

## ORIGINAL ARTICLE

## SURGICAL TREATMENT OF ECHINOCOCCOSIS OF THE LIVER AND ITS COMPLICATIONS

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### ABSTRACT

**The aim:** To analyze the frequency of complications of echinococcal cysts of the liver, the causes of recurrence and the results of surgical treatment of patients with echinococcal liver disease.

**Materials and methods:** The results of surgical treatment of 79 patients who were hospitalized from January 2011 to JANUARY 2022 with liver echinococcosis and its complications were analyzed. Among them there were 11 men (13,9%) and 68 women (86,1%), with average age  $47,5 \pm 2,3$  years. Complications of echinococcal cysts developed in 17 (21,5%) patients.

**Results:** The choice of surgical intervention method was determined individually, taking into account the location of echinococcal cysts, their size, depth, proximity of important anatomical structures. 53 (67,1%) patients underwent total or subtotal pericystectomy, 8 (10,1%) patients underwent liver segment resection, 5 (6,3%) patients underwent cyst dissection with removal and treatment its cavity, PAIR method was applied in 1 (1,3%) patient. Echinococectomy was performed laparoscopically in 12 (15,2%) patients. The use of laparoscopic surgery for echinococcosis of the liver reduced intraoperative blood loss, duration of operation, hospital stay. We did not have recurrences of the disease after radical surgery. After palliative surgery, recurrence occurred in 2 (2,63%) patients.

**Conclusions:** Surgical interventions for urgent indications in patients with complicated echinococcal cysts of the liver increase the risk of recurrence of the disease. Pericystectomy was performed in 53 (67,1%) patients, is a radical and efficient operation for complete recovery and does not lead to recurrence of the disease. The efficiency of laparoscopic echinococectomy has been demonstrated.

**KEY WORDS:** echinococcal cyst of the liver, pericystectomy, complications

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### INTRODUCTION

Echinococcosis is an anthroponozoonotic disease in which a person is an intermediate host and the adult forms of the helminth parasitize in the small intestine of carnivores. Quite often the first manifestations of parasite infection for humans are asymptomatic. As a result, the impact of internal organs with slowly growing cysts, for many years remains unnoticed, which leads in the end result to serious consequences [1,2].

The disease is characterized by endemic spread. Endemic regions include the Mediterranean, South America, the Far East, Central Asia, and Eastern Europe. According to the WHO in these regions the incidence of echinococcosis among humans can reach more than 50 per 100,000 population [3]. A major problem today is the spread of pathology beyond endemic regions, due to the active migration of the population in recent decades. Of particular concern is the increase in the incidence of echinococcosis in children and adolescents - up to 75% of cases. The territory of Ukraine is a center of tension of echinococcosis, the frequency of which has a steady upward trend, where 160-190 cases of echinococcosis in humans are registered annually. This is primarily due to better and more accurate laboratory and instrumental diagnostics. The recurrence rate of the disease varies from 2 to 23,2% and often leads to death [3-5].

Echinococcosis is dangerous because of its complications, the main of which is the rupture of the echinococcal cyst with the subsequent development of secondary infection and anaphylaxis due to the release of large amounts of antigen. Frequent complications are also dissemination of scolexes and formation of daughter cysts in the abdominal cavity, compression of neighboring organs, development of mechanical jaundice, less often - the development of bacterial cholangitis, liver cirrhosis, liver failure, portal hypertension, cachexia, metastatic spread to the pleura, pericardium, brain, lungs, eyes.

In the literature we analyzed over the past 5 years, there are many described individual clinical cases with interesting anatomical localization of cysts, often gigantic in size, which caused various complications and required individualized surgical approaches [6-11]. However, we did not find many studies that resulted in the analysis of large samples, which is due to the difficulty of collecting clinical material, which usually lasts for many years, the lack of specialized centers for patients with echinococcosis, hospitalization of patients with urgent complications in different surgical clinics, when complications have already appeared.

The question about the optimal treatment choice of echinococcal liver cysts remains open. When choosing a

method of surgical treatment of echinococcal liver cysts it is needed to take into account its size, type and the connection with the biliary system of the liver and other organs of the biopancreatic zone [12,13]. The efficiency of radical surgical methods against non-radical interventions in the treatment of hydatid cysts of the liver requires further study [14]. In recent years, there has been a tendency to expand the indications for mini-invasive technologies (laparoscopic echinococectomy, PAIR technology, removal of echinococcal cysts from the mini-access) both in «difficult» localization and in complicated echinococcal cysts. The possibility of using laparoscopic treatment with comparable efficacy and safety as in open surgery has been demonstrated [15].

