



## Open vs thorascopic surgical management of bronchogenic cysts

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### Abstract

**Background:** The aim of this study was to compare the operative outcome in children undergoing open vs thorascopic resection of bronchogenic cysts.

**Methods:** The medical records of children who underwent the resection of bronchogenic cysts from 1990 through 2000 were reviewed. Four cyst resections were performed by the open technique and five using a thorascopic procedure. The age of the patients, length of hospital stay, duration of drainage, operating time, and outcome were investigated.

**Results:** The mean age of patients undergoing the open procedure was 3 years and 3 months; the mean age for thorascopic patients was 7 years and 10 months ( $p < 0.05$ ). The operating time for the open procedure was  $70 \pm 25$  min; for the laparoscopic procedure, it was  $78 \pm 6$  min ( $p$ , NS), except in one case with a main bronchial tail that required conversion (320 min). Duration of surgical drainage was  $6.5 \pm 3$  days for the open procedure and  $2.5 \pm 1$  days for the thorascopic one ( $p < 0.05$ ). Hospital stay for open patients was 12 days  $\pm$  0 days; it was  $6 \pm 1.6$  days for thorascopic patients ( $p < 0.01$ ). There were no deaths. The thorascopic procedure failed once due to a main bronchial tail and had to be converted to an open procedure. Other early complications included a bronchopulmonary infection after an open cyst excision and an atelectasis after a thorascopic cyst excision. Late complications included one reoperation for incomplete excision in each of the two groups.

**Conclusion:** Bronchogenic cyst resection can be performed safely. For complete treatment of these patients, total excision of the wall cyst is needed. In selected patients, the thorascopic procedure may decrease the duration of surgical drainage and length of hospital stay without increasing the operating time or MSK for complications.

**Key words:** Bronchogenic cyst — Thorascopy — Children

Bronchogenic cysts in childhood are benign congenital malformations that evolve inexorably, within quite variable periods of time, toward infectious or compressive complications of the tracheal-bronchial tree and heart cavities. Their surgical removal is ideally preventive and requires the use of the least invasive technique possible at the earliest age. In this retrospective study, we evaluated the potential benefits of thorascopy for this condition.

### Patients and Methods

Our retrospective study has been carried out by the same principal investigator (P.de.L.) for > 10 years, from April 1990 to August 2000, through the study of medical files, taking no exclusion criteria into account. The study included nine children who underwent the removal of a bronchogenic cyst after the condition had been confirmed histologically (pulmonary epithelium) in each case. The following parameters were studied: criteria of diagnosis (preoperative symptoms and results of preoperative imagery), choice of surgical approach, eventual use of selective intubation, operating time, duration of drainage, length of hospital stay, and overall patient outcome. In patients who underwent an open procedure, posterolateral thoracotomy was performed in the fourth to sixth rib space. In patients who underwent a thorascopic procedure, a 10-mm camera port with a thoracoport was introduced below the shoulder blade, on the axillary line, through a small incision. Two or three 5-mm thoracoports were inserted under direct vision, ahead of or behind the axillary line.

The drain was removed when no more secretions were collected and when the lung radiograph had normalized. The child was discharged from hospital when the same autonomy enjoyed before operation had been gained. Aesthetic and functional gains were assessed by questioning and clinical examination during postoperative consultations.

Statistical analysis was carried out via analysis of variances (ANOVA). Values are presented as means  $\pm$  SEM.

### Results

There were statistically significant differences between the two groups under study in the mean age of the pa-

**Table 1.** Outcome data for thoracotomies, thoracoscopies, and conversions in patients with bronchogenic cysts

	Thoracotomies	Thoracoscopies	Conversions
No. of patients	4	4	1
Site	Middle mediastinum ( <i>n</i> = 1) Inferior mediastinum: ( <i>n</i> = 1) Superior pulmonary lobe: ( <i>n</i> = 2)	Middle mediastinum: ( <i>n</i> = 1) Inferior mediastinum: ( <i>n</i> = 2) Superior pulmonary lobe: ( <i>n</i> = 1)	Middle mediastinum
Operating time (min)	70 ± 25 <sup>a</sup>	78 ± 6 <sup>a</sup>	
Duration of drainage (d)	6.5 ± 3 <sup>b</sup>	2.5 ± 1 <sup>b</sup>	6
Length of hospital stay (d) (excepting a complicated thoracotomy: 38 days)	12 ± 0 <sup>c</sup>	6 ± 1.6 <sup>c</sup>	12
Early complications	Bronchopulmonary infection ( <i>n</i> = 1)	Atelectasis: ( <i>n</i> = 1)	Pulmonary infection ( <i>n</i> = 1)
Secondary complications (reoperation for incomplete excision)	1 (at 3 wk)	1 (at 5 mo)	—

Values expressed as means ± SEM

<sup>a</sup> Not significant

<sup>b</sup> Significant at *p* < 0.05

<sup>c</sup> Significant at *p* < 0.01

tients, duration of drainage, and length of hospital stay in days. But time, criteria for diagnosis, localization of cysts, and operating time were statistically similar.

