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Article

Improvement of Early Diagnosis and Choice of Tactical Approaches to Liver Echinococcosis and Extrahepatic Localizations

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Abstract: Echinococcosis is a chronic, widespread disease whose incidence in endemic regions shows no sign of decreasing. It is a dangerous and widespread helminthic infection characterized by the development of cystic lesions in the liver, lungs, and other parenchymatous organs, arising from the implantation of larvae (oncospheres) into target organs. Infection occurs orally. During the parasite's life cycle, the definitive host contaminates the environment with eggs and segments, which, when ingested by the intermediate host, promote the development of echinococcosis, with humans being a biological dead end. Among the most commonly affected organs by Echinococcus are the liver and lungs. However, the parasite can infect any organ or system in the human body. The most common localization of the parasite is the liver (50-80%) and lungs (60-40%), other forms of damage (15-25%) are rare localizations of echinococcosis, 2.5% occur in the kidneys, 2.5% in the heart, 2% in the bones, 1.5% in the spleen, 1% in the muscles, 0.5% in the brain. In the liver, cysts are most often localized in segments 7 and 8 (31-32%). Currently, research is being conducted to develop new immunological diagnostic methods and improve those already used in practice.

Keywords: *Echinococcosis of the liver, cystic biliary fistula, 'Watch and Wait' tactic*

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1. Introduction

Echinococcosis is a chronic, widespread disease whose incidence in endemic regions shows no sign of decreasing. It is a dangerous and widespread helminthic infection characterized by the development of cystic lesions in the liver, lungs, and other parenchymatous organs, arising from the implantation of larvae (oncospheres) into target organs [1].

Infection occurs orally. During the parasite's life cycle, the definitive host contaminates the environment with eggs and segments, which, when ingested by the intermediate host, promote the development of echinococcosis, with humans being a biological dead end [2]. Among the most commonly affected organs by Echinococcus are the liver and lungs [3]. However, the parasite can infect any organ or system in the human body [4].

The most common localization of the parasite is the liver (50-80%) and lungs (60-40%), other forms of damage (15-25%) are rare localizations of echinococcosis, 2.5% occur in the kidneys, 2.5% in the heart, 2% in the bones, 1.5% in the spleen, 1% in the muscles, 0.5% in the brain.

In the liver, cysts are most often localized in segments 7 and 8 (31-32%) [1] [5].

Currently, research is being conducted to develop new immunological diagnostic methods and improve those already used in practice [6].

If instrumental diagnostic methods reveal small cysts less than 3 cm in size, determining their etiology is virtually impossible. For such patients, a "watchful waiting" tactic (controlled observation of the natural course of the process) is used, relying on vis medicatrix naturae (the healing power of nature). In this case, this involves regular ultrasound or other instrumental methods for monitoring cyst growth at least twice a year. If the cyst increases in size to 4 cm or more, the advisability of its drainage is discussed [7].

Currently, the information yield of laparoscopic ultrasound exceeds that of noninvasive imaging methods in detecting small metastases. IOUS allows for precise assessment of the tumor's relationship with major vessels and the precise determination of the extent of invasion. The combination of data obtained with IOUS, combined with the ability to visually inspect the tumor and assess its dissemination and obtain material for histological examination in cases of questionable resectability, allows diagnostic laparoscopy with IOUS to be considered a definitive invasive diagnostic method. Based on the results of diagnostic laparoscopy, a decision is made on the feasibility of liver resection alone or in combination with lacolastic destruction methods, or on the futility of surgical treatment and the advisability of chemotherapy and radiation therapy.

In recent years, both conservative treatment and various minimally invasive methods have become widely used in these patients [8] [9].

Furthermore, cysts grow more rapidly in young patients than in older patients, creating a particular challenge in the treatment of combined echinococcosis in children.

The relationship between lung cyst size and patient age is of interest. According to our data, they were more common in patients under 45 years of age and were smaller in size and number in patients over 60 years of age.

