

**M. S. Opanasenko, B. M. Konik, O. V. Tereshkovich, Y. S. Stavytska, E. M. Mayetny,  
A. M. Stepaniuk, V. I. Lysenko, O. M. Fashchuk, L. I. Levanda, O. D. Shestakova**  
**A CLINICAL CASE OF SINGLE-STAGE VATS-RESECTION  
OF ECHINOCOCCAL CYSTS IN A PATIENT WITH MULTIPLE LESIONS  
OF THE LUNGS AND LIVER**

State Institution "National Scientific Center of Phthysiology, Pulmonology  
and Allergology named after F. G. Yanovsky National Academy of Medical Sciences of Ukraine"

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Abstract

The main method of treatment of pulmonary echinococcosis is surgical. Surgical treatment of pulmonary echinococcosis consists of removing the cyst, destroying the parasite, preventing insemination of the pleural cavity, and eliminating the remaining cavity with maximum preservation of lung tissue. In addition to the basic laws of surgery, which are relevant for any intervention, in the case of echinococcal invasion, germicidal treatment methods that prevent insemination of the pleural cavity and ensure the prevention of disease recurrence come to the fore.

Patients with bilateral lesions of the lungs and other organs (most often the liver) are considered a special difficulty for surgeons. Depending on the location of the cysts and the health of the patient, several techniques are used: median sternotomy, consecutive bilateral thoracotomies, transmediastinal approach: a new technique that uses (unilateral lateral thoracotomy to remove a cyst from one lung followed by resection of the retrosternal mediastinal pleura to reach and remove cysts in the upper part of the contralateral lung, Clymer incision: a large transverse incision that provides wide opening of both pleural cavities, often used for complex or giant bilateral cysts, using VATS sequentially (the procedure usually involves sequential VATS on both sides during a single session of anesthesia). In combined cases: if liver cysts are also present, a one-stage approach including VATS and a transdiaphragmatic or laparoscopic procedure can be performed.

The authors describe an asymptomatic clinical case of one-moment VATS-resection of echinococcal cysts in a 21-year-old patient with multiple lesions of the lungs and liver. We performed bilateral single stage VATS-resection of S4 of the left and VATS-resection of S4 of the right lung. The postoperative period (7 days) was uneventful. One month later, the patient underwent laparoscopic removal of liver cysts in another medical institution. The postoperative period (6 days) was uneventful. The patient continued to take albendazole at a dose of 400 mg per day. During the control CT examination 5 months after the last surgical intervention against the background of constant albendazole, a recurrence of echinococcosis was established in the liver and lungs without pathological changes.

Thus, surgery is the treatment of choice for most patients with pulmonary hydatid cysts. One-stage minimally invasive surgery is superior to the classic two-stage approach because it reduces morbidity, hospital stay, and costs. In the postoperative period, it is necessary to continue a six-month course of oral albendazole, since there is a possibility of recurrence of the disease, especially in the liver.

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Mykola S. Opanasenko  
State Institution "National scientific center of phthysiology, pulmonology and  
allergology named after F. G. Yanovsky NAMS of Ukraine"  
Head of the Department of Thoracic Surgery and Invasive Diagnostic Methods  
MD, Professor  
10, Amosova str. 10, 03038, Kyiv, Ukraine  
opanasenko@ifp.kiev.ua  
ORCID 0000-0003-4071-2005

**КЛІНІЧНИЙ ВИПАДОК ОДНОМОМЕНТНОЇ VATS-РЕЗЕКЦІЇ  
ЕХІНОКОКОВИХ КІСТ У ХВОРОГО З МНОЖИНИМ  
ВРАЖЕННЯМ ПАТОЛОГІЧНИМ ПРОЦЕСОМ ЛЕГЕНЬ  
ТА ПЕЧІНКИ**

**М. С. Опанасенко, Б. М. Конік, О. В. Терешкович, Я. С. Ставицька, Є.  
М. Маєтний, А. М. Степанюк, В. І. Лисенко, О. М. Фащук,  
Л. І. Леванда, О. Д. Шестакова**

Резюме

Основним методом лікування ехінококозу легень є хірургічний. Хірургічне лікування ехінококозу легень складається з видалення кісти, знищення паразита, профілактики обсіменіння плевральної порожнини та ліквідації залишкової порожнини з максимальним збереженням легеневої тканини. Крім основних законів хірургії, що актуальні за будь-якого втручання, в разі ехінококової інвазії на перший план виступають методи герміцидної обробки, які запобігають обсіменінню плевральної порожнини та забезпечують профілактику рецидиву захворювання.