Thus, the question of diagnosis and treatment of echinococcosis and its complications remains relevant in modern surgery. There are many issues that need further study, in particular the lack of well-developed algorithms for the duration and effectiveness of preoperative antiparasitic therapy, needs to develop a classification of complications of echinococcosis, remain open questions about the volume and terms of surgery for echinococcosis, depending on the size of echinococcal cysts, involvement in the process neighbor organs with the development of their dysfunctions, no clearly defined surgical tactics for ruptures of echinococcal cysts with peritoneal spread of cystic contents, open treatment of residual cavity after removal of parasitic cysts and many others.

## THE AIM

The aim of the study was to analyze the frequency of complications of echinococcal cysts of the liver, the causes of recurrence and the results of surgical treatment of patients with echinococcal liver disease.

## MATERIALS AND METHODS

The results of surgical treatment of 79 patients who were hospitalized in the clinic of surgery №1 on the basis of Vinnytsia Regional Pirogov Memorial Clinical Hospital from January 2011 to JANUARY 2022 with liver echinococcosis and its complications. Among them there were 11 men (13,9%), 68 women (86,1%). The average age of patients was  $47,5 \pm 2,3$  years.

Primary echinococcosis was detected in 75 (94,9%) patients, secondary - in 4 (5,1%). Single cysts of the liver were found in 68 (86,1%) patients, multiple - in 11 (13,9%). The size of the cysts ranged from 3,5 to 18 cm in diameter.

When studying the localization, it was noted that the right lobe of the liver was affected much more often - in 56 (70,1%) patients, compared with the left - 20 (25,3%) cases. In 2 (2,5%) patients there was the affection of both lobes of the liver, in 1 (1,3%) patient the affection of a square lobe was found (Table I).

Complications of echinococcal cysts developed in 17 (21,5%) patients. Among them, most often patients were admitted with suppuration of cysts - 14 (17,7%), 1 (1,3%) patient was admitted by emergency with rupture of echino-

coccal cyst into the free abdominal cavity, 1 (1,3%) patient had rupture of echinococcal cysts into the pleural cavity and another 1 (1,3%) patient had a rupture of echinococcal liver cysts into the bile ducts (Table II).

Diagnosis of complicated forms of echinococcosis of the liver was performed using standard general clinical examinations, immunological examinations with serological blood tests for IgG to parasites, computed tomography of the abdominal cavity on Siemens Somatom go.up, enhanced contrast, ultrasound examination on Siemens Healthineers, ACUSON Juniper, with a convex sensor with a frequency of 5.5 MHz. To exclude the combined affection by echinococcosis, patients underwent chest radiography or chest computed tomography, simultaneously performed ultrasound examination of the thoracic cavity, if necessary, performed fibrogastroduodenoscopy and other methods.

All patients, according to the protocol of treatment of echinococcal cysts, received antiparasitic therapy with albendazole. The dose for patients with body weight more than 60 kg was 400 mg 2 times a day, and for less than 60 kg the drug was prescribed at a rate of 15 mg / kg / day. Before and after surgery, two cycles of 28 days were performed, separated by a 14-day break.

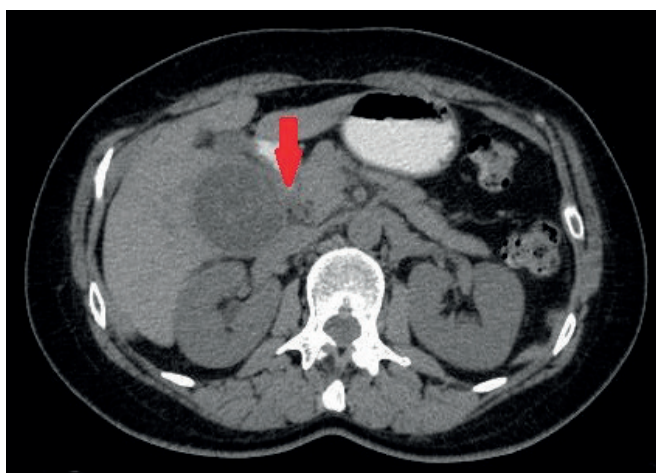
The presence of echinococcal cysts in the liver was an indication for surgical treatment. In 23 (29,1%) cases, mainly with the localization of cysts in the left lobe of the liver, the operation was performed from the upper middle access, in other 56 (70,9%) patients performed oblique subcostal access according to Kocher or Fedorov.

