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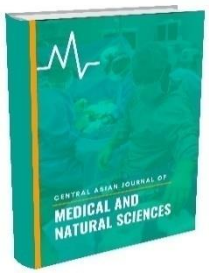

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Radiation Diagnostics of Liver Echinococcosis

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Abstract: The results of radiological diagnostics of liver echinococcosis in 19 patients are presented. In 4 of them echinococcosis of the liver was accompanied by echinococcosis of the lung. The results of sonography, KT, MRI are analyzed. 4 variants of echographical macrostructure have been defined. CT made it possible to differentiate echinococcosis cysts from non-parasitic single and multiple cysts of the liver, even in the absence of other differential-diagnostic signs. In 70% of the cases echinococcosis cysts had a capsule 2-3 mm of thickness. In 1/3 of the cases a partial or total calcification of the capsule was detected, which was the specific sign of a parasitic involvement. In 23% of the patients there were filial cysts and multiple lesions of abdominal organs (spleen, kidneys, adrenals). MRI allowed to detect morphological stages of parasite, which was important for planning the method of surgery. In conclusion, the complex radiological diagnostics is able to detect the hydatid form of a liver echinococcosis with a great degree of certainty, to perform differential diagnostics with other diseases.

Key words: diagnostic, echinococcal, sonography

Introduction. Echinococcosis is a parasitic disease endemic in many regions. Echinococcal invasion can affect any part of the body and manifest itself differently depending on the stage of development, associated complications, as well as the response of the patient's body [2]. Echinococcosis is a serious medical and social problem in many countries of the world, Russia, where large endemic foci remain, and an increase in the number of cases is observed. The disease affects almost all organs and systems of the body [1].Application of research on all stages of the healing-diagnostic the process will help improve the efficiency Surgical treatment of patients with echinococcus[4]. The main methods for diagnosing echinococcosis are traditional radiography and ultrasound examination (ultrasound). Nevertheless, a comparative analysis of the sensitivity, specificity and accuracy of radiography and ultrasound in the diagnosis of echinococcosis in children is currently insufficiently presented in the literature.

Purpose of the study. To develop new and improve the known signs of echinococcosis of the liver according to the data of the complex application of methods of radiation diagnostics[3].

Materials and methods. The data of radiological diagnostics of 19 patients with E of the liver were analyzed, in 4 of whom they were combined with lung damage. In the majority of 13 patients, the disease was detected during the screening ultrasound examination, in which a cystic formation was detected in the liver.3 patients underwent examination for "abdominal enlargement", pain in the right hypochondrium (2 patients), eosinophilia, subfibrillation of unclear etiology (1 patient). Table 1 shows variants of the macro-structure of E cysts detected by ultrasound.

Table 1. Variants of echinococcal cysts of the liver in an ultrasound image.

VIEW	annular	suspension.	thick capsule	calcifications	dilge	segments
Cyst	4	2	3	-	-	6.7
Multi-chamber cyst	9	8	6	-	3	5.6-7.8
Cyst solid formation	2	-	-	2	-	5
Semiring of calcification	4	-	-	4	-	6.7

As can be seen from the table, liver echinococcosis most often looked like a multicamera cystic formation, which was characterized by the presence of echogenic septate structures, corresponding to the development of daughter echinococcal cysts due to the development of the parasite (Fig.1).

Figure: 1. Echinococcal cyst, ultrasound, gray scale - multi-chamber cystic formation with echogenic suspension.

