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SELECTION OF TACTICS AND METHODS OF SURGICAL TREATMENT OF COMBINED PULMONARY AND HEPATIC ECHINOCOCCOSIS IN CHILDREN

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Abstract. Echinococcosis is one of the most severe and dangerous parasitic diseases in many regions of the world. It is characterized by extensive organ involvement and a prolonged chronic course, leading to the development of serious functional disorders of the affected organs. To develop a treatment strategy and select the optimal surgical method for combined pulmonary and hepatic echinococcosis in children. The treatment outcomes of 346 children aged 3 to 14 years with various forms of echinococcosis were analyzed. Combined pulmonary and hepatic echinococcosis was identified in 39 cases (11,3%). A comparative assessment of the effectiveness of surgical interventions for combined pulmonary and hepatic echinococcosis in children showed that comprehensive preoperative preparation, selection of a rational surgical approach and an optimal operative technique, as well as active postoperative management, are the main components contributing to successful and favorable treatment outcomes. When determining surgical tactics, staging, and sequence of operations, it is necessary to consider the presence of echinococcal cysts that pose the greatest risk in terms of complication development. The effectiveness of surgical treatment of combined pulmonary and hepatic echinococcosis in children depends on the localization of cysts and the presence of complications. It is reasonable to perform echinococcectomy first on cysts that are most dangerous in terms of potential complications. All other factors being equal, the staged surgical approach should preferably begin with the pulmonary localization.

Keywords: children, echinococcosis, pulmonary and hepatic echinococcectomy.

БАЛАЛАРДАҒЫ ӨКПЕ МЕН БАУЫРДЫҢ ҚОСАРЛАНҒАН ЭХИНОКОККОЗЫН ХИРУРГИЯЛЫҚ ЕМДЕУДІҢ ТАКТИКАСЫ МЕН ӘДІСІН ТАҢДАУ

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Аңдатпа. Эхинококкоз - әлемнің көптеген аймақтарында кең таралған, ең ауыр әрі қауіпті паразиттік аурулардың бірі. Аурудың негізгі ерекшеліктеріне зақымданудың кең

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көлемде болуы, ұзаққа созылатын созылмалы ағымы және зақымданған ағзалардың қызметінің елеулі бұзылыстарына әкелуі жатады. Балалардағы өкпе мен бауырдың қосарланған эхинококкозын хирургиялық емдеудің тактикасын әзірлеу және оңтайлы әдісін таңдау. Әртүрлі эхинококкоз түрлерімен ауырған 3 жастан 14 жасқа дейінгі 346 баланың ем нәтижелері талданды. Оның ішінде 39 жағдайда (11,3%) өкпе мен бауырдың қосарланған эхинококкозы анықталды. Балалардағы өкпе мен бауырдың қосарланған эхинококкозына жасалған хирургиялық араласулардың тиімділігін салыстырмалы бағалау кешенді операция алдындағы дайындық, ұтымды хирургиялық қолжетімділікті және операциялық араласудың оңтайлы әдісін таңдау, сондай-ақ операциядан кейінгі белсенді жүргізу емнің сәтті әрі қолайлы нәтижесіне қол жеткізудің негізгі құрамдас бөліктері екенін көрсетті. Операцияның тактикасын, кезеңділігін және орындалу ретін анықтауда асқынулардың даму қаупі жоғары эхинококкалық кисталардың болуын ескеру қажет. Балалардағы өкпе мен бауырдың қосарланған эхинококкозын хирургиялық емдеудің тиімділігі кисталардың орналасуына және асқынулардың болуына байланысты. Эхинококкэктомияны асқыну қаупі жоғары кисталардан бастаған жөн. Басқа жағдайлар тең болғанда, хирургиялық емдеудің кезеңділігін өкпелік локализациядан бастау орынды.

Түйінді сөздер: балалар, эхинококкоз, өкпе мен бауырдың эхинококкэктомиясы.