Statistical processing of the study results was performed using the application package "Statistica 5.5" from Statsoft and Excel.

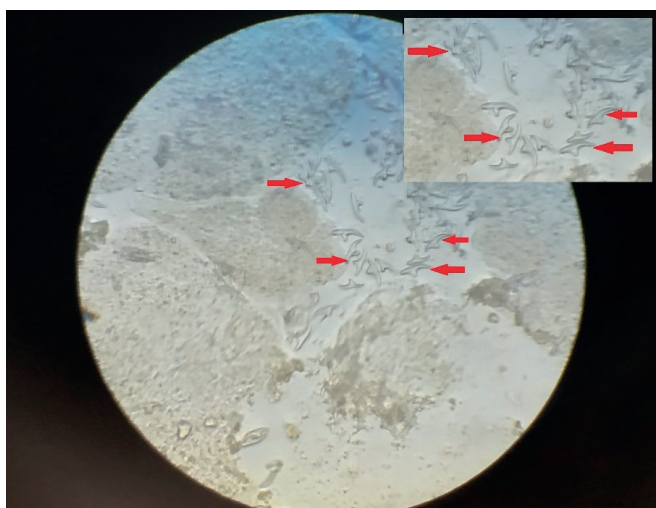
## RESULTS

The choice of surgical intervention method was determined individually, taking into account the location of echinococcal cysts, their size, depth, proximity of important anatomical structures. For the convenience of intraoperative manipulations in the localization of cysts in the right lobe of the liver, liver mobilization was performed by crossing the coronal and round ligaments. The round ligament was taken on a clamp and the liver could be pulled into the wound. To prevent intraoperative dissemination with parasite scolexes, the operating field was covered with three or four tampons soaked in betadine.

Information about the size of the cyst, their number and anatomical location in the liver, the proximity of blood vessels and bile ducts, the stage of development of the parasite, and the possible impression of other internal factors were crucial in determining surgical access, type and volume of surgery, prediction of possible intraoperative complications. To obtain all the preliminary data at the preoperative stage of preparation, 65 (82,3%) patients with «deep» or «difficult» location of echinococcal cysts underwent computed tomography of the abdominal cavity. The study was performed with intravenous contrast with the drug ultravist 370 mg / 100 ml.



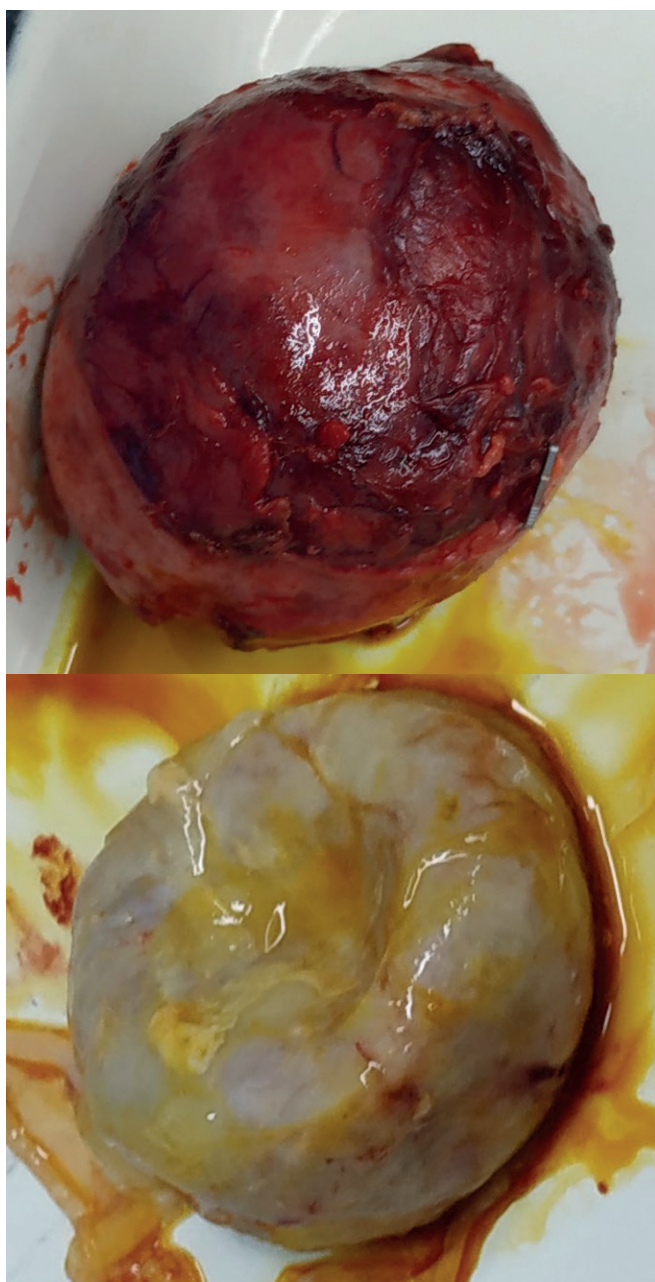
**Fig. 1.** Echinococcal cyst of the liver, the capsule of which is tightly attached to the head of the pancreas (the place of attachment is indicated by an arrow).