The size of E of this species ranged from 5 to 12 cm in diameter. Along with the characteristic septum-like structures in 8 patients, an echogenic suspension was additionally detected, freely moving in the cyst when the patient's body position changed - a symptom of a "snow storm" arose. The suspension consisted of microparticles with a diameter of up to 0.5 mm. In 6 patients, multichambered was combined with the presence of a two-layer capsule along the periphery of E (Fig. 1). The thickness of the capsule was uniform along the entire perimeter, ranging from 1.5 to 2 mm. The outer layer of the capsule was thinner than the inner one, of higher echogenicity, and enclosed the E. in the form of a continuous ring. Its contours could be wavy or ovoid. Between the outer layer of the capsule and the liver tissue, 3 patients had a slit-like hypoechogenic space up to 1.5 mm thick. The inner layer of the capsule had a lower echogenicity, consisted of a set of separate elements of a point, linear nature with small gaps between them. This macrostructure probably corresponded to the purpose of the cuticular membrane - the development of new parasites within the maternal matrix. Ultrasound did not reveal in this group E the presence of signs of calcification in the capsule, which is probably associated with the active phase of E's life, for which the presence of signs of calcium salt deposition in the chitinous membrane is not typical. In 3 patients with echinococcosis localization in the area of the hilum (5.8 segments) and a size of more than 10 cm in diameter, ultrasound revealed dilatation of the intrahepatic

bile ducts due to compression of the hepatic duct of the right lobe of the liver. At the same time, a characteristic symptom of a "double-barreled" arose - along the upper edge of the intrahepatic branch of the portal vein of the right lobe of the liver, a linear hypoechoic structure was traced, corresponding to the course of the intrahepatic bile duct. The diameter of the dilated duct corresponded to or exceeded 1.5 - 2 times the diameter of the corresponding branch of the portal vein. As shown by comparisons with morphological studies of the postoperative material, this type of E in the ultrasound image was the most pathognomonic for the echinococcal cyst. Other variants of the E macrostructure were much less common. E in the form of a simple cyst was observed in 6 patients and was the second most frequent - during ultrasound examination in one of the liver segments anechoic formation with sizes from 3 to 5 cm was detected. In 1 case, an echogenic suspension, a symptom of a “snow storm,” was detected inside a cystic formation, in another case, a possible E was indicated by the presence of a two-layer capsule, and in 2 patients there was a combination of an internal suspension and a thick capsule. In 2 patients, the cyst did not differ from a simple solid cyst of the liver, however, given the endemicity of the area in terms of E, the work associated with caring for animals, serological tests were carried out, which turned out to be positive for E. Surgical intervention confirmed the diagnosis. In the third place in terms of frequency was the detection in the liver of a half-ring of calcification (4 patients) - an arched line of a hyperechoic signal with an anechoic zone distal, the thickness of the half-ring fluctuated from 1.4 to 2 mm (Fig. 2).

Figure: 2. The known capsule E in the US image is an anechoic track. Internal structure is not traceable.

With this ultrasound picture, the internal macro-structure of the detected changes was not revealed due to the complete reflection of ultrasound from calcines. In this clinical and diagnostic situation, the presence of an E cyst could only be assumed, and additional examination was required, in particular, X-ray computed tomography. Differential diagnosis was carried out with obesity metastases of colon cancer (6 patients), obsolescence of hematoma of the liver (2 patients). In all cases, it was possible to make an accurate diagnosis after CT. In 2 patients, an unusual solid formation was revealed in the liver - a rounded shape, neem and liver tissue (Fig. 3a). with a diameter of 5 and 5.7 cm in the 5th and 6th segments of the liver. The unusual thing consisted in the presence of echogenic linear structures chaotically located, tightly adjacent to each other within the formation. Between the formation and the liver tissue, a hypoechogenic strip with a thickness of up to 2 mm was determined. A capsule with inclusions of calcium salts was traced along the perimeter, a marginal symptom of weakening of ultrasound was observed. C (E) DC did not reveal signs of blood flow inside the formation, the hypoechoic zone.

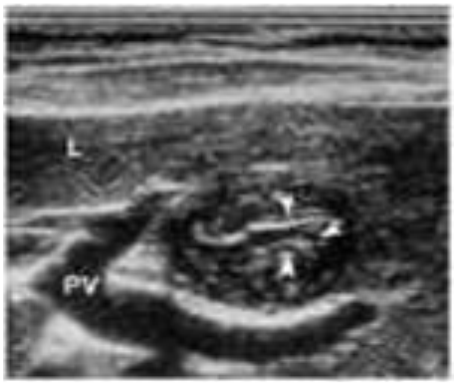

Figure: 3a. Per. Deceased E, ultrasound, gray scale - echogenic linear structures, lack of fluid inside, hypoechoic rim along the periphery.