ВЫБОР ТАКТИКИ И СПОСОБА ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ СОЧЕТАННОГО ЭХИНОКОККОЗА ЛЁГКИХ И ПЕЧЕНИ У ДЕТЕЙ

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Аннотация. Эхинококкоз является одним из наиболее тяжёлых и опасных паразитарных заболеваний во многих регионах мира, которое характеризуется обширностью поражения, длительным хроническим течением, вызывающим развитие серьёзных нарушений функций поражённых органов. Разработка стратегии и выбор способа хирургического лечения сочетанного эхинококкоза лёгких и печени у детей. Проанализированы результаты лечения 346 детей в возрасте от 3-х до 14 лет с различными формами эхинококкоза, из которых в 39 (11,3%) случаях выявлен сочетанный эхинококкоз лёгких и печени. Сравнительная оценка эффективности выполненных оперативных вмешательств сочетанного эхинококкоза лёгких и печени у детей показало, что комплексная предоперационная подготовка, выбор рационального хирургического доступа и оптимального метода оперативного вмешательства, активное послеоперационное ведение больных являются основными составляющими в успешном и благоприятном исходе лечения. При определении тактики, этапности и последовательности операций необходимо учитывать наличие эхинококковых кист, которые представляют наибольшую опасность в плане развития осложнений. Эффективность хирургического лечения сочетанного эхинококкоза лёгких и печени у детей зависит от локализации кист и наличия осложнений.

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Последовательность эхинококкэктомии логично проводить на кистах наиболее опасных развитием осложнений. При других равных обстоятельствах этапность оперативного вмешательства целесообразно начинать с легочной локализации.

Ключевые слова: дети, эхинококкоз, эхинококкэктомия лёгких и печени.

Introduction. Echinococcosis is one of the most severe and dangerous parasitic diseases in many regions of the world. It is characterized by extensive organ involvement and a prolonged chronic course, leading to the development of serious functional disorders of the affected organs [2, 7, 9]. According to WHO data, echinococcosis continues to occupy a leading position in terms of prevalence; in endemic areas, the incidence in humans reaches up to 50 cases per 100,000 population per year [5, 10, 11, 12]. In a number of countries where hydatid echinococcosis is an endemic pathology, its elimination has been elevated to the level of a national priority, and special national programs for disease control and prevention are being developed. Owing to the implementation of such programs, the disease has been practically eradicated in several countries that were previously unfavorable with respect to echinococcosis [13].

Analysis of the literature data and our own observations indicates that the proportion of echinococcal disease in the structure of surgical morbidity has increased over recent decades from 4–8% to 20%; simultaneous involvement of two or more organs has risen from 4% to 26.7%. At the same time, mortality associated with surgical treatment ranges from 2 to 7%. The frequency of purulent complications has increased to 17.9–28.5%; postoperative recurrence of echinococcosis amounts to 5–12%, and the formation and suppuration of a residual cavity after echinococcectomy is observed in 7–20% of cases [1, 3, 6, 8]. In recent years, there has been an increase in simultaneous involvement of multiple organs, as well as in the formation of centrally located cysts causing deformation of the anatomical structures of the organ and severe impairment of their function. The severity and peculiarities of the clinical course, difficulties of early diagnosis, and the variety of surgical treatment methods make this pathology one of the most challenging problems of modern medicine.

At present, the treatment of echinococcal disease presents certain difficulties. Despite the fact that numerous treatment options for this parasitic disease have been proposed worldwide, debates regarding the effectiveness of one method or another continue to be discussed at many international forums and conferences. Long-term comprehensive studies of the problem of echinococcosis have led to the conclusion that complex surgical treatment is the only effective method, regardless of the degree of radicality. This applies equally to uncomplicated and complicated, multiple, polyorgan, and combined forms of the disease.

The presented data demonstrate the relevance of early diagnosis and timely surgical treatment of various forms of echinococcosis in children, which served as the basis for conducting the present study.

Aim of the study. To develop a strategy and determine the optimal method of surgical treatment for combined echinococcosis of the lungs and liver in children.

Materials and methods. The present study is based on the results of examination and treatment of 346 children aged 3 to 14 years with various forms of echinococcosis. Among them,

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combined echinococcosis of the lungs and liver was identified in 39 cases (11.3%). Echinococcosis of the right lung and liver was detected in 18 cases (5.1%), of the left lung and liver in 14 cases (4.1%), and involvement of both lungs and the liver in 7 patients (2.1%) (Figure 1).
All patients admitted to the clinic with echinococcosis underwent clinical, laboratory, and instrumental examinations. The main diagnostic methods included plain chest radiography, ultrasound examination of the lungs and liver, and multislice computed tomography.

