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# IMPROVING THE EFFECTIVENESS OF VIDEOTHORACOSCOPY IN PEDIATRIC PULMONARY ECHINOCOCCECTOMIES

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**Abstract:**

**The aim of the work** is to improve the results of surgical treatment of children with echinococcal lung disease by applying new technologies.

**Materials and methods of research.** 72 children with echinococcal lung disease were operated on in RNPCMECDV during the period from 2005 to 2022. The main methods for diagnosing pulmonary echinococcosis were: chest X-ray examination, ultrasound, serologic reactions for echinococcosis (ELISA), MSCT of the thoracic organs.

**Results.** Analysis of the results shows that echinococcal cysts with a diameter of more than 50 mm, as well as recurrent cysts complicated by suppuration, are considered as "relative" contraindications to videothoracoscopic echinococcectomy of the lung. Endovideosurgical echinocolectomy is and should be a priority in the treatment of pulmonary echinococcosis.

**Keywords:** Echinococcus of the lung; videothoracoscopy; trocars; pediatric surgery.

**INTRODUCTION.** Echinococcosis is a severe widespread parasitic disease and continues to be a serious medical and economic problem in many countries of the world.

Rapid development of pulmonary surgery has changed the tactics of surgeons with regard to certain types of surgical intervention for pulmonary echinococcosis [1,3]. Diagnostic and therapeutic thoracoscopy has been used in clinical practice almost since the beginning of the last century, the indications for it were rather limited for a long time. However, in recent years, thanks to the creation of miniaturized endovascular cameras and instruments for endoscopic operations, operative thoracoscopy is experiencing its second birth, and the indications for its use are constantly expanding [2,4-7].

The indirect visualization of the surgical object, absence of visible interposition of anatomical structures, rigid fixation of the endoscope and manipulators to the surgical ports regulate the inspection and approach to organs from a strictly defined angle [8,9]. At the same time, it is the accuracy of all ports installation that is one of the main factors determining the success of endoscopic surgery. Insufficiently developed technique of endoscopic access is considered as one of the reasons for its conversion and intraoperative complications. This fact necessitates the development of theoretical and technical aspects of optimal endoscopic access [10].

All this dictates the need for early surgical intervention and tИмеющиеся в научной литературе статьи в основном отражают проблемы эхинококкоза у взрослых, хотя одной из эпидемиологически напряженных категорий населения являются дети.

**PURPOSE OF THE WORK;-** To improve the results of surgical treatment of children with echinococcal lung disease by applying new technologies.

**MATERIALS AND METHODS OF THE STUDY.** In the Republican Scientific and Practical Center of Minimally Invasive and Endovascular Surgery for Children 72 children with echinococcal lung disease aged from 2 to 16 years were operated on in the period from 2005 to 2022. Most of the children were over the age of 10 years (35-48.6%). There were 49 boys (68.1%) and 23 girls (31.9%).

The main methods for diagnosing pulmonary echinococcosis were chest X-ray examination, ultrasound, serological reactions for echinococcosis (ELISA), and MSCT of the chest organs was performed in case of difficulties in making a diagnosis, determining the localization and volume of cysts.

**THE RESULTS OF THE STUDY AND THEIR DISCUSSION.**

Right-sided lung lesions with echinococcosis were observed more often than left-sided ones 51

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(70.8%) and 14 (29.2%) respectively, bilateral lesions in 11.1% of cases (8 patients).

Solitary - solitary cysts were found in the majority of cases 48 (66.6%), multiple cysts occurred in 24 (33.4%) children. Small cysts were observed in 10 (13.8%), medium cysts in 31 (43.1%), and large and giant cysts in 22 (30.5%) cases (A.T. Pulatov classification -1999). Large-diameter cysts, as our observations show, are more common in children of high school age.

In terms of localization, echinococcal cysts in the lung tissue were more often detected in the lower peripheral segments (this applied mainly to large and medium-sized cysts), while the central location of the cysts was less common in 11.1% of cases (8 patients).

When dividing the clinical course of pulmonary echinococcosis into stages, we adhered to the classification of A.V. Melnikov (1935).

Asymptomatic course was noted in 23 (31.9%) children. However, in 9 patients we managed to identify hidden symptoms: periodically occurring short-term chest pain, deterioration of appetite, a single cough, malaise, and sweating.

The main complaints in the second stage of the disease in 35 observations (48.6%) were chest pains on the affected side of the lesion of varying intensity, intensified by moving games and physical activity. In 23 (31.9%) patients there was a persistent dry cough, which was poorly amenable to drug therapy. Patients had decreased appetite, general weakness, increased fatigue, sweating, to which parents at the initial stage of the disease more often did not pay due attention. Allergic manifestations were observed in one third of children.

