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Differential Surgical Tactics in Complicated and Complex Forms of Liver Echinococcosis

Mamanov Muhammad Choriyevich
PhD, Ass., Samarkand State Medical University, Samarkand, Republic of Uzbekistan

Abstract: Purpose of the study. To improve the results of surgical treatment of liver echinococcosis and its complications by developing differential tactics with a priority use of minimally invasive technologies. Study materials. Depending on the type and number of operations and examinations performed, patients were divided into two groups. In the main group of 118 patients (2021-2023), surgical treatment using modern diagnostic methods and minimally invasive technologies was used. The comparison group included 106 patients who underwent traditional diagnostic methods and open surgical interventions. Study results. Surgical treatment of liver echinococcosis and its complications using minimally invasive technologies made it possible to significantly improve treatment results by reducing postoperative complications from 21.7% to 9.3%, eliminating deaths, and reducing recurrences from 14.8% to 5.4%.

Keywords: Liver echinococcosis, complications, treatment, recurrence.

The introduction of modern diagnostic technologies into surgical hepatology has significantly improved the quality of diagnosis of liver echinococcosis and its complications. However, many issues related to the mechanisms of disease recurrence and the development of complications have not been fully elucidated, which requires their comprehensive study [2, 5, 8]. To date, there is no consensus on the etiology of disease recurrence (metastatic, implantation, residual, reinvasive) 1. The urgency of the problem of liver echinococcosis (LE) is also associated with the fact that a clear algorithm has not yet been developed on such an important issue as the choice of surgical intervention method and volume aimed at reducing postoperative complications and mortality [3, 4, 6, 7]. The use of minimally invasive methods for the treatment of liver echinococcosis is currently of great interest among various authors, while some are still skeptical about such interventions due to the risk of contamination in the abdominal cavity and the likelihood of disease recurrence, and therefore, specific indications and contraindications have been developed for performing these interventions [5, 7, 8].

The current situation requires the development of pathogenetically sound methods for the treatment of LE and its complications in order to minimize postoperative complications and disease recurrence.

Purpose of the study. To improve the results of surgical treatment of liver echinococcosis and its complications by developing differential tactics with a priority use of minimally invasive technologies.

Materials and methods. The clinical material was analyzed based on the results of a comprehensive examination and treatment of 224 patients with liver echinococcosis (LE)

admitted to the surgical department of the multidisciplinary clinic of Samarkand State Medical University.

Depending on the type and number of operations and examinations performed, patients were divided into two groups. In the main group of 118 patients (2021-2023), surgical treatment using modern diagnostic methods and minimally invasive technologies was used. The comparison group included 106 patients who underwent traditional diagnostic methods and open surgical interventions.

The studied patients consisted of 106 (47.4%) men and 117 (52.6%) women.

In the study group of 118 patients, 160 echinococcal cysts were detected, while in the control group patients, 146 echinococcal cysts were detected. This fact is very important in deciding which operations to perform and how much chemotherapy to administer in order to reduce complications and recurrence of the disease.

Uncomplicated liver echinococcosis was detected in 76 cases (34.1%), in 35 patients (30.5%) in the main group and in 39 patients (37.6%) in the control group. Suppuration of echinococcal cysts of the liver was recorded in 63 cases, which is 28.5% of the total: in 33 patients in the main group - 28.8% and in 29 patients in the control group - 28.8%. Parasitic mechanical jaundice, a severe complication of liver echinococcosis, was detected in 51 cases (22.9%), including 33 patients from the main group (28.8%) and 18 patients from the control group (17.1%).

Recurrent echinococcosis was detected in 17 (8.8%) patients in the main group and in 20 (15.9%) patients in the control group (Table 1).

Patients were divided into groups according to the size of the echinococcal cysts and the possible complications of liver echinococcosis.

According to the WHO classification, echinococcal cysts (EC) of the CL type are characterized by the presence of cysts with anechoic properties, a clear, usually smooth, sometimes moderately uneven contour, and a dense and thick wall that continues along the entire perimeter (Figure 1). The “fish scale” symptom, observed in 61% of cases, is considered one of the informative signs of echinococcal parasite (EC) and its complications (Figure 2). On ultrasound examination, daughter cysts appear as heterogeneous rounded formations located very close to each other.

