion, neutralize the acidic environment coming from the stomach and create an optimal pH level for enzyme activity. In this way, the exocrine function ensures the continuous operation of the digestive system.

The endocrine part is carried out through the islets of Langerhans and produces several types of hormones.



β -cells secrete the hormone insulin. Insulin regulates glucose metabolism, ensuring the transport and use of glucose in cells as energy, and also stimulates the synthesis of glycogen, fat and protein. At the same time, insulin also affects lipid metabolism, stimulating the accumulation of triglycerides in adipose tissue and inhibiting the process of lipolysis. Another important function of insulin is to reduce protein catabolism, stimulate the entry of amino acids into the cell, and support general anabolic processes. It inhibits gluconeogenesis and glycogenolysis in liver cells, thereby maintaining the level of glucose in the blood within the physiological norm. Scientific studies show that insulin secretion is closely related to the ATP/ADP ratio, the activity of K^+ channels, and calcium influx in glucose-sensitive β -cells, and is also enhanced by incretin hormones (GLP-1 and GIP). In this regard, insulin is considered the main anabolic hormone in the body and plays a central role in maintaining metabolic homeostasis.

Clinically, insulin deficiency leads to diabetes mellitus, a condition characterized by hyperglycemia, polyuria, polydipsia , and weight loss. Excess insulin secretion, on the other hand, causes hypoglycemia, which can lead to

syncope, seizures, and in severe cases, coma. Insulin resistance is also closely associated with metabolic syndrome, type 2 diabetes, and obesity.

α -cells produce glucagon. Glucagon balances the effects of insulin by increasing blood glucose levels and stimulates glycogenolysis and gluconeogenesis in liver cells. In clinical practice, increased glucagon secretion leads to hyperglycemia, and its deficiency leads to the risk of hypoglycemia. Glucagon increases blood glucose levels mainly by enhancing glycogenolysis and gluconeogenesis in liver cells.

δ -cells produce the hormone somatostatin. Somatostatin not only inhibits the secretion of insulin and glucagon, but also reduces gastrointestinal secretion and motility. In addition, it suppresses the secretion of growth hormone and other gastrointestinal hormones (e.g., gastrin, secretin). In clinical practice, somatostatin or its analogs (octreotide, lanreotide) are used in diarrhea, endocrine tumor syndromes, gastrointestinal bleeding, and pancreatitis. Excessive secretion of somatostatin can be manifested by growth retardation and metabolic disorders.

PP cells produce pancreatic polypeptide. This hormone not only regulates gastrointestinal secretion and motility, but also influences hepatic glycogen stores and directly affects nutrient intake and energy balance. Pancreatic polypeptide also sends signals to the central nervous system, controlling appetite and nutrient consumption at the neuroendocrine level. Clinical observations have shown that increased pancreatic polypeptide secretion is associated with decreased appetite, while reduced secretion leads to imbalance in gastrointestinal function.

It has also been noted that changes in pancreatic polypeptide levels are associated with obesity, anorexia, and metabolic syndrome. Scientific studies have shown that patients with increased levels of this hormone have a significant decrease in appetite, a slowdown in nutrient utilization, and impaired lipid metabolism. Conversely, in cases of low pancreatic polypeptide secretion , an imbalance in intestinal motility and secretion is observed, and nutrient absorption is impaired. This hormone also participates in general energy homeostasis by regulating liver metabolism, glycogen storage management, and fat metabolism . Pancreatic

polypeptide is also important in neuro-humoral control , closely related to vagus nerve activity, thereby controlling central and peripheral mechanisms in an integrated manner. Clinically, pancreatic polypeptide imbalance is directly associated with an increased risk of obesity, worsening of anorexia , and the formation of metabolic syndrome.

ε -cells secrete the hormone ghrelin. Ghrelin acts on the central nervous system, especially on the appetite center in the hypothalamus, increasing appetite and regulating energy balance. In addition, ghrelin also affects the cardiovascular system, insulin secretion and lipid metabolism. It also stimulates the secretion of growth hormone, increases gastrointestinal motility and accelerates the relaxation of the gastrointestinal tract. One of the main physiological properties of ghrelin is the formation of a “hunger signal” before eating.

In clinical practice, increased ghrelin levels are associated with obesity, metabolic syndrome, hyperglycemia , and some cardiovascular diseases, while its deficiency is manifested by anorexia, cachexia, and energy deficiency.

In recent years, studies have also shown that increased ghrelin levels are associated with various neuropsychiatric disorders (e.g., depression and anxiety syndromes). It has also been shown that ghrelin acts on peripheral and central receptors through the cardiovascular system, immune responses, and inflammatory mediators . Molecular studies have shown that ghrelin can modulate NF- κB signaling pathways and reduce oxidative stress. Therefore, ghrelin is important not only in maintaining metabolic homeostasis, but also in understanding the pathogenesis of clinical diseases, including metabolic, cardiovascular, immune, and neuropsychiatric syndromes, and in developing diagnostic and treatment strategies for them.

These hormones are important in maintaining the body's metabolic homeostasis: insulin regulates glucose metabolism and supplies energy to cells; glucagon stimulates glycogenolysis and gluconeogenesis, increasing blood glucose levels; somatostatin serves as an inhibitory hormone that regulates insulin and

glucagon secretion; pancreatic polypeptide is involved in the neurohumoral control of digestive activity; and ghrelin regulates appetite and energy balance.

Scientific studies have shown that exocrine and endocrine functions are closely interconnected: cases of exocrine insufficiency are often accompanied by endocrine dysfunctions, and in chronic pancreatitis, a decrease in insulin production can lead to the development of secondary diabetes. Therefore, a comprehensive assessment of pancreatic functions is important in clinical practice for early diagnosis, differential diagnosis and development of individual treatment strategies.

CHAPTER II. Clinical types and classification of pancreatitis

Clinically,manifests clinically in a variety of ways and is classified according to internationally accepted classifications. These classifications allow for a systematic representation of the severity of the disease, morphological forms, pathogenetic factors, and clinical consequences.

Scientific sources note that a correctly selected classification is important for a deeper understanding of the etiology of the disease, a clear definition of morphological changes, a systematization of clinical manifestations, and a comparison of treatment results. At the same time, the classification allows for a clear delimitation of the clinical forms of acute and chronic pancreatitis, and facilitates differential diagnosis based on morphological and functional indicators.

In clinical practice, classifications make it possible to divide patients into risk groups, determine the need for intensive therapy , and surgical indications. Therefore, classifications are the main scientific and practical tool not only in diagnostics and treatment, but also in scientific research for the correct division of patient groups, standardization of prognostic criteria, conducting epidemiological observations based on a single criterion, and developing new therapeutic strategies.

The scientific literature notes that correct classification is important for early diagnosis of the disease, determining the differential diagnosis, choosing the right treatment strategy, and determining the long-term prognosis. Classification also allows for the division of patients into groups based on the same criteria in clinical studies, the comparison of the effectiveness of different treatment methods, and the obtaining of objective results in clinical trials.

Therefore, the classification of pancreatitis into clinical types is of great diagnostic and prognostic importance not only for scientific, but also for practical clinical gastroenterology. The correct use of classifications allows doctors to accurately assess the severity of the disease, develop an individual treatment strategy, predict complications, and effectively organize long-term monitoring. In addition, the process of dividing into clinical types also serves as an important theoretical and practical basis for standardizing patient groups in scientific research, assessing the effectiveness of new pharmacological agents and surgical approaches.

Scientific sources note that classifications allow for the precise determination of clinical phenotypes of the disease, the association of molecular genetic factors with clinical manifestations, and the testing of the diagnostic value of various biomarkers. In recent years, clinical studies have made it possible to more

deeply analyze phenotypic changes associated with mutations in the PRSS1 and SPINK1 genes through clinical classification systems.

At the same time, the diagnostic value of biomarkers such as blood trypsinogen levels, CRP, interleukin-6, and procalcitonin in early diagnosis and prognosis is also being evaluated in an integrated manner with classifications. Scientific studies, especially meta-analyses since 2020, have shown that the levels of these biomarkers are directly related to the severity and clinical outcomes of pancreatitis. For example, a CRP level of >150 mg/L indicates a high risk of severe pancreatitis, while interleukin-6 has become an important prognostic marker as one of the early indicators of inflammation. At the same time, it has been noted that the level of procalcitonin has a high sensitivity in predicting complications associated with infection.

Therefore, clinical classification systems are considered a necessary scientific foundation not only for the formation of personalized approaches in modern gastroenterology, but also for genetic screening, biomarker monitoring, algorithmization of clinical decisions and harmonization with international standards. Current scientific research shows that such systems serve as an important foundation for grouping patients based on genetic profiling, linking molecular biomarkers with clinical outcomes, integrating artificial intelligence algorithms for early diagnosis, and harmonizing international clinical protocols. This will allow the development of treatment plans tailored to individual pancreatitis phenotypes and the unification of global health standards.

2.1. Acute pancreatitis: types according to the Atlanta classification

The Atlanta (1992, updated 2012) classification distinguishes mild, moderate , and severe forms of acute pancreatitis, which is important for clinical decision-making.

The mild form is pancreatitis characterized by a short course, without the development of organ failure, free of complications, and with rapid remission, usually responding well to early conservative therapy.

The moderately severe form is characterized by transient organ failure (≤48 hours) and may be accompanied by local complications (such as peripancreatic fluid collections).

The severe form, on the other hand, is defined by organ failure lasting more than 48 hours, accompanied by severe local complications such as necrosis, abscess, or pseudocyst, and is associated with a high mortality rate. Each form is considered an important criterion in clinical practice for choosing a treatment approach, determining the intensity of monitoring, and making an accurate prognosis.

In the updated 2012 version, the clinical severity of acute pancreatitis is assessed based on systemic complications (organ failure, MODS) and local complications (necrosis, abscess, pseudocyst, walled-off necrosis).

At the same time, this classification also takes into account the dynamic course of acute pancreatitis, distinguishing between early (first week) and late (after the first week) periods. This approach is of great importance as a more scientifically based and practice-oriented system for monitoring the disease, choosing a treatment strategy , and determining the prognosis.

This classification allows not only to determine the degree of clinical severity (mild, moderate and severe forms), but also to distinguish morphological changes in pancreatitis (interstitial-edematous and necrotic forms). The interstitial-edematous form is usually accompanied by diffuse edema and mild inflammation in the parenchyma of the gland, has a relatively mild clinical course and responds well to conservative treatment.

The necrotic form is characterized by partial or extensive necrosis of pancreatic tissue, which is often associated with a severe clinical course, high levels of intoxication, sepsis, and multi-organ failure. This classification is also considered one of the main standards used internationally for monitoring patients, identifying complications (e.g., necrosis, abscess, pseudocyst, walled-off necrosis), and selecting individual treatment strategies.

At the same time, the classification also plays a key role in standardizing data for epidemiological studies, developing clinical protocols , and fostering international scientific collaboration.

In addition, classification is of great scientific and practical importance in the rational allocation of resources in the health system, the division of patients into risk groups, and the planning of health policies. From a scientific point of view, such systems also provide the opportunity to create national and international health registries, collect statistical data based on the same criteria, and compare them on a global scale.

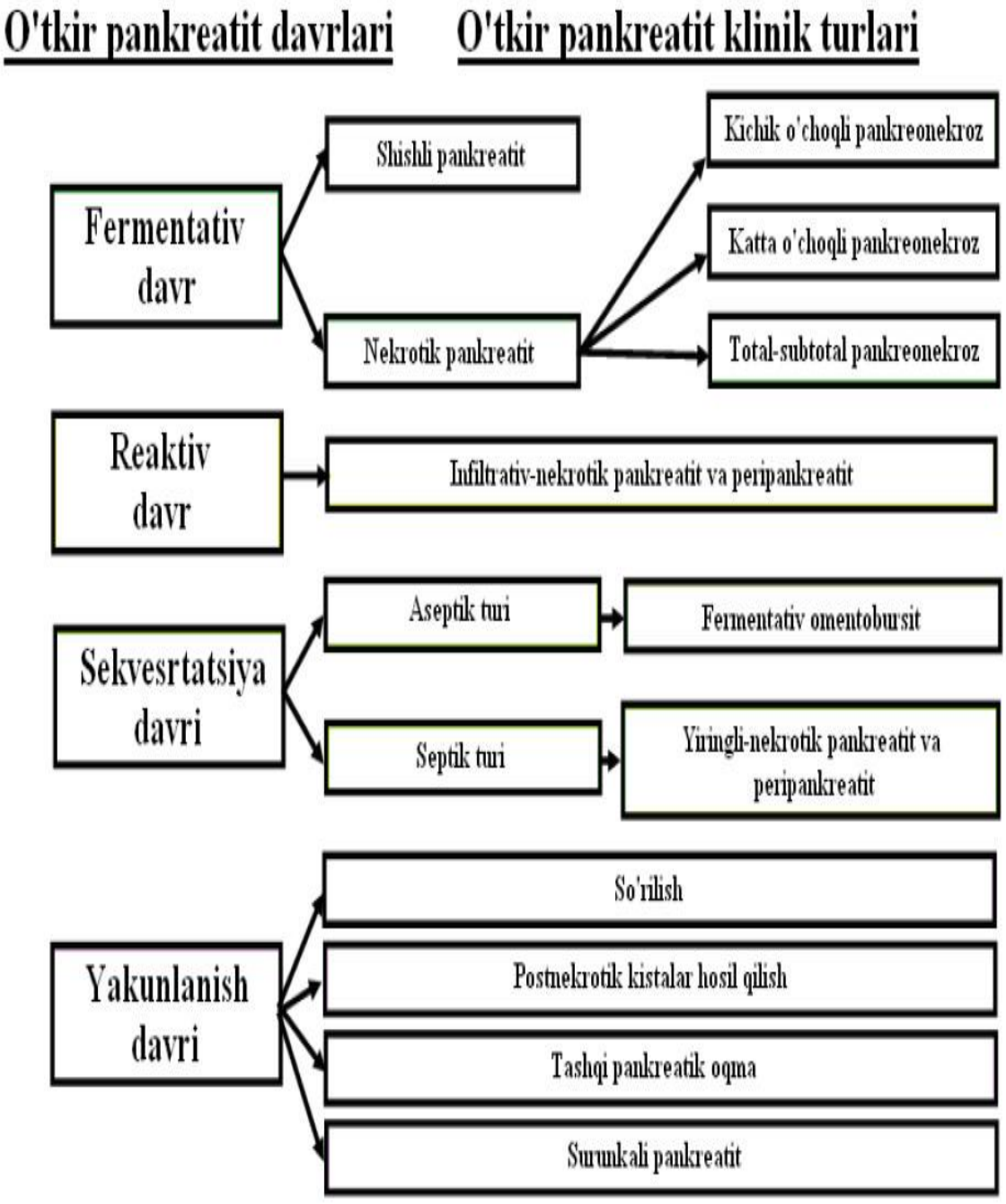
In addition, the following types of acute pancreatitis are distinguished:

1. acute swelling of the pancreas;
2. sterile pancreatic necrosis (fatty or hemorrhagic);
3. purulent pancreatic necrosis.

Such a division into types is somewhat conditional. When morphologically examining a single patient, it is often possible to observe the coexistence of pathological types, as well as transient forms. Acute pancreatitis is observed

somewhat more often (in 77-78% of patients). Sterile and purulent pancreatic necrosis is noted in approximately 10-12% of patients.

Currently, the most convenient classification of acute pancreatitis was proposed by VI Filin. According to this classification, 4 periods are distinguished in the clinical course of acute pancreatitis.



The fermentative period corresponds to the first 5 days of the disease. The reactive period (6-14 days of the disease) is observed only in patients with advanced destructive pancreatitis. The sequestration period begins from the 3rd week of the disease. After 20-24 days, the patients enter the final stage of the disease.

Based on the size of the pancreatic lesions, AD Tolstoy (1999) divides acute pancreatitis into 5 types:

1. acute inflammatory pancreatitis (necrosis of acinar cells);
2. small-focal pancreatic necrosis (focal sizes up to 5 mm);
3. medium-focal pancreatic necrosis (focal sizes from 5 mm to 10 mm);
4. large-focal pancreatic necrosis (focal sizes more than 10 mm);
5. total-subtotal pancreatic necrosis (total-subtotal damage to the pancreas).

multicenter clinical trials based on classifications , comparing their results, and developing new standards. Such studies are important for identifying the diversity of clinical phenotypes, standardizing prognostic indicators , and evaluating new biomarkers. This, in turn, creates a wide opportunity to strengthen the evidence-based approach in clinical practice, support health policy with scientific evidence, and introduce the principles of personalized medicine.

2.2. Chronic pancreatitis: morphological changes, exocrine and endocrine dysfunction

Chronic pancreatitis is characterized by profound morphological changes in the pancreas as a result of a long-term inflammatory process, fibrosis of the glandular tissue, a decrease in parenchymal cells and deformation of the duct system. This process often develops as a result of repeated episodes of chronic inflammation, leading to a gradual loss of the functional capacity of the pancreatic tissue. Histologically, atrophic and fibrotic changes of acinar cells, a decrease in the number of islets of Langerhans, hyperplasia and metaplasia of the ductal epithelium, as well as the formation of calcifications and cysts are observed. In some cases, perilobular

and intralobular fibrosis, dystrophic changes of the acini are also detected. In clinical observations, such morphological changes are directly related to the degree of pancreatic insufficiency , and their aggravation occurs in parallel with an increase in the frequency of steatorrhea, malabsorption and diabetes.