It should be emphasized that patients suffering from combined echinococcosis of the liver represent a special group. The unlimited number of possible locations, damage to the liver and other parenchymal organs, the possibility of the existence of cysts of varying "ages" in the phases of the life cycle, the complexity of their relative positions with other organs and structures, and the risk of rupture of liver echinococcosis into the bile ducts and body cavities—these are just some of the characteristics of the disease that prevent this group of patients from being considered homogeneous, requiring a differentiated approach to each individual patient. [10]

Current trends in liver surgery are marked by the introduction of new technologies aimed at both improving diagnostics and enhancing surgical outcomes by increasing the radicality and reducing the invasiveness of interventions. Minimally invasive treatments for focal liver lesions under ultrasound and computed tomography guidance, local tumor destruction techniques (thermal ablation, cryodestruction, electrochemical lysis), and endovascular interventions are becoming widespread. One of these rapidly developing areas of surgical hepatology is laparoscopic surgery.

For objective reasons, the development of laparoscopic liver surgery has progressed more slowly than surgery on other abdominal organs. The liver's large size and location preclude a comprehensive laparoscopic examination of its entire surface, hindering free instrumental access, especially to the posterior segments. The liver's rich blood supply and complex intrahepatic vascular architecture determine increased bleeding and, at times, significant hemostasis difficulties, making any laparoscopic intervention on the liver potentially dangerous due to massive blood loss.

At the same time, the good results of the first laparoscopic liver surgeries, often for cystic lesions, inspired a certain optimism and served as a basis for the development of this area of endoscopic surgery. Significant improvements in instrumental liver parenchyma dissection techniques and various modern forms of reliable hemostasis adapted to laparoscopic surgery have demonstrated the feasibility of safely performing liver resections, both in atypical and anatomical cases. Improved laparoscopic techniques using modern laparoscopic equipment and a wide range of hemostasis and liver parenchyma dissection methods have significantly expanded the capabilities of

laparoscopic surgery in the treatment of focal liver lesions and significantly improved the safety of such interventions.

The issues of early diagnosis and effective surgical treatment of echinococcosis of the liver and abdominal organs have not yet been sufficiently resolved. This applies primarily to liver echinococcosis, a common parasitic disease that primarily affects young people of working age and often leads to disability and death [6] [11] [12] [13].

Due to late diagnosis, surgical treatment of liver and abdominal echinococcosis is performed after complications have already developed in at least 70-80% of cases, resulting in postoperative mortality rates reaching 10-15% [5] [9] [14].

At the same time, the high incidence of specific complications, observed in 14.1%-35.5% of cases [8] [9] [15] and the significant recurrence rate, reaching 4.6-2.9% are noteworthy [9] [16].

With the introduction of ultrasound (US) and computed tomography (CT) into clinical practice, the detection of patients with parasitic cysts has increased significantly. Along with diagnostic difficulties, the occurrence of postoperative complications and unsatisfactory results of surgical treatment of echinococcosis of the liver and abdominal organs has contributed to traditional tactical approaches and imperfect surgical technique. Until now, most surgeons prefer various types of echinococcectomy as the simplest interventions [10] [17] [18] and practically do not use radical interventions. At the same time, both closed and semi-closed, and especially open echinococcectomies in 30-60% of cases are accompanied by suppuration of the residual cavity, the formation of bile-purulent fistulas [13] [15] [19].

The lack of reliability of the methods used in surgical practice to inactivate the germinal elements of echinococci is evidenced by numerous cases of postoperative recurrence of the disease. The high toxicity or insufficient antiparasitic activity of the contact anti-echinococcal agents used necessitates the development of new, effective, and safe methods for intraoperative inactivation of the germinal elements of echinococci.

It should be noted that, despite the undeniable successes achieved in the detection and treatment of this serious disease, a number of issues remain that cause justified concern among specialists. Specifically, this pertains to the timely identification of patients in the early stages of the disease, the selection of optimal surgical tactics and intraoperative treatment of echinococcal cysts, the prevention of postoperative purulent-septic complications, disease recurrence, and chemotherapy. [5] [13] [20].

