Pancreatic cysts: diagnostics (literature review)

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One of the first cystic formations, observed at the pancreatic autopsy, was described by J. Morgagni in 1761 [2].

However, not so many works in the literature have evaluated the incidence of the pancreatic cystic formations so far.

According to the data of K. de Jong et al., who held a retrospective assessment of the results of 2803 MR imaging in patients who did not have "pancreatic" history, the occurrence of pancreatic cysts was 2.4% [25].

T. A. Laffan et al. got almost identical results in analyzing 2832 CT studies — 2.6% [45].

Different data are presented by K. S. Lee et al., who conducted retrospective assessment of 616 MR imaging and got the incidence equal to 13.5% [44].

Despite this, all the authors noted an increase in the frequency of the incidence of the pancreatic cysts with age (Fig. 1).

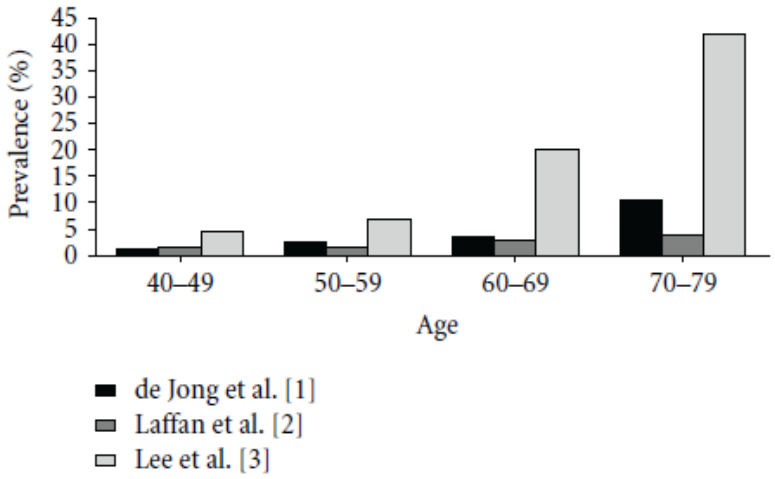

Fig. 1. The frequency of pancreatic cysts in patients depending on their age (according to K. de Jong et al. [25]).

The incidence of cystic formations is much higher in patients with a history of pancreatic disease.

So, X. M. Zhang et al., having conducted the analysis of 1444 MR imaging of patients with previous diseases of the pancreas, identified the presence of cystic formations in 19.6% [37].

Thus, identification of the cystic formations in the pancreas is often an accidental discovery when examining patients for other diseases, and the frequency of detection correlates with the patient's age and the presence of pancreatic disease in history.

Diagnostics of the pancreatic cysts is not usually difficult. Nowadays a number of procedures for the detection and differential diagnostics of cysts in the pancreas are applied in the clinics, which confirms the absence of the "universal" method.

X-ray examination has recently been one of the main and single methods of diagnosing the voluminous (including cystic) formations in the pancreas [2]. It was carried out in different ways — a dry method, after inflating the stomach with the use of the "Potio Riveri", consisting of a mixture of potassium bicarbonate, citric acid and distilled water, or after X-ray-contrast breakfast.

The most important X-ray sign of pancreatic cysts is their "imprinting" on the neighboring internal organs. Depending on the size and location, these structures can shift the stomach, duodenum and transverse colon, and change their shape and size. These changes become more noticeable and clearer upon the examination of patients in the prone position. The modified form is a negative of the shape and contours of the cyst itself [9, 15].

Elevation of the diaphragm cupulae, their reduced mobility, discoid lung atelectasis, usually on the left, are indirect signs of pancreatic cysts. X-ray gastric film may show aerated enlightenments and concrements in the projection of the pancreas.

If the cyst wall is delimed (echinococcus, inflammatory pseudocysts), it is clearly seen in the X-ray study [9].

It should be noted that even large deformation and displacement of organs is not usually accompanied by the disorder of their patency. However, in some cases cysts coming from the pancreatic tail can squeeze the left ureter and cause hydronephrosis, which may completely confuse physical and X-ray finding. Portal vein can be squeezed comparatively rarer with the development of ascites in the future. Conduction of retropneumoperitoneum followed by X-ray tomography is very important to specify the size, shape and location of the pancreatic cysts [9].

