

Diagnosis and Surgical Treatment of Liver Echinococcosis

Anarboev Sanjar Alisherovich

Samarkand State Medical University, Uzbekistan

Abstract Liver echinococcosis has been reported since ancient times. It is a zoonotic infection caused by nine recognized species of tapeworms of the genus *Echinococcus*. Some of them are known to cause human echinococcosis, and there are reasonable doubts about others. Diagnosis is confirmed by epidemiological history, clinical presentation, radiological imaging, and serological tests. Various pathological forms can become life-threatening, and in these cases, treatment is extremely difficult. The main goal of treatment is the complete cure of the disease in order to avoid further complications and relapses. Liver surgery using various techniques gives the best results with acceptable morbidity and mortality rates. In Uzbekistan, this disease is endemic with high incidence and prevalence. The surgical department of the 1st clinic of the Samarkand State Medical Institute has extensive experience in the treatment of echinococcal liver disease. This article focuses on the epidemiology, etiopathogenesis, diagnosis and surgical treatment of liver echinococcosis.

Keywords Liver echinococcosis, Epidemiology, Etiopathogenesis, Diagnosis, Surgical treatment

1. Maintaining

Human echinococcosis, also called echinococcosis, is a zoonosis that has been known since ancient times. Mentions of echinococcosis in both humans and animals are found in such ancient documents as the Ebers Papyrus and the Babylonian Talmud [1,2]. A significant breakthrough occurred around the mid -19th century when the etiology and life cycles of various species of *Echinococcus* were determined, although many related questions were still unresolved [3]. Hydatid disease is caused by nine recognized species of tapeworms of the genus *Echinococcus* (E.). Seven of them cause various forms of human echinococcosis, and the remaining two are being studied for possible infection in humans. In some life cycles of these tapeworms, the hosts are domestic animals, such as dogs as the definitive hosts and sheep as intermediate hosts. Humans are occasional intermediate hosts. Other species of these parasites have wild life cycles, infecting almost exclusively wild animals and rarely humans. In addition, there are more complex cycles in the interaction of wild and domestic animals. Variants of these cycles are known depending on geographical location [4].

Cystic echinococcosis, the most common form of echinococcosis, is an endemic zoonosis caused by the larval stage (metacestode) of the tapeworm *E. granulosus*. In terms of geographical distribution, the disease is present in many countries peace [5]. The diagnosis is confirmed by epidemiological history, medical history, clinical picture,

radioimaging and serological tests.

Surgical treatment uses various methods aimed at achieving the best result for the patient. Partial cystectomy, pericystectomy and liver resection are performed either open or laparoscopic surgical approach, with neoadjuvant or adjuvant with or without drug therapy. There are also various procedures for evacuating the parasite from using percutaneous or endoscopic access. In some cases, antiparasitic drug therapy is used as the only method of treating this disease [6].

The prognosis for these patients will depend on the choice of the most appropriate therapy according to several factors, mainly related to the physical condition of the patient, larval stage of the parasite and its localization [7]. Complex cases should be treated in specialized centers with well trained and experienced hepatobiliary surgeons. This zoonosis has not yet been eradicated completely, and if affected countries do not implement epidemiological control policies, Treatment of this disease will require a lot of resources. Cystic echinococcosis of the liver is endemic, especially in Central Asia [8]. For this reason, the main topic of this article will focus on issues related to this form of hydatidosis.

2. Diagnostics

Currently, when making a diagnosis, it is always necessary to take into account the epidemiological background. Definitive diagnosis is achieved through imaging and, in some cases, with the additional contribution of serology. In the near future, earlier stages of parasitosis will be diagnosed using advances in immunological tests [24,25].

Clinical signs. The clinical picture of liver echinococcosis remains asymptomatic for a long period of time after infection due to the slow growth of the hydatid cyst in the

* Corresponding author:

salimdavlatov@sammi.uz (Anarboev Sanjar Alisherovich)

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liver (1–5 mm per year).