The presence of numerous daughter cysts, usually the anechoicity of the cyst fluid and the separation of the inner membrane, are characteristics of CE3 type echinococcal cysts (Figure 3).

The presence of echinococcal parasite and its complications was confirmed using computed tomography (CT) in 73 of 74 patients (98.1%) (Figure 4).

Magnetic resonance imaging (MRI) was used as the final study method in 47 patients (21.2%) with liver echinococcosis and its complications (Figure 5).

Table 1. Distribution of patients with LE according to the nature of complications (n=224)

Complications	**Main Group (n=118)**		**Control Group (n=106)**	
	abc	%	abc	%
Without complications	35	30,5	39	37,6
Suppuration of the echinococcal cyst	33	28,9	29	28,2
Mechanical jaundice:	33	28,9	18	17,1ъ
Rupture of the echinococcal cyst (EC) into the bile ducts	27	22,9	12	11,8ъ
Presence of echinococcal cysts compressing the bile ducts	6	5,9	6	5,3

Recurrent echinococcosis	17	8,8	20	15,9ъ
Total	118	100,0	106	100,0

Note: * p < 0.05 compared to indicators in the main group (according to the $\chi 2$ criterion)

Figure 1. Ultrasonogram. Liver echinococcal cyst (4 cm) of CL type

Figure 2. Ultrasonogram. Numerous echinococcal cysts of the liver. CE2 type

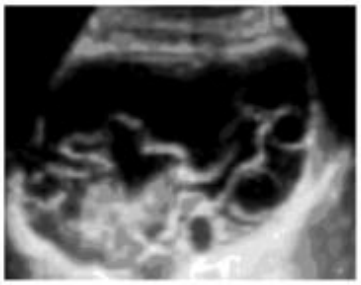

Figure 3. Ultrasonogram. CE3 type echinococcal cysts

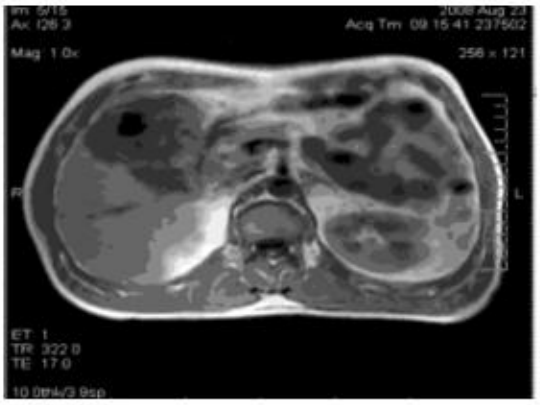

Figure 4. CT scan. Recurrent liver echinococcosis. Calcified fibrous capsule

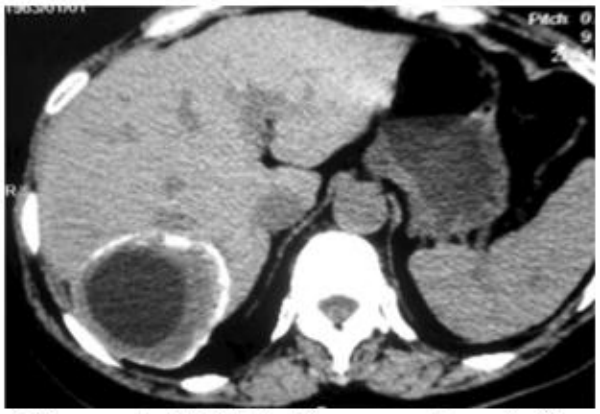

Figure 5. MRI. Echinococcal cyst of the liver in the right lobe. Hypointense signal from the chitin capsule, septal structures, and double-layering of the capsule.