The germinal elements of the echinococcus are responsible for postoperative recurrences of echinococcosis. Therefore, reliable inactivation of the parasite's germinal elements during surgery plays an important role in preventing recurrence of liver echinococcosis. Various chemical and physical agents have been used for this purpose, but they have not found widespread use due to their low antiparasitic activity or high toxicity to the patient's body [2] [10] [17] [21].

The insufficient reliability of the agents used in surgical practice for the inactivation of germinal elements of Echinococcus is evidenced by numerous cases of postoperative relapses of the disease. The high toxicity or insufficient antiparasitic activity of the contact anti-echinococcal agents used dictates the need to find new, effective, and safe agents for the intraoperative inactivation of germinal elements of echinococcus [2] [9] [20] [22].

It should be noted that, despite the undeniable advances in the detection and treatment of this serious disease, a number of issues remain that cause justified concern among specialists. Specifically, this pertains to the timely identification of patients in the early stages of the disease, the selection of optimal surgical tactics and intraoperative treatment of echinococcal cysts, the prevention of postoperative purulent-septic complications, disease recurrence, and chemotherapy [7] [11] [18].

Purpose of the study: Improving the results of early diagnosis and surgical treatment of patients with liver echinococcosis.

2. Materials and Methods

Between 2016 and 2019, 116 patients with various forms of liver and abdominal echinococcosis were treated in our clinic. Sixty-one (52.5%) were women and 55 (47.4%)

were men. Right lobe involvement was detected in 78 (67.2%) patients, left lobe involvement in 19 (16%), both lobes in 11 (9%), and combined liver and lung involvement in 8 (6.8%) patients. The patients ranged in age from 18 to 81 years. The diagnosis was confirmed by serology (antibodies to Echinococcus were detected in ELISA), sonography, MRT, pathomorphological, and parasitological methods.

Before surgical examination, we were able to identify comorbidities in some patients. Indications for surgery and the optimal approach were determined based on the cyst location and the nature of complications. The approach chosen depended on the cyst's location.

One of the most severe complications of EP is rupture of cyst contents into the bile ducts, occurring in 6-63% of cases [8] [19] [23] [24]. In our study, this complication occurred in 29 patients, accounting for 25%. These patients experienced cystic fibrosis with mechanical jaundice and cholangitis, which developed after rupture of cyst contents into the large lobar hepatic ducts. In this group of patients, all symptoms also included signs of liver failure with severe intoxication, chills, and hyperthermia.

Eleven patients (9%) were diagnosed with stage I cystic fibrosis (CBP) with severe obstructive jaundice and cholangitis, which resulted from rupture of cyst contents into large lobar hepatic ducts. Stage II was detected in 8 patients (7%). In this group of patients, inflammatory symptoms predominated, caused by the formation of CBP with a segmental duct, suppuration of the echinococcal cyst, and the development of cholangiogenic abscesses. In 10 patients (8.6%) who did not have clinical manifestations of communication between the echinococcal cyst and the bile ducts, this indicates a small fistula opening (no more than 1.5 mm), which explains the preservation of the integrity of the chitinous membranes.

For cystobiliary fistulas, the treatment strategy depends on the extent of bile duct damage. Treatment is carried out in stages, with the first stage aimed at decompressing the biliary tract and eliminating cholangitis. All patients underwent ERCP and endoscopic cholangiopancreatography (EPS) during the first stage. In four patients, a fragment of the chitinous membrane was successfully removed from the bile duct.

After the manipulation, all patients received antibiotic therapy, detoxification therapy, and hepatoprotectors were administered to eliminate liver failure and purulent cholangitis.

After the first stage of manipulation, the second stage of treatment should be performed: open surgery to determine the most appropriate approach for optimal treatment of the cyst cavity. The main stages of the surgery include laparotomy, cystotomy, excision of the fibrous capsule (if possible), hemostasis, and electrocoagulation (if possible).

During the second stage of the surgery, open echinococcectomy was performed in 21 patients (18%) with signs of cyst cavity suppuration. Of these, semi-closed echinococcectomy with capitonnage of the residual cavity using a thin drain was performed in 5 patients.

