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ULTRASOUND DIAGNOSTICS OF GALLBLADDER DISEASES

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✓ ***Resume***

The use of echography allows you to make the correct diagnosis in the shortest possible time, determine the subsequent therapeutic tactics, and start conservative or surgical treatment in a timely manner. The advantages of ultrasound examination over X-ray cholecystography are shown, the features of echograms in various diseases of the gallbladder are considered.

Keywords: ultrasound, echography, gallbladder, sonography.

УЛЬТРАЗВУКОВАЯ ДИАГНОСТИКА ЗАБОЛЕВАНИЙ ЖЕЛЧНОГО ПУЗЫРЯ

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✓ ***Резюме***

Применение эхографии позволяет в кратчайшие сроки поставить правильный диагноз, определить последующую лечебную тактику, своевременно начать консервативное или хирургическое лечение. Показаны преимущества ультразвукового исследования перед рентгенологической холецистографией, рассмотрены особенности эхограмм при различных заболеваниях желчного пузыря.

Ключевые слова: ультразвук, эхография, желчный пузырь, сонография.

ЎТ ПУФАГИ КАСАЛЛИКЛАРИ УЛТРАТОВУШ ДИАГНОСТИКАСИ

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✓ ***Резюме***

Эхографияни қўллаш қисқа вақт ичида тўғри ташхис қўйиш, кейинги терапевтик тактикани аниқлаш ва консерватив ёки жарроҳлик даволашни ўз вақтида бошлаш имконини беради. Мақолада ултратовуш текширувининг рентген холецистографияга нисбатан афзалликлари кўрсатилади, ўт пуфагининг турли касалликларида эхограммаларнинг хусусиятлари келтирилган.

Калит сўзлар: ультратовуш, эхография, ўт пуфаги, сонография.

Relevance

In recent years, in various fields of clinical medicine, a low-burden, highly informative ultrasound examination method (synonyms: echography, sonography, ultrasonography) has become widely used, the diagnostic value of which is confirmed by the works of many domestic and foreign authors [1,4,6,7,8,10,11].

Ultrasound is an elastic vibration of particles of a material medium with a frequency of more than 20 kHz, i.e. above the threshold perceived by the human ear. Modern ultrasound equipment is based on the principle of echo location, and all diagnostic devices operate in pulse mode. It is important to know that in the radiation mode, the sensor of the device works only 0.1% of the cycle time, whereas in the reception mode - 99.9%. Such a rhythm of work is one of the factors that determine the safety of ultrasound examinations. Echography is not associated with ionizing radiation, which distinguishes it from, for example, computed tomography and puts it in the category of harmless techniques (echography is

allowed to be used during pregnancy due to the absence of a possible damaging effect on the fetus).

The first successful attempt to use ultrasound in medicine was made by the Austrian neurologist Karl Dussick in 1942. However, the systematic use of echography for the purpose of diagnosis began only in the mid-60s. In a relatively short period of time, ultrasound diagnostics has gone from one-dimensional echography, which gave a very small amount of information, to complex scanning in real time, which allows to achieve visualization of not only organs and systems, but also their structural elements. The resolution of modern ultrasonic devices is 0.1 mm, which determines the high accuracy of the method. The first report on the use of echography for the detection of gallbladder diseases was made by Ludwig and Struthers in 1950, and today it is the leading method for diagnosing diseases of the biliary system.

Usually, an ultrasound examination (ultrasound) of the gallbladder is performed in the morning on an empty stomach after a night of fasting, not earlier than 12 hours after eating. In emergency cases, the study can be carried out without prior preparation. Patients with flatulence, concomitant intestinal pathology for 1-2 days before the study, it is desirable to exclude from the diet products that increase bloating (black bread, legumes, sauerkraut, whole milk, grapes, etc.), prescribe the intake of enzyme preparations (digestal, creon 1-2 pills 3 - 4 times a day during meals).

The structure of the bile ducts. The branching scheme of the intrahepatic bile ducts is usually consonant with the anatomy of the segments.The ventrocranial branch and the dorsocaudal hook form the right hepatic duct.The left medial and lateral channels unite into the main left hepatic duct (Fig. 1).The drainage of the caudate lobe varies, it can be associated with the system of the left or right duct. The cystic duct has a length of 2-4 cm, a diameter of 2-4 mm; there is a spiral and smooth part. Convoluted segment with semilunar valves; the rectilinear segment is smooth, often short. The cystic (PP) and common hepatic (AKI) ducts merge into the common bile duct (OGP), (Fig.2).The length of the OGP is 6-7 cm; it enters the posteromedial wall of the descending part of the 12 duodenum. The OGP and the pancreatic duct merge into an ampoule, have a common sphincter of Oddi; there are separate entrances. The oblique intramural tunnel opens into the intestine by the tubercle of the large duodenal papilla.