Three-dimensional reconstruction of the image, layer-by-layer analysis of the internal macrostructure confirmed the data of two-dimensional scanning in the gray scale mode, tissue harmonic about linear soft tissue formations inside the focus, closely adjacent to each other. Attention was drawn to the intermittent saturation of the periphery with calcium salts, the long-term work of patients in the endemic regions of Central Asia. Computer, magnetic resonance imaging confirmed the shell-like calcification along the periphery of the formation, its soft-tissue nature (Fig. 3b).

In the study with amplification, the introduction of a paramagnet, the accumulation of contrast agent in the focus was not determined. Serological reactions to E. were negative. During surgical intervention, the deceased E.

Figure: 3b. The same patient with CT, confirmed by ultrasound data on the soft tissue nature of the deceased echinococcosis, obesity of the capsule (-).

On the basis of ultrasound, we have identified 4 variants of the echographic macrostructure E. 1) “simple cyst” 2) a cyst with an echogenic suspension 3) a cyst with a multilayer capsule (subvariant + echogenic suspension) 4) “multi-chamber” cyst (subvariant + suspension) 5) a cyst with a known capsule On the basis of ultrasound, we have identified 4 variants of the echographic macrostructure E. 1) “simple cyst” 2) a cyst with an echogenic suspension 3) a cyst with a multilayer capsule (subvariant + echogenic suspension) 4) “multi-chamber” cyst (subvariant + suspension) 5) a cyst with a known capsule option multiple microcalcifications in capsule) a 6) pseudosolid (dead) echinococcus. Computed tomography of the liver was performed in 19 (100%) patients from the group of patients with echinococcosis due to suspicion of a parasitic disease and to clarify liver changes with an already established diagnosis of hydatid disease. The analysis of computed tomograms made it possible to determine the localization of parasitic cysts in the liver in accordance with the segmental structure, the ratio of the parasitic focus to the parenchyma, capsule, hepatic gates, large vessels, inferior vena cava,

and neighboring organs. When studying CT images, the shape, outer and inner contours of the cyst, the thickness and density of the cyst wall, its contents, signs of calcium salt deposition were assessed. Computed tomograms revealed the following signs of echinococcal cysts: thickening of the cyst wall, irregularity of its contours, stratification of parasitic membranes, heterogeneity of the contents, presence of daughter cysts, perifocal hypodense rim. The density of the contents of the cysts varied from 9 to 42 H units, increasing in the late stages of echinococcal disease. Daughter cysts had a lower density than the density of the maternal cyst. The variant of solid (deceased) E in the ultrasound image (2 patients) was accompanied by an increase in the density of the contents of the parasitic cyst to 36-42 N. units. In the lumen of the hydatidoma, fragments of parasitic membranes were visualized in the form of high-dense convoluted linear structures; along the periphery, shell-like limescale of the capsule was determined (Figs a, b). In 4 patients, in whom a symptom of a hyperechoic arch with an anechogenic zone was revealed according to ultrasound data, CT scan revealed a multicameral cystic formation with massive capsule obscuration (Fig. 4).

PKT was leading in the differentiation of this ultrasound form of E with metastatic lesions in colloid colon cancer. Metastases were distinguished by an internal solid structure with multiple lumpy inclusions of calcium salts inside. Our observations give reason to disagree with the point of view that the death of the parasite is always accompanied by massive deposition of calcium salts in the capsule.CT was used to clarify ultrasound data for the purpose of differential diagnosis between parasitic and nonparasitic liver cysts in diagnostically unclear cases. Differential diagnosis was performed based on the following CT criteria. Den-sitometric indices of echinococcal and nonparasitic cysts differed with large cysts, amounting to 10-25 units. N with an echinococcal cyst and 0-15 units. H with non-parasitic cyst. This made it possible to distinguish echinococcal cysts from nonparasitic and polycystic cysts of the liver, even in the absence of other differential - diagnostic signs.