Особливу складність для хірургів вважаються хворі з двостороннім ураженням легень та других органів (найчастіше печінка). Залежно від локалізації кіст та стану здоров'я пацієнта використовуються кілька методик: середня стернотомія, послідовні двосторонні торакотомії, трансмедіастинальний підхід: новий метод, при якому використовується (однобічна латеральна торакотомія для видалення кісти з однієї легені з подальшою резекцією загрудинної медіастинальної плеври для досягнення та видалення кіст у верхній частці контралатеральної легені, клаймерний розріз: великий поперечний розріз, який забезпечує широке відкриття обох плевральних порожнин, часто використовується для складних або гігантських двосторонніх кіст, використання VATS — методики послідовно (процедура зазвичай включає послідовні VATS з обох сторін під час одного сеансу анестезії). При комбінованих випадках: якщо також присутні кісти печінки, може бути виконано одноетапний підхід, що включає VATS і трансдіафрагмальну або лапароскопічну процедуру.

Автори описують асимптомний клінічний випадок одномоментної VATS-резекції ехінококових кіст у 21-річного хворого з множинним враженням патологічним процесом легень та печінки. Нами була виконана двобічна одномоментна VATS-резекція S4 лівої та VATS-резекція S4 правої легені. Післяопераційний період (7 днів) перебігав гладко. Через один місяць в іншому лікувальному закладі хворому проведено лапароскопічне видалення кіст печінки. Післяопераційний період (6 днів) перебігав гладко. Пацієнт продовжував приймати альбендазол у дозі 400 мг на добу. При контрольному КТ-обстеженні через 5 місяців після останнього оперативного втручання на фоні постійного прийому альбендазолу було встановлено рецидив ехінококозу в печінці, легені без патологічних змін. Таким чином, хірургічне втручання є методом вибору для більшості пацієнтів з легневими гідатидними кістами. Одноетапна мініінвазивна операція є кращою за класичний двоетапний підхід, оскільки вона зменшує захворюваність, перебування в лікарні та витрати. В післяопераційному періоді необхідно продовжувати шестимісячний курс перорального альбендазолу, оскільки існує можливість рецидиву хвороби, особливо в печінці.

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Юпанасенко Микола Степанович  
ДУ «Національний науковий центр фізіотерапії, пульмонології  
та алергології імені Ф. Г. Яновського НАМН України»  
Завідуючий відділенням торакальної хірургії і інвазивних методів  
діагностики  
Доктор медичних наук, професор  
10, вул. Амосова, м. Київ, 03038, Україна  
opanasenko@ifp.kiev.ua  
ORCID 0000-0003-4071-2005

www.search.crossref.org

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The main method of treatment of pulmonary echinococcosis is surgical [1–13]. Surgical treatment of pulmonary echinococcosis consists of removing the cyst, destroying the parasite, preventing insemination of the pleural cavity, and eliminating the remaining cavity with maximum preservation of lung tissue. In addition to the basic laws of surgery, which are relevant for any intervention, in the case of echinococcal invasion, germicidal treatment methods that prevent insemination of the pleural cavity and ensure the prevention of disease recurrence come to the fore. It has been proven that the most effective germicides regarding the harmful effect on *E. granulosus* are an 80–90 % aqueous solution of glycerin with an exposure of 7–10 minutes and a 30 % solution of sodium chloride. These germicides have a harmful effect not only on protoscolex, but also on acephalocysts, which are most often responsible for the recurrence of the disease [2, 7].