Changes in laboratory parameters in echinococcosis were nonspecific. In peripheral blood analysis, there was an increase in the number of eosinophils in 48.6%, leukocytosis in 32.8%, and acceleration of COE in 53.7% of patients.

In uncomplicated echinococcosis, the echinococcal cyst was a rounded or oval homogeneous more or less intense shadow with clear edges against the background of lung tissue.

Complicated course of the disease in the lungs was observed in 13 (18,1%) patients. In 6 (8,3%) children there was a suppuration of echinococcal cyst with a breakthrough into bronchus, in 5 (6,9%) children there was a breakthrough of echinococcal cyst into pleural cavity. In 2 (2.8%) patients there was cyst suppuration without perforation of the chitinous shell,

All children with complicated forms of pulmonary echinococcosis were admitted to the clinic as an emergency in serious condition.

The severity of the patients' condition was caused by acute respiratory failure of obstructive and restrictive types, hypovolemia, endotoxemia and fluid deficit. These points indicated the necessity of urgent preoperative preparation aimed at correction of the above mentioned disorders.

Clinical manifestation of echinococcosis breakthrough into the bronchus (4-6% of patients) was accompanied by an increase in body temperature up to 38-39°C, fits of severe cough with excretion of a large amount of clear or turbid fluid with fragments of chitinous membrane together with sputum and blood streaks.

The suppuration of the cyst was characterized by signs of acute inflammatory process. These children had increased body temperature (up to 38-39º C), dry cough, pain in the affected side of the chest, increasing with deep breathing, general weakness, and lack of appetite.

In 2 (2,8%) patients the breakthrough of echinococcal lung cyst into pleural cavity developed with manifestations and symptoms of pleuro-pulmonary shock. There was a sharp pain in the chest, restlessness, repeated vomiting, difficult breathing - dyspnea, weakness, adynamia, lethargy. Soon allergic manifestations joined the above symptoms.

Breakthrough of echinococcal cyst into pleural cavity (5 (6.8%) patients) radiologically resembled the picture of pleurisy, the level of fluid and gas bubble above it were determined on the radiograph, or instead of horizontal level of fluid there was a wavy or convexity, which was due to the collapse of the chitinous shell of the parasite - the symptom of "floating chitinous shell", or "sickle-shaped lumen", "crumpled paper symptom". These changes resembled destructive pneumonia and its complications, which caused certain difficulties in diagnostics of pulmonary echinococcosis.

All patients were divided into 2 groups depending on the nature of applied surgical interventions. The control group - 31 patients were operated by traditional accesses. Videothoracoscopic echinococcectomy was performed in -41 patients of the main group.

Duration of preoperative preparation depended on the general condition of the child, disturbance of homeostasis, water-electrolyte equilibrium, on the nature and duration of complications.

Children with uncomplicated pulmonary echinococcosis underwent preoperative preparation according to general surgical rules for 3-4 days, including desensitizing therapy.

When performing echinococcectomy from the lung in the control group (31 patients) we used traditional access - intercostal thoracotomy through V and VI intercostal space. From the existing methods of capitonage of the residual cavity at traditional lung

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echinococcectomies we used the Delba methods in 14 (45,1%), A.V.Vishnevsky in 8 (25,8%) and A.T.Pulatov in 7 (22,6%). Lung lobe resection was performed in 2 (6.5%) patients.

On the first day of the postoperative period, in all cases the patients were anesthetized with narcotic analgesics 2-3 times. The duration of patients' anesthesia was up to 4 days. Due to the strong pain syndrome, activation of patients in the first 2-3 days was difficult, movements in bed were limited. Coughing and difficult expectoration of sputum were accompanied by severe pain in the area of the postoperative wound. Postoperative complications were observed in 3 (9.7%) patients (2 had postoperative pneumonia, 1 had exudative pleuritis). The average duration of hospitalization after traditional pulmonary echinococcectomy was 11±1.3 days.

When selecting patients for videothoracoscopic surgery, we took into account the localization and number of cysts, the nature of the lung tissue lesion, and the history of surgical interventions on the side of the lesion.

To perform surgical interventions we used an endoscopic stand and a set of instruments from "Karl Storz" company.

At the initial stage of our operative practice, we, as well as many other authors, considered as absolute contraindications to performing videothoracoscopic echinococcectomies of the lung: the presence of multiple, complex-shaped cysts with a diameter of more than 7 cm, located in different lung lobes; suppurative echinococcal cysts with pronounced perifocal inflammation; recurrent echinococcal cysts.