Figure: 4. E, RKT - capsule calcification.

The density of the contents of the echinococcal cyst increases significantly (20 units of N and more) after the death of the parasite. In 70% of cases with echinococcosis, a cyst capsule was detected, the thickness of which is 2-3 mm. In a third of cases, it was possible to identify partial or total calcification of the capsule, which is a specific sign of the parasitic nature of the lesion. In 23% of cases with echinococcosis, the presence of daughter cysts and multiple lesions of the abdominal organs (spleen, kidneys, adrenal glands) were noted. Magnetic resonance imaging was used at the final stage of non-invasive diagnostic examination in 13 patients with liver echinococcosis in order to detail the nature of pathomorphological changes in the lesion focus and to clarify the degree of involvement of large vascular-secretory structures in the process. Free-choice of image planes made it possible to refine the topical diagnosis. On the other hand, due to the high soft tissue contrast, MRI revealed significant additional signs of parasitic cysts. For example, MRI was the most informative in identifying irregularities in the inner edge of the cyst and incipient stratification of parasitic membranes. The undoubted advantage of the method is the ability to differentiate changes in the liver

architectonics with high resolution. Around the hydatid cysts on MRI tomograms with indistinct contours, corresponding to pericystic changes (Fig. 5a, b, a rim of weak changes in the MR signal was visualized (hypointense on T1 VI, hyperintensive on T2 VI). The volume of echinococcal cysts, the volume of unaffected liver parenchyma, and the severity of compensatory organ hypertrophy were calculated using MR volumetric. MPT made it possible to diagnose echinococcal cysts in the abdominal cavity with combined echinococcosis without additional contrasting of the intestine. During the MRI they were identified.

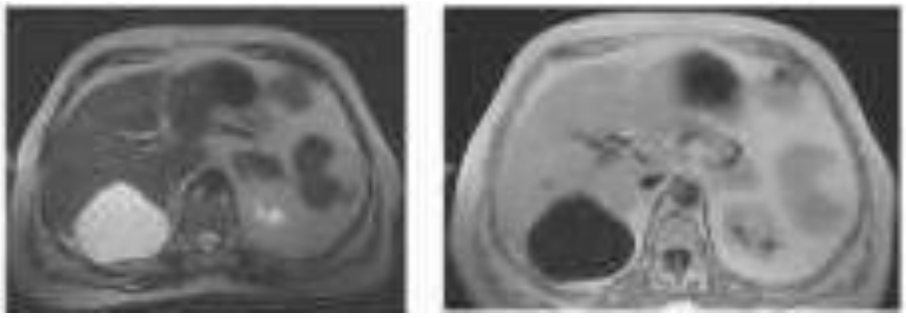

Figure: 5. E, MRI T2, T2 VI - a) hypointense signal from liquid content in T2VI b) hypo-intense in T1VI (against the background of the introduction of 40.0 paramagnets Omniscan).

Visualization of the capsule and pericystic changes revealed the following differential diagnostic signs of echinococcal cysts of the liver. On T2VI, the cyst was detected as a site with an increased intensity of the MR signal, an irregularly rounded shape, with clear, even contours. The hydatid fluid had a uniform hyperintense signal with its moderate hypointensity in the basal regions with a large amount of "hydatid sand" in the cyst. Septa in the lumen of the cyst, walls of daughter and granddaughter cysts had a hypointense signal. The chitinous membrane of the cyst gave a hypointense signal (Fig. 6).

Figure: 6. E, MPT-T2 VI - hypointense signal from the chitinous membrane, cloisonné structures, "hydate sand", two-layer diagnostic capsule, especially with multiple lesions and large cysts, when the determination of its organ affiliation was difficult.

At the same time, the difference in the hypointensity of the fibrous capsule and the chitinous membrane of the parasite created on the tomograms a two-layer image of the cyst wall, which was characteristic only of the parasitic cyst and made it possible to differentiate it from all other cystic

lesions. The same program, but in different planes (axial, coronary and sagittal) was used for the topical one.