At the same time, due to exocrine dysfunction, the production of key digestive enzymes such as trypsin, lipase and amylase is significantly reduced, which leads to steatorrhea due to impaired fat breakdown, malabsorption due to insufficient breakdown of carbohydrates and proteins, protein-energy malnutrition and hypovitaminosis (especially deficiency of fat-soluble vitamins A, D, E, K) . The duration of exocrine insufficiency is associated with weight loss in patients, general dystrophic changes and the development of osteoporosis. When the endocrine part is damaged, insulin secretion is impaired due to dysfunction of the β -cells of the islets of Langerhans and secondary diabetes (pancreatogenic diabetes) develops. The clinical features of such diabetes include lability of glucose levels, episodes of hypoglycemia and increased sensitivity to insulin therapy compared to classic type 2 diabetes.

The scientific literature notes that the clinical consequences of chronic pancreatitis are often associated with a combination of these morphological and functional abnormalities. The degree of fibrosis, calcifications, ductal system deformation , and endocrine dysfunction directly determine the severity of the clinical course. Their early detection is of great importance in improving the prognosis, preventing complications , and developing individual treatment strategies.

Recent studies have shown that the integration of imaging diagnostics (CT, MRI, endosonography) and molecular genetic tests allows for the detection of this process at an earlier stage. Therefore, a comprehensive assessment of the consequences of chronic pancreatitis serves as a scientific and practical basis not only for clinical prognosis, but also for individual therapy and preventive measures.

are a key scientific and practical tool in clinical practice for making a diagnosis, developing a treatment plan , and assessing the patient's prognosis.

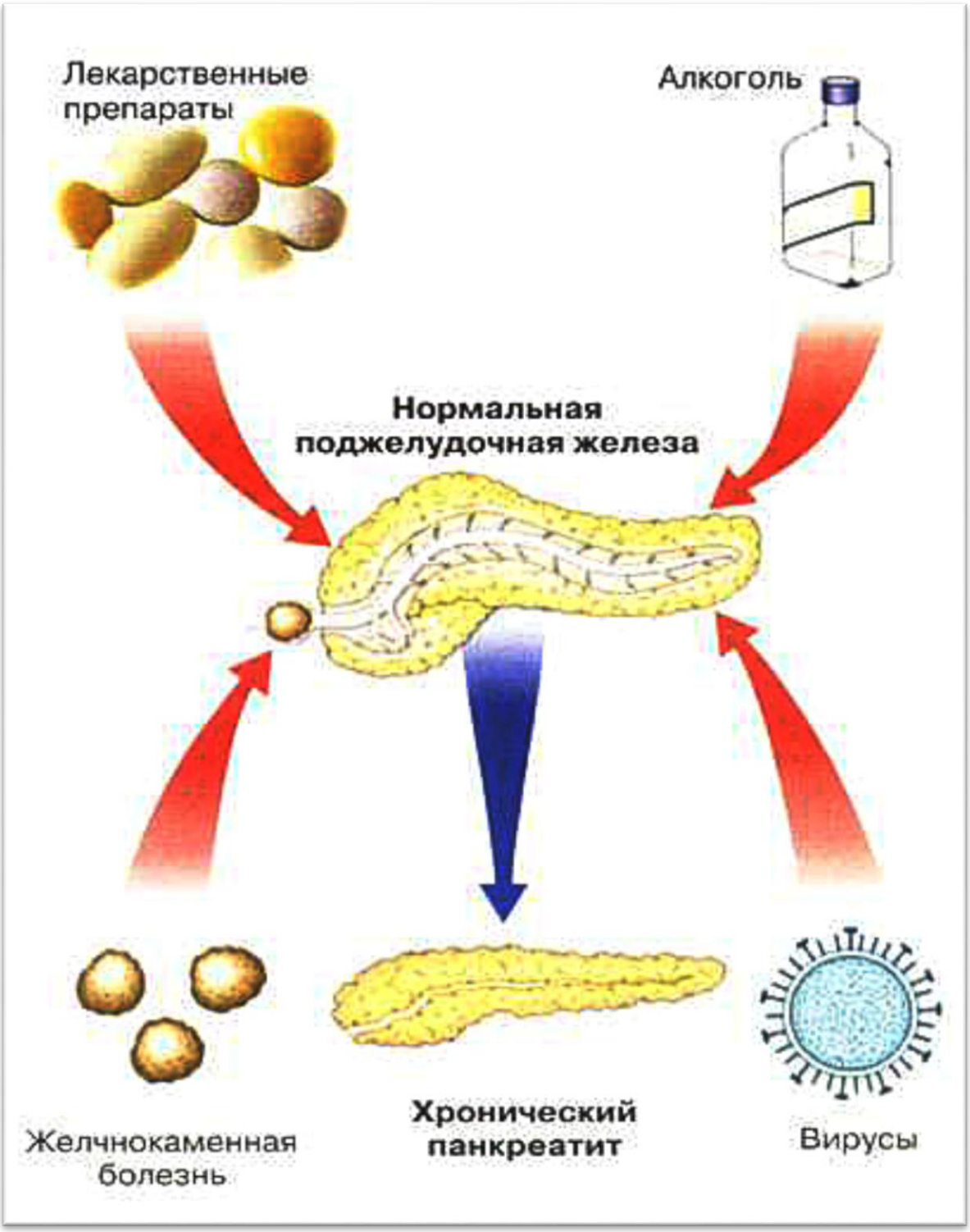
The M-ANNHEIM classification for chronic pancreatitis is also widely used internationally, allowing for a comprehensive assessment of etiological factors, morphological changes, clinical symptoms and functional disorders. This classification systematically classifies the stages of development of chronic pancreatitis: for example, toxico-metabolic forms (associated with alcohol, smoking or drugs), idiopathic forms (of unknown cause), genetic forms (associated with mutations in the PRSS1, SPINK1 or CFTR genes), autoimmune forms (associated with immune system activity) and obstructive forms (associated with biliary obstruction or anatomical defects). Thus, the M-ANNHEIM classification allows not only for diagnosis and treatment in clinical practice, but also in scientific research to identify diverse phenotypes of the disease and correlate them with etiopathogenetic mechanisms.

2.3. chronic pancreatitis : toxico-metabolic, idiopathic, genetic, autoimmune, etc. (M-ANNHEIM classification)

According to the M-ANNHEIM classification, chronic pancreatitis is divided into several main forms:

1. **Toxic-metabolic form :** Dependent on alcohol, smoking, drugs or other toxic substances , clinically manifested by recurrent abdominal pain, dyspeptic symptoms, diarrhea and weight loss. In this form, pancreatic calcifications, fibrosis and progressive exacerbation of exocrine and endocrine insufficiency are often observed. Morphologically, fibrosis processes, calcifications, strictures and cysts in the gland parenchyma are detected.

Clinical studies show that the toxico-metabolic form is the most common form of chronic pancreatitis, accounting for 60–70% of chronic pancreatitis cases in developed countries. Although treatment approaches for this form are often conservative, endoscopic or surgical procedures may be required in complicated cases.



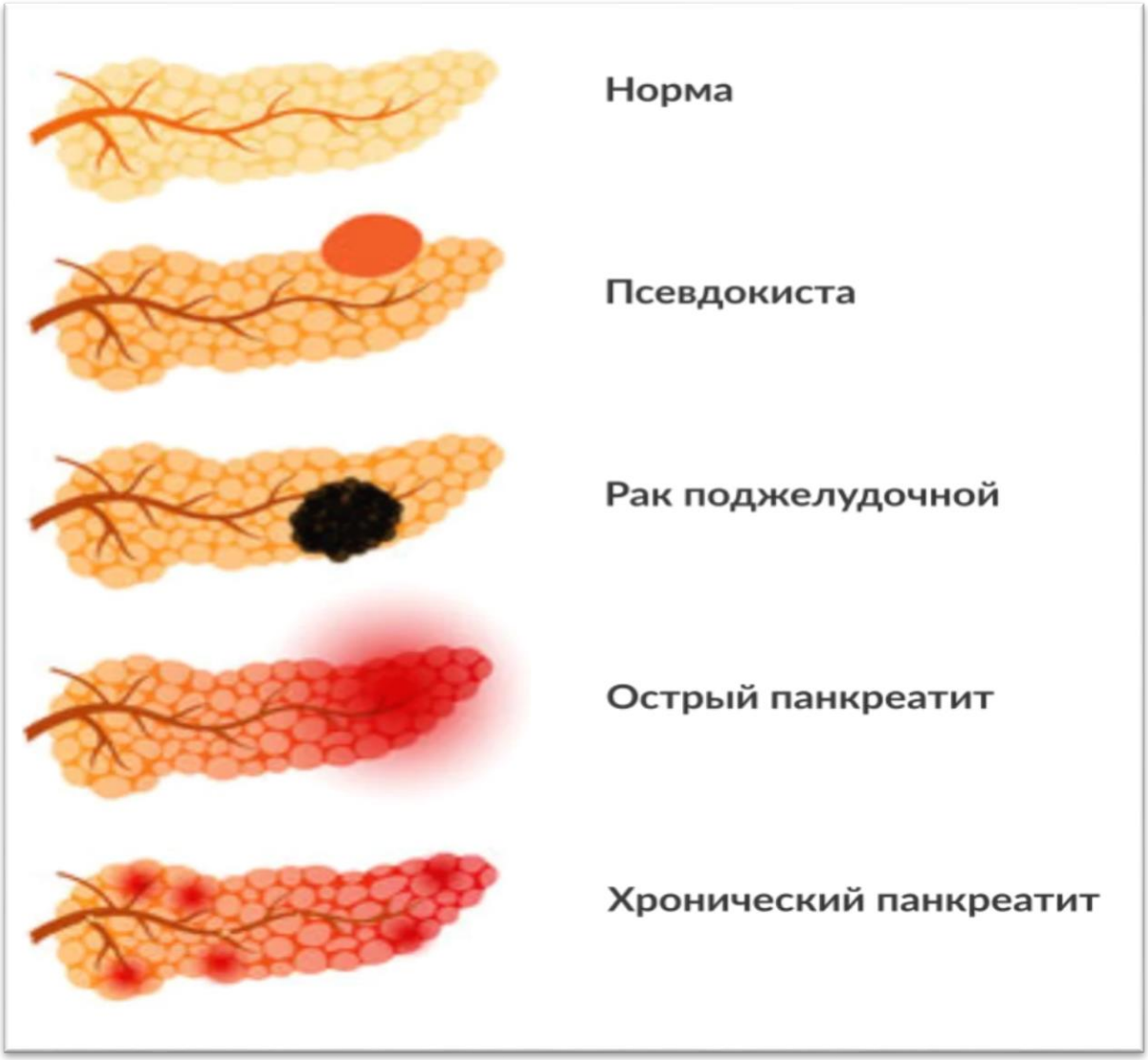
2. Idiopathic form : The cause is unknown and usually begins in childhood or adolescence. Clinical findings include persistent, vague abdominal pain , pancreatic calcifications, ductal strictures, and cysts. Although the molecular basis of the idiopathic form is not yet fully understood , genetic and environmental factors are considered as possible causes. In some cases, mitochondrial dysfunction and oxidative stress are also thought to play a role in the pathogenesis.

Epidemiological data indicate that the idiopathic form occurs in 20–30% of cases of chronic pancreatitis in children and adolescents. Clinical consequences include recurrent episodes of pancreatitis, progressive exocrine and endocrine insufficiency, and sometimes an increased risk of pancreatic carcinoma. CT, MRI , and endosonography play an important role in diagnosis , and treatment often includes symptomatic and enzyme replacement therapy.

3. **Genetic form** : associated with mutations in the PRSS1, SPINK1, or CFTR genes , usually begins at an early age and is characterized by frequent episodes of recurrent pancreatitis. Morphologically, strictures, fibrosis, and calcifications are detected in the pancreatic duct system. Clinical consequences include early development of pancreatic diabetes, progressive exocrine and endocrine insufficiency, and a significantly increased risk of pancreatic carcinoma.

Epidemiological data suggest that the genetic form, although rare, is characterized by severe consequences. In the genetic form, familial aggregation of the disease is observed , and genetic screening plays an important role in early diagnosis. Also, clinical control of this form requires constant monitoring, molecular genetic testing, and the development of individual treatment strategies for patients at risk.

4. **Autoimmune form** : It develops as a result of the immune system's reactivity against its own cells and is usually classified as IgG4-related pancreatitis. Clinical features include jaundice, a mass-like swelling resembling a pancreatic mass, elevated serum IgG4 levels, abdominal pain , weight loss, and nausea. A good response to corticosteroids is characteristic of this form. Endoscopic and histological examinations reveal lymphoplasmacytic infiltration, fibrosis, and ductal strictures. In some cases, pancreatic masses require clinical differential diagnosis with carcinoma. This form is also often associated with other autoimmune diseases (e.g., cholangitis, thyroiditis, Sjögren's syndrome, rheumatoid arthritis). Epidemiological data suggest that the autoimmune form is relatively rare, but if not properly diagnosed, it can lead to unnecessary surgery.



5. **Obstructive form** : develops as a result of mechanical obstruction of the pancreatic duct (gallstones, strictures, or anatomical defects). Clinical symptoms are usually manifested by pain that worsens after meals , nausea, vomiting, and progressive exocrine dysfunction. Radiological examinations reveal ductal dilatation, strictures, or signs of external pressure. This form often requires surgical intervention.

Thus, the M-ANNHEIM classification systematically represents the etiological diversity of chronic pancreatitis and allows for a separate assessment of the clinical manifestations of each form.

CHAPTER III. Etiology and pathogenesis of pancreatitis

Pancreatitis is an inflammation of the pancreas, the etiology of which is associated with various factors. Etiological causes include alcohol abuse, biliary tract diseases (especially gallstones), a high-fat diet, smoking, genetic factors, infections, trauma, drugs, and some autoimmune processes. Hypercalcemia and hypertriglyceridemia also play an important role in the development of pancreatitis.

is complex and is mainly due to the early and uncontrolled activation of enzymes in the pancreas, which initiates autolysis processes. The conversion of trypsinogen to trypsin activates other proteolytic enzymes, which leads to extensive damage to parenchymal cells , necrosis, edema, and severe inflammation.

At the same time, oxidative stress, microcirculatory disorders, release of cytokines and chemokines, inflammatory mediators, thrombosis susceptibility, and immune system imbalance also contribute to the severity of pancreatitis. At the molecular level, calcium homeostasis disorders, mitochondrial dysfunction , and activation of cell death mechanisms further aggravate the disease.

In acute pancreatitis, this process progresses rapidly and can lead to severe clinical conditions. In chronic pancreatitis, repeated episodes of inflammation result in fibrosis and loss of exocrine and endocrine functions.

3.1. Acute pancreatitis : gallstones, alcohol, hypertriglyceridemia, drug manipulations

Acute pancreatitis is an acute degenerative-inflammatory process that occurs as a result of autolysis of pancreatic tissue under the influence of its own enzymes. This disease accounts for ≈6.5% of surgical diseases and ranks third among other diseases of the abdominal cavity after acute appendicitis and acute cholecystitis. The disease attracts the attention of surgeons due to the difficulty of diagnosis, severe course and high mortality rate of 8-10%, and in severe forms - 50%. Acute pancreatitis is most often observed in people aged 30-60 years. This disease is 3-3.5 times more common in women than in men.

The causes of acute pancreatitis are diverse and are considered a polyetiological disease. Despite the large number of etiological factors of this disease, they all stem from the disruption of the structural unity of the gland, the autolysis (destruction) of acinar cells due to the activation of enzymes.

The reasons leading to the activation of enzymes in the gland are:

1. acinar cell damage;
2. hypersecretion of pancreatic juice;
3. difficulty in the flow of pancreatic juice into the duodenum and the development of acute hypertension in its paths.

The following causes can lead to damage to acinar cells:

1. Injuries to the abdominal organs, and in particular the pancreas;
2. Pancreatic surgery;
3. Circulatory disorders in the pancreatic tissue (thrombosis, embolism, vascular occlusion, etc.);
4. Exogenous intoxication;
5. Allergic reaction;
6. Alimentary disorders.

Pancreatic hypersecretion includes excessive drinking of alcoholic beverages (alcohol) and excessive consumption of fatty foods. Factors that make it difficult for pancreatic juice to flow in its own way include pathological processes located in the outlet of the pancreatic duct: gallstone obstruction of the sphincter of Oddi, stricture or stenosis of the large duodenal aspirate, swelling of the duodenal mucosa in this area.

Pathogenesis. Neurogenic or humoral stimulation of pancreatic function is the main factor in the development of acute pancreatitis (overeating, drinking alcohol, diagnostic stimulation with secretin).

Approximately 2/3 of patients with acute pancreatitis are associated with cholelithiasis. However, the pathogenetic mechanism is not entirely clear, but the connection of the gallbladder and pancreas with lymphatic collectors probably plays an important role.

Normally, the activation of pancreatic enzymes, primarily proteases, usually occurs in the duodenal lumen. In acute autolytic pancreatitis, the activation of these enzymes occurs in the gland itself. However, which of the enzymes is more necessary for the self-digestion of the glandular tissue in acute pancreatitis has not yet been fully determined. Trypsin proenzymes, chymotrypsin, elastase, collagenase and phospholipase are the activators of most pancreatic enzymes. Phospholipase releases lysolecithin and lysocephalin, which have a strong cytotoxic effect, from phospholipids and cell membranes . Active proteases act on kininogens to secrete polypeptides and kinins. Kinins cause pain and severe vasodilation, which leads to severe hypovolemic shock.