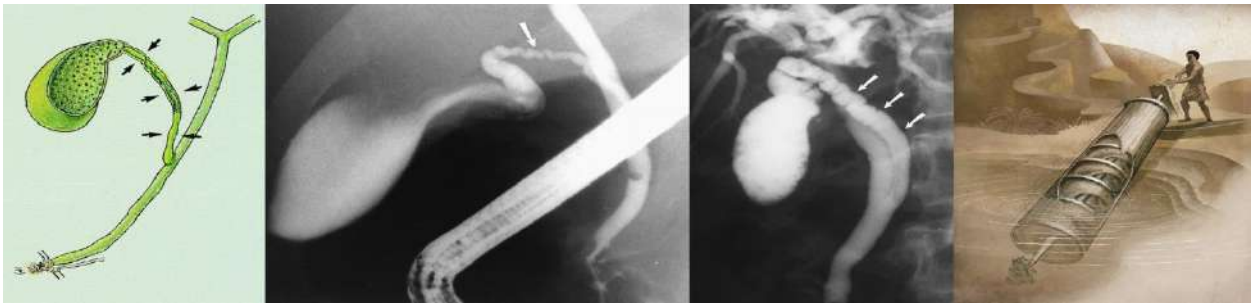

Fig. 1. Spiral proximal and rectilinear distal segments in the cystic duct.

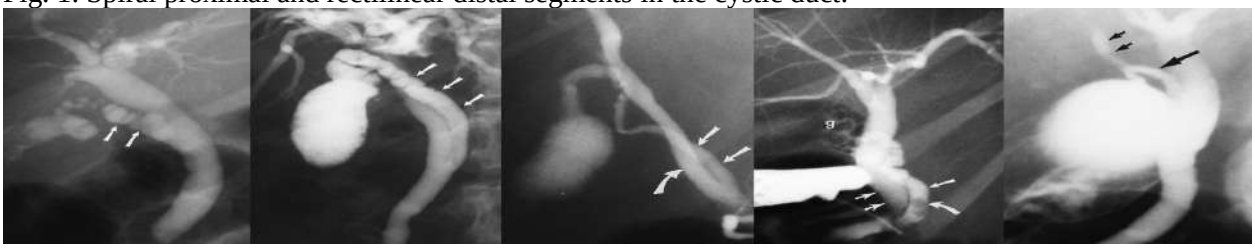

Fig. 2. Confluence of PP and AKI: right, front, low left, in an ampoule and an additional bile duct.

Malformations of the gallbladder. Malformations of the gallbladder are congenital changes in size, shape or position (Fig. 3). Gallbladder atresia is a fibrous heaviness of the cavity, often combined atresia of the ducts.Aplasia (agenesis) of the gallbladder-absent due to the death of the embryo in the embryonic period. Hypoplasia of the gallbladder is an extremely small size in the form of a" potbellied " cystic duct. Diverticula develop due to the tightening of the cords, as well as with the weaknesses of the muscle layer. There are possible options for narrowing and deforming the bladder: "Phrygian cap" or "hourglass".The dicotyledonous gallbladder arises from a variety of variants of the longitudinal septum.Doubling of the gallbladder due to the formation of two cellular bookmarks of the organ from one

common one. With incomplete doubling, the cystic ducts merge into a single one, with full doubling, they go separately. Dystopias — anomalies of the location in the area of the left lobe, round ligament, posterior liver, etc.