Among various surgical interventions for lung echinococcosis, three main types are distinguished: 1) removal of only the elements of the echinococcal cyst without the fibrous membrane (echinococcectomy); 2) removal of the parasite along with the fibrous capsule (pericystectomy); 3) removal of an echinococcal cyst by resection of part of the organ (segmentectomy, lobectomy) [3, 5]. The choice of the method of surgical intervention is differentiated and depends on many factors, the main of which are: localization and number of cysts, their size, general condition of the patient, etc. [7, 9, 11]. If surgery is not possible due to a massive lesion, antiparasitic treatment is performed. Albendazole is prescribed for a course of 3 weeks or several months; the number of such cycles is up to 20 times, the intervals between them are 21–28 days. The effectiveness ranges from 41 to 72 % (on average, the disease recurs in 25 % of patients). Antiparasitic treatment is carried out in the postoperative period to prevent insemination, as well as in patients in endemic foci with the presence of antibodies to echinococcus, but the absence of cysts during a complete instrumental examination. Adverse effects of albendazole include mild hepatotoxicity, leukopenia, hair loss, and gastric upset. In the treatment of pulmonary echinococcosis, symptomatic agents include antihistamines, hepatoprotectors, antitussives, etc. [7, 8, 9].

Patients with bilateral lesions of the lungs and other organs (most often the liver) are considered a special difficulty for surgeons [4, 5, 6, 10, 11].

Depending on the location of the cysts and the patient's state of health, several methods are used:

- Median sternotomy: considered a better alternative for bilateral lung disease because it allows access to both lungs through a single incision. As a rule, it is better tolerated and causes less pain than two separate thoracotomies.
- Consecutive bilateral thoracotomies: performance of separate anterior-lateral or posterior-lateral thoracotomies during one session of anesthesia.
- Transmediastinal approach: a new technique that uses a unilateral lateral thoracotomy to remove a cyst from one lung followed by resection of the retrosternal

mediastinal pleura to reach and remove cysts in the upper lobe of the contralateral lung.

- Clymer incision: a large transverse incision that provides a wide opening of both pleural cavities, often used for complex or giant bilateral cysts.

- Using VATS-methods consistently: the procedure usually involves sequential VATS on both sides during a single session of anesthesia.

Key stages of the procedure are considered [6, 7, 9]:

1. Isolation. The operative field is protected with sponges soaked in scolical solutions (e.g., hypertonic saline, glycerin, or hydrogen peroxide) to prevent accidental leakage and secondary infection.

2. Aspiration and evacuation. The cyst is punctured with a needle to aspire the hydratide fluid, followed by a pneumotomy to remove the stratified membranes.

3. Cavity treatment. Bronchial openings are sutured to prevent air leakage. The remaining cavity is often closed with cavitation (internal suturing to close the space) or left open for drainage if infected.

4. Medical support: to prevent relapse, perioperative treatment with albendazole (usually 10-15 mg/kg/day) is standard.

Advantages of one-stage surgery (especially VATS) [3, 4, 7, 9]:

- Reduced morbidity. Avoiding risks associated with multiple anesthesia sessions and overall recovery time.
- Cosmetic and analgesic benefits. Specialized approaches such as a transmediastinal approach or sternotomy may result in less scarring and less postoperative pain than multiple thoracotomies.
- Reduced trauma. avoiding the cumulative mental and physical trauma of two separate operations and anesthesia sessions.
- Faster recovery. Reduced overall hospital stay and faster return to normal activities compared to staged surgeries.
- Cost-effectiveness. Significantly reduced overall costs of treatment and rehabilitation.

