Surgical treatment of bilateral hydatid disease of the lung


Thoracic Surgery Department, Saint Sophia University Hospital of Pulmonary Diseases, Sofia, Bulgaria

Received 21 October 2000; received in revised form 16 March 2001; accepted 20 March 2001

Abstract

Objective: To evaluate the various tactics and approaches in the surgical treatment of bilateral pulmonary hydatidosis (BPH).

Materials and methods: Between 1969 and 2000, a total of 127 BPH patients underwent surgery. The operative techniques of choice were parenchyma-preserved methods. Up to 1988, two-stage operations via thoracotomies were performed on 30 patients. One-stage operations with successive thoracotomies were carried out on two patients. Since 1988, only four patients underwent two-stage operations. One-stage surgery was carried out on 91 patients: 82 via median sternotomy (MS), one via clamshell incision, four through successive thoracotomies and three through video-assisted thoracic surgery (VATS) and mini-thoracotomies. One-stage bilateral lower lobectomies via MS were performed on one patient. In 11 cases, the concomitant dome localized liver cysts were extirpated via right phrenotomy during MS. Sterno-laparotomy was performed on 11 patients: for associated hepatic (seven), and hepatic and spleen cystectomies (four). In eight cases, abdominal echinococcosis was operated on a second stage, and in one case, a complicated hepatic cyst was extirpated on a first stage.

Results: No intraoperative deaths occurred. The postoperative mortality rate was 0.78%; one patient died of pulmonary embolism. No fatal complications have appeared in eight cases (skin suppuration, residual pleural cavity and atelectasis). Adult respiratory distress syndrome was successfully treated in one case after MS. The long-term postoperative results are considered very good, with no recurrences observed.

Conclusions: One-stage surgery is superior to a classic two-stage approach as it decreases the morbidity, hospital stay and costs. MS is an excellent approach, but in some cases, VATS mini-thoracotomies could be indicated.

Keywords: Bilateral pulmonary hydatidosis; Surgical tactics and approaches; Median sternotomy; Video-assisted thoracic surgery

1. Introduction

Hydatid disease, caused by Echinococcus granulosus, is the most severe helminthic zoonosis, with an important medical, social and economic role. The morbidity rate in the Bulgarian population has increased from 1.97/100 000 in 1984 to 6.95/100 000 in 1996 [1] because of deteriorated quality control in the slaughter-houses and a lack of adequate control of the stray dog population. Therefore, at present, echinococcosis is a real health problem in Bulgaria. The lung is the second most commonly affected organ after the liver; from 10 to 40% [2,3]. Bilateral pulmonary hydatidosis (BPH) varies from 4 to 26.7% [4,5]. Its surgical treatment offers different options for operative tactics and approaches, especially when it is associated with abdominal echinococcosis [6–9].

According to the operative material of our department, the frequency of hydatid multi-organ localization has increased in the last decade. As the surgical treatment of BPH is still a subject of discussion, we present our experience and the gradual improvement of our tactics over a period of 30 years.

2. Patients and methods

Between January 1969 and January 2000, 1061 patients with pulmonary echinococcosis were operated on. The hospital and follow-up records of 127 (12%) of these cases with BPH were reviewed. There were 69 female and 58 male patients, with an average age of 39.6 ± 6.9 (range, 9–72; median, 39.3) years.

A total of 390 pulmonary cysts (281 intact and 109 complicated, ranging in size from 1 to 23 cm) were extirpated. About two-thirds of the patients had a single cyst on each lung, and after 1988, the number of cases with multiple cysts had significantly increased (Fig. 1).

Associated abdominal echinococcosis, predominantly hepatic, was found in 36 (28.3%) of the patients.
The methods of surgical management are outlined in the following sections.

2.1. Anesthesia

Intubation with a double-lumen endotracheal tube and multi-component anesthesia was used.

2.2. Thoracic approaches

Classical posterolateral or anterolateral thoracotomies were carried out in the early years of research. Muscle-sparing thoracotomies have been preferred recently.

A saw or a sternotome was used for median sternotomy (MS) incision. The pleural cavities were opened in succession, usually starting with the more affected side. All adhesions were totally divided to facilitate exploration and re-expansion of the lung.

Sterno-laparotomy started with MS. After an uneventful thoracic stage of the operation, without its closure, the sternotomy incision was prolonged into an upper median laparotomy.

Video-assisted thoracic surgery (VATS) mini-thoracotomy was performed with the patient in the lateral position and with the hand over the head. Three ports were placed in a triangular configuration. A 10 mm, 35° scope was introduced through one of them away from the cyst. After its visualization and fixation at the most fitting intercostal space, a mini-thoracotomy (3–5 cm) was carried out above it. The incision and the neighboring tissues were covered with pads moistened with hypertonic saline. The cyst was evacuated after preliminary puncture, and capitonnage or atypical resection was performed. The pleural cavity was drained through one of the ports.