Small and medium-sized cysts of central hepatic localization are usually asymptomatic, or the patient may experience mild pain in the epigastrium and right hypochondrium along with a feeling of discomfort in the abdomen. In addition, the patient's previous immune status and the anatomical location of the cyst could determine the late manifestation of the first symptoms [26]. When cysts grow and reach significant sizes, the first to be affected are the biliary tree and the hepatic vasculature, resulting from biliary obstruction, portal hypertension and Budd-Chiari syndrome. The magnitude of this effect will determine the varying degrees of jaundice and portal hypertension, which can range from mild increases in bilirubinemia and abdominal venous collaterals to very severe jaundice, ascites, and upper gastrointestinal bleeding [27].

Visualization. In 1981, Gharbi published an ultrasound classification of liver echinococcosis, describing five categories regarding the morphological features of cysts according to their stage of evolution [28]. In 2002, based on this classification, the World Health Organization Informal Working Group on Echinococcosis (WHO-IWGE) formulated a new classification, adding two more categories, to help in choosing the best treatment and follow-up of patients [29-31].

Modern imaging offers several tools for diagnosing this disease. As a rule, imaging diagnostics begins with the use of ultrasound (US), and then for a more accurate diagnosis of the most complex forms of parasitosis, other imaging methods can be used, such as contrast-enhanced ultrasound (USICS), computed tomography (CT), magnetic resonance imaging (MRI), magnetic resonance cholangiography (MRCP), endoscopic retrograde cholangiography (ERCP) and conventional radiography.

Ultrasound. Sonography is widely used because of its low cost and high image clarity, which allows the pathological characteristics of hydatid cysts of the liver and other localizations in the abdominal cavity to be determined. It is also useful in differentiating hydatid cysts from other liver tumors. The use of mobile devices makes it possible to have a portable tool for screening populations in an endemic area with a high risk of infection [30,32,33]. Due to the difficulty of differentiating some forms of alveolar echinococcosis from other types of liver tumors, ultrasound is increasingly used in certain regions where this pathology is endemic [34].

CT scan. Sometimes ultrasound is of little help in diagnosing hepatic hydatidosis for various reasons, such as obesity, the presence of abundant intestinal gas, recurrence of hydatidosis, or residual cavities from a previous operation. In this case, CT is used, taking advantage of its higher sensitivity and specificity.

Non-contrast CT allows better radiographic diagnosis of various forms of cyst calcification [33]. Contrast-enhanced CT helps to select the best surgical technique according to the different presentations or complications associated with the disease, for example, allowing more accurate assessment of vascular and biliary involvement. CT is also helpful in diagnosing cystic migration into the chest and biliary tree

[35,36]. Another advantage of using contrast-enhanced CT is to achieve better differential diagnosis from other focal liver lesions [37].

Magnetic resonance imaging. MRI is useful in diagnosing cases of cholangiohydatidosis. Compared with ultrasound and CT, T2-weighted MRI sequences better define the internal structure of the cyst. It is generally indicated for patients who have difficulties with ultrasound, such as excess bowel gas, previous surgery, disseminated hydatidosis, and obesity. In addition, MRI is recommended when CT is contraindicated due to comorbidities. MRI is used to determine the presence of a cystobiliary fistula and the presence of hydatid material in the biliary tree. It also visualizes a cystobiliary fistula both towards the bronchi and towards the biliary tract [38,39].

Endoscopic retrograde cholangiography. Rupture of an hydatid cyst into the intrahepatic bile duct can cause some complications, which can become serious mainly due to the development of cholangitis and septicemia. In these cases, ERCP makes the diagnosis and performs removal of hydatid material in order to improve the general condition of the patient before definitive surgical treatment [40].

Serology. Currently, diagnosis and follow-up of patients with cystic echinococcosis is achieved primarily through imaging. Serology using the detection of IgG-specific antigens is used for the same purpose. However, low sensitivity and specificity rates have been reported. In addition, false-positive results occur during follow-up due to the persistence of antibodies over time. There are many studies (recombinant proteins, isotopic antibodies, subisotopic IgG, synthetic peptides) aimed at developing new antibodies using molecular techniques to better diagnose this parasitosis [41,42].

3. Surgery

The main goal of treatment for liver echinococcosis is to destroy the parasite and prevent relapse. There is consensus that surgery is the best option to achieve this goal. Currently, it is possible to perform various surgical techniques with acceptable morbidity and mortality rates, depending on the pathological condition of the cysts. In more complex cases, surgery may be complemented by other treatments such as minimally invasive procedures and chemotherapy. Surgical treatment has indications and contraindications depending on the patient's condition and the form of manifestation of the disease [6].

