

## Echinococcosis of The Kidney in Children (Brief Review of The Literature)

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### ABSTRACT

**Objective:** This study aims to provide a comprehensive review of hepatic echinococcosis in pediatric patients, focusing on diagnostic modalities, surgical treatment options, and associated complications. **Method:** A literature-based analysis was conducted, evaluating current clinical practices, imaging techniques, surgical approaches – including open and minimally invasive procedures – and adjunct pharmacological therapies. **Results:** The review highlights the central role of precise imaging and serological testing in early diagnosis. Surgical strategies should be tailored to cyst characteristics, with open surgery remaining crucial for complex cases. Minimally invasive techniques, while promising, require refinement to match the effectiveness of conventional approaches. Antiparasitic chemotherapy serves as a supportive measure in select patients. Recurrence is primarily linked to the thoroughness of surgical intervention rather than the choice of technique. **Novelty:** This study underscores the clinical relevance of emerging technologies such as laser devitalization and addresses ongoing controversies in the classification of surgical methods. It offers a nuanced evaluation of echinococectomy in children, contributing to a better understanding of optimizing treatment outcomes and minimizing recurrence.

## INTRODUCTION

Echinococcoses are chronic parasitic diseases that develop after ingestion of infected eggs of tapeworms of the genus *Echinococcus*. The epidemiology and clinical picture of hepatic echinococcosis are now well known. However, the issues of early diagnosis and effective surgical treatment are insufficiently studied [1].

Echinococcosis as a parasitic disease has been studied for more than 150 years. Children under 14 years of age account for 15-25% of those suffering from echinococcosis. In a child's organism, the echinococcal parasite grows in a wave-like manner. Periods of activation of its vital activity may be associated with a decrease in the reactivity of the patient's organism caused by various extreme factors (severe malaise, prolonged hyperemia, surgical or other aggression, etc.). [2].

The final host of echinococcosis is a dog, wolf, jackal, fox, domestic cat, etc., in the small intestine of which the sexually mature form of the helminth parasitizes. Intermediate hosts of echinococcosis are herbivorous and omnivorous animals, in the organs and tissues of which develop larval forms of the parasite. Man as an intermediate host of echinococcus does not participate in the transmission of infestation. The source of infestation for humans is infected domestic (dog, sometimes cat) and wild (wolf, fox, Arctic fox, etc.) carnivorous animals that contaminate the external environment with their feces containing *Echinococcus* eggs. It has been established that human infection can

occur in three ways: through the mucous membranes of the gastrointestinal tract, through the mucous membranes of the respiratory tract, and through the wound surface [3].

## RESEARCH METHOD

In *E. granulosus* infection, cysts most commonly occur in the liver (70%) or lungs (20%). However, 10% of cysts can be found in any part of the body, including the spleen (6%), heart (1%), kidneys (2%), and brain (1%). *E. granulosus* infections usually manifest as solitary cysts and affect a single organ. In 10-15% of patients, two organs may be affected, depending on the specific geographic region and strain of the parasite [4].

Echinococcosis of the liver is divided according to its clinical course:

1. Initial or asymptomatic
2. Stage of disease symptoms in uncomplicated cysts.
3. Stage of complications of echinococcosis (suppuration, perforation, calcification).

When a person is infected, the first stage is an asymptomatic incubation period during which ingested eggs release oncospheres that are able to penetrate the human intestinal wall. These oncospheres enter the portal venous system, which provides access to the liver, lungs, and various other organs. The oncospheres then begin the development of cysts. The cysts are usually unicameral and can range from 1 cm to 15 cm in diameter. In liver echinococcosis, cysts grow from 1-2 mm to 10 mm per year. They also tend to affect the right lobe more often than the left lobe because of the nature of portal blood flow. The immune system responds to the cyst by forming a calcified fibrous capsule around it, which is the layer most often visualized on imaging studies. The cyst enlarges to form a combination of protoscolexes and daughter cysts. The combination of multiple protoscolexes and cystic fluid looks like grains on an ultrasound image and is therefore called "hydatid sand" [5].