Active lipases break down cellular fats into glycerol and fatty acids, leading to the development of severe dystrophic changes in tissues, allowing fatty necrosis (steatonecrosis) to form in the glandular tissue itself, in the cell wall surrounding the gland, in the mesentery of the small and large intestine, in the large and small intestine, and in other organs. Trypsin and kinins also sharply increase capillary permeability, causing stasis, "microcirculatory block" that stops perfusion along the capillaries, ischemia, hypoxia, acidosis, and hemocoagulation disorders.

The local process quickly affects all organs. A large amount of toxogenic polypeptides, lipids and other products of enzyme autolysis, pancreatic enzymes, biogenic amines enter the lymph and blood, leading to the development of toxemia, which is accompanied by changes in the plasma and thrombin systems of the blood, disruption of central and peripheral hemodynamics, functional insufficiency in parenchymal organs, and toxic complications.

Consequently, in the pathogenesis of acute pancreatitis, 4 interconnected pathobiochemical and morphofunctional processes are involved:

1. lipolysis,
2. proteolysis,
3. demarcated inflammation, expressed by microcirculation disorders in the blood and lymph,
4. Pancreatogenic toxemia is of primary importance.

Despite the variety of morphological changes, three forms of pancreatitis are distinguished: acute swelling of the pancreas, acute hemorrhagic pancreatitis, acute purulent pancreatitis. Acute swelling of the pancreas is sometimes called catarrhal pancreatitis. On macroscopic examination, the gland is enlarged and swollen. The tumor can spread to the retroperitoneal space and the mesentery of the transverse colon. In the abdominal cavity and in the sac of the pancreas, serous-hemorrhagic fluid is most often present. Histological examination reveals intermediate, tissue edema, areas of small hemorrhages, and moderately expressed degenerative changes in the glandular tissue.

ACUTE HEMORRHAGIC PANCREATITIS

In this case, the macroscopic appearance of the pancreas is: enlarged, reddish-black, inflamed, easily disintegrated. Hemorrhagic imbibition of the parapancreatic and retroperitoneal spaces is practically constant. When histologically examined, numerous foci of dystrophy, necrobiosis and necrosis are detected, with areas of unchanged parenchyma of the gland. For hemorrhagic pancreatitis, the widespread distribution of hemorrhagic exudate throughout the fiber and the appearance of ascitic enzymatic phlegmon in the retroperitoneal fiber are characteristic.

Acute purulent pancreatitis develops when bacterial flora joins. Foci of purulent decomposition of glandular tissue are visible. Microscopic examination reveals purulent infiltration in the form of phlegmonous inflammation or numerous abscesses of various sizes , purulent-hemorrhagic or serous-purulent exudate in the abdominal cavity.

The disease begins after a short prodromal period (60-70%), characterized by dyspeptic disorders in the form of a feeling of heaviness in the hypochondrium and under the left ribs, mild pain, belching, and moderate abdominal distension.

Pain is the main and constant symptom of acute pancreatitis. The pain occurs suddenly. By its nature, the pain is very strong, aching, constant, lasts for a short time. The pain is so strong that patients sometimes lose consciousness. The pain can be located under the right and left ribs, but more often it is observed as a belt-like

pain and passes over the shoulders, behind the sternum, which is sometimes mistakenly considered a myocardial infarction. In 85% of cases, the patient vomits (in severe cases, blood is mixed with the vomit). The patient's abdomen becomes increasingly swollen, diarrhea and constipation are observed.

The patient's body position is often forced, most patients are in a semi-recumbent position. At the beginning of the disease, the patient's body temperature is normal or subnormal. High body temperature and fever are characteristic of developing inflammatory complications.

The skin and mucous membranes are pale, cyanotic, indicating a severe intoxication process. In most cases, jaundice is observed, indicating a violation of the normal flow of bile and a severe toxic state in the liver.

The patient's tongue is dry, covered with a gray coating. The abdomen is uniformly raised, the muscle defenses are weak, cyanosis is noted in the lateral parts of the abdomen and around the navel - Gray-Turner symptom and Cullen symptom.

For acute pancreatitis, pain in the epigastric region and under the left ribs is an objective symptom, which often passes with a lack of tension of the muscles of the anterior abdominal wall. Voskresensky's symptom (loss of pulsation of the abdominal aorta in the epigastric region) is detected in a third of patients, and Mayo-Robson's symptom (pain in the left costal-vertebral fold) in more than half of them. The symptom of Schyotkin-Blyumberg is often weakly positive, there is a decrease in the sounds of intestinal peristalsis. Percussion may reveal free fluid in the abdominal cavity.

At the beginning of the disease, there is bradycardia, which is soon replaced by tachycardia. For severe forms of the disease, a rapid pulse with a threadlike character is characteristic. A decrease in arterial blood pressure is observed in most patients.

Dystrophic changes develop in parenchymal organs, their functional state is impaired. These changes are mainly hyperenzymemia, microcirculatory disorders and intoxication. Particularly severe disorders are observed in renal function. In 10-

20% of patients, diuresis changes from oliguria to anuria, manifested by the development of acute renal failure.

Laboratory tests show an increase in proteolytic enzymes (amylase, trypsin, lipase, transaminase) in acute pancreatitis.

The level of diastase in the blood and urine is not always increased. A sudden increase in the level of amylase (more than 512-1024 TB) indicates acute pancreatitis, but the normal level of amylase does not exclude this disease. When the gland undergoes significant changes, the level of diastase in the blood and urine does not change significantly, sometimes it decreases.

A significant increase in trypsin levels is also a pathognomonic sign of acute pancreatitis. Since in this disease the levels of trypsin and its inhibitors increase very early, while the increase in lipase concentration occurs somewhat later (on the 3rd-4th day of the onset of the disease).

Hyperglycemia and glucosuria indicate involvement of the islet apparatus of the gland in the pathological process. Hypocalcemia is pathognomonic for destructive forms of acute pancreatitis. It usually appears between the 4th and 10th days of the disease, that is, during the period of the most advanced fat necrosis. A decrease in calcium below 4 mEq/L is considered a poor prognostic sign.

In addition to an increase in the level of pancreatic enzymes, protein, erythrocytes, and casts appear in the urine. In severe cases, toxic-infectious damage to the kidneys leads to acute renal failure, which is manifested by oliguria or anuria, the accumulation of nitrogenous waste in the blood.

The examination of pancreatic tissue enzymes is of particular diagnostic importance. In all forms of the disease, the activity of these enzymes has been found to be relatively high. In the blood of healthy people, elastase and transaminase activity are not detected. In patients with acute pancreatitis, elastase activity in the blood is around 4.3 to 5 μmol/min. Transaminase activity varies from 2.29 to 4.29 μmol/min.

The main complications of acute pancreatitis: early complications - shock and acute heart failure, peritonitis; somewhat late complications - pancreatic abscess, retroperitoneal cell phlegmon, subdiaphragmatic, interintestinal, Charvi's pouch, arrosive bleeding, migration of necrotic tissue, acute renal failure. Later, there is a possibility of the appearance of pseudocysts and fistulas of the pancreas, intestinal fistulas, diabetes mellitus, etc.

Acute pancreatitis should be differentiated from perforated gastric and duodenal ulcers. For perforated ulcers, such characteristic signs as the patient's young age, the presence of ulcers in the anamnesis, "stab-like" pain, the absence of vomiting, and a "board-shaped" abdomen help to differentiate. The loss of dullness of the liver during percussion and the presence of a sickle-shaped free air mass under the diaphragm, detected on X-ray examination, are characteristic. Acute pancreatitis is usually more common in older people with gallstone disease and impaired fat metabolism. For acute pancreatitis, the belt-like nature of the pain, its characteristic irradiation, continuous vomiting, the absence of a "muscle protection" symptom, abdominal distention, leukocytosis, hyperenzymemia, and diasturia are characteristic.

Acute cholecystitis and attacks of biliary colic have a number of common symptoms with acute pancreatitis (sudden onset, acute pain, pain irradiation, decreased peristalsis, etc.). However, for acute cholecystitis, the localization of pain under the right ribs, a symptom of muscle protection is detected during palpation - an enlarged and painful gallbladder or an infiltrate under the right ribs, normal diastase indicators in the blood and urine. Often, acute pancreatitis develops against the background of gallstone disease (cholecystopancreatitis).

Differential diagnosis between acute pancreatitis and acute mechanical intestinal obstruction is carried out on the basis of the following signs: in acute pancreatitis, the pain is constant and passes with a decrease or complete loss of peristalsis, the pain is in the upper and middle parts of the abdomen. On the contrary, in acute intestinal obstruction, the pain is wavy throughout the abdomen; in the initial

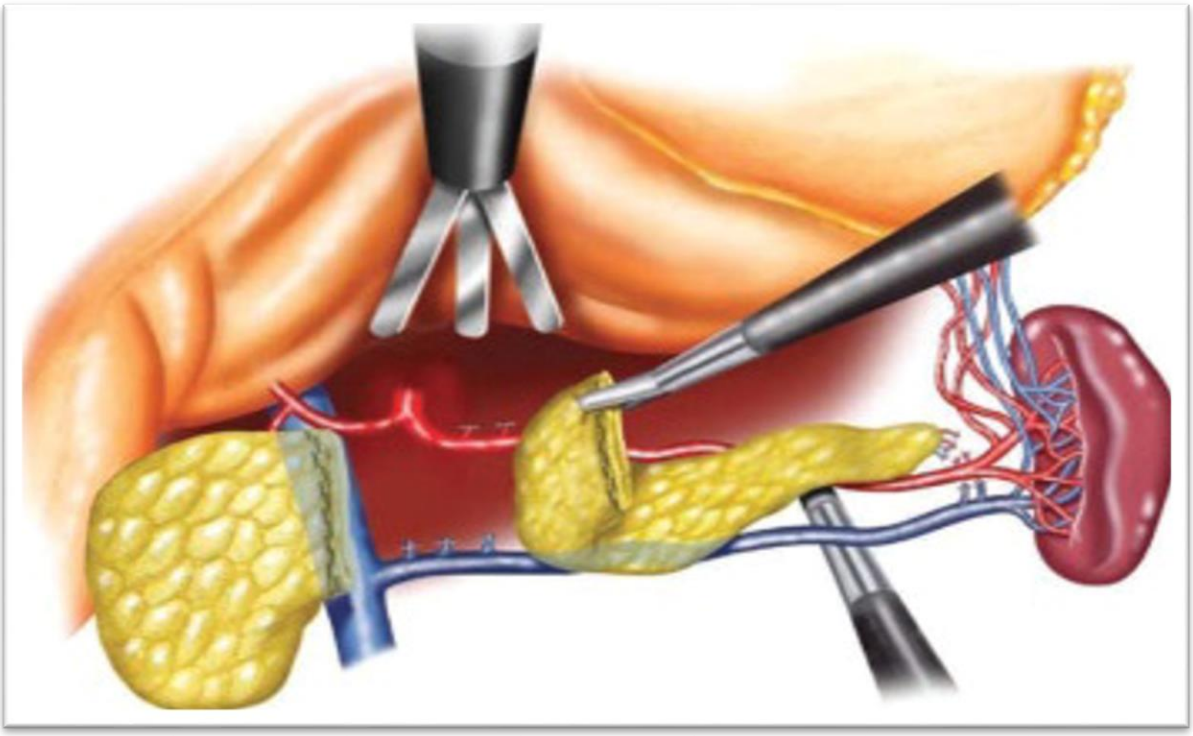
period of the disease, peristalsis is strong. Elevated levels of pancreatic enzymes in the urine and blood confirm the diagnosis of acute pancreatitis.

Acute appendicitis, like acute pancreatitis, often begins with pain in the epigastric region. However, in appendicitis, the pain in the epigastric region is short-lived, after 3-4 hours the pain moves to the right iliac region, is accompanied by abdominal wall distension and other symptoms of developing local peritonitis. Examination of diastasis in urine and blood allows for a clear differential diagnosis between these two diseases.

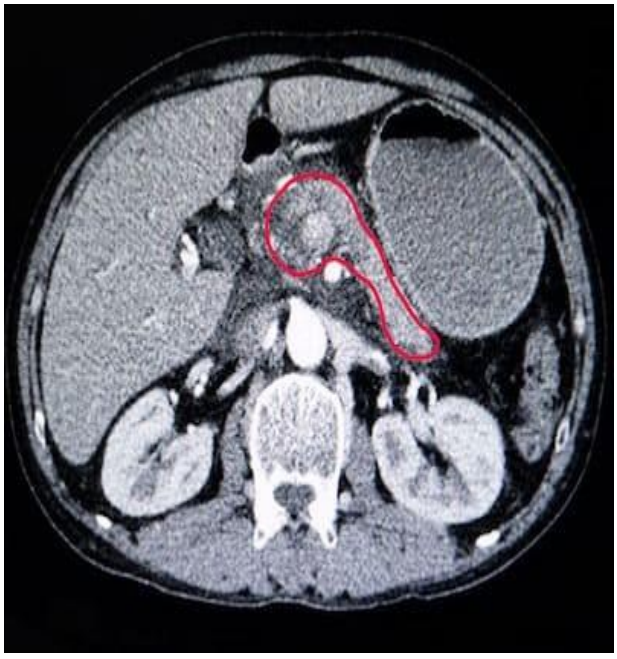
The diagnosis of acute pancreatitis is based on the anamnesis (overeating and drinking alcohol, injuries, etc.), severe pain in the upper abdomen, often with a sharp pulsating sensation, accompanied by tachycardia and a decrease in blood pressure. Until peritonitis develops, the abdomen remains soft, but is raised, and peristalsis is absent. Sometimes the Mayo-Robson symptom is positive.

Laparoscopic examinations in acute pancreatitis are one of the most valuable methods for the urgent diagnosis of this disease. Laparoscopy in acute pancreatitis helps to determine the form of acute pancreatitis, to determine the pathobiochemical type of pancreatic necrosis, to detect pancreatogenic peritonitis, and to identify concomitant diseases (destructive cholecystitis).

Indications for laparoscopic examination are: the uncertainty of the clinical picture, the need for differential diagnosis between pancreatitis and other acute diseases of the abdominal cavity. When clinical signs of acute pancreatitis are obvious, laparoscopy is performed to determine the form of the disease and perform therapeutic procedures. Laparoscopy cannot be used in patients who have undergone abdominal surgery, as well as in patients with large ventral hernias.



In recent years, computed tomography (CT) and ultrasound have become the most informative methods, which are used to determine the size of the pancreas, the unevenness of its structure, and the degree of the pathological process.



selective and superselective angiography of the abdominal aortic branches into the clinic has somewhat improved the diagnosis of pancreatic diseases. Angiographic examination allows you to identify changes in the angioarchitectonics of the pancreas that occur in acute pancreatitis.

All angiographic symptoms of acute pancreatitis can be divided into three groups:

1. changes in the arterial trunk of the pancreas;
2. hemocirculatory disorders in the pancreas;
3. Changes in the vessels surrounding the pancreas and in the vessels of the abdominal aorta basin.

Changes in the arterial trunk of the pancreas in acute pancreatitis include dilation, displacement, elongation and straightening of the arterial lumen, vagueness of its contours (contortion), change in shape and narrowing, irregular location, disruption of some vessels, as well as defects in the vessel wall.

X-ray examination reveals indirect signs of acute pancreatitis. A plain X-ray shows an enlarged stomach with fluid in it. Usually the duodenum is dilated and paretic.

Sometimes signs of acute pancreatitis can be detected by special diagnostic procedures, such as transparietal puncture of the abdominal cavity, palpation of the pancreas with instruments, transparietal puncture and drainage of the gallbladder. Sometimes signs of acute pancreatitis can be detected by special diagnostic procedures, such as transparietal puncture of the abdominal cavity, palpation of the pancreas with instruments, transparietal puncture and drainage of the gallbladder.