Previously, only conservative methods were used to treat liver echinococcosis. Among them, marsupialization involved opening and removing the parasite, followed by moving the residual cavity toward the abdominal wall, awaiting closure by secondary intention. Cystoenteroanastomosis was also performed, anastomosing the residual liver cavity with the duodenum or a defunctionalized loop of jejunum. Currently, these conservative techniques are not indicated due to the high risk of developing complications such as relapses, liver abscesses, intestinal obstruction, biliary fistulas, biliomas, biliary peritonitis, cholangitis, and septicemia. However, there are surgical centers that report good results in treating

large cysts with laparoscopic cystojejunostomy [40].

Different surgical centers perform different resective surgery procedures. When indicated, it is necessary to take into account the age, general condition of the patient, the pathological state of the cysts and their localization in other organs, as well as the presence of important concomitant diseases that are difficult to control. Although it is a benign pathology, its evolution can sometimes be very complex, requiring multiple surgeries and leading to a poor prognosis. Surgical resections are performed open or laparoscopically. Below are the most used methods from least to most complex.

Subtotal cystectomy by open surgery. This technique, performed by open surgery, follows the following steps according to the location of the cysts:

- Right or bilateral subcostal laparotomy.
- In order to gain good access to the cyst, dissection of the round ligament and dissection of adhesions to the diaphragm or adjacent organs can be performed. The use of intraoperative ultrasound is useful when the cyst is located posteriorly and centrally to avoid damage to the retrohepatic vena cava or hepatic veins.
- During puncture and removal of exudate and echinococcal membrane, it is necessary to isolate the surgical field with compresses filled with scolicidal agents (20% hypertonic solution or diluted povidone-iodine).
- Wide resection of the adventitia and further revision to eliminate daughter vesicles in the cavities located in the remaining adventitia.
- Identification and suturing of the bile ducts.
- Closure of the residual cavity using capitonage or omentoplasty. For giant cysts, capitonage is not recommended to avoid deformation of the biliary tree and intrahepatic vasculature with subsequent functional consequences.
- In some cases, to prevent postoperative biliary fistulas, drainage is installed in the residual cavity or choledochostomy is performed with a Kera tube.
- When the cyst is located close to the main bile duct or the subhepatic and vena cava, the adjacent adventitia should be left in place to prevent biliary fistula or bleeding.

4. Laparoscopic Subtotal Cystectomy

Laparoscopic subtotal liver cystectomy offers all the advantages of minimally invasive procedures. It offers increased vision with better assessment of the cyst, residual cavity and biliary tract. In addition, it causes less postoperative pain and earlier discharge. Comparative studies between these two techniques have been reported, and the future trend appears to favor the laparoscopic technique [41]. However, technical difficulties currently remain in preventing leakage of fertile hydatid material into the peritoneal cavity with anaphylactic reactions and secondary hydatid implants. For this reason, and to prevent this complication and

possible uncontrolled bleeding, the laparoscopic approach is contraindicated in the following situations:

- Cyst diameter more than 10 cm;
- More than three cysts and/or the presence of cysts of the peritoneum or other organs;
- Very thin or calcified adventitia;
- Cysts located in the dome and central parts of the liver;
- Complicated cysts with rupture and emptying onto the biliary tree or peritoneum;
- Imaging signs of severe pericystic inflammation;
- Cysts with fibrous adhesions on the diaphragm migrating to the chest.

According to the rules of laparoscopic liver surgery, the location of the entrance ports depends on the anatomical location of the cyst. To prevent echinococcal contents from entering the abdominal cavity, it is necessary to have a good puncture and aspiration system similar to the Perforator-Grinder [42].

5. Pericystectomy

Open or laparoscopic pericystectomy is based on the concept of complete removal of parasites. This method consists of flat resection of the cyst through the hepatic parenchyma adjacent to the adventitia, which avoids recurrence due to the presence of daughter cysts in the adventitia or in the surrounding hepatic parenchyma [12]. For complicated cysts, pericystectomy is not recommended due to the risk of further bleeding or damage to the bile ducts. Previous radiological studies are critical to determine the relationship of these structures to cysts. Nowadays, laparoscopic pericystectomy helps prevent the above-mentioned risks due to increased visibility, more efficient liver transection instruments, and wider access. Well-trained surgeons in laparoscopic liver surgery are more likely to successfully perform this technique [13].