Table 3. Nature of minimally invasive interventions in patients of the main group with Liver Echinococcosis (LE) and its complications (n = 118)

Nature of Minimally Invasive Interventions	Number	%
Open Minilaparotomy Echinococcectomy	31	26,2
Percutaneous Transhepatic Puncture and Drainage Interventions	10	8,4
Laparoscopic Echinococcectomy	19	16,1
Laparoscopic Ideal Echinococcectomy	7	5,9
EPST. Transpapillary endoscopic removal of echinococcal cyst elements and CBD + Conventional Open Echinococcectomy	5	4,2
Conventional Open Echinococcectomy + Videoendoscopy of the Residual Cavity	5	2,9
Total	77	65,2

The presence of LE and its complications was confirmed in all 118 cases (100%) by complex and combined ultrasound (US) and computed tomography (CT) examinations.

In 77 cases (72.4%), removal of echinococcal cysts was performed using the traditional, organ-preserving method. A subcostal oblique incision approach was used for surgery in 88 patients (82.9%), while a midline laparotomy was used in 18 patients (17.1%).

Radical or conditionally radical operations were used in 29 cases (27.6%) in the treatment of liver echinococcosis and its complications. Total pericystectomy (11 cases) and subtotal pericystectomy (13 cases) were performed in 21.7% of cases.

In addition, a bloody liver resection was performed in 6 cases (5.8%).

The objective criteria developed in the clinic allowed for the selection of differential surgical tactics in each specific case, based on the selection of a pathogenetically sound technique for minimally invasive treatment of LE and its complications.

Open echinococcectomy was performed in 31 (26.2%) cases using various mini-approaches.

Single-stage percutaneous transhepatic puncture and drainage interventions were performed in 10 patients (8.5%). Laparoscopic echinococcectomy was performed in 26 (22.0%) cases, of which laparoscopic ideal echinococcectomy was performed in 7 cases, and laparoscopic total and subtotal pericystectomy in 19 cases. In 5 (4.2%) cases, due to the presence of choledocholithiasis, endoscopic transpapillary interventions were performed in the first stage with removal of echinococcal cyst elements from the lumen of the common bile duct, and echinococcectomy was performed in the second stage using an open approach. Thus, strictly differentiated surgical tactics using minimally invasive technologies were followed in 77 (65.2%) patients with LE and its complications, and traditional open interventions were performed in 41 (34.7%) patients. For the treatment of LE and its complications, minilaparotomic open echinococcectomy was performed in 31 (26.5%) patients using the "Mini-Assistant" instrument set (Figure 6).

In 17 (54.8%) patients, echinococcectomy from segments II, III, and IV of the liver was performed using the superior midline mini-laparotomy technique (Figure 7). Access via right-sided transrectal and subcostal mini-laparotomy was used in 14 (45.2%) patients to perform echinococcectomy in cases where echinococcal cysts were located in segments I, IV, V, and VI of the liver. Video endoscopy was used in 18 cases to diagnose cystobiliary fistula and examine the residual cavity for its electrocoagulation. The following contact germicides are used for antiparasitic treatment of the cyst cavity and the walls of the fibrous capsule: 80% glycerol solution and 75% ethyl alcohol. No complications were observed during minimally invasive echinococcectomy.Study results. In the postoperative period, a complication in the form of bile leakage was recorded in 1 case on the 14th day and stopped spontaneously.

Laparoscopic echinococcectomy was performed in 26 patients (22.0%), of which total and subtotal pericystectomy was performed in 19, and laparoscopic ideal echinococcectomy in 7. Karl Storz (Germany) instrument sets were used to perform laparoscopic echinococcectomy. The following protocol was used for laparoscopic echinococcectomy of the liver. After creating a carbonxypyritoneum at a pressure of 10-14 mm Hg, a 10 mm port was installed to insert a camera laparoscope slightly above the umbilicus. In addition, two ports with a diameter of 5 mm were installed under the right costal arch and on the left along the linea axillaris anterior. The next step was adhesiolysis and revision. A cyst was then detected on the surface of the liver.