Results and discussion. The success of surgical treatment of echinococcosis was determined by the stage of the disease, the anatomical and topographic localization of the parasite, the size of the cysts, the presence of complicated forms, the patient's age, the state of immunobiological defense mechanisms, and the presence of concomitant diseases. These factors significantly influenced the choice of tactics and the rational sequence of surgical interventions in combined echinococcosis of the lungs and liver in children, thereby determining the operative risk. In our observations, in all 39 cases of combined echinococcosis of the lungs and liver, tactical decisions were based on the principles of organ-preserving surgery. Patients were operated on after appropriate preoperative preparation aimed at improving the general condition, reducing intoxication and allergic background, enhancing immunological parameters, and normalizing the main functional indices of vital organs.

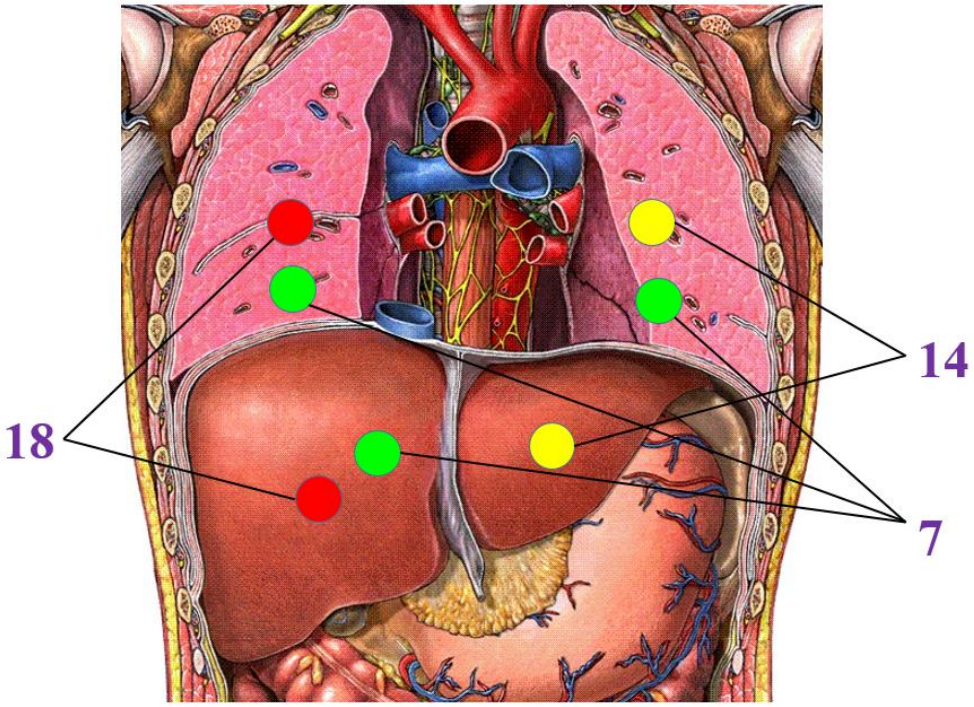

Figure 1. Organ localization of combined echinococcosis of the lungs and liver

In cases of combined involvement of the right lung and liver, one-stage echinococcectomy was performed in 14 patients (35.9%); in combined involvement of the left lung and the left lobe of the liver, in 5 patients (12.8%). The rationale for one-stage interventions was the localization of cysts in the middle and lower lobes of the right lung and in segments VII–VIII of the liver, as well

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as cyst localization in the lower lobe of the left lung and in segments I–II of the liver. In these cases, the surgical approach was a lateral or posterolateral thoracotomy in the seventh–eighth intercostal space with simultaneous transdiaphragmatic echinococcectomy of the liver. In the remaining 20 patients (51.3%) with combined lung and liver involvement, two- and three-stage echinococcectomy was performed, since cyst localization did not allow for their simultaneous removal; the interval between surgical stages did not exceed 2 months. We believe that one-stage echinococcectomy of the lungs and liver is possible only in the absence of significant technical difficulties in mobilizing both organs, when both procedures can be performed through a single incision. In such situations, this approach is justified, as it eliminates the need for repeat surgical intervention.