6. Liver Resection

Sometimes it is necessary to perform liver resections, for example, in the presence of relapses of echinococcus in the same previously operated lobe or in residual cavities that have a risk of subsequent infection with the development of liver abscesses and cholangitis. When the infection is controlled by antibiotic therapy or percutaneous drainage, resection of the compromised lobe, which is usually more atrophic, is recommended. Therefore, this operation will be more labor-intensive. However, compensatory hypertrophy of the unaffected lobe determines a lower risk of postoperative liver failure. To completely eradicate the parasite and prevent recurrence, several surgical centers are increasingly performing liver resection either open or laparoscopically, with acceptable morbidity and very low mortality. Liver resection is more indicated for alveolar echinococcosis due to the higher frequency of relapses and

infiltrative nature, similar to malignant neoplasms. There are recent reports of liver transplantation, as well as ex vivo resection operations with autotransplantation for this type of echinococcosis [29,34]. In summary, liver resection, which has been little used in the past, now appears to be a viable alternative in selected cases, performed in specialized reference centers.

The pain associated with resection surgery depends on the complexity of the hydatidosis and the extent of the operation performed. The most difficult to treat include biliary fistulas, bleeding and infections. For example, in patients with fistula cysts towards the bile ducts and chest, it is advisable to work in stages, for example, first treat cholangitis, and then, when the patient's condition has stabilized, drain the pleural empyema. After restoration of the general condition, resection surgery is indicated. Regarding morbidity and mortality rates, what has been reported so far shows a wide discrepancy in the figures. Employees of the Department of Surgical Diseases No. 1 of the Samarkand State Medical Institute conducted a study of risk factors that determine postoperative morbidity in a significant number of foreign publications. The results indicate a rather low level of evidence [44]. The objective is to perform a prospective series to reach consensus regarding the indications for surgical treatment of this complex disease.

Percutaneous treatment. This therapy is carried out by puncture, aspiration, administration of scolicidal agents and respiration of fluid and echinococcal membranes (PAIR). In some cases, the procedure is performed under ultrasound guidance. This procedure was developed by a Tunisian group in 1986. The WHO recommends this procedure because it is less invasive than surgery, provides good evacuation of the parasite, reduces hospitalization time, and is less expensive. The following recommendations contain indications and contraindications for this procedure [16]. Anesthetic support should be available to manage a possible anaphylaxis crisis due to hydatid fluid leakage during PAIR [17].

Chemotherapy. Numerous publications report the use of drugs that can penetrate and destroy hydatid cysts of the liver. These drugs are given alone or together with surgery and less invasive treatments such as PAIR. Currently, albendazole has shown effectiveness in reducing the size or even killing the parasite. For this reason, it is used to prevent recurrence after surgery. It is also used as sole therapy in patients who refuse surgery or are inoperable due to disseminated echinococcosis or other comorbidities [18]. At the Department of Surgical Diseases No. 1 of the Samarkand State Medical Institute, it is prescribed before surgery in doses of 10 mg/kg body weight for one cycle lasting 14 or 21 days and after surgery from one to three cycles, depending on the possible occurrence of liver dysfunction.

7. Conclusions

Hydatidosis of the liver continues to be a disease that is spreading without epidemiological control in many parts

of the world. The continuous biological adaptation of the parasite to exist in an intermediate host has also been demonstrated, which explains the great difficulties in eradicating this zoonosis. The constant and even increasing incidence of this disease determines very high medical costs for treating patients, sometimes with a complex pathological picture. Efforts are being made to find new alternatives for diagnosing the early stages of parasitosis. The development of new vaccines to immunize the intermediate host would determine the best control of *Echinococcus* in humans. Surgical advances have made it possible to perform increasingly radical surgical procedures with acceptable morbidity and mortality rates. However, performing minimally invasive surgeries is associated with significantly higher costs. Logic dictates that the best way is to minimize the number of new patients through successful epidemiological control.

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