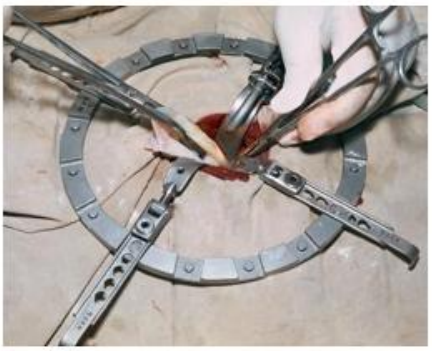

Figure 6. Cystotomy and removal of the chitinous membrane via mini-laparotomy

Figure 7. Intraoperative photo. Minilaparotomic echinococcectomy

Figure 8. LEE. Cyst puncture

Figure 9. LEE. Evacuation of chitin into an endo-container

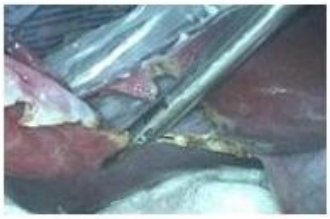

Figure 10. LEE. Subtotal pericystectomy

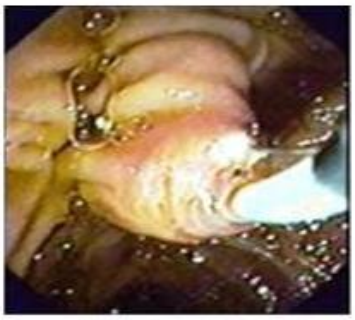

Figure 11. ERCP. A rounded formation in the lumen of the hepaticocholedoch. ERCP with removal of echinococcal cyst fragments.

a

b

Figure 12. Ultrasound (a) during liver puncture and after puncture completion (b). Collapsed cyst with minimal fluid and folded chitinous membrane.

Gauze sponges moistened with antiscolex solution were placed at the designated puncture site. Following this, a puncture needle was inserted into the abdominal cavity from the planned puncture site. We selected the highest point for puncturing the cyst, opening its cavity, and aspirating its fluid (Figures 8, 9).

The hydatid fluid was evacuated to the maximum extent possible. Then, the abdominal cavity pressure was raised to 10-14 mm Hg, and an 80% glycerol solution was injected into the cyst cavity in a volume equal to 50-70% of the aspirated fluid. Ten minutes later, the fluid in the cyst was aspirated, and cystostomy was performed using electrocoagulation methods. After this, a procedure was carried out to evacuate the chitinous membrane into a special container. The remaining cyst contents were removed, and the presence of potential cystobiliary fistulas was checked. Subsequently, the cyst cavities were repeatedly treated with gauze balls moistened with 96% alcohol. The next step was drainage of the residual cyst cavity or removal of the free edges of the fibrous capsule (Figure 10).In five cases, laparoscopic ligation of the cystobiliary fistula was performed, and in six cases, cholecystectomy was performed.

The average duration of the surgical intervention was 116.2 ± 36.8 minutes. This indicator largely depended on the volume of the surgery and the presence of concomitant surgical or other pathologies. The total volume of blood loss ranged from 50 to 350 ml, with an average value of 155.76 ± 37.503 ml.

Table 4. Nature of conventional surgical interventions in patients with Cholelithiasis (or other condition denoted by ЖЭ) and its complications in the main group (n=118)

Nature of Surgical Intervention	Number	%
Conventional Organ-Preserving Echinococcectomy	30	25,4
Closed Echinococcectomy	26	22,0
Open Echinococcectomy	4	3,3
Radical and Conditionally Radical Operative Interventions:	11	9,3
Total Pericystectomy	3	2,5
Subtotal Pericystectomy	5	4,2
Liver Resection	3	2,5
Total	41	34,7

“Following normalization of hyperbilirubinemia and liver function test parameters, planned radical surgical interventions were performed.

In 10 patients (8.4%) in the main group, percutaneous transhepatic puncture and drainage procedures were carried out. Notably, complications related to the condition (ЖЭК) were observed in 8 of these cases.

