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Possibilities of Mini-Invasive Interventions in Pulmonary Echinococcosis

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ABSTRACT

We present an analysis of the results of surgical treatment of 182 patients with pulmonary echinococcosis (126 patients with uncomplicated and 56 with complicated pulmonary echinococcosis). Of these, only in 23 patients out of 25 planned, it was possible to carry out echinococcectomy purely thoracoscopically through trocar punctures. In 134 cases, videothoracoscopic echinococectomy was performed using a mini-access. In case of bilateral localization of cysts, 7 patients underwent stage-by-stage operations, and in 3 (36.36%) cases - single-stage echinococcectomy. Echinococcectomy from the lung was performed in 25 patients using a wide thoracotomy approach.

All patients underwent anterolateral thoracotomy. Basically (97.67%) performed organ-preserving operations with the elimination of the residual cavity in the lung with suture plastics in various modifications. In 2 patients with marginal location and pneumocirrhosis, marginal resection of the lung with an echinococcal cyst was performed. With combined echinococcosis of the lungs and liver, 10 patients were operated on. 6 patients underwent surgical interventions on the lungs and liver through separate approaches at the same time. The use of minimally invasive techniques for pulmonary echinococcosis is possible in more than 2/3 of patients. We present an analysis of the results of surgical treatment of 182 patients with pulmonary echinococcosis (126 patients with uncomplicated and 56 with complicated pulmonary echinococcosis). Of these, only in 23 patients out of 25 planned, it was possible to carry out echinococcectomy purely thoracoscopically through trocar punctures. In 134 cases, videothoracoscopic echinococectomy was performed using a mini-access. In case of bilateral localization of cysts, 7 patients underwent stage-by-stage operations, and in 3 (36.36%) cases - single-stage echinococcectomy. Echinococcectomy from the lung was performed in 25 patients using a wide thoracotomy approach. All patients underwent anterolateral thoracotomy. Basically (97.67%) performed organ-preserving operations with the elimination of the residual cavity in the lung with suture plastics in various modifications. In 2 patients with marginal location and pneumocirrhosis, marginal resection of the lung with an echinococcal cyst was performed. With combined echinococcosis of the lungs and liver, 10 patients were operated on. 6 patients underwent surgical interventions on

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the lungs and liver through separate approaches at the same time. The use of minimally invasive techniques for pulmonary echinococcosis is possible in more than 2/3 of patients.

KEYWORDS: laparoscopic surgery, mini-invasive intervention, general surgery, surgery, echinococcectomy

INTRODUCTION

Echinococcosis is endemic in many developing countries around the world. According to the WHO, in endemic areas, the incidence of echinococcosis in humans is 50 cases per 100,000 people per year, and in some parts the prevalence rates can be as high as 5-10%. Echinococcosis affects both different segments of the population and different age groups. Surgeons and infectious disease specialists in endemic regions of several countries of the world are of particular interest in this disease. Although parasites can affect various organs of the body, echinococcosis usually affects the liver and lungs. In adults, the lungs (18–35%) are the second most frequent localization of echinococcosis after the liver (50–70%). Mortality in echinococcosis reaches 2.5-7%. (15).

The only radical treatment for echinococcosis is still surgical. The principles of surgical treatment of an echinococcal cyst include: complete emptying of the cyst with removal of the endocyst; prevention of pollution and spillage; careful closure of the bronchial openings; residual cavity treatment; and maximum preservation of the lung parenchyma. Enucleation with or without capitonnage is a classic operation. However, the operation performed is influenced by many factors, including whether the cyst is intact or ruptured; single or multiple; unilateral or bilateral; associated with a cyst of the dome of the liver; and are associated with the destruction of the lung parenchyma (1-6).

The introduction of endosurgical technology eliminated one of the most significant drawbacks of traditional abdominal surgery - the discrepancy between traumatic access and minimal intervention on the organ itself, and minimally invasive surgery has become a possible approach to the treatment of pulmonary echinococcosis. The wide development of surgical endoscopy, low trauma and low incidence of complications, economic efficiency and reduction of the rehabilitation period for patients allows us to revise the principles of treatment of patients with echinococcosis of all localizations (2, 3, 4).