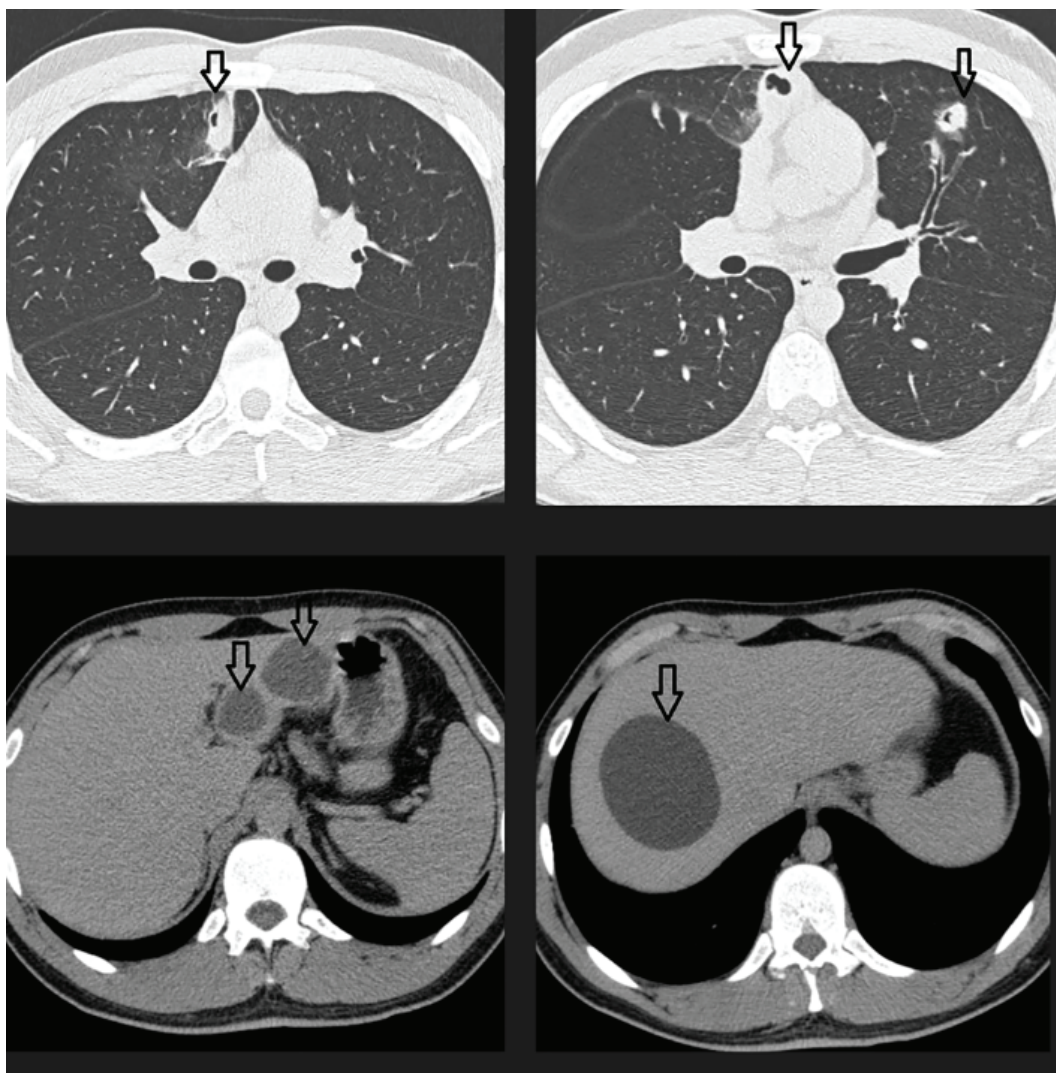
#### *Clinical considerations*

Indications. Best for patients with good cardiopulmonary reserve and uncomplicated cysts (usually no more than two large cysts per lung). Alternative one-stage approaches: in difficult cases, a median sternotomy can be used to access both lungs simultaneously, although it is more invasive than VATS.

In combined cases: if liver cysts are also present, a one-stage approach including VATS and a transdiaphragmatic or laparoscopic procedure can be performed [6, 7, 8, 9].

#### **Clinical case**

Patient L., 21 years old, was hospitalized in the surgical department No. 2 of the National Scientific Center of Phthisiology, Pulmonology and Allergology named after F.G. Yanovsky National Academy of Sciences of Ukraine". There were no complaints at admission. Before hospitalization the patient underwent a CT scan of the chest (cystic hypoplasia was suspected) and abdomen, and a diagnosis of echinococcosis of the