The sequence of removal of echinococcal cysts was determined by their size and the presence of complications, which facilitated subsequent stages of surgery from a technical standpoint. Priority was given to the removal of larger cysts to prevent their intraoperative rupture in case of accidental iatrogenic injury. Subsequently, echinococcal cysts that did not interfere with free manipulation within the operative field were removed, thereby creating favorable conditions for completion of the procedure without complications.

Determining the sequence of echinococcectomy was particularly challenging in 7 patients with bilateral pulmonary echinococcosis combined with liver involvement. In 2 patients with large and complicated liver cysts, the first stage of surgical intervention was performed on the liver, followed by surgery on the lungs (Figure 2).

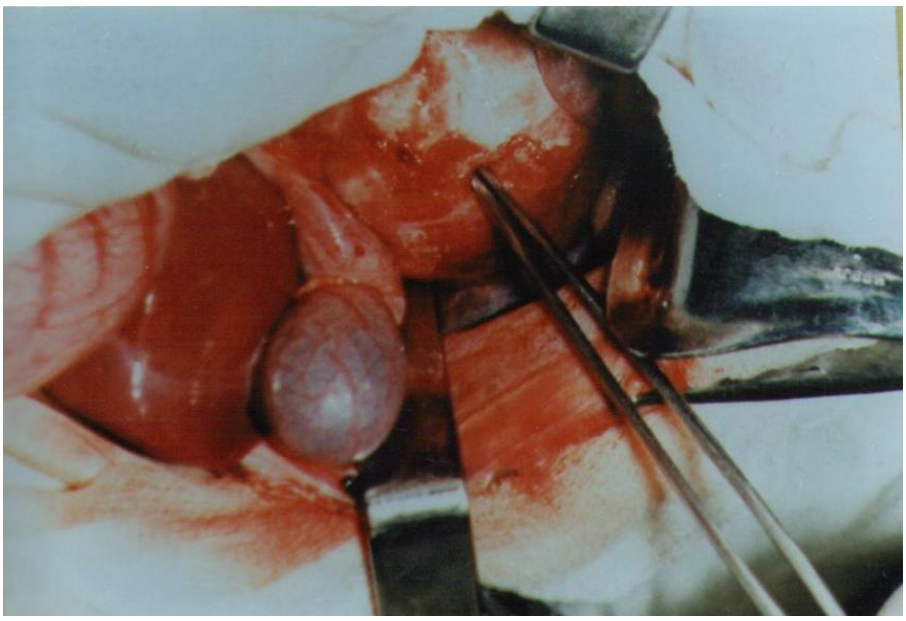

Figure 2. Echinococcal cyst occupying the entire left lobe of the liver.

In cases of single-cyst involvement of both lungs and the liver (3 observations), the cysts were approximately equal in size and showed no signs of complications. In these patients, multistage surgical treatment was performed with an interval of 2–3 months, with the sequence of

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operations beginning with the pulmonary localization. In the presence of multiple bilateral echinococcosis of the lungs and liver (2 patients), the staging of surgical interventions was determined by the greater number of cysts in the affected organ.

A mandatory condition for the successful performance of surgical interventions in echinococcosis is strict adherence to measures aimed at preventing contamination of surrounding organs and tissues with parasite elements. An essential requirement for achieving ablasty during pulmonary echinococcectomy, in our opinion, is preliminary short-term occlusion of the lobar bronchus of the affected segment during evacuation and sanitation of the cyst cavity. This approach allowed us to significantly reduce intraoperative and postoperative complications (Figure 3).