Drug therapy for echinococcosis includes drugs of the benzimidazole group, namely mebendazole or albendazole. Chemotherapy is considered appropriate for small cysts (<3 cm), patients with contraindications for surgery. Albendazole has better bioavailability and is more effective and is currently the drug of choice. Although the optimal duration of pharmacotherapy for pulmonary echinococcosis is unknown, it is usually prescribed for 3–6 months. It used to be thought that albendazole was given in 1-month courses with 14-day breaks to avoid hepatotoxicity. More recently, it has been demonstrated that continuous therapy is more effective than cyclic therapy without increasing side effects. Most lung cysts disappear within 5-14 months after treatment. It has been demonstrated that preoperative treatment with albendazole, despite the high concentration of albendazole in the serum and cyst fluid, the cyst can remain viable. Proto-splinters retain their viability in dead cysts. A high incidence of relapses has been reported without postoperative anthelmintic therapy (5, 7).

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MATERIALS AND METHODS

We analyzed the data of surgical treatment of 182 patients with pulmonary echinococcosis (126 patients with uncomplicated and 56 patients with complicated pulmonary echinococcosis), carried out in our clinic in the period from 2005 to 2020. The age of the patients varied from 5 to 83 years. Men - 77 (42.30%), women - 105 (57.70%).

There were 223 cysts in the lungs. At the same time, 81 (36.32%) cysts were localized in the upper lobes, 24 (10.76%) - in the middle lobe, and 118 (52.92%) - were in the lower lobes of the lungs. 132 (59.19%) cysts were found in the right lung and 91 (40.81%) cysts in the left lung. The sizes of cysts in the lungs varied from 3 to 15 cm in diameter. In the lungs, a complicated course of echinococcosis was observed in 56 (30.76%) patients. Of these, 34 (60.72%) - cyst breakthrough in the bronchus, 15 (26.79%) - cyst suppuration and 7 (12.50%) - cyst breakthrough into the pleural cavity.

In addition to clinical examination, chest x-ray and computed tomography were the main diagnostic methods. A serological test for echinococcus was not performed in our clinic. Fibrobronchoscopy (detection of endobronchial whitish-yellow or white gelatinous membrane) was used for diagnosis in patients with atypical clinical and radiological signs. Computed tomography (CT) of the chest showed oval or spherical opacities in the lungs. To identify liver cysts, CT and ultrasound of the abdominal cavity were performed; cystic liver lesions were found in 23 cases. Casoni's subcutaneous test showed positive results 86.7% (59/68), and tests for indirect hemagglutination and convection immunity gave positive results 83.9% (47/56) and 65.5% (36/55), respectively.

Out of 182 patients with pulmonary echinococcosis operated on, 23 (12.64%) underwent thoracoscopic echinococcectomy (through trocar punctures on the chest wall). In 134 (73.62%) patients, echinococcectomy from the lungs was performed through minithoracotomy with video assistance. Echinococcectomy from the lung was performed in 25 (13.74%) patients through a wide thoracotomy access.

To perform thoracoscopic operations, an endoscopic stand and a set of instruments from Karl Storz and Auto Suture were used. The operating team consisted of 3 surgeons, an operating nurse and a younger operating sister.

Taking into account the non-standard localization of cysts in the lungs, the points of application of pneumothorax and the introduction of trocars were selected in each case individually. Preference was given to points located in the 7-8 intercostal space along the posterior axillary line, the 3rd intercostal space along the anterior axillary line, taking into account the use of these punctures for draining the pleural cavity after the completion of the operation, as well as points located along the 5 or 6 intercostal spaces, taking into account the possibility of transition to thoracotomy. A pneumothorax was applied, and a trocar for a thoracoscope was inserted at the point most distant from the cyst localization zone. A thorough revision of the pleural cavity was performed and a 5 mm trocar for instruments was inserted at one of the above points. After determining the exact localization of the cyst, a trocar was inserted directly above it to puncture the echinococcal cyst. Puncture of the cyst is the first stage of thoracoscopic surgery for pulmonary echinococcosis. The puncture technique and the corresponding devices are of paramount importance to comply with the principle of aparasitism of the operation to prevent the contents of the echinococcal cyst from entering the pleural cavity. For the puncture of the cyst, we used a special “needle - suction cup” developed by us (rats.pred. No. 1812). The advantage of this needle is its well-known design feature: the needle is located in a suction tube that is connected to