2.3. Operative techniques

The classical rules of operative hydatology were followed strictly. The operative field was isolated with hypertonic saline pads for protection. Conservative parenchyma-preserved techniques were the methods of choice. Pulmonary cysts were seldom extirpated by the Barrett technique [10]. They were usually evacuated after preliminary cyst fluid aspiration. The residual cavities were carefully treated with hypertonic saline solution and all bronchial leaks found were closed individually with absorbable sutures. The cavity was obliterated with purse-string sutures of absorbable material, starting from the bottom (capitonnage) or its modifications. In large and enormous cysts, we made use of suture-gluing capitonnage, applying fibrin glue on the fibrous capsule after every purse-string suture, thus avoiding the formation of residual spaces between them. In some peripheral cysts, after resection of the free parts of the fibrous capsule, the bottom of the cavity was converted into lung surface after its inflation.

Anatomical resections were carried out only in cases with complicated cysts and irreversible changes in the adjacent parenchyma, or when a big cyst or numerous cysts had destroyed a certain anatomical substrate.

The pleural cavity was drained with two tubes anteriorly and posteriorly. The hepatic cysts were always extirpated after preliminary cyst fluid aspiration. The residual cavity was flushed with hypertonic saline solution. After suturing the visible biliary fistulas, it was obliterated by capitonnage, inversion of the free parts of the fibrous capsule or omentum major tamponade. Its drainage was indicated in very limited cases with big biliary fistulas and enormous residual cavities with irreversible changes in the fibrous capsule and recesses near the big hepatic vessels.

2.4. Postoperative analgesia

Epidural catheter, at the level Th7–Th8, for prolonged postoperative analgesia (lidocaine (1%) + fentanyl (5 mg/ml) + adrenaline 1:200 000) was applied in 88 patients. The pain was evaluated by visual analogue scale at 2, 4, 6, 24 and 48 h. Non-steroidal, anti-inflammatory drugs were applied on request. The epidural catheter was taken out after pleural drain withdrawal.

2.5. Medical treatment

Postoperative Albendazole treatment (400 mg twice a day for the first 15 days of the month) was administered to 84 patients for a period of at least 3 months.

2.6. Data analysis

Fisher’s exact test with Yates correction or the two-tailed Students’ t-test was used for comparison between groups. Differences were considered significant if P was less than 0.05.

3. Results

The observed 30-year period was divided into two parts, 1969–1988 and 1998–2000, according to the surgical strategy, and based on the application of the new, different one-stage surgical method.

During the first period, the two-stage operation was the
tactic of choice in almost all cases: 30 patients. The mean interval between thoracotomies was 41.95 (range, 14–257; median, 32.7) days.

The one-stage operation via successive thoracotomies was performed on only two patients. The surgical procedures carried out in this period are presented in Table 1. Four patients (12.5%) with associated abdominal hydatidosis were treated via phrenotomy during right thoracotomy (two patients), or a laparotomy was performed at a third stage (two patients).

During the second period, the two-stage operation approach was followed in only four cases. The mean interval between thoracotomies was 75 ± 12.73 (range, 30–120; median, 75) days. The rationale behind two-stage operations included: reduced cardiopulmonary reserve in an old patient (two patients), a larger number of pulmonary cysts (20), some of them complicated (one patient), and lobectomy required with massive pleural adhesions (one patient).

One-stage operation was the new tactic of choice in 91 cases. MS was predominantly used (82 patients), followed by successive thoracotomies (four patients), clamsheel incision (one patient) and VATS, combined with mini-thoracotomies (three patients).

The rationale behind the one-stage operation via successive thoracotomies included: cyst localization in the dorsal pulmonary segments on the left side, pleural adhesions (three patients) and surgeon’s choice (one patient).

The rationale behind the one-stage VATS and bilateral mini-thoracotomies included: relatively small solitary cysts with peripheral localization in both lungs, intact or complicated, without irreversible changes in the adjacent parenchyma in patients with normal chest wall thickness. The surgical procedures performed during the second period are presented in Table 2.

Associated abdominal hydatidosis was found in 32 (39%) cases. One of the patients was treated with Albendazole for multiple hepatic and splenic cysts after two-stage extirpations of 20 pulmonary cysts. The rest of the patients were in the MS group. The operative tactics in associated pulmonary and abdominal hydatidosis are presented in Table 3.

Postoperative Albendazole treatment was administered to 84 patients for a period of at least 4 months. No intraoperative death occurred.

### Table 1

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>Number of cysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystectomy and capitonnage</td>
<td>56 (68)</td>
</tr>
<tr>
<td>Cystectomy a modo Vishnevsky</td>
<td>10 (12)</td>
</tr>
<tr>
<td>Wedge resection</td>
<td>8 (10)</td>
</tr>
<tr>
<td>Segmental resection</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Polysegmental resection</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
</tr>
</tbody>
</table>

* Figures in parentheses represent percentage values.