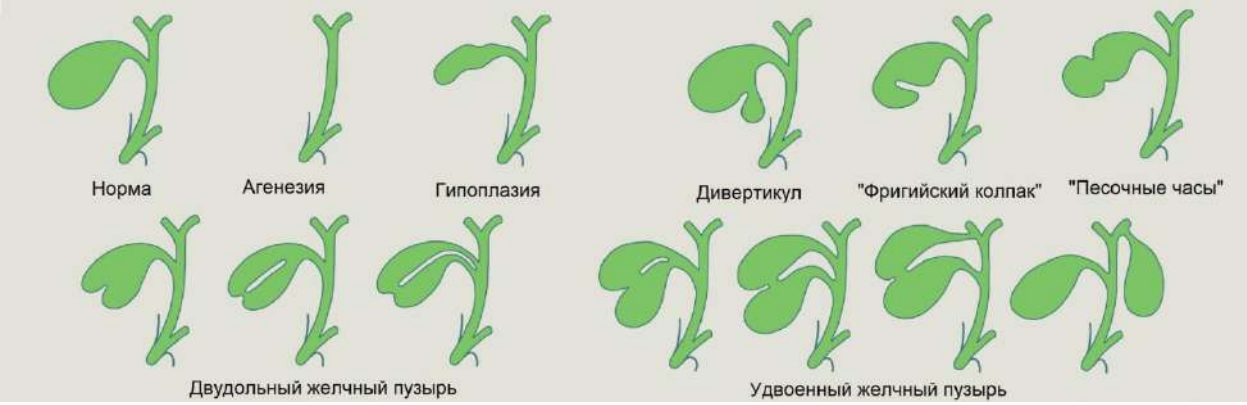

Fig 3. Malformations of the gallbladder-congenital changes in size, shape or position.

The examination is usually carried out in the position of the patient lying on his back with a breath delay in the deep inhalation phase, if necessary on the left side, sitting or standing.

Normally, the gallbladder is defined as a clearly contoured, free from internal structures, echonegative formation of a pear-shaped, ovoid or cylindrical shape, located in the upper right quadrant of the abdomen. Its size varies widely - the length ranges from 6 to 9.5 cm, and the width (diameter) does not exceed 3-3.5 cm. The bubble wall is represented by a fairly uniform thin (no more than 2 mm) line of moderately increased echogenicity. The external and internal contours of the bubble are clear and even. As our studies have shown [5,9,10] the density of the walls changes (increases) with age. This is due to the fact that after 60 years, the mucous membrane and the muscle layer atrophy and connective tissue gradually develops in them, the bladder wall is sclerosed and compacted. Therefore, the density of the bubble wall should always be correlated with the age of the subject.

The experience of using echography shows that it can be successfully used to detect developmental anomalies, diagnose various diseases of the gallbladder. Echographically, partitions, kinks and deformations of the bladder are easily detected. In some regions, excesses are detected in 60-75% of those undergoing examination [1,2,12], while on echograms the gallbladder can acquire a different, sometimes bizarre shape (Fig. 3).

Ultrasound is one of the main methods of diagnosing gallbladder dyskinesia, acute and chronic cholecystitis. With hypomotor dyskinesia, the bladder can be both normal-sized and enlarged. In the absence of cholecystitis, its wall is not changed. To assess the functional status of the motor-evacuation function of the gallbladder first measure its volume (V) on an empty stomach (in modern devices, this parameter is determined automatically) or calculated by the formula proposed by F. Weill [4,6,8,11]:

$V = P (p/2)2 \bullet l$, where R is the width, l is the length.

Then, after taking two egg yolks at equal 5-10-minute intervals, the volume of the remaining bile is determined for 1.5-2 hours, if they want to follow the full cycle of emptying and relaxing the bladder. The motor activity of the gallbladder is considered normal if the volume decreases by 50-70% by the 45th minute. In everyday practice, in a simplified version, you can limit yourself to measuring the largest diameter of the bladder on an empty stomach and at the 45th minute, as radiologists do.

It should be noted that the data on the motor activity of the gallbladder obtained by oral and ultrasound cholecystography completely coincide. Therefore, to detect dyskinesia of the gallbladder, it is advisable for patients to perform ultrasound, and not X-ray (associated with radiation, taking contrast agents) cholecystography.

In acute cholecystitis, the gallbladder may be enlarged in size, normal or even reduced, and one of the main echographic signs is a thickening of the wall, the appearance of a double contour. In this case, a sharp soreness is determined when the device sensor is pressed on the area of the gallbladder projection (a positive ultrasound symptom of Murphy). Using echography, it is possible to identify complications of acute cholecystitis: empyema, gangrene, wall perforation.