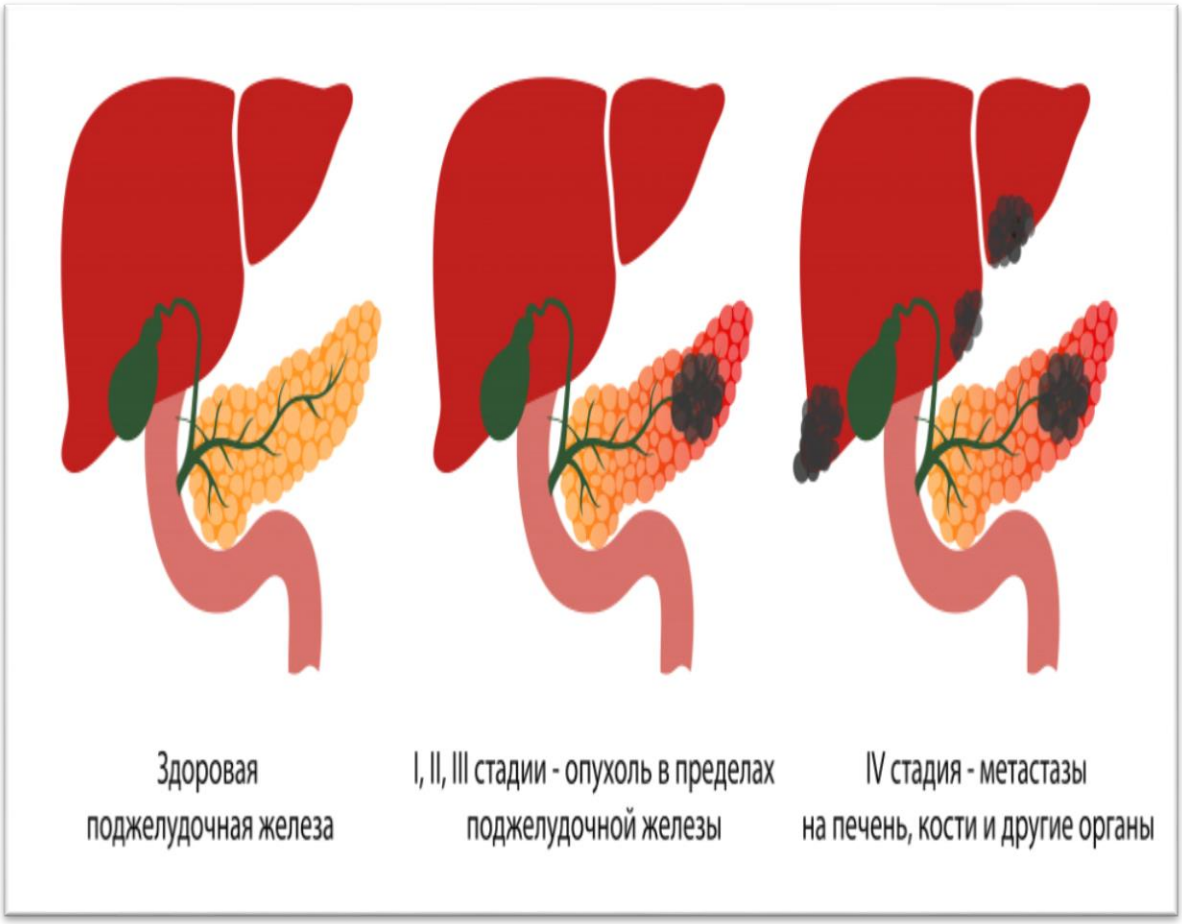
3.2. Chronic pancreatitis : recurrent inflammation, fibrosis, and immune mechanisms

In chronic pancreatitis, repeated episodes of inflammation lead to permanent damage to parenchymal cells. At the heart of the pathogenesis is the premature activation of enzymes in pancreatic acinar cells and increased oxidative stress. During this process, the activation of proteolytic enzymes such as trypsin, elastase , and phospholipase A2 damages cell membranes and stromal tissues. The high release of inflammatory mediators (IL-1 β , IL-6, TNF- α) and chemokines ensures the continuation of chronic inflammation by attracting neutrophils and macrophages. This process expands the foci of necrosis, which subsequently increases the fibrosis

process. As a result of fibrosis, normal exocrine and endocrine cells are replaced by collagen tissue and myofibroblasts, which leads to a significant decrease in the production of digestive enzymes, impaired insulin secretion, impaired cell regeneration, and ultimately the development of pancreatogenic diabetes.

Immune mechanisms also play an important role: activation of T-lymphocytes, B-lymphocytes and macrophages, as well as antigen presentation by dendritic cells, enhance the inflammatory process. The release of cytokines (IL-1, IL-6, TNF- α , IFN- γ) and chemokines promotes chronic inflammation and tissue fibrosis. Also, autoimmune reactions, in particular the formation of antibodies against pancreatic cells, cause severe and rapid exacerbation of pancreatitis in some patients . As a result, the pancreatic ducts narrow, the outflow of secretion is impaired, intraductal pressure increases and repeated attacks of inflammation occur.

All this creates the basis for the formation of persistent and severe pain syndrome, malabsorption, steatorrhea, pancreatogenic diabetes, vitamin and microelement deficiencies, weakening of the immune system and many other systemic complications in patients. According to clinical observations , in a large proportion of patients with chronic pancreatitis, the quality of life decreases sharply, work capacity is limited, and long-term disability develops. This condition negatively affects not only the digestive system, but also general metabolic processes, the cardiovascular and respiratory systems, kidney function, and psychological health. In the long term, patients develop osteoporosis, chronic anemia, asthenic syndrome, and difficulties in social adaptation.



I V. Measures for the treatment and prevention of pancreatitis

The main goal of pancreatitis treatment is to reduce inflammation, prevent complications , and maximize pancreatic function. In acute pancreatitis, initial treatment includes fasting, parenteral fluids, analgesics , antispasmodics, antibiotics (if necessary), intravenous fluids, and electrolyte balance. In severe cases, intensive care, surgery, or endoscopic procedures may be required.

Treatment for chronic pancreatitis is aimed at compensating for enzyme deficiency, reducing pain , treating complications, and improving the patient's quality of life. For this purpose, pancreatic enzyme preparations, strict adherence to a diet, pain relievers, vitamin and micronutrient supplements, and in cases of advanced diabetes, insulin therapy are used.

4.1. Treatment strategies (conservative, surgical and minimally invasive methods)

Pathogenetic treatment of acute pancreatitis, that is, the main therapeutic measures, should be consistent with the concept of pathogenesis.

The following are used to combat enzyme toxemia:

1. Aspiration of gastric juice and washing the stomach with a cold soda solution (hydrochloric acid in gastric juice is a stimulant of pancreatic secretion). Administration of atropine to relieve spasm of the sphincter of Oddi, hypothermia of the pancreas, administration of cytostatics for up to 4-5 days (5-fluorouracil, fluorofuran and other drugs that inhibit the production of pancreatic enzymes) reduces the exocrine function of the gland;

2. ensuring normal evacuation of produced enzymes by administering spasmolytics;

3. removal of enzymes that have entered the bloodstream or abdominal cavity; drainage of the thoracic lymphatic system with lymphosorption, stimulation of diuresis; drainage of the abdominal cavity;

4. inactivation of enzymes with protease inhibitors (contrical, gordox, tsalol, etc.).

To eliminate or reduce pain, it is necessary to use analgesics and antispasmodics (no-shpa, papaverine, platifillin). Epidural blockade (catheterization of the epidural space of the spinal cord with the introduction of anesthetics) is effective.

To maintain water-electrolyte balance, normalize cardiac activity, and reduce toxicosis, 5-10% glucose solutions, polyionic solutions, polyglucin, and plasma are prescribed. Potassium preparations and cardiac glycosides are prescribed according to indications.

To improve the rheological properties of blood and prevent blood clotting inside the vessel, rheopoliglyukin and heparin (5000 TB) are administered every 4 hours.

Antifermentative therapy. Treatment with protease inhibitors. In 1953, Frea first used a kallikrein inactivator - trasilol - for the treatment of acute pancreatitis. Currently, other inhibitors are widely used: contrical, gordox, pantripin, iniprol,

zymofen, etc. Despite the many years of use of inhibitors, there is no consensus on their mechanism of action, phases, and additional effects. Numerous studies have shown that protease inhibitors have a real therapeutic effect in pancreatic necrosis, and combined treatment with shock doses slightly reduces mortality from pancreatogenic toxemic complications. Administration of the drug by conventional methods (intramuscular and intravenous) does not provide high concentrations of antifermentative drugs in the pancreas and abdominal cavity. This is achieved by administering drugs in a combined manner: intravenously, regionally - arterially, intraperitoneally, retroperitoneally. High local concentrations of protease inhibitors block active trypsinogen, inactivate trypsin in the periacinar space and inhibit regional processes of proteolysis, kininogenesis and fibrinolysis.

Treatment with cytostatics. Cytostatics (5-fluorouracil, fluorofur) that inhibit protein synthesis in acinar cells and suppress the exocrine function of the pancreas were used in the second half of the 1970s for pancreatic necrosis. 5-fluorouracil is diluted in 500 ml of saline and administered once a day for 2-3 days at a dose of 250-300 mg. Treatment is most effective when the drug is selectively injected into the abdominal aorta. It should be noted that the therapeutic effectiveness of cytostatics in late stages of the disease is very low.

Detoxification. Pancreatogenic toxemia develops in the first period of the disease. If detoxification is not carried out during this period, the patient's condition worsens, inhibitory barrier mechanisms are disrupted, the local pathological process is disrupted, and its exacerbation occurs under the influence of microcirculation disorders and intravascular coagulation syndrome. Only timely detoxification treatment stops the further development of the pathological process.

One of the effective methods of detoxification is the combination of infusion therapy with fluid saturation of the body (hemodilution) and increased diuresis. The principles of hemodilution and increased diuresis are simple, universally recognized. Increased diuresis is prescribed when diuresis falls below 25 ml per hour.

External drainage of the thoracic lymphatic tract. The use of this method for the treatment of acute pancreatitis is pathogenetically based. In pancreatic necrosis,

due to swelling and compression of the interstitial spaces of the liver, as well as microcirculatory disorders, pancreatic enzymes and autolysis products begin to enter the lymph in large quantities, which sharply increases its toxicity. The degree of toxicity of the lymph depends on the severity of pancreatic damage. During the process of lymph drainage, its toxicity decreases mainly in the first 2-3 days. During this period, a large amount of autoaggressive enzymes - lipase and trypsin - is excreted along with the lymph. Especially in fat necrosis, external lymphatic drainage gives a truly detoxifying effect. The loss of proteins and electrolytes along with the lymph is a negative side of lymph drainage.

In recent years, active detoxification methods have been rapidly introduced into clinical practice: lymphosorption (R. Panchenko, 1982) and hemosorption (Yu.M. Lopukhin, 1975). Reinfusion of lymph purified with sorbents is a further development of the method of external drainage. There are practically no contraindications to lymphosorption, but its use gives good results in cases of high lymphorrhea.

Hemosorption in pancreatic necrosis should be used in severe endotoxicosis, pancreatogenic shock phenomena, and intoxicating psychoses that develop in hepatic and renal failure.

High therapeutic results have been obtained with plasmapheresis in severe pancreatic endotoxicosis (AM Sazonov, 1984). In this method, with the help of equipment, lymph fluid is separated (up to 1-1.5 l) and mixed with donor plasma and albumin. The therapeutic effect of plasmapheresis is to remove exogenous and endogenous toxins along with plasma. The purified lymph is then re-infused into the body.

Laparoscopic drainage and perfusion of the abdominal cavity. Pancreatogenic peritonitis is acute, causes rapidly increasing intoxication, parenchymal organ dystrophy, and severe hemodynamic disorders.

An effective measure to combat peritonitis is the active removal of exudate, the introduction of anti-enzyme drugs and antibiotics into the abdominal cavity. For this purpose, the most effective and harmless method of treating pancreatic necrosis

is laparoscopic drainage of the abdominal cavity, simultaneous removal of exudate and the establishment and use of peritoneal dialysis in the abdominal cavity.

Laparoscopic treatment of pancreatogenic peritonitis consists of two stages - diagnostic and therapeutic. The diagnostic stage determines the type of pancreatitis and the presence or absence of peritonitis. Hemorrhagic exudate, steatonecrosis spots and signs of aseptic pancreatogenic peritonitis are the main indications for the second stage - drainage of the abdominal cavity for intraperitoneal perfusion or infusion.

Intra-arterial regional infusion therapy (RIM). The main indication for this method is exacerbation of pancreatic necrosis, peritonitis and toxemic complications . The composition of the mixture of drugs used for RIM: contrical - 60,000 TB, heparin - 2,000 TB, rheopoliglyukin - 400 mg, nicotinic acid - 20 ml, novocaine - 2.5 g, isotonic sodium chloride solution or Ringer-Locke solution - up to a total volume of 1,000 ml.

For this purpose, the catheter is placed under the control of an X-ray television device. The main therapeutic task of RIM is to stop the processes of proteolysis and kininogenesis, to treat local and systemic changes in blood microcirculation, as well as to eliminate central hemodynamic disorders. Accordingly, RIM is one of the main methods in the treatment of pancreatogenic shock, prevention of the development of pancreatic necrosis and enzymatic peritonitis.

Local hypothermia of the pancreas. The complex of measures for the treatment of acute pancreatitis includes the creation of a state of hypothermia by cooling the pancreas through the abdominal wall, stomach, and colon. In this case, a significant decrease in temperature slows down metabolic processes in the gland tissue, reduces its enzymatic function and the activity of proteolytic enzymes.

Direct local hypothermia is performed in the postoperative period using a special probe inserted into the pancreas during surgery. After the main operation on the gland (resection, drainage, omentopexy, abdominization, etc.), a specially

prepared latex balloon connected to a two-lumen tube is inserted into it, which is removed through an incision under the left ribs.

The pancreas is cooled regularly for 2-4 hours, 3 times a day. Many scientists believe that the advantage of this method, which is noted by many, is that it induces a state of general or local hypothermia in the pancreas.

Many scientists believe that the advantage of this method, which they have noted, is that it induces a state of general or local hypothermia of the pancreas. However, they do not recommend performing a special surgical operation to perform hypothermia.

Surgical treatment of acute pancreatitis. Acute pancreatitis is surgically treated as follows:

1. acute pancreatitis, its destructive forms; when combined with cholecystitis;
2. When conservative treatment fails within 36-48 hours;
3. in pancreatogenic peritonitis where laparoscopic drainage of the abdominal cavity is not possible;
4. in complications of acute pancreatitis; abscess of the sac of the liver, phlegmon of the retroperitoneal cavity.

Laparoscopy is of great importance in the diagnosis and treatment of destructive forms of acute pancreatitis. It can be used to establish the diagnosis, identify biliary hypertension, and perform percutaneous cholecystostomy under laparoscopic control, but most importantly, drain the abdominal cavity for fluid aspiration (to reduce enzyme toxemia), and wash the abdominal cavity with antibiotics and protease inhibitors.

Treatment of acute pancreatitis is based on the stage of the disease. In the enzymatic stage of the disease, patients are given basic, antisecretory, detoxification therapy, immunostimulation, and antibacterial therapy. Treatment in the enzymatic stage of the disease has its own characteristics in relation to the destructive process in the pancreas. Treatment in acute edematous pancreatitis consists of basic and antisecretory therapy.

Conservative treatment for small-focal pancreatic necrosis includes:

1. **Suppression of pancreatic function:** fasting, local hypothermia (cold application to the abdomen), gastric probing and continuous aspiration, antisecretory therapy (octreotide, sandostatin) are used. At the same time, proton pump inhibitors and H2-blockers can be used as adjuvants to reduce secretion. Clinical studies show that these methods are important in reducing pancreatic secretion, controlling the autolysis process, and supporting the regeneration processes in the gland parenchyma.

2. Detoxification: plasmapheresis, laparoscopic abdominal drainage according to indications , large-volume infusion procedures, increased diuresis, and hemodialysis or hemofiltration are performed if necessary. In addition, the use of lipid emulsions and colloidal solutions is recommended. In some cases, hemosorption and plasmafiltration are also used, which help remove toxins from the body. In modern approaches, hemosorption is also used to reduce cytokine storm .

3. Antifermentative treatment: along with the drugs Kontrical, Gordox, Trasilol, protease inhibitors and modern antienzymatic agents are used. Their early use is important in limiting the necrosis process. Studies at the molecular level show that protease inhibitors also have an effect on reducing the cytokine storm , controlling inflammatory mediators, and improving microcirculation.

4. Pain prevention: comprehensive pain control is carried out using antispasmodics, analgesics, novocaine blockades, epidural anesthesia, and psychotropic drugs . Neuroblockades and multimodal analgesia methods can be used for recurrent pain . Neuromodulation methods, acupuncture, physiotherapeutic procedures, psychotherapy, and rehabilitation exercises are also used as auxiliary tools.

5. Additional measures: antibiotic therapy (if there is a risk of secondary infection), antioxidants, immunomodulators and proper organization of nutrition by parenteral or enteral route. Early enteral feeding is important in maintaining the intestinal barrier, reducing bacterial translocation and preventing the risk of sepsis. Also, probiotics and prebiotics help restore the intestinal microflora. Modern studies

indicate that omega-3 fatty acids , glutathione preparations, selenium and vitamin D provide additional benefits due to their antioxidant and immunomodulatory effects.

In large-focal pancreatic necrosis, patients are given antisecretory, detoxification, antioxidant, antihypoxant, and antienzyme therapy. If the patient presents late, antisecretory therapy is not given in large-focal pancreatic necrosis, because pancreatic necrosis has already developed and in this case there is no benefit in suppressing pancreatic function.

Treatment of acute destructive pancreatitis in the reactive period consists of the following: enteral tube feeding, high-calorie diet; restoration of normal intestinal flora; prevention of purulent complications (antibiotics, immunocorrection); antioxidants and antihypoxants.

In the case of acute destructive septic pancreatitis, patients are shown surgical treatment. The following types of operations are used in the surgical treatment of acute pancreatitis:

1. Drainage of the Charvi sac: this method is used to remove necrotic exudate and inflammatory fluids, to prevent the development of infection. It is often performed laparoscopically or open and provides additional effectiveness to conservative treatment. Also, endoscopic drainage is widely used in modern approaches, which reduces invasiveness, shortens the rehabilitation period and is also beneficial in reducing the patient's pain syndrome. In some centers, stenting is used, which increases the effectiveness of restoring pancreatic outflow.

2. Resection of the tail and body of the pancreas : in the presence of necrosis or irreversible fibrosis, it is performed to stop the inflammatory process and reduce complications by removing the damaged part of the gland. To prevent bleeding during the resection, modern hemostatic technologies, energy-based cutting and welding equipment are used. It is also necessary to take into account changes in the lymph nodes and peripancreatic tissues. The procedure poses a risk of subsequent endocrine and exocrine insufficiency, therefore, patients require long-term enzyme therapy and endocrine monitoring.

3. is the complete removal of the pancreas , and is used in very severe cases - extensive pancreatic necrosis, malignancy, or severe chronic pancreatitis that does not respond to treatment. This operation dramatically changes the patient's metabolic status, so it requires ongoing enzyme and insulin replacement therapy. After pancreatectomy, patients' quality of life is often affected by diabetes and complicated by malabsorption. Therefore, multidisciplinary monitoring with the participation of a gastroenterologist, endocrinologist, dietitian and psychologist is of great importance. In modern clinics, nutritional psychology, physical rehabilitation and psychosocial support are being included as mandatory components in post-operative rehabilitation programs.