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a vacuum. Before puncture, it is necessary to connect the needle to the aquapurator in aspiration mode, the suction function of the tube was ensured by tight fit of its tip to the protruding surface of the cyst and connecting a vacuum electric suction (vacuum 20-30 mm Hg). The puncture needle was passed through the lumen of the suction tube. After puncture and evacuation of the echinococcal fluid, the fibrous capsule collapsed. Immediately after the evacuation of its contents and before opening the fibrous capsule, 100% glycerin was injected into the cyst cavity. During thoracoscopic surgery, this allowed subsequently to safely move the cuticular membrane of the parasite from the residual cavity into the endocontainer. After puncture, evacuation of the contents, antiparasitic treatment of the cyst, the chitinous membrane was removed. To do this, in the most convex part of the cyst, the fibrous capsule was opened with electrosurgical scissors, after having brought the open wide endocontainer here. For revision of the residual cavities, complete removal of the cuticular membrane and detection of bronchial fistulas, endovideoscopy of the residual cavity was performed in all cases. The chitin sheath, the identified remains of the parasite, safety napkins were placed in an endocontainer, which was removed at the end of the operation through one of the 10-mm trocars, if necessary, slightly widening the wound. The elimination of the residual cavity is the final stage of the surgical intervention. Free areas of the fibrous capsule were excised under electrocoagulation. The inner surface of the cyst was also additionally coagulated to eliminate small bronchial fistulas. The remaining cavity was in the form of a saucer.

During thoracoscopic operations, the capitonage of the residual fibrous cavity is of particular difficulty. With intracavitary ligation with endoscopic clamps, the nodes are usually not fully tightened. To eliminate this drawback, we have developed a device for endoligation (rac. No. 1814.).

Technical difficulties in performing thoracoscopic echinococcectomy associated with the removal of the chitinous membrane and observance of aparasiticity gave rise to the development of the operation of echinococcectomy from the lungs through minithoracotomy with video assistance.

Technique of execution: Depending on the size of the echinococcal cyst, surgical intervention (access to the object) was started by two methods:

For cysts ranging in size from 5 to 10 cm in diameter, surgical intervention began with the imposition of pneumothorax. Veresh's needle was injected into the VII-VIII intercostal space along the posterior axillary line with the localization of the cyst in the anterior-upper parts of the lung and in the III intercostal space along the anterior axillary line with the localization of the cyst in the posterior-lower parts of the lung.

According to the parameters of the insufflator sensors, the freedom of the pneumothorax was monitored. After the application of pneumothorax at the same point, a trocar and optics were introduced into the pleural cavity. During the revision of the pleural cavity, the exact localization of the cyst was established and a minithoracotomy was performed over its projection - an incision up to 5 cm long.Depending on the localization of the cyst, minithoracotomy was performed in the IV-VI intercostal spaces in the zone located between the anterior and posterior axillary lines.

For cysts larger than 10 cm in diameter, as well as difficulties in applying pneumothorax associated with adhesions in the pleural cavity, surgical intervention began with a mini-thoracotomy, the landmarks for which were previously planned according to X-ray examination data. In this case, the localization of the cysts was of decisive importance: when the echinococcal cyst was localized in the upper lobe, the mini-access was made in 4-5 intercostal spaces, and,

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depending on the segmental localization, the incision was mixed to the anterior or posterior axillary line. When the cyst is localized in the lower lobe, the incision was made along the 6-7 intercostal space. Under visual control, a 10 mm trocar for optics was inserted into the third intercostal space along the anterior axillary line or in the VII-VIII intercostal space along the posterior axillary line.