For chronic cholecystitis, the following signs are most characteristic: compaction and thickening of the wall, unevenness and deformation of the contour of the bladder, reduced or no movement during breathing, inhomogeneity of the contents, "bile" sediment, a positive ultrasound symptom of Murphy. To establish the diagnosis of chronic cholecystitis, of course, it is necessary to compare the results of ultrasound with the clinical signs of the disease.

Echography is of the greatest importance for the diagnosis of cholelithiasis, the accuracy of the method reaches 98-99% (the accuracy of oral cholecystography does not exceed 70%). A gallstone in the gallbladder looks like a dense formation, followed by an ultrasound shadow, located, as a rule, on the back wall of the bladder, shifting when the patient's body position changes (Fig.4). The smallest size of concretions diagnosed by ultrasound is 1-2 mm. In some cases, it is possible to determine the sediment (sand) in the gallbladder (Fig. 5).

It should be noted that the size of the stones during ultrasound does not correspond to their true size, they look somewhat larger. With multiple concretions, it is not always possible to determine their exact number.

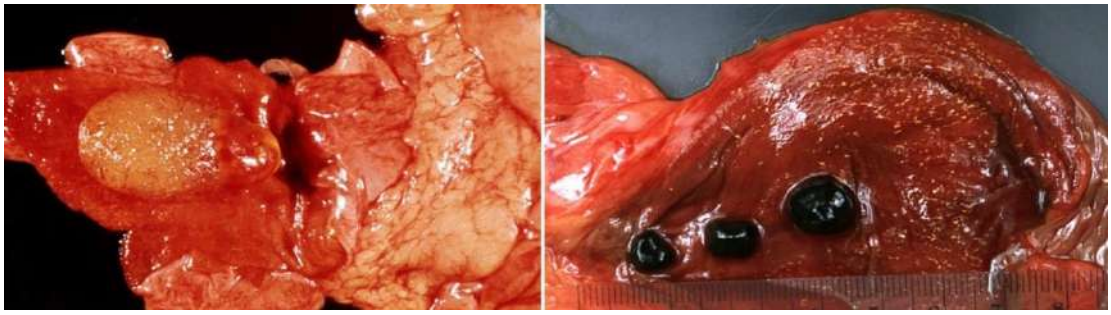

Fig. 4. Simple gallstones from crystals of cholesterol monohydrate and calcium bilirubinate.

Unfortunately, echography does not allow us to determine the composition of the stone (pigment or cholesterol), the degree of its calcification.

Ultrasound allows you to diagnose a disabled gallbladder when it is filled with concretions, and free bile in the lumen is not detected. In this case, a conglomerate of dense echostructures is visualized in the bubble projection area, giving an acoustic shadow (Fig. 5).

Fig. 5. Complex cholesterol-pigment and cholesterol-pigment-calcareous gallstones

Echography allows you to diagnose hypertrophic diseases of the gallbladder, such as adenomyomatosis and cholesterol. The polypoid form of gallbladder cholesterol is particularly well detected (Fig. 10), while it is always necessary to conduct a differential diagnosis with gallstone disease. The main difference is that the cholesterol polyp (polyps) does not give an acoustic shadow and does not shift when the patient's body position changes.

Note that in patients with ascites on echograms, the gallbladder protrudes into the ascitic fluid, is atonic, the contents are often heterogeneous, the walls are dense, thickened, a double contour appears.

Primary gallbladder cancer is considered a fairly rare disease, mainly occurs in elderly and senile patients who have suffered from gallstone disease for a long time. Although the clinical recognition of this suffering is extremely

difficult, the accuracy of ultrasound diagnostics is 86-88%.

It is interesting to note that by examining the gallbladder, a diagnosis of acute viral hepatitis can be established with a high degree of reliability. It is proved that in the first days of jaundice, the volume of the gallbladder decreases sharply (ranging from 3-4 cm3 to 0.5-1.0 cm3), while the wall appears to be sharply thickened.

Acute calculous cholecystitis on ultrasound. Acute calculous cholecystitis is an inflammation of the gallbladder caused by gallstones. When the outflow is blocked, the intravesical pressure increases, which disrupts blood circulation in the wall. If the outflow does not revive after 6 hours, the mucous layer will begin to exude serous fluid. Then the pressure inside the bubble increases even more, and the vicious circle of "ouroboros" closes.