At present, we, as well as other authors, consider the central location of echinococcal cysts, as well as multiple (more than 2 cysts) located in different lung lobes, impossibility of palpatory and manual examination of lung tissue in order to search for small deep-lying cysts as absolute contraindications to videothoracoscopic echinococcectomy of the lung. The remaining cases (cysts with diameter more than 50 mm, as well as recurrent cysts complicated by suppuration), which according to the literature are also considered to be an absolute contraindication to videothoracoscopic echinococcectomy of the lung, we have allowed ourselves to treat them as "relative". Since with sufficient experience of the surgeon, such operations are quite feasible by endovision method and effective in all parameters.

If it was difficult to eliminate residual echinococcal cavity, presence of multiple bronchial fistulas, we switched to video-assisted thoracoscopic intervention (minithoracotomy access).

In case of bilateral lung lesions we performed staged echinococcectomy. After traditional echinococcectomy, the children were discharged home for outpatient observation and treatment for at least 1 month to restore their physical activity and improve their general condition. After thoracoscopic echinococcectomy, the physical activity of patients recovered much faster, and therefore the second stage of surgery on the opposite side was performed, as a rule, on average two weeks after the primary one.

The technique of videothoracoscopic pulmonary echinococcectomy included 5 consecutive stages: - introduction of the first trocar, creation of pneumothorax, revision of the pleural cavity; introduction of working trocars; echinococectomy proper; reduction of the residual cavity size; suturing of the accesses.

Videothoracoscopic echinococcectomy was performed with single-lung ventilation, i.e. with intubation of the right or left main bronchus. The patient's position on the operating table was on the healthy side. Four trocars were used. After insertion of the first 5 mm trocar with video optics, CO2 was insufflated into the pleural cavity under pressure of 6-8 mmHg. The remaining 3 trocars were then inserted.

Trocar placement: for the upper pleural cavity for the normosthenic chest type, the optimal areas for trocar insertion were: for optics - V intercostal space along the anterior axillary line, for working trocars - V intercostal space along the posterior axillary line and III intercostal space along the parasternal line. For hyperstenic type: for optics - V intercostal space along the anterior axillary line, for working trocars - IV intercostal space along the posterior axillary line and III intercostal space along the parasternal line. For the asthenic type: for optics - VI intercostal space along the anterior axillary line, for working trocars - V intercostal space along the posterior axillary line and III intercostal space along the parasternal line. To perform VTV in the middle floor of the pleural cavity for the normosthenic type of the thorax, the optimal areas for trocar insertion were: for optics - V intercostal space along the posterior axillary line, for working trocars - V and III intercostal spaces along the midclavicular line. For hyperstenic type: for optics - V intercostal space along the posterior axillary line, for working trocars - IV and II intercostals along the midclavicular line. For asthenic type: for optics - V intercostal space along the posterior axillary line, for working trocars - VI and III intercostals along the midclavicular line.

The optimal areas for trocar insertion in the lower pleural cavity from the front for the normosthenic chest type were: for optics - V intercostal space along the anterior axillary line, for working trocars - V intercostal space along the posterior axillary line and III intercostal space along

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the midclavicular line. For hyperstenic type: for optics - V intercostal space along the anterior axillary line, for working trocars - IV intercostal space along the posterior axillary line and in III intercostal space along the midclavicular line. For asthenic type: for optics - V intercostal space along the anterior axillary line, for working trocars - VI intercostal space along the posterior axillary line and III intercostal space along the midclavicular line.

The optimal areas for trocar insertion for the normosthenic and asthenic chest types were: for optics - V intercostal space along the posterior axillary line, for working trocars - III intercostal space along the anterior axillary line and V intercostal space along the midclavicular line. For hyperstenic type: for optics - V intercostal space along the posterior axillary line, for working trocars - III intercostal space along the anterior axillary line and IV intercostal space along the midclavicular line.

If minithoracotomy was necessary, it was optimized for the upper floor in IV, in the middle floor - in V, in the lower floor in front in VI, and behind in VII intercostals in the area lying between the posterior and anterior axillary lines. In doing so, we tried to avoid muscle crossing as much as possible (muscle fibers were separated layer by layer, except for the intercostal muscles).

In order to know the optimal areas of trocar insertion for performing IVT in a particular pathology preoperatively, we conditionally divided the pleural cavity obtained by reconstruction of MSCT images into 4 floors: upper, middle, and lower, in which we also distinguished the anterior and posterior surfaces. It should be noted that the more floors we divide the pleural cavity into, the more optimal are the trocar insertion zones we are looking for. In addition to the division into floors, we also considered each chest from the standpoint of its type. On the basis of several variants of trocar insertion zones, we chose the most optimal one in each specific case. That is, we determined the optimal trocar insertion zones depending on the type of chest and the localization of the object of intervention.