When assessing the general condition of children suffering from echinococcosis, we have to take into account not only the severity of damage to the organs where the cyst is localized, but also the general reaction of the body to the invasion of the parasite. It manifests itself in the form of signs of chronic intoxication: lag in physical development, weight deficit, adynamia, hypochromic anemia, dysproteinemia, etc. Characterization of the general reaction of the body would be incomplete, if we do not mention the existing still allergic background of patients with echinococcosis, which undoubtedly increases as the disease progresses. Therefore, in children we can speak about echinococcal disease with great reason [6].

## RESULTS AND DISCUSSION

The issues of diagnostics of parasitic liver cysts are well developed and covered in detail in Russian and foreign literature. The main and highly informative methods of diagnostics of parasitic liver cysts are ultrasound, CT and MRI. The leading place in the diagnosis of liver echinococcosis belongs to ultrasound as a screening method. According to most authors, ultrasound should be supplemented with CT or MRI, which allows to

obtain a spatial image of liver volumetric masses, their relation to vascular structures and bile ducts, to clarify the volume of functioning parenchyma and areas of atrophy, to determine the optimal surgical access. If the cyst ruptures, an appropriate examination should be made for protoscolec, brood capsules and cyst walls in sputum, vomit, feces or urine. The diagnosis is confirmed by serologic tests for echinococcosis. These include fluorescent antibodies and indirect antibody hemagglutination. Serology is 80-100% sensitive and 88-96% specific for liver disease. Eosinophilia is not a consistent finding [7].

Choice of optimal management tactics should be individualized and based on an analysis of the risks benefits of a particular method, taking into account contraindications. Echinococcosis is often a costly and difficult-to-treat disease, so prospective clinical trials are needed to better inform management decisions.

Treatment options include surgery, medication, or a combination of both. The success of these methods depends on the stage and location of hepatic cysts. In turn, surgical methods are subdivided into conventional and minimally invasive (puncture and video endoscopic). Unfortunately, the recurrence rate of the disease remains high, which causes understandable dissatisfaction of surgeons with the results of treatment of this category of patients [8].

The issue of classification of surgical interventions for echinococcosis still causes considerable controversy, which first of all concerns the terms of open and closed echinococectomy. The point is that some authors understand closed echinococectomy as an operation in which the echinococcal cyst is removed without opening its cavity, which excludes the contact of healthy tissues with germinal elements of the parasite, while other authors define these terms in relation to the residual cavity (its blind suturing or suturing the edges of the fibrous capsule to the wound of the anterior abdominal wall) [9].

The most common open surgical techniques for hepatic echinococcosis are echinococectomy, perfect echinococectomy, pericystectomy, and resection of the liver together with the cyst, but the more effective extent of intervention remains a matter of debate, as there is no consensus on whether the fibrous capsule can carry germinal elements and be the cause of disease recurrence [10].

The method of removing the cyst without disturbing the integrity of the shells is commonly referred to as perfect echinococectomy. This operation is performed either by excising the chitinous shell cyst from the fibrous capsule cavity or by removing the parasitic cyst together with the fibrous capsule in its entirety. Typically, chitinous cyst excision is performed for superficially located parasitic cysts when the fibrous capsule protrudes from the parenchyma of the affected organ. The chitinous shell of the cyst of children is extremely thin, so the technique of cyst excision from the bed of the fibrous capsule in relatively small formations, up to 10 cm in diameter. This method of echinococectomy with larger cysts carries the danger of rupturing them during surgery. Removal of the entire parasitic cyst together with the fibrous capsule, as a rule, is carried out at the marginal location of the cyst, when it hangs on a relatively thin pedicle. It is advisable to remove a large cyst after its preliminary puncture, evacuation of liquid

contents and opening of its lumen. This technique O.B. Milonov called "echinococectomy after suctioning the cyst contents" [11].