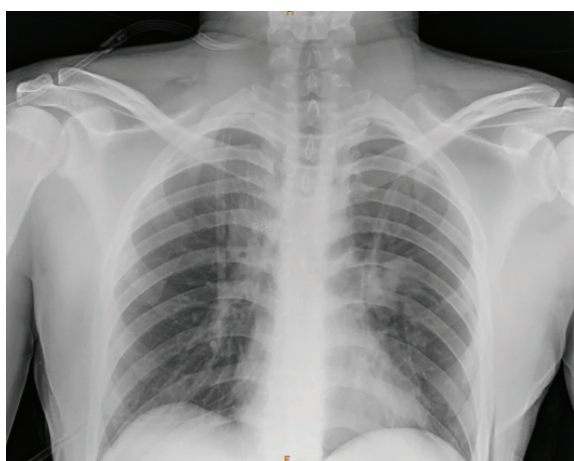
**Figure 1. Chest and abdomen CT before surgery (arrows indicate echinococcal cysts in the lungs and liver)**

lungs and liver was established (Figure 1): the presence of echinococcal cysts in S4 of the middle lobe of the right lung and in S4 of the upper lobe of the left lung, as well as the presence of 3 cysts in the liver. Epidemiological history was not burdensome. In general, clinical studies revealed no abnormalities. Serological blood studies (reactions of indirect immunofluorescence, passive hemagglutination, enzyme

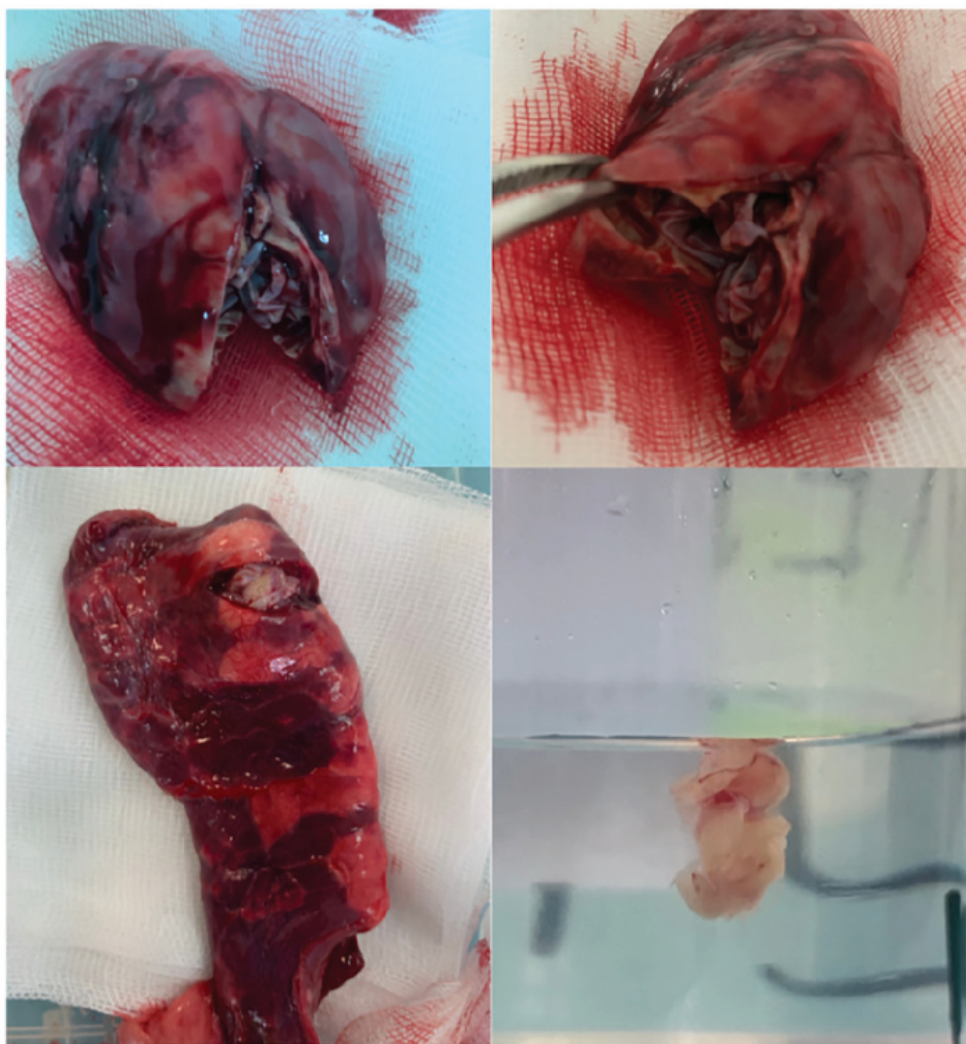
immunoassay) tested positive for specific antibodies to echinococcus. A 2-month course of treatment with albendazole was completed. The CT picture was unchanged.