The mean age of the patients was 5 ½ years (range, 5 days to 13 years) and the sex ratio was 1.25 (five girls and four boys). The age difference was statistically different (*p* < 0.05) for the open (3 years and 3 months) vs the thoracoscopic procedure (7 years and 10 months). Medical history before diagnosis of the cyst included a pneumothorax in an asthma crisis that was homolateral to a cyst located in the inferior mediastinum; a case of digestive duplication that had been managed surgically 2 years earlier; a posttransfusion case of HIV seropositivity; a toxoplasmic seroconversion case; and a case of malaria.

Localization and repercussion of these cysts were determined via radiograph (*n* = 9), ultrasound (*n* = 2), thoracic scan (*n* = 6), MRI (*n* = 3), bronchoscopy (*n* = 2), and contrast radiography (*n* = 1). The presence of associated thoracic lesions can also be detected by thoracic scan. We observed three cysts, respectively, in the middle mediastinum, the inferior mediastinum, and the superior pulmonary lobe. Five of the nine cysts were complicated by compression from the following adjacent organs: trachea, carina, lower right or left bronchus, or left auricle of the heart.

In two patients, the diagnosis of an intrathoracic lesion was made in the prenatal period, during the second trimester of pregnancy. Two-thirds of the patients presented with preoperative respiratory symptoms, such as dyspnea, cough, or laryngitis. In one patient, the diagnosis was made during a checkup for pulmonary tuberculosis.

Four thoracotomies were performed during the first 7 years of the study. In the 3 following years, thoracoscopy was used five times; in one of these cases, conversion was necessary for a bronchial lesion. Superior lobectomy was indicated in three cases, and cyst excision was performed for the six mediastinal cysts. Selective intubation, to enable preoperative collapse of the lung bearing the cyst, was used during four of the five thoracoscopies.

On average, the operating time was ≤ 70 min for thoracotomies and ≤ 78 min for thoracoscopies; the difference was not statistically significant. Of the five thoracoscopies, there was a single conversion that required 3 h 20 min (Table 1).

The mean duration of thoracic drainage was 6.5 days after thoracotomy and 2.5 days after thoracoscopy; average length hospital stay was, respectively, 18.5 days and 6 days (Table 1). Average length of hospital stay after uncomplicated thoracotomy was 12 days, but the average was increased by a patient who required 38 days of hospitalization because of a secondary bronchopulmonary infection. Duration of drainage and length of hospital stay were both statistically different.

There were two early complications after thoracotomy. In one case, respiratory distress was observed on day 3, with a secondary bronchial infection that required intubation and antibiotic therapy in intensive care. In the other, a secondary pulmonary infection appeared 3 months postoperatively and was treated with antibiotic and ambulatory physiotherapy. In another patient who underwent thoracoscopy, there was an atelectasis of the superior lobe that regressed after 4 days.

In the long term (follow-up, 3–13 years; mean, 5.9), two new surgical interventions were required due to incomplete removal of the cyst wall. In one case, intervention was needed, 3 weeks after thoracotomy; in the other case, it was done 5 months after thoracoscopy. In both cases, the recurrence was detected by control thoracic scan. Both of these new operations were performed by thoracotomy.

## Discussion

Through the examination of our results and a review of the literature, we wanted to evaluate the benefits of thoracoscopy for children requiring the excision of bronchogenic cysts. The main advantage obtained after thoracoscopy is a postoperative improvement in patient comfort. There is less pain due to the lack of resection of

the intercostal muscles and the lower risk for rib fracture. Compared to thoracotomy, thoracoscopy reduces the duration of drainage and length of hospitalization, respectively, by a half and a third. There are major gains in both the aesthetic outcome and functional status because of the small size of the incision needed for pleural endoscopy and the possibility of instituting early and effective physiotherapy. By reducing the length of the hospital stay and the consumption of analgesics, pleural endoscopy contributes to a global financial gain, even though more expensive instrumentation is needed and the operating time is initially longer for surgeons new to this technique. However, in our series, there was no significant difference between both the two techniques in average length of operating time. Whichever technique is used, dissection of the cyst will be easier if it remains whole as long as possible.

In the studies reported in the literature, the patient groups are very diverse, especially in terms of age. For example, a series reported by Ribet et al. [10] included 69 patients ranging in age from 1 day to 64 years' who were treated over a period of 25 years. As indicated by our study, the mean gap in age in the two groups is not significant of the samples under comparison increases. Preoperative symptoms—if there are any—may include pain, cough, dyspnea, infection, hemoptysis [11], or dysphagia (in the case of paraesophageal cyst) [8]. As in one of our cases, two of our series cysts were discovered during a checkup for tuberculosis.