**Fig. 3.** Cystic fluid with multiple scoleces.

Preferred radical surgery. 53 (67,1%) patients underwent total or subtotal pericystectomy, 8 (10,1%) patients with deeper cysts underwent liver segment resection, 5 (6,3%) patients underwent cyst dissection with removal and treatment its cavity, PAIR method was applied in 1 (1,3%) patient. Echinococectomy was performed laparoscopically in 12 (15,2%) patients (Table III).

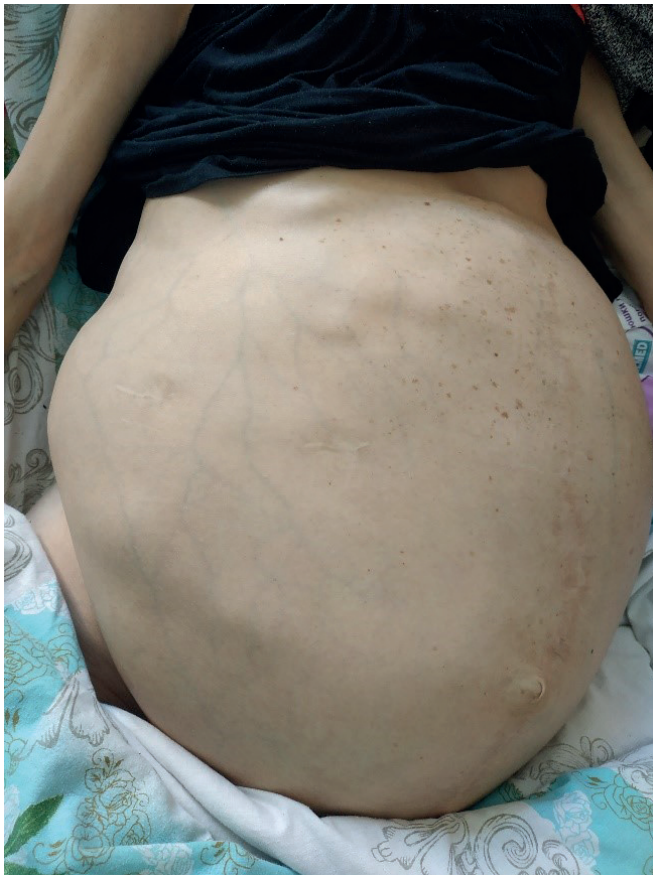
In 19 (24,1%) cases, the cyst was ingrown with neighboring organs such as the stomach, gallbladder, diaphragm, omentum, and pancreas (Fig. 1). During their separation there was a threat of disturbance of the cyst capsule integrity and dissemination of abdominal cavity with scoleces. The presence of perifocal inflammation causes an increase of tissues density around the cyst membranes and the difficulty of separating it from the surrounding organs. In such cases, it is important not to damage both the membrane of the cyst, so as not to cause generalization of the process, and the organ involved in the process. In these cases, when it was impossible to remove the cyst without damaging it, a puncture of the cyst, evacuation of its contents, cystotomy and removal of the chitinous membrane