Eight (7%) patients underwent endoscopic biliary tract ablation with subsequent drainage, given the severe manifestations of cholangitis.

In patients with combined echinococcosis (8 patients), simultaneous endoscopic biliary tract ablation was performed. We first performed a thoracotomy for endoscopic biliary tract ablation from the lungs and liver. Given the small size of the liver cyst, no more than 3-4 cm, endoscopic biliary tract ablation was not performed in two patients, and chemotherapy was prescribed according to the regimen.

Right lobe echinococcectomy was performed in 51 patients (44.8%) using laparotomy, of which solitary liver cysts were noted in 4 cases. Closed echinococcectomy and hepatic echinococcectomy with abdominal drainage were performed in 8 patients with concomitant cholelithiasis. Ideal echinococcectomy with subhepatic drainage was performed in five cases.

Diagnostic laparoscopy revealed hemangiomas in the right lobe of the liver in six cases, including segment VI in two cases, segment V in three cases, and one in segment I Following examination and recommendations from an oncologist, the patients were

referred to the oncology department for further evaluation and treatment. Organ-preserving surgeries were performed in the remaining cases.

In 22 (19%) cases of superficially and peripherally located cysts without daughter cysts, laparoscopic echinococcectomy was performed. Due to technical difficulties and the presence of biliary fistulas, conversion with subsequent drainage of the residual cavity was performed in three cases.

3. Results

During the period from 2016 to 2019, a total of 116 patients with various forms of hepatic and abdominal echinococcosis were examined and treated. Among them, 61 (52.5%) were female and 55 (47.4%) were male. The patients' ages ranged from 18 to 81 years, with the highest incidence observed in the 30–55 age group, which represents the most socially active segment of the population.

Echinococcal cysts were localized in the right hepatic lobe in 78 patients (67.2%), the left lobe in 19 patients (16%), both lobes in 11 patients (9%), and combined hepatic and pulmonary involvement was found in 8 patients (6.8%). All patients presented with common symptoms such as right hypochondrial pain, fatigue, nausea, and allergic manifestations. Laboratory studies revealed eosinophilia in 43%, elevated bilirubin and transaminase levels in 21%, and signs of obstructive jaundice in 25% of cases.

The diagnostic workup included serological testing (ELISA), ultrasonography (USG), magnetic resonance imaging (MRI), and pathomorphological and parasitological examinations. Ultrasound imaging demonstrated cystic lesions with typical echogenic membranes and internal septations, while MRI allowed precise delineation of cyst boundaries and their relationship with surrounding tissues.

These findings confirm that a comprehensive diagnostic approach plays a crucial role in the early detection of hepatic echinococcosis. One of the most severe complications of echinococcosis observed was rupture of cyst contents into the biliary ducts, recorded in 29 patients (25%). This condition led to cystobiliary fistulas, accompanied by mechanical jaundice, purulent cholangitis, and hepatic failure.

1. Stage I cystobiliary fistulas (rupture into major hepatic ducts) were detected in 11 patients (9%), who exhibited pronounced jaundice and cholangitis.
2. Stage II fistulas (involving segmental ducts, cyst suppuration, and secondary cholangiogenic abscesses) were found in 8 patients (7%).
3. In 10 patients (8.6%), microfistulas less than 1.5 mm in diameter were identified without clinical symptoms.

These data are consistent with the literature, which reports cystobiliary communications in 6–63% of cases [8] [19] [23] [24], confirming the importance of early assessment of the biliary system to prevent severe complications.

A two-stage therapeutic approach was applied in all patients with cystobiliary fistulas. At the first stage, all 29 patients underwent endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic papillosphincterotomy (EPST) to achieve biliary decompression. In four cases, cyst membrane fragments were successfully removed from the bile ducts during ERCP. Subsequently, antibiotic therapy, detoxification, and hepatoprotective treatment were administered. At the second stage, after stabilization of the general condition, open echinococcectomy was performed in 21 patients (18%).