In our series, the same proportion of cysts in asymptomatic patients was found at all sites. However, in a series twice as large as ours, the intraparenchymatous cysts were symptomatic more often than the mediastinal ones [4]. Our survey of the literature confirms that compressive cysts are frequent and that they mainly cause pulmonary distension and mediastinal deviation [7, 10]. A death caused by a compressive cyst in a central location has also been described [11]. It should be noted that these clinical observations depend more on cyst localization than on the size factor [10].

The diagnosis of bronchogenic cyst cannot be made solely based on a lung radiograph. In 69% of cases, it requires a CT scan; and in 100%, it depends on an MRI that enables distinction between cystic and tissue mass [4]. Endoscopic scanning can be useful to document a paraesophageal cyst [3]. Precise localization of the cyst may prompt a modification of the patients position on the operating table. Lateral decubitus is the usual position for such procedures, but the patient could be tilted forward or backward if necessary.

The indications for the surgical excision of these lesions have been evolving over the years. In 1992, Bolton and Shahian [2] recommended conservative treatment and simple observation for adults with small asymptomatic cysts. As a therapeutic alternative to surgical intervention, they recommended percutaneous or transbronchial aspiration of the cyst, arguing that surgical procedures should be reserved for patients with respiratory symptoms, infectious complications, the presence of tracheal or bronchial communication, and in cases where there was diagnostic uncertainty. In 1993, Acuff et al. [1] stated that the advent of pleural endos-

copy provided a far less invasive means of diagnosing and treating intrathoracic lesions in pediatric patients. They envisioned a widening of the surgical applications for this technique. In 1995 and 1996, Ribet et al. [10] defended the systematic and preventive resection approach. Indeed, the preoperative differential diagnosis between congenital or acquired and benign or malignant, lesions was sometimes unsure. Furthermore, the natural evolution of these cysts and the percentage that would remain asymptomatic were unforeseeable. In 1999, Kanemitsu et al. [4] argued that this interventionist attitude should be maintained as a means of preventing complications. Nowadays, most pediatric surgical teams apply this principle of preventive intervention with all children once the diagnosis has been made. Neither the age nor the weight of the child represents a real contraindication [3, 7]. The present limits of the thoracoscopic approach appear to be the difficulty encountered when attempting to resect infected cysts and the inability to palpate the cysts in cases where small intraparenchymatous masses have been identified [6].

Prenatal diagnosis enables early management of these cysts and appropriate supervision. In all cases, as in the case of pulmonary malformations that are diagnosed antenatally, we recommend excision between the ages of 4 and 6 months.

In most patients, except those classified as American Society of Anesthesiologists [ASA] IV, selective ventilation is possible. This technique enables periods of lung collapse on the side to be operated on, as well as optimization, of the visual field, and thus the performance of thoracoscopy. Selective ventilation is most useful when the lesion is located entirely in the parenchyma and less useful when it is mediastinal. This technique requires the use of an intubation catheter with two lights (Carlens or Wright type) and a minimum patient weight of 30 kg. Underneath, a Fogarty ballone that is slid down the intubation catheter is used to exclude one of the bronchial stems.

The conversions mentioned in the literature, as in our series, were due to difficult dissections or to trauma to adjacent tissue, mainly the esophagus or tracheal-bronchial tree [5]. A diagnostic error discovered perioperatively may also prompt the surgeon to convert the thoracoscopy, especially when faced with a lesion suspected to be malignant.

All authors do not acknowledge the need for thoracic drainage. Some recommend it be done routinely; others insert a drain only after excision of a lesion in the central mediastinum [5]; still others do not use a drain at all [9]. We inserted a drain in each of our nine patients.

The early complications in our patients were essentially infectious; in the series reported by other authors, there was one case of pneumothorax after drain removal and one esophageal breach [7]. The lack of any significant difference between the two techniques in terms of morbidity justifies the choice of the less aggressive one.

In cases where the resection is incomplete electrocoagulation or laser destruction of the residual wall can be used to destroy the patent pathological cells, thereby significantly reducing the recurrence risk [4, 5, 7]. Careful midterm and long-term postoperative observa-

tion needs to be carried out at shorter intervals, because recurrences have been described as long as 10–25 years after the initial resection [7]. All of these recurrences were managed by thoracotomy.

In conclusion, thoracoscopy—ideally, associated with selective intubation and complete resection—is now our first-choice reference technique for the excision of bronchogenic pulmonary or mediastinal cysts in children, with no inferior age limit.

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