**Fig. 2.** A - general view of echinococcal cyst. B - inner (germinative) membrane of the echinococcal cyst capsule.

with daughter bubbles were performed. In one case, sub-capsular localization of an echinococcal cyst at the border of IV-V segments of the liver caused its prolapse towards the liver gate with gallbladder flattening on the cyst surface and bladder duct compression with the development of acute cholecystitis. Topographically, the cyst was localized near the head of the pancreas. During the operation, the fibrous cyst was removed without opening its lumen, but apparently, manipulations in this area led to injury of the pancreatic parenchyma, which led to the development of postoperative pancreatitis in the postoperative period, for which the patient received one-week infusion therapy in postoperative period. Numerous scoleces were revealed by microscopy in cystic contents (Fig. 1, Fig. 2 a, b).



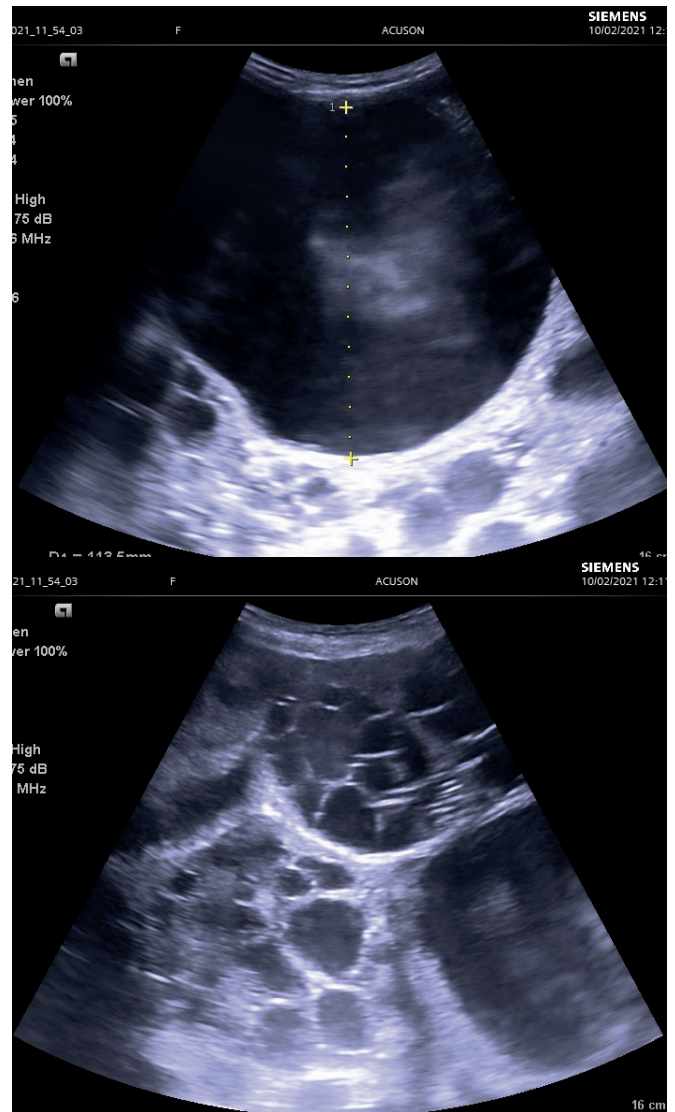


**Fig. 4.** General view of the abdomen in patient with recurrent widespread multichambered peritoneal echinococcal affection of the abdominal cavity due to rupture of the echinococcal liver cyst.

In 9 (11,4%) patients with multichambered echinococcal cysts, the contents could not be removed by puncture due to obturation of the lumen of the needle with fragments of the chitinous membrane. In these cases, a cystotomy had to be performed and the inner surface was treated with a high-frequency welding electrocoagulator EK-300M "Svarmed". In 16 (20,3%) patients after evacuation of the contents of the cyst revealed perforating bile ducts that opened into its lumen. The further course of surgery depended on the individual characteristics of the cyst. It was possible to complete the operation without the formation of a residual cavity in the liver by performing a subtotal pericystectomy.