Needle pancreatography (wirsungraphy) and cystsography can reveal a connection of cyst with pancreatic ductal system. Research is conducted under ultrasound or CT guidance [5]. However, the implementation of pancreatography demands at least 10 mm extension of main pancreatic duct, which does not allow optimal application of this technique in the diagnostics of the pancreatic cysts [8, 12].

Moreover, according to some authors, single percutaneous and intraoperative puncture cystography of the pancreatic pseudocysts in most cases can give false-negative information on the relationship between cyst and ductal system [7, 10, 11, 16, 32]. This is primarily due to the blockage of the cystic-pancreatic ducts with purulent necrotic masses and detritus, or their significant narrowing as a result of inflammatory edema of the surrounding tissues. On the other hand, a difference in the

pressure level in the cystic cavity and in the lumen of the pancreatic ducts may cause the impact on the results of cystography. Thus, according to data by E. L. Bredley, the pressure inside the cyst may be approximately 378±39 mm of water column, which exceeds intraductal pressure in 3-4 times [19].

Today, X-ray examination is rarely used in the diagnostics of pancreatic cysts and largely has a historical significance.

Transabdominal ultrasound study replaced radiography, which is currently the most simple and less-invasive method of diagnosing the voluminous formations of parenchymal organs. Upon ultrasonography, pancreatic cyst is presented as hypoechoic, homogeneous formation with a thin wall. Unlike pseudocysts, cystic tumors are not usually homogeneous, with thick wall. The presence of identifiable voluminous cyst formations or cyst with solid nodes located on the periphery, with or without septa, is considered as a sign of neoplasia.

Diagnostic value of ultrasound significantly increased by using color flow (Doppler) imaging (CFI) and pulse-Doppler ultrasound [4, 6].

Application of CFI, in particular, allows to conduct a differential diagnosis between cyst and giant pseudoaneurysms [29].

Duplex scanning in combination with ultrasound 3D-angiography provides the most precise data on the vessel wall, adjacent to cystic formation, as well as its possible destruction [13].

It should be noted that the ultrasound sensitivity in the diagnostics of cysts in the pancreas may be influenced by both objective (bloating, excess fat fiber), and subjective (qualified staff) factors [14, 18, 29].

According to Dr. B. Jabłońska, diagnosis upon ultrasonography, as a rule, does not require further investigation [31]. However, a significant number of authors believe that in most cases, the "traditional" ultrasonography is not enough for a correct diagnosis — execution of additional instrumental examinations is required.

A relatively new method of diagnostics of voluminous formations of hepatobiliary and pancreatic area is a **contrast enhanced ultrasonography** (CEUS)

[47]. Thus, in particular, upon pancreatic cystic formations, CEUS allows better diagnose the septa and parietal nodules [23].

Serous cystic neoplasia appears as well-contoured mass with small cysts inside. After contrast injection septa are enhances, acquiring a form of cell structures.

Mucinous cystic neoplasm is characterized by cystic areas separated by septa, with nodules and papillary projections in the wall of the cyst, which can be left unnoticed upon "traditional" ultrasonography because of abundant mucinous content [39].

However, in most cases, CEUS does not add any significant diagnostic information upon pancreatic cysts, so, in case of doubt in the diagnosis, implementation of endoscopic ultrasonography (EUS) or computed/magnetic resonance tomography seems to be the most reasonable [36].

Another informative and accessible method of the diagnostics of voluminous pancreatic lesions is **endoscopic ultrasonography** (EUS), performed by using echo-endoscope.

Upon EUS, there is no interference from gas in the intestines and adipose tissue. The combination of ultrasonic and endoscopic research both in intragastric, and intraduodenal position is of particular informative value upon voluminous pancreatic lesions.

EUS can typically visualize the main pancreatic and common bile duct, the upper mesenteric and the lower cava [1].

Visualization of the pancreas using EUS provides in high image quality due to the vicinity of the ultrasonic sensor in the zone of interest [29, 41].

In the presence of cysts and pseudocysts in the projection of the pancreas, echo-transparent ("dumb") areas of 3-12 cm in size, with clear contours and echo-free space inside, with stronger echoes behind their walls are determined [17].

EUS can help perform fine needle puncture of the cyst with the contents intake for cytological or genetic research, and drainage to evacuate the contents can be installed [29]. Thus, the method is important not only as a diagnostic, but as a medical one.

EUS has a high sensitivity (93-100%) and specificity (92-98%) [40] for the diagnostics of pancreatic cysts.