In our country, closed operations are more common - drainage of the sac of the pancreas, peritoneal perfusion, omentopancreatopexy, wrapping the anterior surface of the pancreas with a large bundle of gauze. Omentopancreatopexy allows to delimit the process, improve the blood supply to the pancreas, accelerate the healing of necrotic areas. This method should be used in small and large-focal single forms of fatty pancreatic necrosis.

large and total necrosis, early radical operations: sequestrectomy, necrectomy, gland resection, pancreatectomy are the most promising. The next two operations are more preferable in patients with rapidly progressing necrotic processes, in whom active complex treatment has not yielded results.

Sequestrectomy - removal of a necrotic part of the gland within the boundaries of the necrotic tissue - can be performed by a bypass, digitoclasm , and there is no bleeding.

Necrectomy – removal of the necrotic part of the gland at the border of the blood-supplying tissues – is performed acutely; the glandular tissue is cut along the border of necrosis and the bleeding vessels are sutured tightly.

Pancreatic resection is the removal of a part of the organ by a transverse cut along the border of the intact tissue of the gland, which may or may not be accompanied by splenectomy. Often, corpocaudal resection of the pancreas is performed in conjunction with removal of the spleen, since splenic vein thrombosis

is common in pancreatic necrosis, which usually occurs with retroperitoneal infiltration. In addition, the operation is complicated by the difficulty of separating the vascular pedicle from the glandular tissue while preserving the spleen.

In radical operations, drainage of the surface of the pancreas and the abdominal cavity is of particular importance. The experience of many scientists shows that the outcome of the operation largely depends on good evacuation of exudate and constant washing of the operated area. The most convenient placement of drains in the abdominal cavity after pancreatic resection was proposed by VS Zemskov.

first successfully used in the former Soviet Union by AA Shalimov (1979) in patients with total pancreatic necrosis with destruction of the duodenal wall .

4.2. Prevention of pancreatitis

is an inflammation of the pancreas , and its prevention includes primary and secondary measures. The main goal of prevention is to prevent the disease, reduce the likelihood of relapse , and prevent the development of complications.

1. Primary prevention (prevention of disease)

Healthy eating: It is necessary to form a proper diet, limiting fatty, fried, spicy and spicy foods. Meals should be taken 4-5 times a day, in small portions. It is important to give preference to plant fibers, fresh vegetables and fruits, steamed or boiled products in the diet, as well as limit fast food, carbonated drinks and trans fats. Eating more easily digestible foods rich in proteins and vitamins strengthens the body's immunity and relieves the work of the pancreas. In addition, it is useful to include fish products rich in omega-3 fatty acids , probiotics (yogurt, kefir) and products rich in antioxidants (greens, berries) in the diet. In clinical practice, such a nutritional approach is often combined with dietary tables, which reduces the secretory load of the pancreas. It is also important to control the glycemic index when creating a diet: limiting quickly digestible carbohydrates and increasing the consumption of complex carbohydrates reduces the risk of pancreatitis recurrence. It is also recommended to use vegetable oils in limited quantities in the diet, instead of animal fats. Steamed, rather than raw, versions of fruits and vegetables are considered easier on the pancreas. These methods are also recommended by international gastroenterology societies , and clinical observations show their effectiveness.

It is recommended to use salt in moderation and reduce excessive sugar consumption. From a preventive point of view, it is also useful to control the calorie balance in the daily diet of patients, to include products rich in microelements such as vitamin D, magnesium and zinc. At the same time, the recommendations of international gastroenterology associations note the importance of including calcium and B vitamins in the diet. Also, international clinical guidelines emphasize diet therapy as a key part of pancreatitis prevention. In practice, diet therapy helps to maintain long-term remission and reduces the frequency of relapses. Clinical trials in this regard have shown that the frequency of relapses is 2–3 times lower in patients who adhere to the diet . Therefore, it is necessary to regularly monitor the diet not only under the supervision of a doctor, but also by the patients themselves through special educational programs. In addition, the widespread introduction of preventive

measures in the media, schools and polyclinics is also important in forming a culture of healthy eating.

In this regard, not only the qualitative but also the quantitative aspects of nutrition are important: a diet adjusted to daily energy expenditure, maintaining a balance of protein/fat/carbohydrate ratios, and regular drinking water consumption (1.5–2 liters) are of great importance for the body. Clinical observations show that in patients who adhere to a proper diet, the rate of pancreatitis recurrence is reduced by up to 50%. In addition, the inclusion of antioxidant supplements (vitamins C, E), polyphenols , and plant bioflavonoids in the diet is also useful. Scientific literature has shown that these substances reduce oxidative stress in pancreatic cells and protect tissues from free radical damage. At the same time, it is also recommended to include additional sources of microelements such as selenium, zinc, and coenzyme Q10 in the diet. In this way, a healthy diet is considered not only the main, but also a comprehensive strategic measure in the prevention of pancreatitis. This comprehensive approach is also reflected in international clinical protocols , and it is recognized in practice as one of the most effective methods for maintaining long-term remission.

Avoid alcohol: Since alcohol is one of the main causes of pancreatitis, it is important to completely ban it. Alcohol has a toxic effect on pancreatic cells , leading to premature activation of enzymes, which destroys the tissues of the gland. Therefore, one of the most effective preventive measures is to completely abandon alcohol. At the same time, for long-term prevention, it is recommended to consume healthy drinks (for example, mineral water, fruit juices, herbal teas, cocktails based on dairy products) instead of alcohol. Public health promotion, social advertising and public education are also useful. According to studies, the risk of pancreatitis in people who abstain from alcohol is reduced by up to 60%, and long-term remission periods are extended by 2–3 times. According to epidemiological data , reducing the population's alcohol consumption by 10% reduces the incidence of pancreatitis by 5–7%. Clinical observations also show that the risk of developing other

gastrointestinal diseases is also dramatically reduced in patients who stop drinking alcohol.

Quit smoking: Nicotine and other toxic substances in tobacco have a negative effect on the pancreas, significantly increasing the risk of pancreatitis. Smoking leads to a lack of oxygen in the blood, spasm of blood vessels, and impaired blood supply to the pancreas. Therefore, scientific studies have confirmed that the frequency of relapses of the disease in patients who quit smoking is sharply reduced. Clinical and practical observations show that severe attacks of pancreatitis are reduced by 40–50% in those who quit smoking. Therefore, group psychological support, nicotine replacement therapy, special programs , and training on a healthy lifestyle are effective. According to the World Health Organization, quitting smoking reduces the risk of pancreatitis by 2 times, and long-term remission is prolonged by 1.5–2 times .

Healthy lifestyle: Being overweight and being physically inactive can lead to pancreatic diseases. Therefore, regular physical exercise (for example, walking, swimming, light gymnastics, yoga, Pilates, breathing exercises) is beneficial. Weight control helps prevent metabolic disorders and reduces risk factors such as diabetes and hyperlipidemia. 30–40 minutes of daily physical activity may be sufficient. According to statistics , people who exercise at moderate intensity for 150 minutes a week have a 35% lower risk of pancreatic diseases. In addition, physical exercise not only increases the overall tone of the body, but also provides psycho-emotional stability, reduces stress hormones and strengthens immunity. Scientific studies have shown that in patients who exercise regularly at least 3–4 times a week, the frequency of pancreatitis recurrences is reduced by 30–40%. A healthy lifestyle also includes proper organization of the daily routine, quality sleep (7–8 hours), giving up harmful habits, and maintaining a balance between work and rest. As a preventive approach, social sports events, health marathons, and team training also play an important role in motivating patients.

Treatment of gastrointestinal diseases: Timely detection and treatment of diseases such as gallstones, gastritis, duodenitis, hepatitis prevents pancreatitis. At

the same time, control of biliary pathologies, which are one of the main risk factors for the development of pancreatitis, is of particular importance. Also, early detection and treatment of parasitic infections (giardiasis, opisthorchiasis, strongyloidiasis, amebiasis) is important in preventing pancreatitis. Sanitation of chronic infectious foci, monitoring liver function are also important parts of general prevention. Also, the use of probiotics and prebiotics to restore the balance of intestinal microbiota, and enrichment of the diet with fiber products are useful. Some clinical studies have shown that probiotic and synbiotic complexes prolong remission in patients with pancreatitis. Epidemiological observations show that early surgical removal of gallstones reduces the risk of pancreatitis recurrence by up to 40%.

In clinical practice, treatment of parasitic liver infections, use of hepatoprotective agents, control of viral hepatitis, and maintenance of normal secretion of digestive enzymes are also recommended as effective approaches to prevent the development of pancreatitis. Also, improving sanitary and hygienic culture among the population, improving the quality of drinking water, and early diagnosis of infectious diseases are also recommended as general preventive measures.

2. Secondary prevention (prevention of recurrence)

Strict adherence to the diet: Patients with chronic pancreatitis should strictly monitor their diet. It is recommended to eat food frequently, in small portions . Fat and fried foods are strictly limited in the diet, it is important to include a moderate amount of protein and complex carbohydrates. Eating according to diet table No. 5p is a key factor in preventing pancreatitis from recurring. It is also recommended to drink plenty of fluids, avoid carbonated drinks, and give preference to probiotic products in the diet. Scientific studies have shown that the frequency of recurrences in patients who follow this diet is reduced by 2–3 times. Clinical guidelines also note that strict dietary control reduces the risk of severe attacks in patients, stops the development of complications, and improves the overall quality of life. It is also recommended to maintain a calorie balance in the diet, adjusted to

daily energy expenditure, take into account individual intolerances, and draw up an individual nutrition program under the supervision of a dietitian. According to the World Health Organization, personalized diet therapy has been shown to be 40–60% effective in preventing pancreatitis recurrence. In addition, adherence to the diet also helps to normalize the intestinal microbiota, strengthen immunity, and improve the patient's psycho-emotional state.

At the same time, enriching the diet with vitamins and microelements, taking into account individual intolerance and drawing up an individual nutrition program adapted to the patient's metabolic characteristics is also effective. In clinical practice, it has been observed that patients under the supervision of a dietitian achieve long-term remission. Strict adherence to the diet helps to reduce complications associated with pancreatitis, in particular steatorrhea and malabsorption syndrome. In addition, international studies have shown that diet therapy and microelement supplements (for example, zinc, selenium, coenzyme Q10) improve the clinical indicators of patients. Personalized diet programs not only relieve pancreatic function, but also restore intestinal microbiota, strengthen immunity and help improve the quality of life of patients. Scientific observations have also noted a significant decrease in the frequency of relapses of pancreatitis under complex supervision in collaboration with a dietitian and a gastroenterologist.

Controlled medication: Medications that can damage the pancreas (for example, some antibiotics, diuretics, corticosteroids, cytostatics, immunosuppressants) should not be taken without medical supervision. Also, taking medications on time and in the prescribed doses, strictly following the doctor's instructions, significantly reduces the recurrence of pancreatitis. Clinical observations show that irregular or uncontrolled use of medications increases the risk of severe pancreatitis and recurrence by 2–3 times. Therefore, it is important to develop an individual drug therapy plan for each patient, assess the interaction of the drugs used, and regularly monitor the patient's laboratory parameters. In practice, it has been noted that the frequency of complications is significantly reduced in

patients who use medications under supervision, and the periods of remission are longer.

Monitoring and dispensary control: Patients with chronic pancreatitis should be under regular supervision by a gastroenterologist. It is important to undergo laboratory and instrumental examinations, ultrasound and MRI control every 6–12 months. It is also recommended to use additional methods such as CT, endoscopic ultrasound or ERCP, if necessary. Regular monitoring of blood biochemistry, enzymes (amylase, lipase), glucose levels helps in assessing the clinical course of pancreatitis. Early diagnosis and regular monitoring reduce the development of complications of pancreatitis. Scientific observations show that in patients under dispensary control, severe complications are 30–40% less common, and remission periods are longer.

Prevention of complications: In the event of diseases of the gallbladder, liver, intestines , their timely detection and treatment significantly reduces the severity of pancreatitis. Also, if there is a deficiency of digestive enzymes, it is recommended to use substitution enzyme therapy. This relieves pancreatic secretion, prevents malabsorption syndrome and steatorrhea, and ensures the patient's full utilization of nutrients. Clinical experience shows that early enzyme therapy reduces the development of severe complications, including cachexia, hypovitaminosis, and osteopenia in the bones. Also, early detection and treatment of complications that can develop against the background of pancreatitis, such as diabetes, portal hypertension, and pancreatic cysts, is an integral part of prevention. Long-term follow-up has shown that a comprehensive approach aimed at preventing complications improves the quality of life of patients, preserves working capacity, and prolongs periods of remission.

Stress management: Stress hormones can disrupt pancreatic function, so psycho-emotional hygiene is also important. Meditation, yoga, psychotherapy, autogenic training, breathing techniques, and relaxation techniques are effective for reducing stress. Music therapy, art therapy, group psychological training, walking in nature, playing sports , and participating in social activities also give good results.

Clinical studies have shown that the frequency of pancreatitis relapses in patients who receive psychological support is reduced by 20–30%. Stress management exercises improve overall quality of life, normalize sleep hygiene, reduce depression and anxiety, and increase patient adherence to treatment. Also, special training in psychological support programs and rehabilitation centers is of great importance in maintaining long-term remission.

3. General recommendations

Regular medical check- ups: at least 1–2 times a year, a gastroenterologist, therapist, and other specialists are important in detecting early signs of pancreatitis. If necessary , it is recommended to use more in-depth examinations such as endoscopic ultrasound, CT, or MRI.

Strict adherence to the recommendations of the “diet table No. 5p” (Pevzner diet) in nutrition: this diet involves limiting fats, maintaining a balance of proteins and carbohydrates, and avoiding gassy and spicy foods. Clinical studies have confirmed the prolongation of remission periods in patients who follow this diet. Also, following the diet improves the intestinal microbiota, strengthens immunity, and ensures overall metabolic balance.

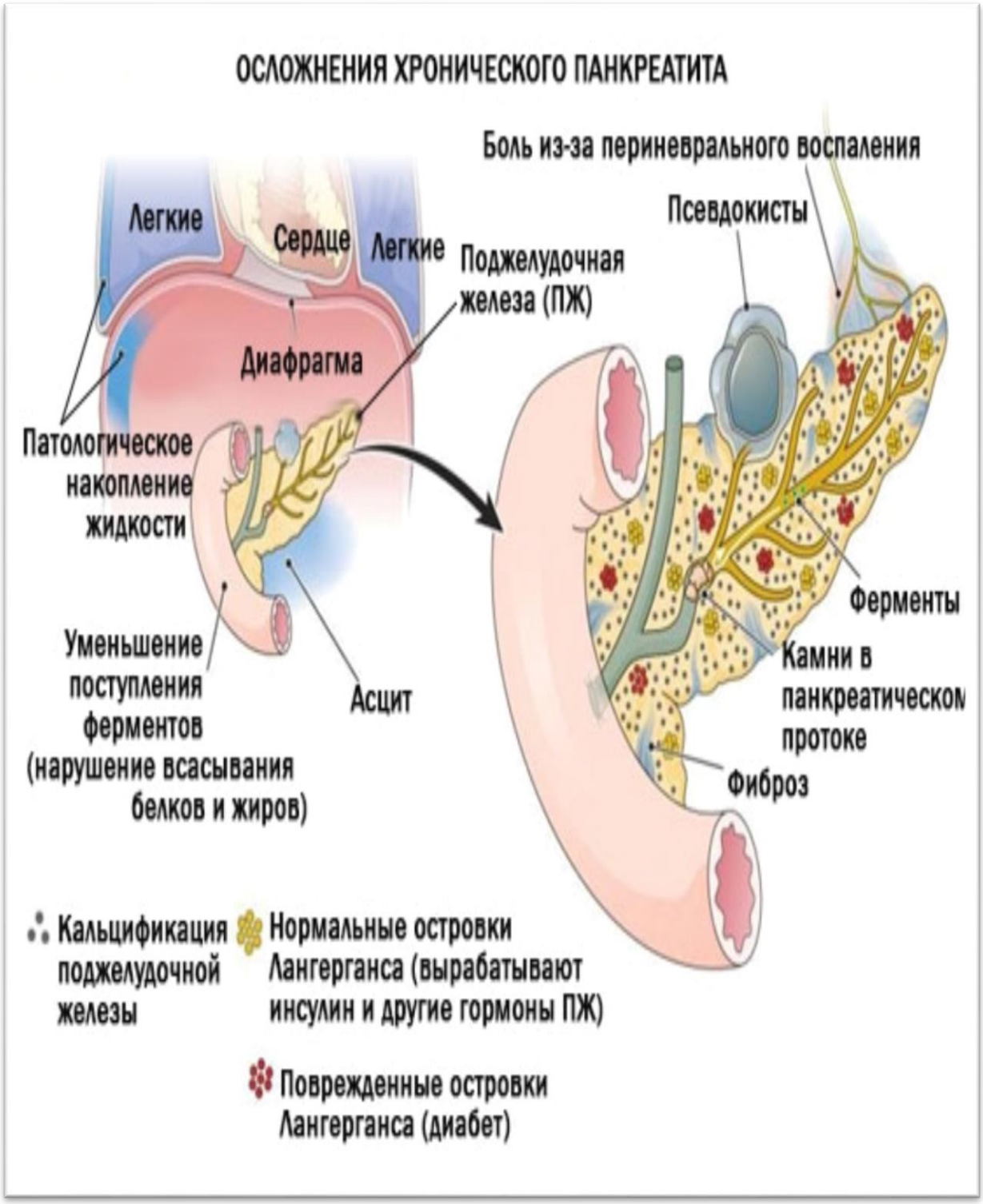
Giving up bad habits and adopting a healthy lifestyle: complete abstinence from smoking and alcohol, regular physical activity, quality sleep, stress reduction, and psychological hygiene are key factors in the prevention of pancreatitis. Scientific observations show that the risk of pancreatitis recurrence in patients who adopt a healthy lifestyle is reduced by 40–50%.