A retractor was installed and the cyst was isolated from the pleural cavity with a napkin moistened with glycerin. The stages of echinococcal cyst removal were common: - cyst puncture with fluid evacuation; - cystotomy and removal of the chitinous membrane; - treatment of the fibrous cavity with scolexicide (100% glycerin); - excision of a part of the fibrous capsule protruding above the lung tissue; - suturing of large bronchial fistulas, coagulation of small ones; - elimination of the residual cavity with suture plastics.

Performing minimally invasive interventions is difficult if there are daughter blisters in the cyst. In such cases, we use the "trocar-extractor" developed by us (rac. Pre. No. 1815).

The pleural cavity was drained in the III intercostal space along the midclavicular line and in the VII or VIII intercostal space along the posterior axillary line. The minithoracotomy wound was sutured in layers. The drains were connected to an active aspiration system with a small vacuum.

The peculiarities of the operation were bright illumination and visual control of the course of the operation from the side of the pleural cavity, the use of instruments with long branches for manipulation in the depth of the wound.

RESULTS

With uncomplicated pulmonary echinococcosis, it was possible to carry out echinococcectomy purely thoracoscopically through trocar punctures only in 23 out of 25 patients. In 2 cases, intraoperative technical difficulties required a switch to minithoracotomy. The sizes of the cysts varied from 5 to 8 cm. In 5 cases, after thoracocystoscopy, a partial pericystectomy was performed and, due to the absence of bronchial fistulas, the Vishnevsky capitonage was performed. In 7 cases, the residual cavity was eliminated according to Vakhidov. And in the remaining 11 cases, the fibrous cavity was eliminated according to Bobrov. A postoperative complication was observed in 2 (8.69%) patients (residual lung cavity).

In 2 cases, due to technical difficulties during thoracoscopic echinococcectomy by the trocar method, it was necessary to switch to minithoracotomy and, after manual revision, echinococcectomy was performed.

In 134 cases, videothoracoscopic echinococectomy was performed using a mini-access. The sizes of the cysts varied from 10 to 17 cm. In 7 (5.22%) cases, 3 cysts were removed, in another 12 (8.95%) 2 cysts were removed. With localization of cysts in the upper lobe, 12 (8.95%) had minithoracotomy in 4 and 38 (28.36%) patients with 5 intercostal spaces, and with cysts of the middle and lower lobes, only 23 (17.16%) had 7 intercostal space and in 61 (45.53%) 6 intercostal spaces. In 42 (31.34%) cases of large cysts, minithoracotomy was performed without preliminary thoracoscopy in order to prevent damage to the cyst during thoracoscopy and thoracoscopy. Capitonage of the cavity was performed depending on the configuration and volume of the cyst. With rounded cysts in 70 patients, the cavity was eliminated according to the Vakhidov method. With deep semi-oval cysts in 34 patients, capitonage was made with vertical semi-lace sutures. In 18 patients, the Bobrov-Spasokukotsky technique was performed. In 12 cases, the Vishnevsky technique was performed. In case of bilateral localization of cysts, 12

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patients underwent step-by-step operations, and in 5 cases - a single-stage echinococcectomy.

Echinococcectomy from the lung was performed in 25 patients using a wide thoracotomy approach. All patients underwent anterolateral thoracotomy. It should be recognized that echinococcectomy from the lungs by thoracotomic access was most often performed only in case of complex cases of echinococcosis. In 12 (48%) cases it was recurrent echinococcosis, in 9 (36%) - multiple echinococcosis, where cysts are scattered, another 4 (16%) had giant cysts. In most cases - 9 (81.82%), organ-preserving operations were performed with the elimination of the residual cavity in the lung with suture plastics in various modifications. In 2 (18.18%) patients according to the Vishnevsky method, in 3 (27.27%) - according to Bobrov-Spasokukotsky, and 4 (36.36%) had vertical half-string sutures. And 2 (18.18%) patients underwent marginal resection of the lungs.

Basically, organ-preserving operations were performed with the elimination of the residual cavity in light suture plastics in various modifications. In 2 patients with marginal location and pneumocirrhosis, marginal resection of the lung with an echinococcal cyst was performed.