For the purpose of disinfection of the fibrous capsule cavity, a variety of agents were used: phenol, alcohol iodine solution, ethyl alcohol, hypertonic sodium chloride solution, formalin solution. The use of these drugs is sometimes the cause of various postoperative complications. These drugs are also characterized by hepato- and nephrotoxicity of varying degrees of severity, which is sometimes the cause of death of the patient. Many authors have described cases of shock after the application of antiseptic drugs in the bed of echinococcus. In order to devitalize the parasite in the cavity of the fibrous capsule after echinococectomy, low-frequency ultrasound and high-energy carbon dioxide laser units have recently been used. Laser beams have bactericidal properties and high hemostatic qualities, stop bile flow and close small bronchioles in the form of biological welding. After treatment of the parasite bed in the fibrous appear absolute sterility, postoperative complications are reduced.

The next and final part of the operation is the elimination of the fibrous capsule cavity or residual cavity after echinococectomy. It can be performed in different ways and depends on the size of the residual cavity, the elasticity of its walls and the organ where the cavity is localized. Thus, with small size of the cavity and elasticity of its walls, most surgeons prefer suturing it with separate knotted or continuous circular sutures in several ties. In echinococectomy of small cysts, regardless of the organs in which they are localized, you can apply and Boborov-Posadas method. This operation is reduced to filling the cavity of the fibrous capsule with physiologic sodium chloride solution and hermetic suturing of the edges of the fibrous capsule. However, after the Bobrov-Posadas operation, the possibility of nonparasitic cyst formation cannot be excluded. Therefore, at present, the general direction of surgeons is to eliminate the residual cavity after echinococectomy, preventing the conversion of a parasitic cyst into a nonparasitic, false cyst [8].

The low probability of recurrence associated with the preservation of the fibrous capsule is also evidenced by the results of F.G. Nazirov's study. He concluded that only 26.6% of recurrences of echinococcosis occurred in the zone of primary localization of the echinococcal cyst. More than 60% of recurrences occurred in segments distant from the primary focus and the opposite lobe of the liver. In this regard, it can be assumed that recurrences are not related to the preservation of the fibrous capsule, but to errors made during surgery, primary-multiple invasions or reinfection. Also, the results of a number of multicenter studies of the long-term results of surgical treatment of echinococcosis have shown that the frequency of recurrence of echinococcosis is influenced primarily not by the method of surgery, but by the thoroughness of its performance: the use of germicide with proven efficacy, strict adherence to the principles of aparasitic and antiparasitic. Thus, most researchers agree that maximum radicalism with respect to the parasite is crucial in the prevention of recurrences, and liver resection and pericystectomy should be performed according to strict indications [12].

Video-endoscopic operations are increasingly being introduced into surgical practice. But in echinococcosis surgery it is necessary to be guided by the principles of aparasitism and antiparasitism. In this regard, when performing laparoscopic echinococcectomy, it is necessary to carry out measures aimed at isolating the abdominal cavity from contact with the contents of the cyst. During the puncture of the cyst due to high intracystic pressure, part of the hydatid fluid spills into the abdominal cavity. And even the use of various devices that prevent contamination of the abdominal cavity, can not prevent the leakage of hydatid fluid. The result of such interventions are pronounced anaphylactic reactions and postoperative recurrences. In this regard, laparoscopic operations in liver echinococcosis are not widely used. However, they have taken their place when it is technically possible to remove the cyst without its opening, i.e. when it is possible to perform the so-called ideal echinococcectomy. This situation is possible only in case of marginal, so-called extraorganic location of the cyst. Or the cysts should be localized in the lower anterior segments of the liver [13].