### Table 2

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>Number of cysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cystectomy and capitonnage</td>
<td>236 (76.6)</td>
</tr>
<tr>
<td>Cystectomy and suture-gluing capitonnage</td>
<td>20 (6.5)</td>
</tr>
<tr>
<td>Cystectomy a modo Vishnevsky</td>
<td>17 (5.6)</td>
</tr>
<tr>
<td>Wedge resection</td>
<td>31 (10)</td>
</tr>
<tr>
<td>Polysegmental resection</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>3 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>308</td>
</tr>
</tbody>
</table>

* Figures in parentheses represent percentage values.

The mean operative durations were as follows: (1), MS group, 101 ± 11 (range, 74–118; median, 94) min; (2), sterno-laparotomy group, 160 ± 39 (range, 120–205; median, 157) min; (3), successive thoracotomy group, 131 ± 16 (range, 86 ± 145; median, 109) min; and (4), VATS mini-thoracotomy group, 68 ± 12 (range, 57–90; median, 66) min.

One patient died of pulmonary embolism on the ninth post-MS day. Therefore, the overall postoperative mortality was 0.78%, and it was 1.2% only in the MS group.

Non-fatal complications, such as three skin suppurations, three residual pleural cavities and three atelectases, appeared in the two-stage operation group.

There were two postoperative complications in the one-stage operation group: one wound suppuration and adult respiratory distress syndrome (ARDS), successfully treated in a patient with multiple cysts after MS.

The mean hospital stay was significantly shorter in the one-stage operation group: 13.8 ± 4.6 (range, 8–32; median, 14.1) days compared with 54.7 ± 27.1 (range, 29–131; median, 51.7) days in the two-stage operation group (P < 0.05). Since most of the patients were from distant rural regions, we preferred to carry out their complete postoperative physiotherapy under supervision in the hospital.

Long-term follow-up information was available for about 121 patients, from 1 to 23 years postoperatively.

The pulmonary function showed reduced lung volumes in

### Table 3

<table>
<thead>
<tr>
<th>Operative approaches</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-stage operation</td>
<td></td>
</tr>
<tr>
<td>Sternotomy and right phrenotomy</td>
<td>11</td>
</tr>
<tr>
<td>Sternotomy and upper laparotomy *</td>
<td>11</td>
</tr>
<tr>
<td>Two-stage operation</td>
<td></td>
</tr>
<tr>
<td>Sternotomy and right phrenotomy + laparotomy</td>
<td>4</td>
</tr>
<tr>
<td>Sternotomy + laparotomy</td>
<td>4</td>
</tr>
<tr>
<td>Laparotomy + sternotomy</td>
<td>1</td>
</tr>
</tbody>
</table>

* Seven patients with hepatic and four with hepatic and splenic hydatidosis.
all patients (total lung capacity and vital capacity, <75% predict) during the first month of the postoperative period. At follow-up, about 80% of the patients exhibited a gradual return towards normal lung function.

Patients in the one-stage operation group restored their full working capacity in a shorter period (3–5 months) compared with 5–13 months in the two-stage operation group ($P < 0.05$).

No recurrences were observed. In one case, 6 years after MS and phrenotomy, a residual hepatic cyst was extirpated via right thoraco-phrenotomy.

4. Discussion

The development of anesthesiology and intensive care medicine and the refinement of surgical experience have all contributed to the achievement of various operative strategies and techniques in the treatment of bilateral echinococcosis.

In earlier publications, a number of authors have recommended two-stage operations with an interval of 2–3 weeks between interventions [2,6,7]. Until 1988, we also adhered to this practice. The side of complicated cysts or that with a higher probability of complication was operated first. The second operation was carried out after the patient’s functional recovery. The present rationale behind two-stage operations includes: (1), a larger number of pulmonary cysts, especially in complicated echinococcosis; (2), when lobectomy is required in the presence of pleural adhesions; (3), poor cardiopulmonary reserve; and (4), uncompensated chronic conditions.

A one-stage operation has a number of advantages:

1. The patient is operated on just once, thus being spared psychic trauma related to the second general anesthesia and operation.
2. Possible complications of the remaining cysts, as well as deterioration of the patient’s general condition in the period between the operations, are avoided.
3. The period of rehabilitation and disablement, as well as the overall treatment costs, are considerably reduced.

A rich experience with one-stage successive thoracotomies has been reported by Denis et al. [11]. They have operated on 19 patients with good cardiopulmonary reserves, except for children and the elderly. Galindo et al. [12] have successfully performed such an intervention on 24 children, and other authors have used it accidentally [8]. Karapetyan et al. [9] stress the necessity of using non-traumatic, muscle-sparing thoracotomies, taking into account the accurate topography of the process. According to them, the indication for one-stage successive thoracotomies was found at no more than two large cysts in each lung, without infection and pleural complications.