Currently, with suppuration of echinococcal cysts, we perform transthoracic drainage of cysts under the control of thoracoscopy or fluoroscopy.This drainage method was used in 12 patients, in 7 cases, cavities were drained under the control of a thoracoscope, in 5 cases - under X-ray control. With a right-sided single cyst in 8 patients, left-sided - in 4 patients.

Of 12 cases, one patient had a complication, which was manifested by limited pleural empyema. After conservative measures with drainage of the abscess, the process was resolved. In one case, the cyst cavity was not obliterated, leaving a dry residual cavity. In this case, the cyst diameter exceeded 12 cm.

With a breakthrough cyst in the bronchus, without obvious signs of suppuration, 34 patients were operated on. In 18 patients, cysts were localized in the right lung, in 9 - in the left lung, and in 7 cases a bilateral arrangement of cysts was noted. 2 patients were diagnosed with 3 cysts in one lung and 5 - 2 cysts each.

All patients underwent surgery. In 32 patients, operations were performed using the minithoracotomy method. In this category, due to possible complications, the mini-access was performed without preliminary thoracoscopy. After polypositional fluoroscopy, in accordance with our technique, in 2 cases the access was made according to IV, in 12 - according to V, in 14 - according to VI, and in 6 patients - along the VII intercostal space. In 2 cases, 3 cysts from one lobe were removed from the mini-access, and in 4 patients, 2 cysts were removed from two lobes. In 7 cases, the localization of cysts was bilateral. In 4 patients, the first stage was performed on the side of the complicated cyst. Three patients underwent simultaneous operation through mini-access. These patients had a high probability of rupture of the cysts of the opposite lung during surgery or the immediate postoperative period. A breakthrough of a cyst into the pleural cavity is considered one of the most severe complications of echinococcosis. For the prevention of pyopneumothorax, patients should undergo surgery in a timely manner.

X-ray examination revealed hydropneumothorax in 6 cases of our patients. All patients underwent surgery through a minithoracotomy access after preliminary thoracoscopy, where an echinococcal cyst breakthrough into the pleural cavity was revealed.

With the breakthrough of echinococcal cysts into the pleural cavity, in all 6 cases, the pleural cavity was sanitized with an ozonized saline solution, the chitinous membrane was removed and the residual cavity was removed without suturing bronchial fistulas.

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With combined echinococcosis of the lungs and liver, 10 patients were operated on. 6 patients underwent surgical interventions on the lungs and liver through separate mini-accesses at the same time. In 4 cases, echinococcectomy from the lungs and liver was performed simultaneously with separate mini approaches, and in 2 cases the minithoracotomy access was combined with wide laparotomy. Removal of cysts from the lungs and liver was performed in 4 patients in stages. Moreover, all stages of treatment were carried out using only mini - accesses.

In most cases, organ-preserving operations were performed with plastic surgery of the residual cavity in various modifications. The indications for lobectomy in 2 patients were cases of complicated echinococcosis, in which cysts occupied the entire lobe of the lung and led to its pneumocirrhosis.

All patients in the postoperative period, a month later, were prescribed chemotherapy with albendazole at a dose of 12 mg / kg per day for 30 days. One of the positive properties of this drug is its low toxicity, which allows it to be used for rather long courses with a significantly lower risk of side effects.

CONCLUSION

Thus, echinococcectomy from the lungs through minimally invasive approaches was possible in more than 2/3 of patients, and the use of endovisual technology made it possible to reduce the number of postoperative complications to 4% and the duration of treatment from 14.2 to 6.4 days.

In our opinion, thoracoscopic echinococcectomy requires further technical improvement. In this respect, it is easier to perform and more efficiently according to the results of echinococcectomy from the minithoracotomy access. At the same time, it should be recognized that echinococcectomy from the thoracotomic access is most often indicated in case of recurrent echinococcosis of the chest cavity and sometimes with a complicated course of the disease.

Simultaneous operations from mini-approaches, with bilateral pulmonary echinococcosis or in combination with the liver, are the operations of choice and can be performed in patients with good functional parameters of the cardiovascular and respiratory systems.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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