However, according to the results of studies by some authors show that videolaparoscopic echinococcectomy is the most effective and minimally invasive method of treatment, compared with open methods of echinococcectomy, has such advantages as minimal traumatization, excellent visibility and ease of manipulation and can be successfully used in the surgical treatment of hepatic echinococcosis and its complications. The period of hospitalization after videolaparoscopic echinococcectomy is shorter than in traditional echinococcectomy. Minimal traumatic nature of these operations contributes to the reduction of postoperative complications, lethality. After careful selection of patients, videolaparoscopic echinococcectomy from the liver can be the method of choice and an alternative to traditional echinococcectomy [14].

Chemotherapy with albendazole has been used as a conservative treatment method to date.

Indications for treatment with antihelminthic drugs are:

1. Anticedative therapy after any type of surgical intervention for echinococcosis;
2. Spontaneous or traumatic rupture of the cyst.
3. Multiple cysts in one or more organs with the size not more than 3.5 cm, provided that it is impossible to perform surgical treatment for one or another reason (unfavorable premorbid background of the patient);
4. Inoperable echinococcosis (technical difficulties, multiple lesions, etc.)

The number of courses of therapy is determined by the volume of the lesion and the patient's condition. In the treatment of inoperable echinococcosis, 9-10 courses are possible. For the purpose of antiretroviral therapy after surgical intervention, at least 3 courses of treatment are recommended. Albendazole is prescribed in a dose of 10 mg per 1 kg of body weight per day in 2 doses - morning/evening with an interval of 12 h for 28 days. The drug is recommended to be taken during a fatty meal, which increases its bioavailability. The interval between courses is 14 days. Despite the relative safety of the drug, it has side effects, including suppression of bone marrow function. It should be

prescribed with caution in severe liver disease. Control of liver function and monitoring of blood cellular composition is performed before treatment and every 14 days of the first course of therapy. In the absence of pronounced changes in blood parameters during subsequent courses of blood tests are performed at least once a month. If leukopenia occurs, therapy is stopped until normalization of indicators. Treatment with albendazole is carried out against the background of basal therapy (diet, diet). Due to the fact that the drug has teratogenic effect, it is contraindicated in pregnant women. Administration of hepatoprotectors, desensitizing reduces side effects during prolonged treatment.

Absolute contraindications to the prescription of antihelminthic drugs are individual intolerance, localization of cysts in the heart, brain before surgical intervention, the first trimester of pregnancy [15].

Patients with multiple echinococcosis of complicated course are examined annually. Examination includes blood analysis, urine, serum bilirubin, thymol test, total protein and protein fractions, aminotransferases (ALT, AST), alkaline phosphatase, prothrombin, as well as serologic reactions for echinococcosis (immunoenzyme analysis), chest X-ray, ultrasound of the abdominal cavity, small pelvis, electrocardiography.

Basic measures for the prevention of echinococcosis:

1. Prevention of human infection from domestic, farm and wild animals;
2. Public health education;
3. Personal hygiene;
4. Not consuming unwashed wild berries;
5. Regular laboratory examination of risk groups (livestock breeders, fur farmers, hunters and their families) for early detection of the disease.

## CONCLUSION

**Fundamental Finding :** This review confirms that while a variety of diagnostic tools and surgical techniques exist for managing hepatic echinococcal cysts in children, the optimal approach remains contentious, particularly in complex or recurrent cases. **Implication :** The persistence of reliance on traditional open surgery in difficult cases underscores the need for standardized criteria in surgical decision-making and highlights the importance of tailoring interventions to cyst characteristics and patient-specific factors. **Limitation :** A major limitation identified in the current body of literature is the lack of high-quality, comparative studies evaluating long-term outcomes of different surgical approaches and residual cavity management techniques in pediatric populations. **Future Research :** Further investigations should focus on the development and validation of minimally invasive surgical innovations, the integration of advanced imaging and intraoperative technologies, and the refinement of antiparasitic regimens to enhance treatment efficacy and minimize recurrence across all cyst types and locations.

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