4.3. Complications of acute and chronic pancreatitis

Complications of acute and chronic pancreatitis are very extensive, and their development directly depends on many factors - the severity of the disease, its duration, the patient's age, gender, genetic predisposition, eating habits, lifestyle, environmental factors (for example, air pollution, alcohol and tobacco consumption), occupational exposure (work with chemicals, radiation factors), concomitant diseases (diabetes, obesity, hepatobiliary pathologies, cardiovascular

diseases, chronic infections, weakened immune system, endocrine disorders), the level of psychological stress, the availability of social support and genetic characteristics, as well as the timely, regular, continuous and effective implementation of treatment. Together, these factors determine the severity and course of complications, and also affect the patient's quality of life and long-term prognosis.

At the same time, the patient's socio-economic conditions, adherence to a healthy lifestyle, proper nutrition, giving up harmful habits (alcohol and tobacco), and regular medical supervision also have a significant impact on the development of complications. Also important are the level of physical activity, stress management skills , a healthy sleep pattern, and the availability of psychological support. In addition, the development of social support networks, family environment, economic opportunities for healthy nutrition, and the level of regular medical care also contribute to the reduction of complications. Promoting a healthy lifestyle among the population, regular dispensary observation of patients, involvement in rehabilitation programs, psychological support, involvement of family members in disease prevention, and implementation of comprehensive health programs are of particular importance in this process.



Although complications vary , they all have a significant negative impact on the patient's quality of life, physical performance, and psychological stability. Clinical observations show that complications occur in 60–70% of cases of severe pancreatitis, and some international studies have reported that this figure can reach 75%. For example, in studies conducted in European countries, sepsis or multi-organ failure developed in more than 40% of patients with acute necrotizing pancreatitis .

Other clinical studies have shown that these indicators can increase mortality by 20–30%. Therefore, early diagnosis of these complications and timely initiation of intensive treatment measures are crucial in reducing the consequences of the disease.

according to annual statistics , 20% of patients with acute pancreatitis develop severe infectious complications, and 15% develop hemorrhagic disorders. In chronic forms, more than a third of patients develop complex complications, which can lead to long-term disability. Clinical observations show that 10–12% of patients with chronic pancreatitis eventually develop pancreatic cancer, and 30–40% develop severe endocrine and digestive disorders.

and in-depth study of these complications is of great importance in clinical practice for their early detection, the use of effective preventive measures, the selection of individual treatment strategies and the development of complex rehabilitation methods. In addition, studying the pathogenesis of complications, their analysis at the molecular and genetic levels will also allow the creation of new drugs and treatment methods in the future. Therefore, it is necessary to expand fundamental scientific research along with clinical practice.

Below, the main groups of complications, their clinical manifestations , diagnostic methods, treatment and rehabilitation approaches are described in detail. According to statistics , 20–25% of patients hospitalized with acute pancreatitis develop severe complications, and in some severe cases this figure reaches 30%. In cases of chronic pancreatitis, various complications are detected in about 40–50% of patients observed for 7–10 years, and in long-term follow-up this figure can increase to 60%. For example, epidemiological studies conducted in Germany and the USA show that 12–15% of patients with chronic pancreatitis eventually develop pancreatic cancer. Also, clinical observations conducted in Japan and Russia have shown that 35–40% of patients with chronic pancreatitis have endocrine disorders, and 25% have severe digestive insufficiency.

Therefore, an in-depth study of complications is of great social and economic importance not only for clinical, but also for the health system. According to the World Health Organization (WHO), complications of pancreatitis cause up to 30%

of work disability in developed countries. In the USA, more than 250 thousand patients are diagnosed with pancreatitis every year , and 20–25% of them have severe complications. According to statistical observations conducted in the UK , complications of pancreatitis bring additional costs to the health system of more than 150 million pounds sterling per year. In Uzbekistan and Central Asian countries, complete statistical data on this disease are insufficient, but clinical observations show that complications of pancreatitis have been increasing in recent years.

health economic analyses conducted in European countries show that complications associated with pancreatitis lead to hundreds of thousands of lost working days each year, reduced productivity and a significant financial burden on the health system. For example, in Germany, direct medical costs associated with complications of pancreatitis are more than 200 million euros per year. In France, these costs average 120 million euros per year, and in Italy they are more than 100 million euros. Also, in the Scandinavian countries (Sweden, Norway, Denmark), economic losses are mainly manifested in the form of loss of working capacity and disability benefits , and the additional burden on the health system exceeds 80 million euros per year.

1. Complications of acute pancreatitis

Complications of acute pancreatitis play a very important role in clinical practice and are directly related to the general condition of the patient, the course of the disease and the timely initiation of treatment. Since these complications can be life-threatening in a short period of time, every doctor should be familiar with them. Their types and clinical signs are discussed in more detail below.

Local complications: pancreatic necrosis (death of pancreatic tissue), abscess (formation of purulent foci), pseudocyst (false cysts), peripancreatic infiltrate and peritonitis. These conditions are often accompanied by severe pain, fever, intoxication and accumulation of pus in the abdominal cavity. Sometimes pancreatic necrosis can be sterile , but if not treated in time, a purulent-necrotic process occurs due to the addition of a secondary infection. Pancreatic abscess

usually develops at a late stage and requires surgical intervention. Pseudocysts, on the other hand, form 4–6 weeks after pancreatitis and, when enlarged, can put pressure on neighboring organs, rupture or become infected.

Peripancreatic infiltrate is manifested by significant abdominal pain, high fever, and leukocytosis in laboratory parameters. This process usually occurs 7–10 days after the onset of pancreatitis and can be detected by palpation in the abdominal cavity as a dense mass. Clinically, patients have severe pain , flatulence, loss of appetite, and general weakness.

Diagnostics uses ultrasound, CT, MRI , and , if necessary, endoscopic ultrasound to determine the size, structure, composition of the infiltrate, and the level of pressure on adjacent organs. Laboratory tests can detect inflammatory markers (CRP, procalcitonin) and changes in blood composition. Treatment is usually conservative and consists of infusion therapy, broad-spectrum antibiotics, analgesics and anti-inflammatory drugs, bed rest, and dietary restrictions. When the patient's condition worsens , parenteral nutrition is also used. If the infiltrate becomes purulent, rapidly increases in size, or exerts pressure on adjacent organs, surgical or endoscopic drainage interventions are required. In recent years, minimally invasive methods (laparoscopic or percutaneous drainage) have been widely used, which accelerate the patient's recovery and reduce the risk of complications.

Each of these complications is severe and requires timely diagnosis and complex treatment measures. Each of the local complications requires complex diagnostic and treatment approaches: for example, CT, MRI or endoscopic ultrasound is used to confirm necrosis, and abscesses require drainage and antibiotic therapy.

requiring endoscopic drainage or surgical removal . When the peripancreatic infiltrate becomes purulent, the risk of sepsis increases and requires prompt intensive care. Therefore, early detection of local complications and their complete treatment are the main conditions for saving life in acute pancreatitis. In addition, regular clinical monitoring, modern instrumental diagnostics and a multidisciplinary

approach (collaboration of a surgeon, gastroenterologist, radiologist) increase the patient's chances of recovery.

Hemorrhagic complications: internal bleeding, gastrointestinal bleeding, hemoperitoneum (bleeding into the abdominal cavity), retroperitoneal hematoma, and even rupture of a splenic artery aneurysm may also occur. This complication develops as a result of the erosion of blood vessels located in or around the pancreas and is often life-threatening.

Clinical signs include abdominal pain , vomiting blood (hematemesis), blood in the stool (melena or hematochezia), pale skin, tachycardia, low blood pressure, dizziness, and fainting. If not diagnosed promptly, there is a high risk of hemorrhagic shock and death . In some cases, the patient may have an enlarged abdomen due to blood accumulation in the abdominal cavity , with painful masses felt on palpation.

Ultrasound, CT, MRI, angiography, and laboratory tests are important in diagnosis. Endoscopic examinations (EGD) also help to identify the source of gastrointestinal bleeding. Laboratory tests may reveal a sharp decrease in hemoglobin and hematocrit, thrombocytopenia, and coagulation disorders.

Treatment requires rapid resuscitation measures, blood and plasma transfusions, hemostatic therapy, endovascular embolization techniques, and often surgical intervention. In recent years, minimally invasive approaches, such as angiographic embolization or laparoscopic hemostasis, have been widely used. Invasive monitoring in the intensive care unit , frequent laboratory tests, and multidisciplinary team collaboration are also important in saving the lives of patients.

Therefore, early detection of hemorrhagic complications and immediate comprehensive treatment are crucial for saving the patient's life. According to statistical observations, the mortality rate of patients with acute pancreatitis with hemorrhagic complications reaches 30–40%. In clinical practice, it is recommended to use multiple laboratory monitoring, CT or MRI examinations, angiography and endoscopic methods for early diagnosis of these complications .

Treatment includes continuous monitoring in the intensive care unit , invasive hemodynamic control, regular transfusion of blood components, and, if necessary, surgical intervention. At the same time, international experience has confirmed the effectiveness of minimally invasive methods and endovascular embolization. Preventive measures include early control of severe pancreatitis , prevention of coagulopathies, and regular monitoring of patients by classifying them into high-risk groups.

Infectious complications: purulent peritonitis, sepsis, retroperitoneal phlegmon, infection of pancreatic abscesses and foci of necrosis, as well as pancreatogenic sepsis and infection of pancreatic fistulas. Infectious processes often occur as a result of the addition of microorganisms to necrotic tissues and worsen the general condition of the patient.

Clinically, high fever, chills, severe abdominal pain, leukocytosis, hemodynamic disturbances, and often intoxication syndrome are observed. Some patients may also experience fainting, a sharp drop in blood pressure, and respiratory failure. If not treated promptly, their development can lead to sepsis, multi- organ failure, and even death.

CT, MRI, UTT, microbiological tests, blood culture, puncture biopsy, as well as inflammatory markers such as procalcitonin and CRP are important in diagnostics. In some cases, endoscopic ultrasound or laparoscopic examination is also used. Treatment includes broad-spectrum antibiotics, infusion therapy, drainage of purulent foci, minimally invasive surgical procedures, immunomodulators and, if necessary, open surgery. In severe cases, resuscitation measures, intensive care and frequent laboratory monitoring are required.

Obstructive complications: compression of the common bile duct, cholestasis, mechanical jaundice, duodenal obstruction , and sphincter of Oddi dysfunction. As a result of compression of the bile ducts by pancreatic edema, cysts, or infiltrates, bile flow is impaired, resulting in jaundice, yellowing of the skin and sclera, itching, acholic feces, and dark urine. Obstructive jaundice in severe pancreatitis is often associated with pressure on neighboring organs by the infiltrate.

Clinically, patients experience nausea , loss of appetite, general weakness, and pain under the right rib.

Laboratory indicators include increased levels of bilirubin, liver enzymes, and cholestatic markers. Ultrasound, ERCP, CT, and MRI are important in diagnosis, and endoscopic ultrasound also increases diagnostic efficiency. Treatment includes conservative therapy (infusion, symptomatic), comprehensive medications, endoscopic stenting, percutaneous drainage, or, if necessary, surgical procedures. Untimely detection and In untreated cases, severe consequences such as chronic jaundice, liver cirrhosis, cholangitis, and cholangiocarcinoma may develop.

Systemic complications include acute respiratory distress syndrome (ARDS), renal failure, cardiovascular collapse, multi- organ failure, electrolyte imbalance, severe sepsis, and shock. In addition, hepatocellular failure (liver failure), disseminated intravascular coagulation (DIC), metabolic acidosis, lactic acidosis, brain edema, encephalopathy, and immune system failure may also occur. These complications develop in the most severe forms of pancreatitis and are associated with high mortality rates.

Clinically, ARDS is manifested by shortness of breath, hypoxemia, auscultatory changes in the chest, cyanosis, and oxygen dependence. According to statistical observations , death occurs in 35–50% of patients with acute pancreatitis with systemic complications. Therefore, in such cases, intensive care, constant resuscitation control , and a multidisciplinary approach are necessary.

Renal failure is characterized by decreased or absent diuresis, increased creatinine and urea levels, increased potassium (hyperkalemia), and acid-base imbalance. Clinically, the patient may also experience edema, changes in blood pressure, general weakness , and impaired consciousness. In severe cases, anuria, intoxication, and uremic encephalopathy develop.

Cardiovascular collapse is characterized by a sharp decrease in arterial pressure, tachycardia, fainting, and impaired peripheral circulation. Multi -organ failure is characterized by the simultaneous failure of several systems. Hepatocellular failure is characterized by yellowing of the skin, impaired blood

clotting , and signs of encephalopathy. DVT syndrome is characterized by hemorrhagic rashes, multiple bleeding sites, and impaired coagulation in laboratory parameters. These systemic complications require urgent resuscitation measures, extensive intensive care, and often artificial respiration, hemodialysis, plasmapheresis, or invasive monitoring.

The complications of chronic pancreatitis are multifaceted and are mainly associated with long-term inflammation and fibrosis of the pancreas. This process is accompanied by pathological mechanisms that lead to gradual changes in the parenchyma of the gland, a decrease in exocrine and endocrine activity, and atrophy. The most important of them are:

Steatorrhea and malabsorption: Due to insufficient breakdown of fats, the stool becomes fatty, bulky, foul-smelling, and floats in the water; protein and carbohydrates are also poorly absorbed. This condition leads to severe weight loss, muscle loss, dry skin , hair loss, brittle nails, and general fatigue in patients. Long-term steatorrhea increases the risk of electrolyte imbalance, dehydration, edema, hypovitaminosis , and metabolic disorders.

According to clinical observations, steatorrhea is observed in 30–50% of patients with chronic pancreatitis, and most of them require parenteral or enzyme therapy. Treatment includes pancreatic enzyme preparations, a low -fat diet, vitamin supplements, and regular gastroenterological monitoring. Prevention includes a healthy diet, restriction of fatty foods, and regular laboratory monitoring.

Vitamin and micronutrient deficiencies: Vitamin A, D, E, K deficiency is manifested by decreased vision, softening of bones and osteoporosis, hemorrhagic diathesis, and weakened immunity. In addition, dry skin, hair loss, and brittle nails are also observed. Vitamin B deficiency causes nervous system disorders, polyneuropathy, cognitive decline, anemia , and neuropathies. Iron, zinc , and magnesium deficiencies are common and disrupt blood formation, leading to chronic anemia, muscle weakness, fatigue, and increased susceptibility to infections.

In prolonged cases, fetal malformations may occur in pregnant women, and growth and development retardation in children. According to clinical studies,

varying degrees of vitamin and microelement deficiency are detected in 40–60% of patients with chronic pancreatitis. Treatment includes vitamin complexes, parenteral supplements, dietary compliance , and regular laboratory monitoring.

Pancreatogenic diabetes: Due to damage to the islets of Langerhans, insulin secretion decreases, glucose tolerance worsens. This diabetes is often insulin-dependent and is complicated by frequent episodes of hypoglycemia. Clinically, thirst, polyuria, weight loss, frequent attacks of ketoacidosis, decreased vision , and rapid fatigue are observed. In addition, a characteristic feature of pancreatogenic diabetes is that patients have a sharp change in glucose levels, high sensitivity to insulin, and frequent hypo- and hyperglycemic episodes. According to statistics , 30–50% of patients with chronic pancreatitis develop pancreatogenic diabetes over time.