The first step in videotoracoscopic echinococcectomy was revision of the pleural cavity and lung to detect adhesions and additional echinococcal cysts. In case of adhesions in the pleural cavity, they were separated by monopolar coagulation and scissors. The area of the supposed needle injection in the area of the echinococcal cyst was covered with napkins soaked in 80% glycerin to prevent the surrounding tissues from being contaminated with cystic fluid and to observe the principles of aparasitism. The next step was to puncture the cyst with a needle connected to an aspirator and the cyst contents were evacuated using a vacuum extractor. Then 80% glycerin solution heated up to 60º C was injected into the remaining cyst cavity with its exposure for 10-15 minutes for its sanation, then the glycerin was removed through a vacuum pump. After that, the fibrous capsule was opened by monopolar coagulation, and a window was created for insertion of a 10-mm vacuum suction for evacuation of the chitinous shell with fluid residues (in contrast to the common method of removal with an endocontainer). The formed fibrous capsule was again treated with 80% glycerol solution heated to 60ºC, with exposure for 10-15 min, then the glycerol was removed again by vacuum suction. Within the healthy lung tissue, the fibrous capsule was circumferentially excised with monopolar coagulation scissors, the residual cavity was injected with saline solution to identify bronchial fistulas, which were sutured with PDS II 3/0 thread or coagulated with bipolar coagulator, then the cavity was sutured with cicatricial sutures. After elimination of the residual cavity, the operation was completed by drainage of the pleural cavity. If it was impossible to eliminate the residual cavity, it was drained with a polychlorovinyl tube with lateral openings. In 4 (5.5%) cases due to a giant cyst with multiple large-caliber bronchial fistulas, a combination of trocar access with minithoracotomy (incision length not more than 5 cm) was performed.

There were no intraoperative complications. Postoperative management of children with EL includes: infusion therapy, analgesia, prophylaxis and treatment of pneumonia and symptomatic therapy.

In the early postoperative period, all patients were admitted to the anesthesiology and intensive care unit. The average bed-day was 2.5 ± 0.6. An essential role in the prevention of early pulmonary complications was given to adequate analgesia, giving preference to non-narcotic analgesics, especially in the first three days after surgery. Early activation of patients, inhalation of humidified oxygen, inhalation with medicinal herbs and bronchomucalitics, respiratory exercises were considered mandatory in postoperative management of patients with OED.

In the postoperative period, complications were observed in 2 (4.9%) patients: residual cavity - in 1 (2.5%), exudative pleurisy - in 1 (2.5%), which were resolved after conservative therapy.

As a rule, the patients were discharged from the hospital on the 6-8th day after the operation. The average terms of hospital stay amounted to 8.4±1.2 days/day. No recurrences

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after thoracoscopic echinococcectomy of the lung were observed in the postoperative period within 1.5-2 years (if antiparasitic drugs (albendozole) were taken correctly).

Thus, our experience shows that the use of endovision technique in lung echinococcosis surgery is justified and is a promising direction in the treatment of parasitic lung cysts.

At the same time we believe that at correct selection of patients and strict observance of antiparasitic principles, videothoracoscopic pulmonary echinococcectomy is a promising method of surgical treatment of pulmonary echinococcosis.

Table 1.

**Comparative evaluation of postoperative treatment results in the compared groups**

| | Conventional echinocolectomy (n=31 | Thoracoscopic echinococcectomy (n=36) |
|---|---|---|
| Total duration of the operation (minutes) | 75±10 | 65±7 |
| Duration of analgesic use (24 hours) | 4,3±0,5 | 2,2±0,4 |
| Beginning of patient activation after surgery (day) | 3,5±0,6 | 2±0,5 |
| Length of hospital stay | 11±1,3 | 7,4±1,2 |

This significantly reduces the consumption of medications, the time of hospitalization (8.4±1.2 k/d), the time of recovery of physical activity of the patient and obtains a good cosmetic effect.

**CONCLUSION.** Without detracting from the advantages of traditional echinococcectomies, we believe that the approach to the choice of the method of surgery should be strictly differentiated.

Only in case of absolute contraindications to thoracoscopic pulmonary echinocolectomy, traditional echinocolectomy should be performed.

Echinococcal cysts with a diameter of more than 50 mm, as well as recurrent cysts complicated by suppuration, we have allowed ourselves to treat them as "relative" contraindications to videothoracoscopic pulmonary echinococcectomy, In the treatment of pulmonary echinococcosis endovideosurgical echinocolectomy is and should be a priority.

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