Few authors have made use of transternal submammarian thoracotomies in BPH [8,13]. Narbona and Elarre [13] have published their experience of one exitus using the same approach. In our view, the clamshell incision is more traumatic than the bilateral successive thoracotomies, which ensure adequate exploration of both pleural cavities.

In recent years, MS has become the preferred approach for numerous authors because of its easy application and adequate exposure of even the posterior segments of the lower lobes by a resection of the inferior pulmonary ligament [4,5,8]. However, some of them apply it only if there is an anterior cyst localization [8,9]. So far, the authors Cetin et al. [5] have the richest published experience of 60 consecutive patients, with a 5% postoperative mortality. On the basis of the results of 82 operated cases, we share their opinion that the size, number and localization of the cysts, as well as the age of the patients, presuming their good general condition, have not affected the indications for MS utilization. It should be noted that work on the posterior segments, especially in left lower lobe cyst localization, is accompanied by an abrupt deterioration in the hemodynamics. These changes are reversible after the inflation of the operated lung. Although we have successfully performed bilateral lower lobectomies via MS, we do not advocate their application. We believe that in such cases, one-stage bilateral thoracotomies could be a better option.

MS is considered unsuitable in the following cases: (1), pleural complications, such as empyema and intrathoracic evolution of a complicated liver cyst; (2), massive infection or dimension of the cyst, when extensive resection is required (especially left lower lobectomy); and (3), impaired general condition of the patient contraindicated for extended surgical procedures. In these cases, we make use of two-stage operations via thoracotomies.

The operative tactics in associated BPH and abdominal echinococcosis are determined by the evolution of the cysts in these body cavities, as well as the localization of the hepatic cysts and the patient’s general condition. In uncomplicated cases, and if the decision for a two-stage operation is taken, we start with the lung, as laparotomy at the first stage is more frequently accompanied by pulmonary complications.

Some authors have evacuated liver cysts via phrenotomy during one-stage successive thoracotomies [9,14] or MS in BPH associated with hepatic dome localized cysts [15,17]. Unlike them, Cetin et al. [5] recommend surgical treatment of the liver cysts ‘at a separate operation due to the possible complications after large liver cysts long-term tube drainage’. Athanassiadi et al. [16] suture the diaphragm to the margins of the evacuated hepatic cyst with drainage of the cystic and pleural cavities. In such cases, we prefer to close the residual liver cavities without drainage because of the excellent result.

In two patients, Dhaliwal et al. [17] operated the hepatic cysts with anteroinferior localization transabdominally through a vertical mid-line incision as a continuation of the mid-sternotomy incision. Our personal experience
encompasses seven BPH patients with hepatic cysts (irrespective of their diverse localization) treated by the same approach. For the first time in surgical practice, we introduced a median sterno-laparotomy (Figs. 2–4) for one-stage treatment of multi-organ echinococcosis (combined bilateral pulmonary, hepatic and splenic). This extensive operative procedure is indicated in carefully-selected young patients with a limited number of pulmonary and hepatic cysts (not more than four in each localization) suitable for organ-preserving techniques, especially in patients with contraindications for chemotherapy. A small number of peripheral splenic cysts, appropriate for simple cystectomy, as well as an uneventful thoracic stage of the operation are also required.

Recently, a few papers on the surgical approach to pulmonary hydatidosis via mini-thoracotomy by means of video-assisted thoracoscopy have been published [18–20]. In cases of bilateral cyst localization, Krotov et al. [20] applied this approach in two stages. Making use of VATS mini-thoracotomies, we have successfully treated three BPH patients in one stage. We believe that the rationale behind such a technique includes relatively small solitary cysts in both lungs, intact or complicated without irreversible parenchymal changes, in patients with a normal chest wall thickness. There is a possibility that these indications could widen with future elaboration of the technique.

Although we used to apply routine postoperative Albendazole treatment, in recent years, we have come to believe that it is indicated only in cases of intraoperative spillage or when small undetected cysts are suspected.

5. Conclusions

The diversity of the pathological process offers various tactics and approaches in the surgical treatment of BPH, which must be individually tailored in each and every case. One-stage surgery is superior to a classic two-stage operations as it decreases the morbidity, hospital stay and costs.

We believe that MS is a better approach than either one-stage successive thoracotomies or clamshell incision thoracotomy as it involves less postoperative pain and does not precipitate a decrease in respiratory capacity.

One-stage VATS bilateral mini-thoracotomies are suitable for carefully selected patients, with excellent cosmetic, functional and cost results.

Sterno-laparotomy is a good alternative in a limited number of cases with associated BPH and abdominal hydatidosis.

References