During removal of single echinococcal cysts blood loss did not exceed 200 - 300 ml. During removal of numerous echinococcal cysts (two patients had more than 5 cysts) including «difficult» places (VII and VIII segments of a liver), sometimes reached to 1,1 l of blood.

Laparoscopic echinococectomy was performed with localization of cysts in II, III, IV, V, VI and was not used in disseminated echinococcosis of the liver and in the localization of cysts in segments I, VII and VIII. The use of laparoscopic surgery for echinococcosis of the liver reduced intraoperative blood loss in 9 times ( $p = 0,0001$ ); duration of operation - from  $3,5 \pm 0,3$  to  $1,5 \pm 0,1$  hours (2 times) ( $p > 0,05$ ), stay in a hospital - from  $10 \pm 2,0$  to 3



**Fig. 5.** Sonogram of a patient with recurrent multichambered echinococcal affection of the abdominal cavity. A - a giant echinococcal cyst of the mesentery of the small intestine. B - multiply small echinococcal cysts of the peritoneum.

$\pm 1,0$  days (3,3 times) ( $p = 0,002$ ); recurrences occurred in 2 (2,6%) cases with laparotomy access and were absent after laparoscopic interventions.

In the postoperative period 6 (7,6%) patients developed right-sided exudative pleurisy, which resolved conservatively. Bleeding was observed in 1 (1,3%) patient, which was stopped by welding electrocoagulant and additional stitching of the wound surface of the liver. In 1 (1,3%) case, postoperative pancreatitis developed. We did not have recurrences of the disease after radical surgery (pericystectomy, resection of a segment with a cyst). After palliative surgery, recurrence occurred in 2 (2,63%) patients. There were no fatalities after performing these interventions.

Both cases of recurrence developed in patients with complications of cysts after non-radical surgical interventions for urgent indications. In one case, recurrence occurred in a patient after suppuration of the liver cyst

**Table I.** Distribution of the patients according to localization of echinococcal cysts.

Localization of echinococcal cysts in the liver	Number of patients	
	Absolute number	%
The right lobe	56	70,9
The Left lobe	20	25,3
Right and left lobes	2	2,5
Square lobe	1	1,3
Total	79	100,0

**Table II.** Distribution of the patients according to the development of complications of echinococcal cysts of the liver

Complications of echinococcal cysts of the liver	Number of patients	
	Absolute number	%
Suppuration of cysts	14	17,7
Rupture of the cyst:		
into the free abdominal cavity	1	1,3
into the pleural cavity	1	1,3
into the bile ducts	1	1,3
Total	17	21,5

**Table III.** Distribution of the patients with echinococcal liver cysts depending on the type of surgery

Type of surgery	Number of patients	
	Absolute number	%
Pericystectomy	53	67,1
Resection of the liver segment	8	10,1
Opening of the cyst	5	6,3
Laparoscopic echinococectomy	12	15,2
PAIR	1	1,3
Total	79	100,0

and the opening of the cyst with removal of the contents and treatment of its cavity. Recurrent cyst was diagnosed five years after the first operation. Pericystectomy was performed, followed by long-term antiparasitic therapy for 2 years according to the scheme. In the second case, recurrence with a massive spread of the parasitic process throughout the abdominal cavity occurred 7 years after surgery for rupture of the parasitic cyst and diffuse peritonitis. Due to the generalization of the process throughout the peritoneum, the patient developed multichambered peritoneal echinococcosis, which caused a sharp increase in the abdomen, compression of all internal organs and significantly increased intra-abdominal pressure (Fig. 4).

At such massive dissemination of parasitic process in the abdominal cavity there were numerous cysts of the different size, from 2 cm to 18 cm in the diameter in the patient (Fig. 5). Expressed cachexia. A sharp increase in intra-abdominal pressure caused the elevation of the domes of the diaphragm to the second intercostal space, the development of portal hypertension, ascites. The increase in the size and weight of the abdomen due to the spread of the parasitic process made it difficult to move independently, as a result of which the patient fell and received a closed fracture of the femur in the middle third with displacement. Currently, the patient continues treatment

for hip fracture and echinococcosis of the abdominal cavity. The PAIR technique was chosen in this patient. Under the local anesthesia, the largest cyst was punctured under ultrasound control, its contents were removed, and 96% ethyl alcohol was injected into the cyst cavity. This has reduced intra-abdominal hypertension. Currently, the patient continues treatment in the hospital, planned gradual drainage with the introduction of 96% ethyl alcohol from other cysts.