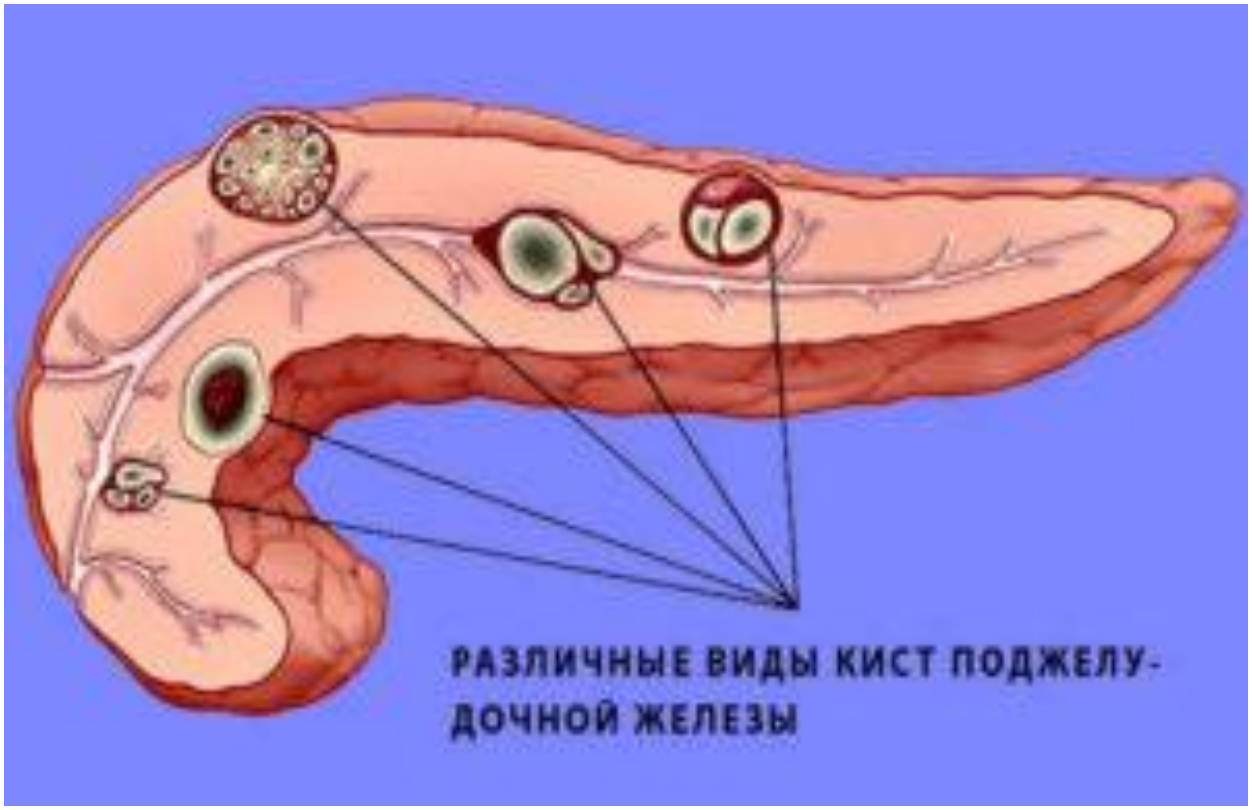
Some sources indicate that this figure can reach up to 60%. Insulin therapy plays a key role in treatment, as well as diet, proper planning of physical activity, regular endocrinological monitoring, and diabetes education programs for patients.

Pain syndrome: occurs as a result of damage to pancreatic nerve fibers, fibrosis, and increased pancreatic secretion pressure. Chronic pain constantly torments the patient, reduces work capacity, and leads to psychological depression. Pain is usually radiating back, radiating from the epigastric region to the back. Their intensification worsens the patient's sleep quality, can cause depression, anxiety, and even social isolation.

According to clinical observations , 70–80% of patients with chronic pancreatitis have varying degrees of pain syndrome, and in some international studies this figure reaches 85%. Treatment includes analgesics , antispasmodics, strict adherence to a diet, physiotherapy, psychological support, as well as endoscopic and surgical methods. In severe cases, the use of neuroblockade or opioid analgesics may be necessary.

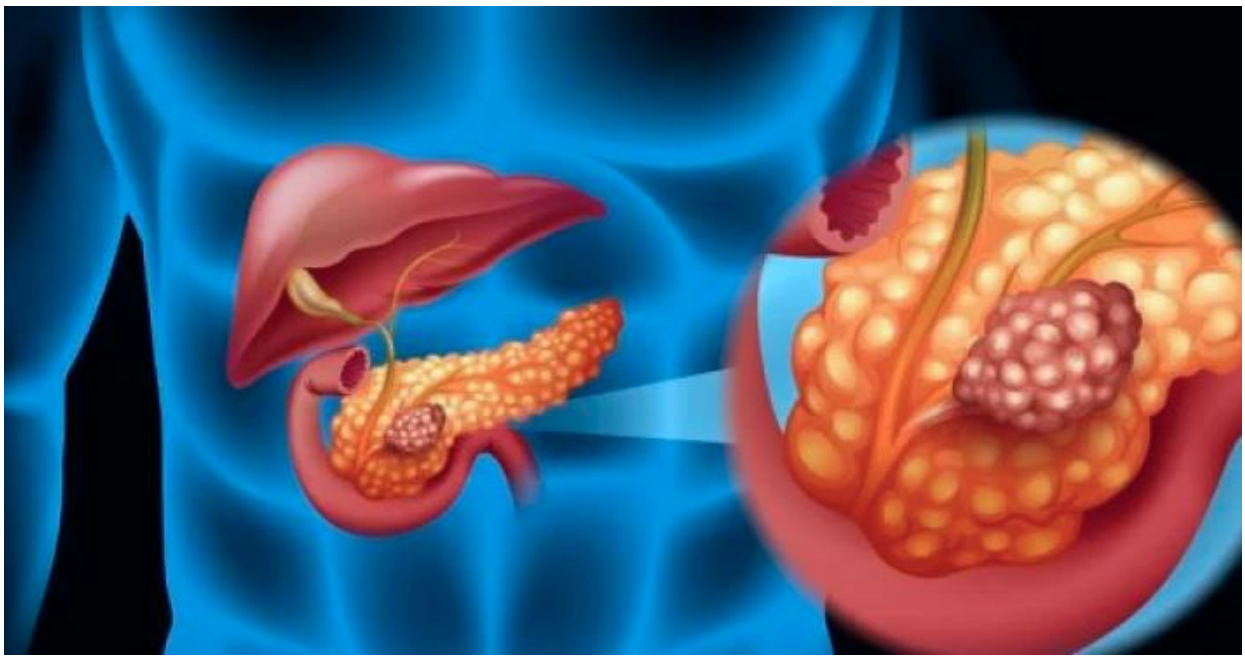
Pancreatic cysts and pseudocysts: when enlarged, they compress the bile ducts and duodenum, and if ruptured, they can cause peritonitis or internal bleeding. If the cysts become infected, an abscess may form . In some cases, they may regress

spontaneously, but large and symptomatic cysts may require endoscopic or surgical drainage.



Pseudocysts can also cause hemorrhagic complications by exerting prolonged pressure on blood vessels. Clinical observations have shown that pseudocyst formation occurs in 20–40% of patients with chronic pancreatitis.

According to statistics , 10–15% of large pseudocysts rupture, 5–7% develop infection and abscess formation, and 3–5% erode blood vessels and cause hemorrhagic complications. UTT, CT, MRI, and endoscopic ultrasound are important in diagnosis. Treatment methods include minimally invasive endoscopic drainage, percutaneous drainage , and , if necessary, open surgery.



Mechanical jaundice: occurs as a result of compression of the bile ducts, often accompanied by itching, yellowing of the skin and sclera, dark brown urine, and pale stools. The general condition of patients is characterized by loss of appetite, weight loss, fatigue , and sometimes fever. Laboratory parameters include a significant increase in bilirubin, liver enzymes, and cholestatic markers, and abnormalities in blood coagulation parameters may also be detected.

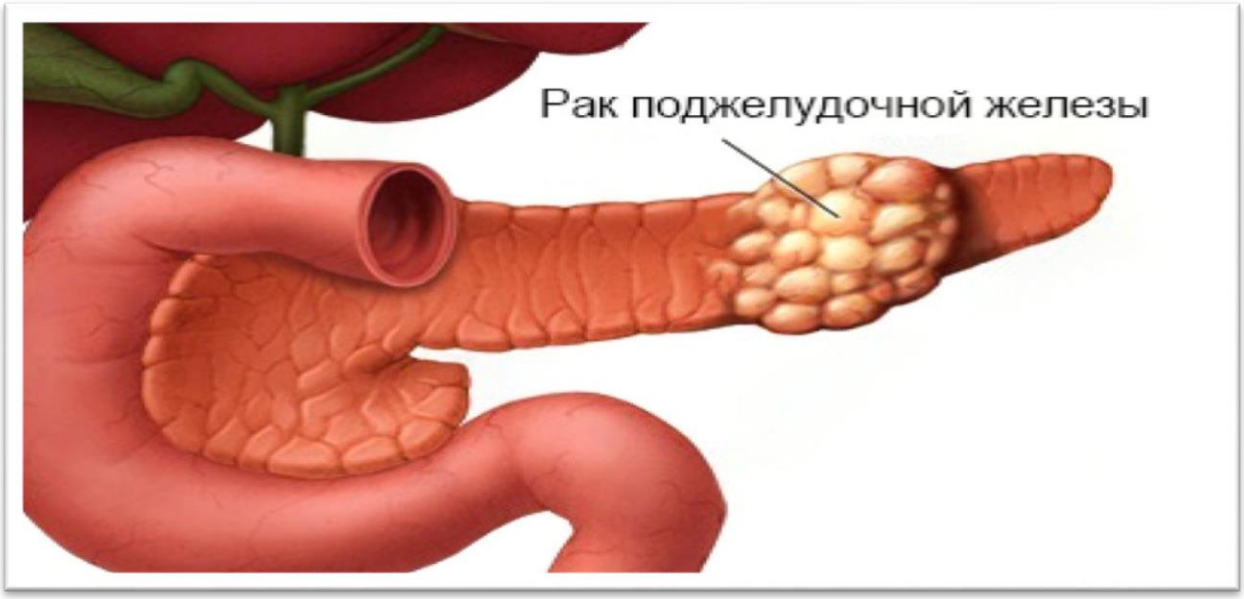
Prolonged mechanical jaundice can lead to severe complications such as cholangitis, liver cirrhosis, liver failure, and even cholangiocarcinoma. According to statistics , mechanical jaundice develops in 10–15% of patients with chronic pancreatitis. Ultrasound, CT, MRI , and ERCP play an important role in diagnostics, and in some cases endoscopic ultrasound and MR cholangiography are also used. Treatment includes endoscopic stenting, drainage, percutaneous methods, or, if necessary, surgical methods. For prevention, early treatment of chronic pancreatitis, regular monitoring , and timely examination of the biliary tract are necessary.

Fistulas: Pathological pathways are formed between the pancreatic ducts and other cavities, leading to persistent infection, drainage problems, and recurrent purulent inflammatory processes. Fistulas often increase the risk of long-term purulent discharge, accumulation of pus in the abdominal cavity , electrolyte

imbalance, chronic intoxication, and sepsis. In some cases, they develop into external fistulas through the skin , further worsening the patient's general condition and requiring surgical intervention.

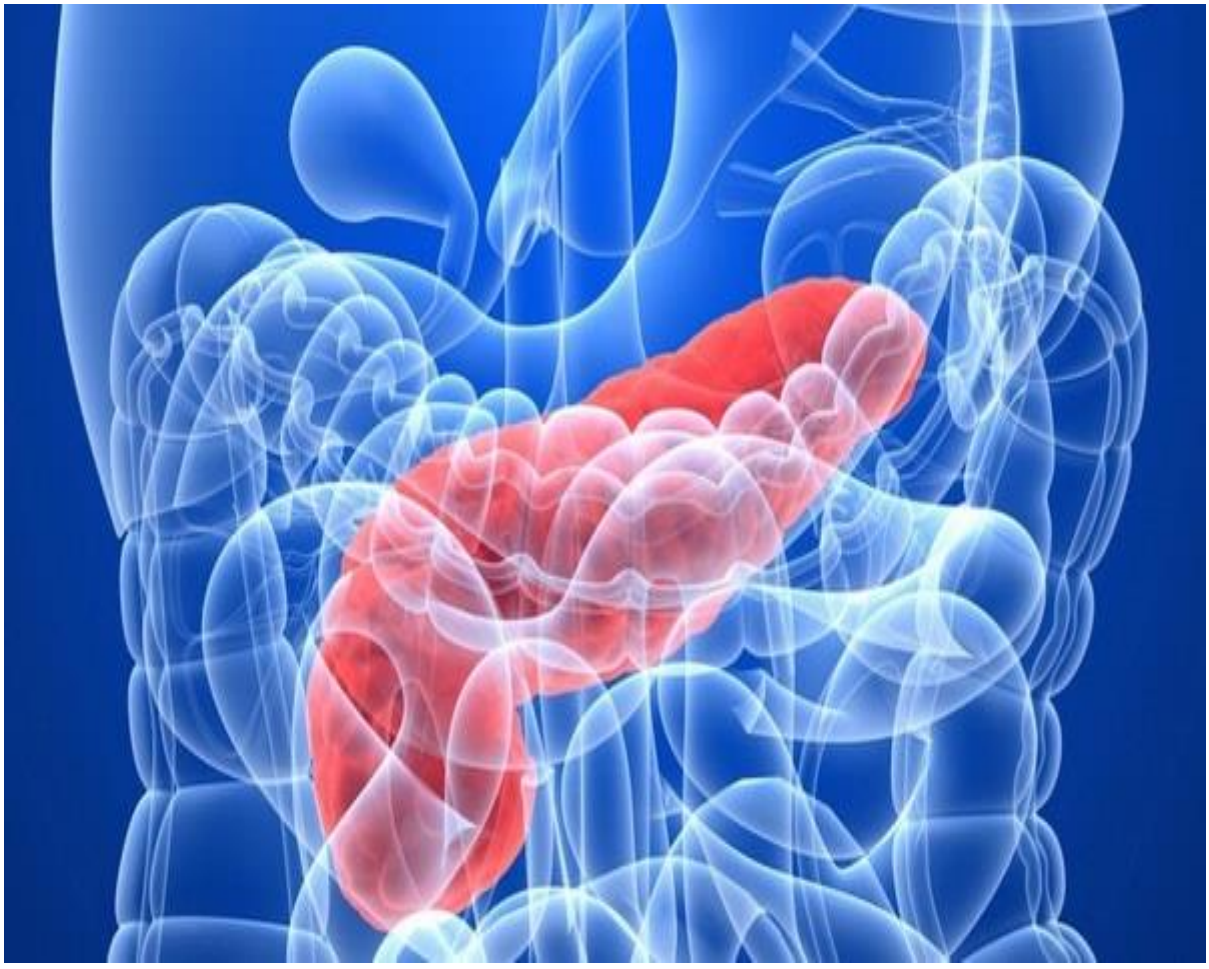
According to statistics , 5–10% of patients with chronic pancreatitis develop fistula complications. CT, MRI, fistulography and endoscopic examinations play an important role in diagnostics. Treatment can range from conservative therapy (antibiotics, electrolyte balance restoration, parenteral nutrition) to minimally invasive drainage or open surgical interventions. In severe cases, the patient is observed in the intensive care unit and a multidisciplinary approach is required.

Risk of malignancy: Against the background of long-standing chronic pancreatitis, the probability of developing pancreatic cancer increases to 10–12%, which indicates the need for regular oncological monitoring .



According to some international studies , malignancy was detected in 15% of patients who had been living with chronic pancreatitis for 20 years. Other statistics indicate that up to 20% of patients who had the disease for 25 years or more develop pancreatic cancer. Therefore, it is recommended that patients with chronic pancreatitis undergo regular examinations using modern instrumental methods such as CT, MRI or endoscopic ultrasound, as well as be monitored for tumor markers (CA 19-9, etc.).

Each of these complications reduces the patient's quality of life, leads to long-term disability , and sometimes poses a threat to life. Also, their presence significantly limits the patient's psychological state, social adaptation, and working capacity. Therefore, their early detection, prevention, strict adherence to a diet, pharmacotherapy, constant monitoring with modern instrumental methods, and multidisciplinary treatment approaches are of great importance. In addition, involving patients in a healthy lifestyle, rehabilitation programs, and psychological support also play an important role in reducing the consequences of the disease.



Conclusion

Complications of chronic pancreatitis are severe clinical consequences of the disease, which have a profound negative impact not only on morphological and functional disorders of the pancreas, but also on the general metabolic processes of the whole organism, the protective mechanisms of the immune system, endocrine functions, cardiovascular system, respiratory and renal function, the stability of the nervous system, psychological well-being, working capacity and social activity, as well as the psycho-emotional state of the patient.

Complications manifest themselves in various forms, reduce the patient's quality of life, increase the level of disability, and sometimes even cause the risk of death. At the same time, they impose an economic burden on the healthcare system, negatively affect the socio-economic situation of families, and limit the ability of patients to work. Therefore, their early diagnosis, timely treatment, and preventive measures are of great importance not only for ensuring the health of individual patients, but also for the effectiveness of the entire healthcare system. In this process, state healthcare policy, scientific research, the implementation of international experience, and continuous professional development of specialists are of great importance.

In addition, international experience shows that regular dispensary surveillance, modern instrumental examinations, monitoring based on genetic and biochemical markers, individual rehabilitation programs, a multidisciplinary approach, psychological support, dietary education, and teaching patients a healthy lifestyle play an important role in reducing the consequences of chronic pancreatitis.

In conclusion, chronic pancreatitis is a complex disease that causes not only a medical problem, but also social and economic problems. To reduce its consequences, a comprehensive approach, support at the state and community levels, strengthening preventive programs, regular monitoring of patients, and the implementation of international experience are of particular importance.

Recommendations

1. In clinical practice, patients with chronic pancreatitis should be regularly monitored by a gastroenterologist, endocrinologist, surgeon, dietitian, and, if necessary, a psychologist and oncologist. Their diagnostic cards, laboratory and instrumental examination results, and treatment plan should be regularly updated.

2. Practical dietary recommendations: avoid fatty, fried, spicy foods and alcoholic beverages, eat a diet rich in easily digestible proteins and complex carbohydrates, create individual nutrition programs, regularly take vitamin and micronutrient supplements, maintain fluid balance, and adhere to dietary psychology.

3. pain syndrome, along with analgesics, antispasmodics, and neuroblockades, physiotherapy, acupuncture, psychological support, and stress management programs are important.

4. at risk of malignancy should be monitored with oncomarkers such as CA 19-9, genetic screening, immunohistochemical markers, and, if necessary, ERCP, endoscopic biopsy, CT, and MRI examinations.

5. During the rehabilitation phase, patients are advised to gradually increase physical activity, manage stress, develop a healthy lifestyle, undergo a specific exercise program, dietary counseling, psychotherapy, and group rehabilitation programs.