Ischemia of the wall sometimes resolves into necrosis(necrosis), perforation (rupture) and peritonitis (Fig. 6). According to the nature of inflammation, acute cholecystitis borders on catarrhal and destructive forms. With catarrhal cholecystitis, the mucosa is full-blooded, focal leukocyte infiltration. The bile in the lumen of the bladder is watery, since it is diluted to varying degrees with serous exudate. Destructive cholecystitis (phlegmonous, gangrenous) marks the occurrence of wall necrosis.

Purulent exudate stained with bile accumulates in the lumen, and often with a bloody additive. With phlegmonous cholecystitis, leukocyte infiltration of all layers of the wall, erosion and ulcers. When necrosis penetrates the entire thickness of the organ wall, we can talk about gangrenous cholecystitis. Emphysematous form of cholecystitis occurs after the introduction of gas-forming microflora. Morphologically, there are extensive hemorrhagic necroses in the wall, gas-filled depressions (Fig. 8). With destructive forms of acute cholecystitis, near-vesicular abscesses are often formed. The central task of ultrasound is to distinguish between catarrhal and destructive forms of acute cholecystitis. In catarrhal inflammation, the wall is diffusely thickened, the peripubular fat is echogenic (edema). In the destructive form, a thick wall with defects, mucosal pseudomembranes in the lumen. During perforation, the defect of the wall is through, liquid spills around the bubble, often stones.In emphysema, the echogenic gas reflects ultrasound and gives a "dirty" rear acoustic shadow. The shadow is not purely anechoic (as in the case of bile concretions), but of intermediate echogenicity (Fig. 7). The diagnosis of acute calculous cholecystitis is established only by having a system of signs: A punctured concretion in the neck of the gallbladder or cystic duct disrupts the outflow; The gallbladder is swollen, the longitudinal size is >120 mm, and the anterior-posterior size is >40 mm; The wall thickness is >3 mm, double contour, layered structure or diffuse heterogeneity; In the fossa of the gallbladder of high echogenicity, amniotic fat and anechoic fluid; A positive Murphy symptom, if the sensor pressure on the bottom of the bladder is increased pain.

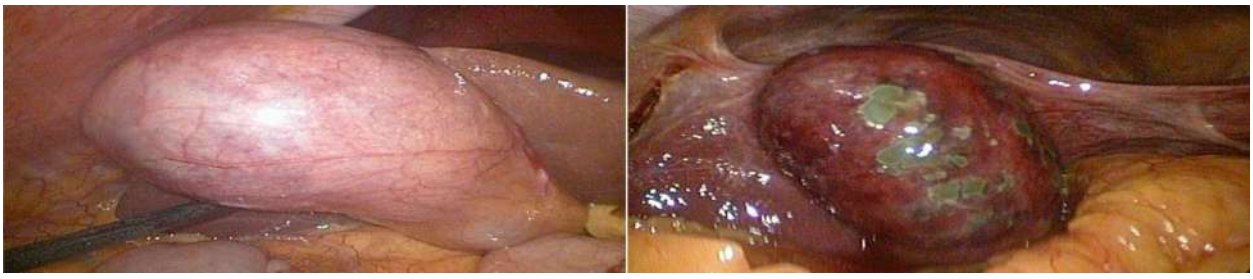

Fig. 6. Acute calculous cholecystitis: catarrhal and destructive (gangrenous) variants.

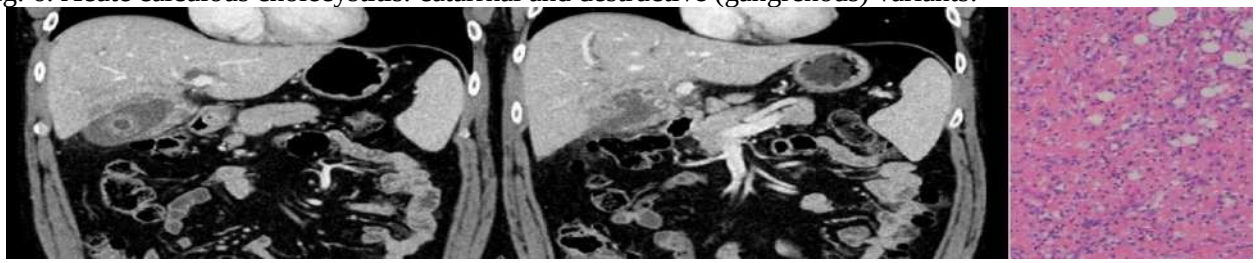

Fig. 7. Acute calculous cholecystitis with empyema on CT similar to a malignant tumor.