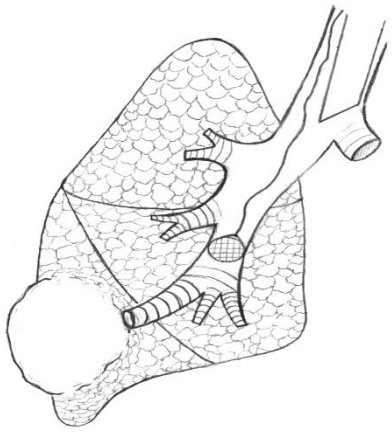

Figure 3. Schematic illustration of short-term occlusion of the lobar bronchus

This technique is considered appropriate and is used by us during echinococcectomy of medium-sized, large, and complicated cysts, when the risk of endobronchial leakage of echinococcal fluid is particularly high. Prior to tracheal intubation, obturation of the lobar bronchus supplying the segment containing the echinococcal cyst is performed. We consider this stage of echinococcectomy to be fundamental both in terms of ensuring the ablasty of the operation and in preventing bronchopulmonary complications resulting from the entry of contact chemical germicidal agents into the bronchi.

The technical steps of echinococcectomy were conventional: isolation of the cyst with gauze pads soaked in a contact-acting germicidal solution; puncture of the cyst and evacuation of its contents; cystotomy; removal of the chitinous membrane; treatment of the cyst bed with a betadine–alcohol solution; electrocoagulation of the entire inner surface of the fibrous capsule; closure of bronchial and biliary fistulas; and complete obliteration of the residual cavity by capitonnage. In our clinic, a modified capitonnage technique using figure-of-eight layered sutures (cross-layer sutures) has been introduced and successfully applied for obliteration of the cyst cavity (Figure 4).

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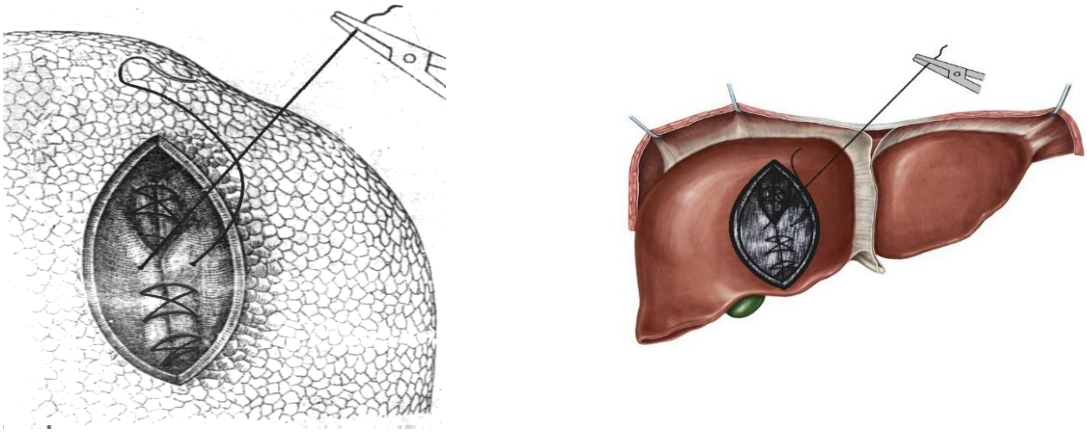

Figure 4. Schematic illustration of capitonnage performed using figure-of-eight layered sutures

When performing capitonnage with figure-of-eight layered sutures, we strictly adhere to the rules of suture placement: from the depth toward the surface, parallel to vessels, bronchi, and bile ducts, in order to avoid their injury and deformation. At the same time, we always strive to achieve complete apposition of the opposing walls of the fibrous capsule, which ensures their reliable fusion even in the presence of small bronchial and biliary fistulas. The advantages of this method of obliterating the residual cavity include significant time savings, hermetic sealing, creation of favorable conditions for healing of the lung and liver due to the alignment of corresponding tissue surfaces, as well as a reduction in ischemic zones.

The use of electrocoagulation during echinococcectomy was based on several practical considerations. First of all, coagulation of small bleeding vessels, bronchial and biliary fistulas was performed to prevent postoperative complications such as accumulation of blood, mucus, and bile in the residual cavity. In turn, electrocoagulation of the entire inner surface of the fibrous capsule led to the formation of a delicate coagulation eschar that functioned as a biological barrier; at the same time, the fibrous capsule itself became denser, contracted, and its surface area decreased. In addition, electrocoagulation of the inner surface of the fibrous capsule exerted a pronounced antimicrobial and anti-scolicidal effect as a result of thermal impact on protoscolices located both within the fibrous capsule itself and pericystically at a depth of up to 1 cm. This was confirmed by our histological and electron microscopic studies (Figure 5).