At a multidisciplinary conference (surgeons, pulmonologists and infectious disease specialists), a decision was made to treat the patient surgically (risk of surgery ASA 3).

Bilateral one-moment VTS-resection of S4 of the left and VATS-resection of S4 of the right lung was performed. After treating the skin with an antiseptic and using a protective film, under single-lung intubation anesthesia, the right pleural cavity was reached with the help of 3 thoracoports. On examination, a whitish neoplasm of 4.5×3 cm was found in the right S4. S4 was resected using endostaplers. Removed via endoBag. Biopsy of the pleura. Hemostasis. Gas was aspirated - aerostasis. Wounds are sewn up in layers. Drains are connected behind Büla. Ass. bandage. After treating the skin with an antiseptic, the left pleural cavity was reached using VATS access (3 cm). At examination, there was a 3.5×3cm neoplasm in S4 of the left side. S4 was resected using endostaplers. Removed via endoBag. Viscerolysis (pulmonary ligament destroyed). Hemostasis



**Figure 2. Chest X-ray immediately after the operation**

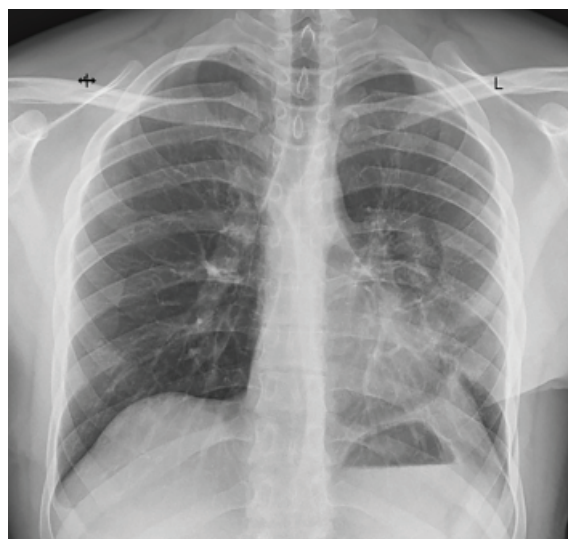


**Figure 3.** The appearance of the resected parts of both lungs and the chitinous membrane of one of them is presented

during the operation - dry. 2 drainages into the pleural cavity, which are fixed with knotted sutures. Gas is aspirated – aerostasis. Wounds were sewn up in layers. Drains were connected behind Bülow. The duration of the operation is 140 minutes, blood loss is 40 ml. X-ray immediately after the operation: both lungs were flattened, drainage in the pleural cavities (Figure 2).