On T2VI and T2VI with suppression of the signal from fat, the cyst wall was detected as a very low-intensity rim surrounding the cyst. The thickness of the cyst wall varied between 1 and 5 mm (average thickness 2.2 ± 0.7 mm). Linear areas of reduced signal intensity in the lumen were characteristic of a dead cyst and represented a detached chitinous sheath. On T1VI in the axial plane, the cyst was visualized as an area with a reduced intensity of the MR signal, an irregularly rounded shape, with clear, even contours. In this case, the cyst wall was usually difficult to assess due to a similar low-intensity signal, the same as from the fluid in the cyst cavity. Suppression of the signal from adipose tissue allowed differentiation of fatty and hemorrhagic inclusions in cysts, which was especially important in the diagnosis of complicated liver cysts. Calcifications in the cyst walls were identified as areas with no MR signal, i.e., as dark areas in the walls with low or very low signal intensity. The use of MR angiography (MRA) and MR cholangiopancreaticography (MRCP) made it possible to accurately localize the extent and topographic relationship of the cyst with a large vessel, the ductal system of the liver. Correct interpretation of images using MRI was possible in all cases when the cysts had a diameter of more than 30 mm. These cysts always had typical signs corresponding to echinococcal lesions. Typical signs: fibrous and chitinous membrane of the cyst with a hypointense gap between them, calcifications in the wall of the fibrous capsule, the presence of daughter cysts in the maternal lumen, floating chitinous membrane in the lumen of the cyst ("lily" symptom) and the intensity of the signal from the fluid hydatid cyst.

However, with cysts less than 30 mm in diameter, typical signs characteristic of echinococcal cysts were not always revealed, and therefore differential diagnosis with other cystic liver lesions was extremely difficult. Comparison of the diagnostic accuracy of the methods we use allows us to assert that MRI is the most accurate method in the detection and differential diagnosis of echinococcal liver cysts. Thus, MRI is a method of non-invasive diagnostics, which makes it possible to effectively examine patients with liver echinococcosis, to carry out differential diagnosis of the disease. It makes it possible to identify the morphological characteristics of the development of the parasite, which are of decisive importance in the choice of the method of surgical treatment. It can be recommended as a clarifying method that can be used in diagnostically difficult cases, as well as to clarify the localization of extrahepatic cysts of the abdominal cavity and for preoperative examination of patients with hepatic echinococcosis, especially in cases where it is required to clarify the definition of the relationship of cysts with blood vessels. liver and bile ducts.

Comprehensive radiological examination revealed the involvement of large vascular structures of the liver and the inferior vena cava in 9 patients with echinococcosis, with displacement and compression of the vessels being the most typical. The most effective methods for diagnosing these complications were CT scan with bolus contrast enhancement and MRI. Here is a clinical observation. Painful G-va V.A. 35 years old, no complaints. During a preventive examination, ultrasound revealed: in organs without features, heart sounds are muffled, pulse 79 beats per minute, A / D 140/95 mm Hg. The abdomen is soft and painless. Laboratory data - general blood test - eosinophilia, general urine analysis, coagulogram within the age norm. Ultrasound of the abdominal organs revealed two cystic formations, occupying the right lobe with a multilayer capsule characteristic of E (Figure 7a). CT, MRI clarified the cystic nature of the changes, their localization, the presence of a thick capsule (Fig. 76). On the basis of a comprehensive analysis, a diagnosis of an E cyst was made. Calcification foci characteristic of parasitic liver cysts were identified in 1 patient. In 13 patients, cysts were more than 100 mm in diameter. The most informative and universal method was ultrasound, which is a screening method for examining patients with cystic lesions of the abdominal organs. The exact diagnosis of liver echinococcosis by ultrasound was established in most cases of patients.