6. Based on clinical protocols, antibiotic therapy, infusion therapy, immunomodulators, probiotics, antioxidants , and other treatment methods must be implemented with an individual approach.

7. and implementing modern drugs, it is possible to reduce the consequences of chronic pancreatitis, improve the quality of life of patients, and ensure their social adaptation.

Important issues

Situational issue 1.

History: 42-year-old man, 2 days of sudden onset of severe pain in the epigastric region, radiating to the back, complaints of vomiting and nausea. Regularly consumes alcohol for 15 years. In recent years, frequent abdominal distension, feeling of heaviness after meals have also been observed. **Clinic:** Severe pain in the epigastrium, flatulence, protective muscle tension on palpation in the upper abdomen. Temperature 38°C, heart rate 110/min. **Laboratory:** Blood amylase 4x↑, lipase 6x↑, LPK 15×10⁹/L, high CRP, glucose 11 mmol/L. Hematocrit is elevated, diuresis is slightly reduced. **Instrumental:** UTT – pancreas is swollen, uneven contours, peripancreatic exudate. No signs of necrosis are seen on CT . **Additional:** 3 positive criteria according to Ranson criteria , BISAP score 2 points. **Questions:** Determine the diagnosis. How to assess the severity ? What additional laboratory and instrumental examinations are necessary? Describe the initial treatment step by step.

Answer: Acute alcoholic pancreatitis. Severity is determined by Ranson or BISAP scales; glucose, LDG, AST, hematocrit, diuresis and organ dysfunction are monitored. Additional CT with contrast, arterial blood gases, electrolyte monitoring are important. Treatment: NPO, fluid resuscitation (Ringer lactate), pain control with strong analgesics, PPI, oxygen therapy, glucose control, antibiotics only if infection is present. If necessary, admission to the intensive care unit.

2-situational issue.

History: A 28-year-old woman, 36 weeks pregnant. Over the past 24 hours, she has had severe pain in the epigastrium and under the left rib cage, vomiting, and shortness of breath. She has also had dyspeptic complaints after fatty meals in recent weeks .

Clinic: AB 90/60, pulse 120/min, general condition is severe , skin is pale, diffuse pain on abdominal palpation, flatulence. Fetal heart rate is accelerated.
Laboratory: Amylase 3x↑, lipase 5x↑, glucose 12 mmol/L, LPK 14×10^9/L, CRP is high. Electrolytes – Na+ is slightly low, Ca2+ is reduced.
Instrumental: UTT – enlarged head of pancreas, uneven contours, peripancreatic free fluid. Fetal condition is monitored on UTT, uterine contractility is not increased.
Additional: CT is contraindicated, but MRI can be used if necessary .
Questions: Diagnosis? What are the restrictions during pregnancy? What additional laboratory and instrumental examinations are needed? In what stages is the treatment tactic carried out?

Answer: Acute pancreatitis in pregnancy. Radiological CT and antibiotics harmful to the fetus are contraindicated; when choosing drugs, drugs that are safe for the fetus are used. Additional laboratory tests - arterial blood gases, electrolytes, liver tests. Treatment: fluid resuscitation (Ringer lactate), oxygen, analgesia (non-fetal opioid/NSAID), parenteral nutrition, continuous fetal and maternal monitoring. If necessary, preterm labor is considered on the basis of a multidisciplinary consultation.

3-situational issue.

History: A 50-year-old patient presented with complaints of yellowing of the skin and sclera, itching, dark urine, and pale stools over the past few weeks. There is pain in the epigastric region and under the right rib. He had a history of gallstones.

Clinic: Clear jaundice of the skin and sclera, itching of the skin, pain under the right rib, slightly enlarged liver on palpation. General condition is moderately severe .

Laboratory: Bilirubin 180 μmol/L, high ALP and GGT, amylase 2x↑, slightly elevated AST and ALT. Mild leukocytosis in blood formation. **Instrumental:** ERCP - 1 cm stone in the common bile duct, dilation in the distal part, the pancreatic duct is also slightly dilated. Elongated bile ducts visible on UTT. **Additional:** Additional examination using CT and MRCP may be performed. **Questions:** What is the predominant etiology of pancreatitis? What complications can be expected? What is the treatment strategy?

Answer: Biliary pancreatitis is associated with a stone in the bile duct. Complications include cholecystitis, choledocholithiasis, and pancreatic duct obstruction. Treatment: ERCP stone removal, restoration of bile duct patency, followed by cholecystectomy. Conservative measures: infusion, analgesia, antibiotics (if necessary), PPIs, diet.

4-situational issue.

History: A 35-year-old man, diagnosed with acute pancreatitis, was treated for 1 week , his condition was stable in the first days, but in the last 48 hours he developed high fever, abdominal pain, and deterioration of general condition. **Clinical features:** T 39°C, tachycardia 120/min, slightly low blood pressure, protective tension in the abdominal wall, palpation of infiltrate in the epigastrium and left subcostal area. Signs of sepsis - chills, pallor of the skin .

Laboratory: LPK 20×10^9/L, CRP >200, high procalcitonin, elevated glucose , decreased potassium. Bacteria were isolated in blood culture. **Instrumental:** CT – areas of necrosis in the pancreas, peripancreatic fluid accumulation, gas bubbles (infected necrosis). **Additional:** Ranson score 5 points, MODS signs are observed. **Questions:** What complication has occurred? How is the risk of sepsis assessed? What additional examinations are needed? What treatment steps should be performed?

Answer: Infected pancreatic necrosis. High risk of sepsis, organ dysfunction is assessed by SOFA score. Additional examinations: blood culture, CT with contrast,

ABG, electrolytes. Treatment: broad-spectrum antibiotics (carbapenem), intensive resuscitation measures, minimally invasive drainage (percutaneous or endoscopic), if necessary , open or laparoscopic necrotectomy.

5-situational issue.

History: A 27-year-old woman presented with complaints of epigastric and left subcostal pain after meals , flatulence, and nausea for 2 years. Over the past year, she has lost 12 kg of weight, her general condition has deteriorated, and she is experiencing rapid fatigue.

Clinical: Steatorrhea (oily stool), hypotrophy, dry skin and hair, brittle nails. Significant epigastric pain on palpation .

Laboratory: Low fecal elastase, glucose 9 mmol/L, HbA1c 7.8%. Lipidogram shows high triglycerides. Low vitamin D and B12 levels.

Instrumental: CT – elements of fibrosis and calcification in the pancreas , uneven expansion in the duct system. MRCP clearly shows duct stricture .

Additional: Exocrine enzyme deficiency is confirmed along with signs of endocrine insufficiency.

Questions: Make a diagnosis. What is the main pathogenesis of chronic pancreatitis? What additional tests should be performed? What are the treatment options?

Answer: Chronic pancreatitis, with exocrine and endocrine insufficiency. Pathogenesis: fibrosis against the background of repeated inflammation, stricture in the duct system, decreased exocrine enzyme secretion, decreased insulin production. Additional examinations: glucose tolerance test, endoscopic UTT, examination of the liver and biliary tract. Treatment: avoidance of alcohol and fatty foods, pancreatic enzyme preparations, supplementation with fat-soluble vitamins, pain control, treatment of diabetes (insulin or OGTT preparations), if necessary, surgery (pancreatojejunostomy).

6-situational issue.

History: A 60-year-old man presented with persistent epigastric pain , dyspeptic symptoms that worsened after fatty meals, abdominal distension, and weight loss for the past 6 months. He does not drink alcohol, but has a diagnosis of hypertension and hyperlipidemia.

Clinic: Moderate pain on palpation in the epigastrium, flatulence, general condition is average. The skin is pale, there is a tendency to hypotrophy.

Laboratory: Amylase is slightly ↑, elastase is low, glucose is 8 mmol/L. The blood lipid profile shows high cholesterol and triglycerides. Liver tests show slightly elevated ALT and AST.

Instrumental: MRCP – the pancreatic duct is dilated up to 8 mm, a stricture in its distal part, and the bile ducts are also dilated. Endoscopic UTT showed fibrotic changes around the stricture.

Addendum: Biliary tract disease or periampullary tumor should be excluded as the cause of chronic obstructive pancreatitis . **Questions:** What form is suspected? What other methods are needed to deepen the diagnosis? What are the main stages of treatment?

Answer: Chronic obstructive pancreatitis. Etiology: ductal stricture. Diagnosis: ERCP to clearly visualize the extent of the stricture and obtain a biopsy, if necessary, CT or MRI with contrast. Treatment: endoscopic stenting, if ineffective, surgery (pancreaticojejunostomy), conservative measures - diet, pancreatic enzymes, diabetes control.

7-situational issue.

History: A 48-year-old man presented with severe epigastric pain , vomiting, and fainting episodes for 3 days. He had a history of frequent alcohol consumption.

Clinical features: Signs of shock – arterial pressure 80/50 mmHg, pulse 130/min, pale skin , decreased diuresis (<0.5 ml/kg/h). Severe abdominal pain on palpation , flatulence. Rapid breathing, SpO_2 90%.

Laboratory: Amylase sharply ↑, hematocrit ↓, lactate ↑, low Hb, thrombocytopenia, abnormal coagulation tests. Electrolytes: low Ca^{2+}, slightly low K^{+}. **Instrumental:** CT scan – large hemorrhagic exudate in the pancreas, peripancreatic hematoma, free fluid in the abdominal cavity .

Additional: Ranson score ≥6, high risk of developing MODS. **Questions:** What complication has occurred? What additional examinations should be performed? What urgent resuscitation measures should be performed? **Answer:** Hemorrhagic pancreatitis. Additional examinations: blood gases, coagulation profile, ultrasound control, CT with contrast. Treatment: immediate resuscitation measures - aggressive infusion therapy (Ringer lactate, plasma), administration of blood components and coagulation factors, strong analgesia, oxygen therapy, electrolyte correction, diuresis control. If necessary, surgical consultation and examination of the abdominal cavity.

8-situational issue.

History: A 39-year-old woman has been hospitalized for 2 weeks with acute pancreatitis. In recent days, epigastric pain has increased, fever has appeared, and digestion has been disturbed. Weight has slightly decreased. **Clinical examination:** A localized infiltrate is palpated in the epigastrium, the abdominal wall is slightly swollen. General condition is average. T 37.8°C.

Laboratory: LPK 13×10^{9}/L, CRP high, amylase close to normal, but lipase remains slightly elevated. Hemoglobin slightly low. **Instrumental:** CT – pseudo-cyst around the pancreas, 6 cm in diameter, thick walls, fluid inside. Also confirmed by UTT.

Additional: More than 2 weeks have passed since the pseudo-cyst formed . **Questions:** What complications have arisen? When is surgery or drainage required? What methods can be used to treat it?

Answer: Pancreatic pseudocyst. If the cyst is >6 cm , persists for more than 6 weeks, symptoms (pain, pressure) persist, or there is evidence of infection – surgical or minimally invasive drainage is performed. Treatment options: percutaneous

drainage, endoscopic drainage (cystogastrostomy), open surgical marsupialization. If small and asymptomatic – observation.

9-situational issue.

History: A 45-year-old man, a long-term alcoholic. He complained of abdominal distension, heaviness, shortness of breath, loss of appetite , and weight loss over the past few weeks. **Clinical examination:** Abdominal swelling due to ascites, tenderness on palpation, and a slightly enlarged liver on palpation. Spider angiomas on the skin, tendency to hypotrophy. **Laboratory:** Amylase in ascites fluid is sharply elevated, protein content is moderate, and LDG is high. Blood: hyponatremia, hypoalbuminemia, and high CRP. **Instrumental:** UTT and CT scan – large volume of ascites, signs of pancreatic duct dilation and possible rupture. Doppler – no signs of portal hypertension.

Appendix: Differential diagnosis - cirrhosis of the liver, malignant ascites, heart failure.

Questions: How is the diagnosis made? What additional tests should be performed? What are the stages of treatment?

Answer: Pancreatogenic ascites is a ruptured pancreatic duct that leaks enzyme-rich fluid into the abdominal cavity . Additional investigations: ERCP or MRCP to identify the site of the duct rupture, fluid cytology, liver function assessment. Treatment: strict NPO, parenteral nutrition, broad-spectrum antibiotics (if necessary), somatostatin analogues, ascites drainage. Endoscopic stenting or surgical repair of the duct is performed.

10-situational issue.

History: A 33-year-old man has had regular epigastric pain , dyspeptic complaints, weight loss, and diabetes mellitus in the last month for the past 3 years. He drinks a lot of alcohol.

Clinic: Pain on palpation in the epigastrium, pale skin, hypotrophy, large and fatty stools due to steatorrhea. General condition is average.

Laboratory: Steatorrhea, high glucose, HbA1c 9%. Fecal elastase is sharply low, vitamin A, D, E, K levels are low. Blood lipidogram is slightly disturbed. **Instrumental:** CT - calcinosis in the pancreas, fibrotic changes, deformation of the duct system. Uneven expansion of the main duct on MRCP. Calcification in the parenchyma on endoscopic UTT.

Appendix: Severe calcified form of chronic pancreatitis . **Questions:** How is the diagnosis made? What consequences are expected? What additional tests are needed? What are the stages of treatment?

Answer: Chronic calcified pancreatitis. Consequences: pancreatic duct strictures, exocrine enzyme deficiency, endocrine dysfunction (diabetes), vitamin deficiency. Additional tests: glucose tolerance test, monitoring of fat-soluble vitamins, bone density test (risk of osteoporosis). Treatment: strict diet, enzymes, diabetes control with insulin, vitamin supplements, pain management (analgesia, nerve blockade), if necessary, surgery - pancreatojejunostomy or resection.

Glossary

Amylase is an enzyme produced by the pancreas and salivary glands that breaks down starch; its levels in the blood are elevated in pancreatitis.

Lipase is a pancreatic enzyme that breaks down fats into monoglycerides and free fatty acids ; the main diagnostic sign of pancreatitis.

Steatorrhea is an increased amount of fat in the stool , a sign of exocrine insufficiency in chronic pancreatitis.

Exocrine insufficiency is a disorder of the digestion of fats, proteins , and carbohydrates due to a decrease in the secretion of pancreatic enzymes .

Endocrine insufficiency – the development of diabetes mellitus due to decreased insulin production.

Biliary pancreatitis is pancreatitis that develops due to stones or obstruction in the bile ducts.

Hemorrhagic pancreatitis is a severe form of pancreatitis characterized by bleeding and necrosis in the pancreas.

Necrotic pancreatitis is a severe form of pancreatitis with a high mortality rate, characterized by the death of pancreatic tissue .

Pseudocyst – a wallless collection of fluid that forms after pancreatitis , requiring surgery if there are signs of infection or pressure.

ERCP (Endoscopic Retrograde Cholangiopancreatography) is a method of examining and treating the bile and pancreatic ducts using an endoscope with contrast.

MRCP (Magnetic Resonance Cholangiopancreatography) is a non -invasive method that allows imaging of the bile and pancreatic ducts.

Ranson criteria are clinical and laboratory criteria used to assess the severity of acute pancreatitis .

The BISAP score is a scoring system designed to quickly assess the severity of acute pancreatitis .

SOFA score – a system for assessing sepsis and multiple organ dysfunction.

Whipple procedure – resection of the head of the pancreas, duodenum , and bile ducts, used for pancreatic tumors.

Fecal elastase is an enzyme level measured in feces, a criterion for assessing pancreatic exocrine function.

CRP (C-reactive protein) is a marker of inflammation, and its levels increase sharply in severe pancreatitis.

MODS (Multiple Organ Dysfunction Syndrome) – multiple organ dysfunction syndrome in severe pancreatitis.

SIRS (Systemic Inflammatory Response Syndrome) is an inflammatory reaction that affects the entire body and occurs in pancreatitis.

Pancreatogenic shock is a shock state characterized by hemodynamic failure in severe pancreatitis.

Peripancreatic collection – a collection of inflammatory fluid around the pancreas.

Necrectomy is the surgical removal of infected necrosis.

Marsupialization is a method of surgically opening a pseudocyst into the internal cavity .

Somatic pain – pain localized in the abdominal wall, with peritoneal symptoms.

Visceral pain is diffuse pain originating from internal organs.

ARDS (Acute Respiratory Distress Syndrome) is a pulmonary failure syndrome that occurs in severe pancreatitis.

Endoscopic drainage is a method of draining a pseudocyst or fluid collection using an endoscope.

Glucose tolerance test - a method for early detection of diabetes, used in chronic pancreatitis.

HbA1c is a form of glucose bound to hemoglobin, an important indicator in diabetes control.

LDH (Lactate dehydrogenase) is a marker of cell breakdown and may be elevated in pancreatitis.

ALT (Alanine aminotransferase) is a liver enzyme that may be elevated in pancreatitis of biliary etiology .

AST (Aspartate aminotransferase) is a liver and muscle enzyme, indicating biliary obstruction and other complications.

GGT (Gamma-glutamyl transferase) – increases in cholestasis and alcoholic pancreatitis.

ALP (Alkaline phosphatase) is one of the indicators of biliary obstruction.

Diet No. 5p is a special diet used for pancreatitis.

Pancreatogenic pleural effusion is the accumulation of pleural fluid on the background of pancreatitis.

Splenic vein thrombosis is one of the vascular complications of pancreatitis.

Pancreatogenic abscess – a collection of fluid and pus due to infection.

Immunohistochemical markers – CD45, CD117 , etc., are used in morphological examinations.

Pancreatic stellate cells are cells that play a key role in the development of fibrosis in chronic pancreatitis.

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