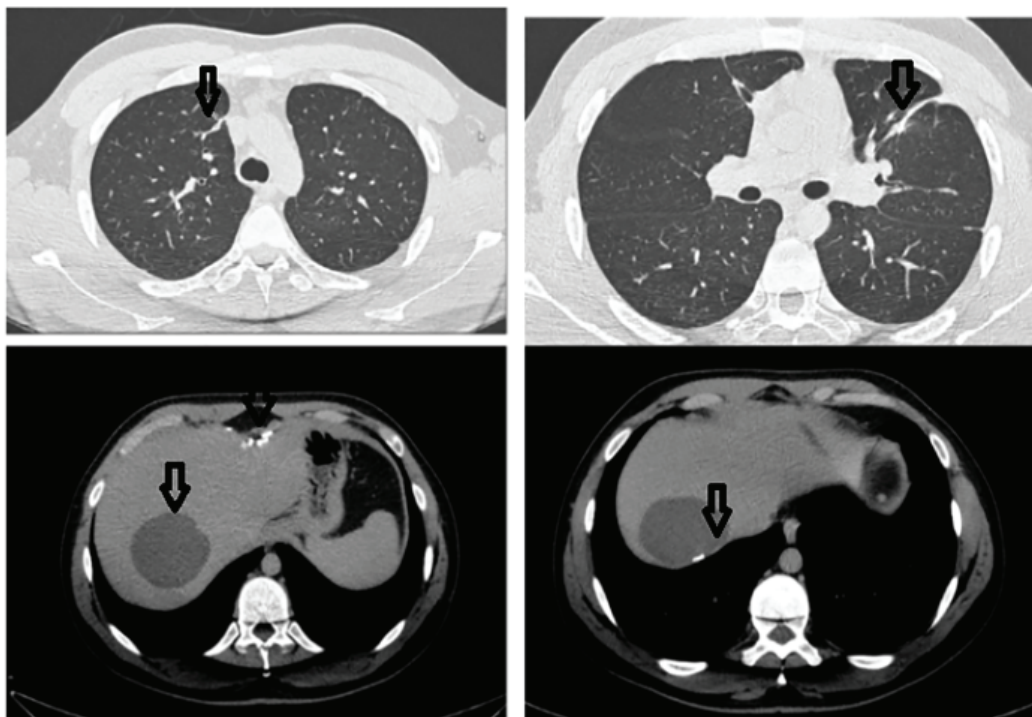
Figure 3 shows the appearance of the resected parts of both lungs: irreversible fibrotic changes in the lung parenchyma and the presence of a chitinous membrane are clearly visible. The postoperative period was smooth. The patient was prescribed albendazole at a dose of 400 mg per day for a long period. Drainages were removed on days 3 and 4. After 7 days, the patient was discharged from the hospital with recommendations to contact an abdominal surgeon to resolve the issue of removal of echinococcal liver cysts.

One month later, the patient underwent laparoscopic removal of liver cysts at another hospital. The postoperative period was smooth. The patient continued to take albendazole at a dose of 400 mg per day. The drainages were removed on the 3rd day. After 7 days, the patient was discharged from the hospital with recommendations to continue taking albendazole at a dose of 400 mg per day (Figure 4).



**Figure 4.** Chest X-ray at discharge from the department

During the control CT examination 5 months after the last surgical intervention on regular albendazole treatment, a recurrence of echinococcosis was established in the liver, no lung lesions (Figure 5).



**Figure 5.** CT scan 6 months after surgery (arrows indicate mechanical sutures on the lungs without any signs of recurrence, and recurrence of a cyst in the liver)

### Discussion

Deeb S. et al. [3] report the case in 8-year-old boy who complained of weight loss, cough, and hepatomegaly. Imaging revealed over 35 hydatid cysts in the liver and both lungs. He underwent staged bilateral removal of the lung cyst using hybrid minimally invasive surgery followed by PAIR procedures for the liver cysts and albendazole therapy. Postoperative recovery was uneventful, with complete resorption of the lung cysts and a significant reduction in the burden of the liver cyst.

Ulku R. et al. [4] report on 139 cases of pulmonary echinococcosis. 123 patients (88.5 %) had pulmonary hydatid cysts alone, whereas 15 patients (10.8 %) had combined lung and liver disease. One patient had a hydatid cyst in both the lung and the spleen (0.7 %). Lateral thoracotomy was performed in 115 patients (82.73 %), bilateral thoracotomy — 9 (6.48 %), thoracofrenotomy — 11 (7.91%), median sternotomy and frenotomy — 4 (2.88 %). Resection methods were used in only 10 patients. The most frequent complication was atelectasis (5.0 %). The mortality rate was 1.8% (3 patients). Surgery is the treatment of choice for most patients with pulmonary hydatid cysts. Thoracofrenotomy may be chosen as a surgical intervention in the treatment of hydatid cysts of the liver and lungs.