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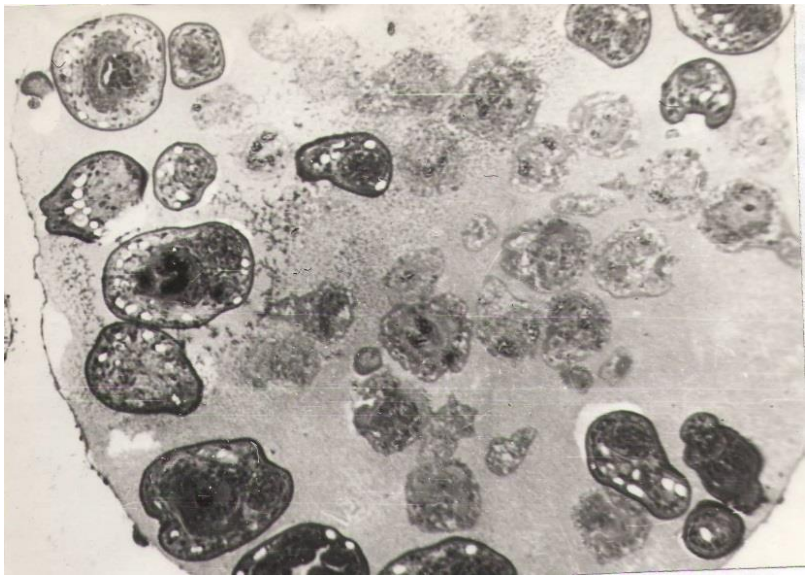

Figure 5**.** Alteration and destruction of protoscolices (treatment with betadine and electrocoagulation).

Despite strict adherence to all principles of ablasty during surgery and the introduction of various chemical and physical methods of action against the parasite, the recurrence rate of the disease remains high, reaching 12–33% [4]. In this regard, chemotherapy was administered in the preoperative and postoperative periods in order to sanitize the child's body from echinococcosis and to prevent disease recurrence. For this purpose, chemotherapy was carried out using the anthelmintic drug **Zentel**, which has demonstrated high efficacy and a broad spectrum of activity. Zentel was prescribed to all patients as a mandatory component of treatment; the daily dose was 10 mg/kg, administered in two divided doses for 14 days, followed by a repeated course after 2 months. Studies have shown that the anthelmintic drug Zentel causes irreversible disturbances in glucose utilization by the helminth and inhibits ATP synthesis. It exerts a destructive effect on the germinal elements of echinococcus by disrupting the function of the cellular microtubular apparatus and damaging tubulin protein. As a result, biochemical disorders develop within the cell, including inhibition of glucose transport and fumarate reductase activity, which underlies suppression of cell division at the metaphase stage. This mechanism is responsible for the inhibition of oviposition and larval development of helminths.

The results of the study demonstrated that the criteria for assessing the immediate and long-term outcomes of the effectiveness of surgical treatment of combined echinococcosis of the lungs and liver were the presence or absence of complications and disease recurrence. Our data indicated satisfactory function of the operated lungs and liver, and no recurrences of the disease were observed in our series. We believe that the combination of surgical intervention and chemotherapy constitutes the main criterion for preventing disease recurrence and achieving complete recovery of patients with echinococcosis.

Thus, comprehensive preoperative preparation, selection of a rational surgical approach and the optimal method of surgical intervention, as well as active postoperative management, are

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the main components of a successful and favorable treatment outcome. Surgical tactics in combined echinococcosis of the lungs and liver in children are rather complex, which is explained by the staged nature and sequence of echinococcectomy depending on cyst localization and the presence of complications. When determining the sequence of operations and the choice of surgical access, it is logical to perform echinococcectomy first in those areas where cysts pose the greatest risk of complications. Under otherwise equal conditions, it is advisable to begin staged surgical intervention with the pulmonary localization.

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