The widespread introduction of the methods of **computer and magnetic resonance tomography** into clinical practice has made these methods competitive types of examination of patients with a voluminous pathology of the pancreas, surpassing the previously used X-ray and ultrasound techniques in volume and quality of received diagnostic information. High quality of the image allows to obtain an accurate claim topical localization of formation, its size and characteristics, the relationship with other organs and tissues [3].

On the other hand, despite all the advantages and benefits of spiral CT and MRI in terms of diagnostics and differential diagnostics of voluminous pancreatic formations, there is no consensus on the superiority of a particular method nowadays [28, 30, 34, 35, 38, 42].

Y. C. Kim et al., comparing the results of EUS and MRI in the evaluation of cysts of the pancreas, came to the conclusion that there was no significant difference between MRI and EUS in the correct detection of lesion as cystic or solid (accuracy of 90-98% vs. 88%; $p>0.05$). The analysis of predicting malignancy did not show statistically significant difference for those techniques (0.755-0.774 for MRI vs. 0.769 for EUS; $p>0.894$) [22].

Comparison of the results of computed (CT) and positron emission tomography (PET) in assessing the malignancy of cystic formations shown that upon CT study there was a significant correlation between tumor size and the probability of its malignancy [43]. Sensitivity and specificity of CT diagnostics was, respectively, 66.7-71.4% and 87.0-90.5%, while PET figures were 57.1% and 65.2%. However, upon the combined use of PET/CT, sensitivity was significantly better (85.7%), while specificity (91.3%) was comparable.

H. J. Lee et al., comparing the accuracy of CT and MRI in the differential diagnostics between benign and malignant cystic formations, came to the conclusion that both techniques had almost the same accuracy in the differential diagnostics of benign and malignant cystic pancreatic formations [46]. The combined use of CT and

MRI does not give a significant increase in the accuracy of diagnositsc, but may have clinical significance in some cases. Accuracy in setting specific diagnosis in CT diagnostics ranges from 39% to 44.7% according to different authors, the same index for MRI study varies from 39.5-44, 7% to 50% [21, 24, 26].

Information about relationship of the pancreatic cystic formations with pancreatic ducts plays a crucial role in the planning of therapeutic tactics. For this purpose, various techniques of visualization of the link between pancreatic duct with cystic formation are offered: ERCP, MRCP, endoscopic ultrasonography.

Magnetic resonace cholangiopancreatography (MRCP) is a fast developing diagnostic technique, which is now widely used to evaluate diseases of the bile ducts and the pancreas. The absence of contrast substances or ionizing radiation is its advantage. The procedure is non-invasive and almost without complications [33].

In determining the relationship between cysts of the pancreas and pancreatic ducts, MRCP sensitivity and specificity is respectively 91.4% and 89.7%, while the indices of EUS are 88.5% and 92.3% [27].

Y. C. Kim et al. in their study analyzed the results of about 50 patients who underwent MRCP and EUS, sensitivity in the determination of relationship between cysts of the pancreas and pancreatic ducts for MRCP and EUS was about 100% and 88.9% respectively [22].

K. Mera et al. in the analysis of 15 cases of pancreatic cystic formations compared the efficacy of MRCP, ERCP and CT. According to the authors, relationship between the main pancreatic duct and cystic formation was identified in 100% cases of using MRCP, whereas this index for ERCP was 60% (9 patients out of 15), for CT — 93.3% [20].

Thus, the diagnostics of the pancreatic cysts, despite its apparent simplicity, is a complex of diagnostic problem, which solving should apply the entire complex of instrumental studies, including invasive (EUS, ERCP) and non-invasive (US, MRI, CT, PET) techniques.

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Pancreatic cysts: diagnostics (literature review)

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The article provides an overview of methods for diagnostics of pancreatic cystic formations on the basis of the analysis of domestic and foreign literature. Comparison of different diagnostic methods (X-ray, ultrasound, CT, MRI, ERCP, endoscopic ultrasound) is conducted to evaluate their effectiveness in describing the various characteristics of cystic formations: wall thickness, cyst volume, nature of the cyst contents, connection with the duct system, evaluation of potential malignancy. Considering available literature data, it is concluded that the diagnostics of pancreatic cysts should use the whole complex of instrumental studies, including invasive (EUS, ERCP) and non-invasive (ultrasound, MRI, CT, PET) techniques.