Petrov D.B. et al. [2] report on 127 cases of bilateral impression of the lung. Two-stage operations by thoracotomy were performed in 30 patients. Two patients underwent simultaneous operations with consecutive thoracotomies. Since 1988, only four patients have undergone two-stage operations. One-stage surgery was performed in 91 patients: 82 by median sternotomy (MS), one by shell incision, four by sequential thoracotomies, and three by VATS and mini-thoracotomies. One patient underwent simultaneous bilateral lower lobectomy by the MS method. In 11 cases, accompanying dome-shaped liver cysts were removed by right frenotomy during MS. Sternotomy was performed in 11 patients: attached

hepatic (7), cystectomy of the liver and spleen (4). In 8 cases, the second stage was operated on for abdominal echinococcosis, in one case, a complicated liver cyst was extirpated at the first stage. Results: there were no intraoperative deaths. The postoperative mortality rate was 0.78 %; one patient died of pulmonary embolism. In 8 cases, there were no fatal complications (suppuration of the skin, residual pleural cavity and atelectasis). Respiratory distress syndrome in adults was successfully treated in one case after MS. The authors conclude that one-stage surgery is superior to the classic two-stage approach because it reduces morbidity, hospital stay, and costs. MS is an excellent approach, but in some cases VATS mini-thoracotomy may be indicated.

Aghajanzadeh M. et al. [5] report that a previously healthy 20-year-old woman from northern Iran with no history of lung or liver disease presented with right upper quadrant and right sided chest pain and low-grade fever for the past month. Imaging revealed one cyst in the left lung, two cysts in the right lung, and two cysts in the liver. Because the cysts were symptomatic, it was decided to treat these cysts surgically. The patient underwent bilateral anterolateral thoracotomy and frenotomy under general anesthesia, and all cysts were evacuated. The patient was discharged in satisfactory condition.

Messaoudi H. et al. [6] inform that the simultaneous hydatid cyst of the lungs and spleen is a rare clinical manifestation, and the spleen is affected in only 0.5 % of cases. A one-stage operation was performed on a 17-year-old boy. Imaging revealed a complex hydatid cyst in the left lung and an incidental splenic cyst. Serological studies confirmed the presence of antihydatid antibodies. One-stage surgical intervention was performed transthoracically, which included cystectomy and pericystectomy of the lung cyst followed by removal of the splenic cyst. Postoperative recovery was uneventful and the patient was discharged on day five with a six-month course of oral albendazole.

Akar F. A. et al. [8] report on 39 patients who underwent single-port VATS surgery for the treatment of echinococcal lung cysts. The number of cysts per patient ranged from one cyst in most cases to five cysts (maximum number per patient) in one patient with bilateral disease. Bilateral one-stage uniportal uniportal VATS (UVATS) was successfully performed in this patient, and intraoperative ultrasound was used to identify some deep and small lesions. One patient with liver and lung involvement was treated with a one-stage combined laparoscopic and UVATS procedure, and the other cases were treated later medically or surgically. The authors conclude that with increasing experience among thoracoscopic surgeons, surgical treatment of pulmonary echinococcosis using the UVATS technique has become possible to perform safely. Intraoperative ultrasound helps to localize small and deep lesions. The UVATS technique has several advantages over conventional open thoracotomy.

Aghajanzadeh M et al. [1] inform that concomitant hydatid cysts of the lungs and liver occur in 4 % of patients with echinococcosis. To evaluate the safety of one-stage surgery, the experience of using this procedure between 1992 and 2005 was reviewed. Of 152 patients who underwent surgery for an

ae gydatid cyst of the lung, 30 in all cases had an additional liver cyst located on the upper dome of the liver. Pulmonary cysts were first excised using a posterolateral thoracotomy. After frenotomy, the hydatid cyst of the liver was evacuated without padding, and a Foll catheter was left in the cavity. Postoperative complications in 30 patients with cysts of both locations included empyema in 2, bronchopleural fistula in 1, profuse bile secretion in 3, and hemorrhage in 1. Hydatid cysts of the liver recurred in 2 patients. There was no hospital death. One-stage posterolateral thoracotomy for removal of hydatid cyst of the lungs and liver is an effective and safe surgical method with few complications.

### Conclusion

Surgery is the treatment of choice for most patients with pulmonary hydatid cysts. One-stage minimally invasive surgery is superior to the classic two-stage approach because it reduces morbidity, hospital stay, and costs. In the postoperative period, it is necessary to continue a six-month course of oral albendazole, since there is a possibility of recurrence of the disease, especially in the liver.

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