1. Semi-closed echinococcectomy with capitonnage and drainage was carried out in 5 patients.
2. Endoscopic biliary drainage was performed in 8 patients.
3. In 8 patients with combined hepatic and pulmonary echinococcosis, simultaneous thoracotomy and hepatic echinococcectomy were performed.

In two patients with small cysts (≤ 4 cm), surgical treatment was not indicated, and conservative therapy with albendazole was administered instead. Among all cases, open

echinococcectomy via laparotomy was performed in 51 patients (44.8%) with right-lobe involvement.

Closed echinococcectomy with abdominal drainage was conducted in 8 patients, while ideal echinococcectomy was performed in 5 cases.

Diagnostic laparoscopy identified hepatic hemangiomas (segments V–VI) in 6 patients, who were subsequently referred for oncological observation.

Laparoscopic echinococcectomy was successfully performed in 22 patients (19%) with superficially or peripherally located cysts. However, conversion to open surgery was necessary in 3 cases (2.5%) due to technical difficulties and bile leakage.

The overall postoperative complication rate was 11.2%, including:

1. Bile leakage – 5 patients (4.3%)
2. Residual cavity infection – 4 patients (3.4%)
3. Wound suppuration – 2 patients (1.7%)
4. Postoperative bleeding – 2 patients (1.7%)

One patient (0.8%) died due to severe septic complications and multiple organ failure.

The average hospital stay after open surgery was 12.4 ± 3.2 days, while after laparoscopic surgery, it was 6.8 ± 1.5 days, confirming that minimally invasive techniques significantly shorten recovery time.

4. Discussion

The results demonstrate that the use of a staged surgical strategy combining endoscopic and minimally invasive methods significantly improves the treatment outcomes of hepatic echinococcosis.

Endoscopic decompression of the biliary system at the initial stage effectively reduces purulent-septic complications and ensures safer conditions for subsequent surgery.

Laparoscopic echinococcectomy minimizes surgical trauma and accelerates postoperative recovery; however, it remains technically demanding and requires careful patient selection.

Diagnostic laparoscopy combined with intraoperative ultrasound (IOUS) allows for precise assessment of cyst localization, depth, and proximity to major vascular and biliary structures, thereby enhancing surgical accuracy and minimizing the risk of intraoperative cyst rupture.

Our findings are consistent with previous studies, confirming that improved diagnostic capabilities and the integration of minimally invasive surgical techniques significantly reduce postoperative morbidity and mortality in hepatic echinococcosis [9] [13] [17]. Nevertheless, achieving reliable inactivation of parasite germinal elements and preventing disease recurrence remain important areas for future research.

5. Conclusion

Thus, the primary diagnostic tool for the early stages of liver failure is the simultaneous detection of morphological and biochemical changes in liver cells and tissues. Doppler ultrasound and clinical and laboratory blood tests in patients complicated by echinococcosis are only informative when more profound liver changes develop.

The most rational methods for complicated liver echinococcosis, specifically in the bile ducts, are EPST, which allows for the resolution of cholestasis and the performance of radical surgical intervention in the most favorable conditions.

Selecting the most appropriate surgical approach for each patient allows for thorough visual inspection, clarification of the cyst's configuration and its connection with the ducts, and their removal. Reliable capitonnage of the residual cavity with vertical sutures and decompression by endoscopic papillosphincterotomy in the pre- or postoperative period allows for full recovery. The problem of preventing complications after echinococcectomy can be resolved through a comprehensive preoperative diagnosis, including a full range of clinical, laboratory, and instrumental examinations.

Cystobiliary fistulas were identified in 25% of cases and represented the major source of postoperative complications. A stepwise approach — initial endoscopic decompression followed by echinococcectomy — proved to be the most effective treatment strategy. Laparoscopic echinococcectomy is safe and effective for peripherally located cysts up to 5 cm in diameter without biliary communication.

Diagnostic laparoscopy and intraoperative ultrasonography enhance surgical precision and safety. Further studies are needed to improve cyst sterilization techniques and to prevent recurrence of echinococcosis

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