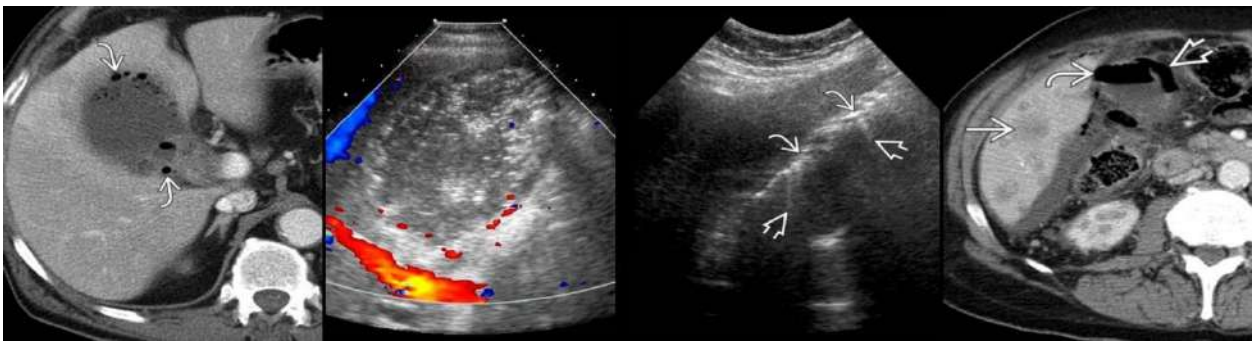

Fig.8. Emphysematous cholecystitis: gas in the lumen of the bladder, intrahepatic, beyond the border of the organ.

Mirizzi syndrome on ultrasound. Mirizzi syndrome — a stone in the neck of the gallbladder or in the cystic duct tramples AKI. The hepatic bile ducts and AKI are more often expanded to the place of external compression. From local inflammation and bedsores, a cholecystocholedochal fistula can be organized. Mirizzi syndrome is difficult for a surgeon, since chronic inflammation destroys the anatomy (Fig. 9).

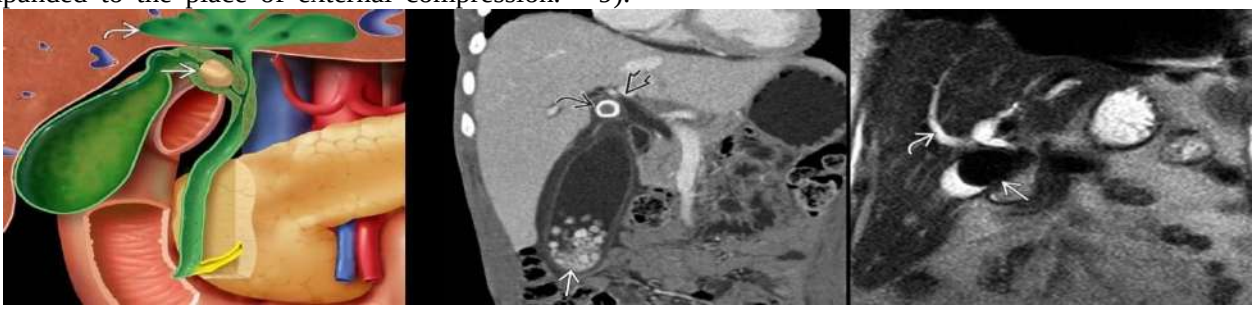

Fig. 9. Mirizzi syndrome: embedded concretion in the neck, dilated hepatic ducts.

Thus, echography provides significant assistance in the diagnosis and differential diagnosis of gallbladder diseases. Summing up the data given in this article, we can conclude that the indications for ultrasound examination of the gallbladder are: suspicion of a violation of motor evacuation function, typing the type of dyskinesia; acute and chronic cholecystitis (determination of the functional state of the bladder, the state of the walls, size, shape, presence of anomalies); suspicion of gallstone disease (detection of gallstones); jaundice of various origins (to clarify the genesis of jaundice, differentiation of mechanical jaundice from parenchymal); pancreatitis of various origins (to identify a concomitant disease, and with reactive pancreatitis - the main one). The use of echography allows you to make the correct diagnosis in the shortest possible time, determine the subsequent therapeutic tactics, and start timely conservative or surgical treatment.

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