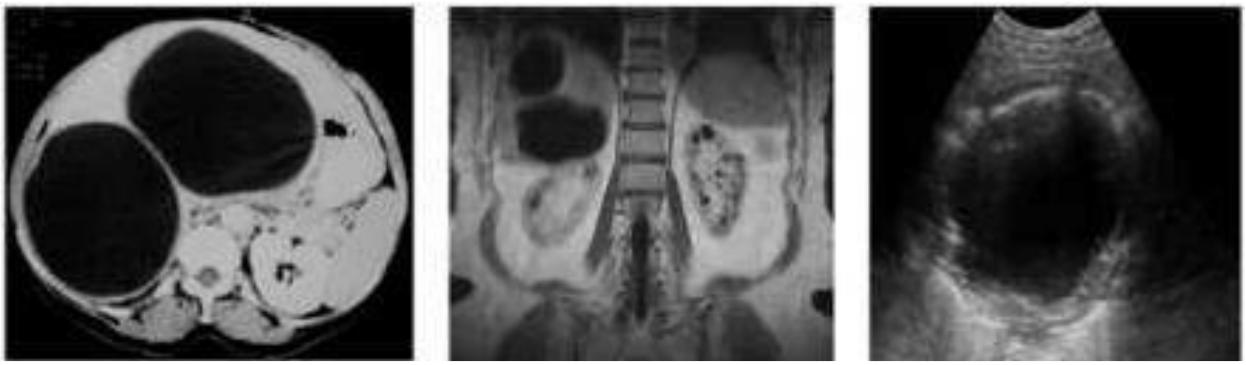

Figure: 7. E of the liver a) ultrasound - cystic formation with a multilayer capsule, echogenic suspension, marginal weakening of ultrasound b, c) RCT, MRI - cystic formations, thick capsule.

Table 2. Diagnostic efficiency of radiation research methods for liver echinococcosis.

Diagnosis	Sensitivity			Specificity		
Echinococcosis of the liver	Ultrasound	Ultrasound + CT	Ultrasound + CT + MRI	Ultrasound	Ultrasound + CT	Ultrasound + CT + MRI
	63,8%	82,5%	89,5%	67,6%	88,2%	91,8%

At the same time, the determination of the nature of intracystic inclusions (daughter cysts, partitions, etc.) facilitated differential diagnosis. The resolution of diagnostic doubts was facilitated by serological reactions (RIGA and ELISA) for echinococcosis, as well as data from cytological, bacteriological, biochemical studies and microscopy of the native material obtained by percutaneous diagnostic puncture under the control of ultrasound. Ultrasound was less informative in case of multiple and widespread echinococcosis. Determining the exact topical diagnosis by ultrasound was difficult with giant echinococcal cysts and multiple lesions; in these cases, it became necessary to combine ultrasound with CT or MRI. Difficulties in differential radiation diagnosis of echinococcal liver diseases were associated with the structural features of parasitic foci. Difficulties were encountered in the differentiation of simple cysts and monovesicularechinococcal cysts with thin membranes, without stratification of parasitic membranes and internal structures. Correct diagnosis in such cases was based on a comprehensive clinical, laboratory and radiation examination of patients. When analyzing the results of SCT with bolus contrast enhancement, it was noted that the contrasting of the surrounding liver parenchyma in parasitic cysts was diffusely uneven in 50% of cases. For radiation diagnosis of echinococcal cysts of the pseudotumor type, Doppler ultrasound was used, demonstrating avascularity by hydatid, computed and tomography, which clarified their structure. Among benign liver tumors in terms of differential diagnosis with echinococcosis, the greatest difficulties were presented by biliary cystadenomas. Identification of tumor nodes and papillary growths that accumulate contrast during enhancement, contributed to the correct diagnosis of tumors. The diagnostic efficiency of radiation research methods in the recognition of liver echinococcosis is presented in Table 2. As the analysis showed, CT was the most specific and sensitive method in the determination of liver Echinococcosis in a number of methods, followed by MRI and ultrasound. A comprehensive analysis of these radiation methods has significantly increased the specificity and sensitivity of the methods in the preoperative diagnosis of parasitic lesions. Thus, a complex radiation examination allows with a high degree of reliability to make a diagnosis of the hydatid form of echinococcal liver damage, to carry out differential diagnostics with other diseases.

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