Thus, the clinical course of echinococcosis was asymptomatic for a long time, as a result of which 17 (21,5%) patients were hospitalized with complicated forms of echinococcosis (suppuration of the cyst, rupture into the free abdominal cavity, into the pleural cavity, rupture into the biliary tract); in 19 (24,1%) patients - there were ingrown of the cyst with neighboring organs (stomach, gallbladder, diaphragm, omentum, pancreas); in 16 (20,3%) patients - bile fistulas opened into the lumen of echinococcal cysts. These patients, on admission, had complaints of pain in the right hypochondrium, periodic fever, skin rash, itching, jaundice. In the diagnosis of echinococcal cysts, the main method were ultrasound and CT, which were performed to identify daughter cysts and determine the volume of the operation. For these 53 (67,1%) patients pericystectomy was performed, where it was possible to radically remove the cyst capsule, achieve stable hemostasis and prevent bile leak-

age thanks to the use of the welding electrocoagulator. In 12 (15,2%) patients with uncomplicated forms of echinococcal cysts laparoscopic echinococectomy without damaging the capsule was performed.

## DISCUSSION

Diagnosis of echinococcosis is complex and includes both imaging and laboratory methods [3]. It should be remembered that negative serological tests do not exclude an infection with a hydatid cyst [16]. In this study, in addition to contrast-enhanced CT, all patients underwent serological tests for immunoglobulins G, as well as performed microscopic analysis of cystic fluid for the detection of scolaxes. The clinical course of echinococcosis can remain asymptomatic for a long time, which is the reason for late referral to a medical institution, usually when certain complications have already developed. In our study, 17(21.5%) patients came with complicated forms of echinococcosis after a long asymptomatic initial period of the disease.

The larger the sizes of a hydatid cyst the higher the risk of its growing with the neighboring organs, which occurred in 19 (24.1%) patients, and this in turn created the threat of violation of the integrity of the cyst capsule during its separation and contamination of the abdominal cavity with scolexes. In our study, in one patient due to the growing of echinococcal cysts in the pancreas after removal of the cyst, in the postoperative period postoperative pancreatitis developed, which is a rare complication of the liver echinococcosis [17].

The generally accepted treatment approaches for liver echinococcosis today are: chemotherapy, surgery and interventional procedures. Numerous studies recommend preoperative use of albendazole [18]. In our study, all patients with liver echinococcosis, who underwent elective surgery, received albendazole at a dose of 400 mg 2 times a day for a two-week course preoperatively to minimize the risk of the intra-operative spread of scolexes and reduce the risk of possible recurrence.

The choice of surgical tactics for liver echinococcosis remains controversial [19]. In this study, radical surgical procedures, such as pericystectomy and resection, were performed in 62 (78.2%) patients. In the study period, recurrence after radical surgery was not detected. Recurrence occurred in two patients who were operated on for urgent indicators due to rupture of echinococcal cysts and the generalization of cystic fluid in the peritoneal cavity.

In the present study, compared with radical surgery, laparoscopic echinococectomy, which was performed in 12 (15.2%) patients, showed a number of advantages, such as reduction of intraoperative blood loss, duration of operations, less length of hospital stay.

## CONCLUSIONS

1. Ultrasound diagnosis of echinococcal cysts of the liver becomes less informative in the case of cysts with «difficult» topographic anatomical localization, so it should be supplemented by computed tomography with contrast enhancement, which provides information about the spatial location of cysts relative to other important

anatomical structures.

2. Surgical interventions for urgent indications in patients with complicated echinococcal cysts of the liver increase the risk of recurrence of the disease, which occurred in 2 (2,5%) patients.
3. Pericystectomy with complete excision of the fibrous capsule of the liver was performed in 53 (67,9%) patients, is a radical and efficient operation for complete recovery and does not lead to recurrence of the disease.
4. The possibility of using laparoscopic echinococectomy with comparable efficiency and safety compared to open surgery with less intraoperative blood loss, less duration of the operation and less hospital stay has been demonstrated.

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#### **Conflict of interest:**

*The Authors declare no conflict of interest.*

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**A** - Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis,

**D** – Writing the article, **E** – Critical review, **F** – Final approval of the article



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