For percutaneous puncture of suppurative echinococcal cysts of the liver, both one-stage and two-stage techniques are employed. In both approaches, the puncture was performed using a Chiba needle with a diameter of 20-22 Fr. Subsequently, a catheter with a twisted ‘pigtail’ tip (e.g., Huisman, ‘Putopix’, DLAW) or a straight ‘Argyle’ catheter measuring 6-9 cm in diameter was introduced into the cyst via the needle. The choice of catheter was determined by the size of the parasitic formation and the anticipated trajectory of the puncture tract. The next step involved utilizing a vacuum aspirator to evacuate the fluid from the cyst cavity, which led to the rapid collapse of the cyst walls (Figure 12).

In patients with suppurative echinococcal cysts of the liver, a significant improvement in their overall condition was observed after percutaneous puncture under ultrasound guidance, attributed to a reduction in endotoxemia levels.

In the control group (n=106), 23 patients (21.7%) experienced postoperative complications. Reoperation was necessary in 2 cases (1.9%) to manage these complications. During the follow-up period, one patient (0.9%) died from acute liver-kidney failure.

In the main group, 11 patients (9.3%) developed postoperative complications that did not require relaparotomy. Corrective measures for these complications did not necessitate repeated surgical interventions.

Therefore, the differential application of minimally invasive techniques in the surgical management of liver echinococcosis and its complications led to a reduction in mortality and postoperative complications. Long-term outcomes were also contingent upon the scope of the surgery. Postoperative chemotherapy with albendazole is a crucial step in minimizing the risk of echinococcosis recurrence.

A follow-up study of long-term treatment results was conducted on patients from the main (n=110) and control (n=101) groups over a one-to-five-year period. Relapse of liver echinococcosis occurred in 21 patients (9.3%) in total, comprising 6 patients (5.4%) from the main group and 15 patients (14.8%) from the control group.

It is important to note that of the six patients in the main group with chronic liver echinococcosis, three required surgical intervention due to disease recurrence. In the control group, 9 out of 15 patients with recurrent liver echinococcosis underwent surgery. The timing of recurrence varied between both groups; early relapses occurred within three years post-surgery, while late relapses developed after five years."Recurrences of liver echinococcosis were detected in three patients from the main group and seven patients from the control group during the first three years after echinococcectomy. Early recurrences are presumed to be residual, while late recurrences may result from implantation, metastasis, or reinvasion. This is linked to the faster growth of residual cysts compared to other cysts. Cysts grew an average of 0.5-1 cm per year.An analysis of the follow-up of 21 patients with liver echinococcosis recurrences revealed late recurrences in three patients from the main group and eight patients from the control group.

The follow-up data for 21 patients with liver echinococcosis recurrences were analyzed, considering the onset of the disease and the initial localization of the cysts. It was found that 81.5% of patients with recurrence had one or more primary liver cysts. In 18.5% of patients, combined echinococcosis was present. The results indicated that if the primary cyst was located in the liver, recurrences developed more frequently within the liver. Furthermore, a comparative analysis showed that in cases of combined primary echinococcosis, recurrences were observed more often in the liver, particularly in the early postoperative period (28.6% versus 3.6%), and these differences were not statistically significant.

Conclusion.

The algorithm for diagnosing liver echinococcosis and its complications, utilizing modern radiological diagnostic methods (Ultrasound, CT, MRI, ERCP) step-by-step, allows for the examination of cyst type, its current characteristics, and the presence of complications with up to 100% informational accuracy, which aids in selecting surgical tactics.The developed criteria for choosing the surgical intervention method for liver echinococcosis and its complications allow for the implementation of minimally invasive surgical interventions in 65.3% of cases using endovideosurgery or navigational-puncture techniques.The selection of differentiated surgical tactics based on the type of echinococcal cysts, their location, number, and the presence of complications allows for the preferential use of less invasive methods as the final treatment or as an initial stage of sanitizing the purulent focus in cases of endogenous intoxication due to cyst suppuration and penetration into the biliary tract.Surgical treatment of liver echinococcosis and its complications using minimally invasive techniques significantly improved treatment outcomes by reducing postoperative complications from 21.7% to 9.3%, eliminating mortality, and reducing recurrences from 14.8% to 5.4%.

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