

Video-Assisted Thoracoscopy in the Management of Recurrent Spontaneous Pneumothorax in the Pediatric Population

Gustavo Stringel, MD, Nikhil S. Amin, MD, Allen J. Dozor, MD

ABSTRACT

Background and Objectives: The purpose of the present study was to evaluate the application of video-assisted thoracoscopy in the management of recurrent spontaneous pneumothorax in the pediatric population.

Patients and Methods: Between 1995 and 1997, four patients with recurrent spontaneous pneumothorax were treated. Ages varied from 14 to 17 years. There were three males and one female. Two patients had spontaneous pneumothorax twice, and the other two had it three times. Three patients had primary spontaneous pneumothorax, and the fourth one had spontaneous pneumothorax secondary to cystic fibrosis. Computerized tomography of the chest demonstrated blebs in two patients, and in the other two it was suggestive of apical blebs but not definitive. All patients had failed treatment by tube thoracostomy. Video-assisted thoracoscopy demonstrated blebs in all patients. Removal was easily accomplished with an endoscopic automatic stapling device. The procedure was completed with mechanical pleurodesis, multiple intercostal blocks and intrapleural bupivacaine for control of pain.

Results: All patients had a quick and uneventful recovery. Follow-up ranged from one to three years. There were no complications or subsequent recurrences of the pneumothorax.

Conclusions: Video-assisted thoracoscopy is a safe and effective technique in recurrent spontaneous pneumothorax. It allows for accurate identification and removal of the blebs, with quick recovery, minimal discomfort and good cosmetic results.

Key Words: Video-assisted thoracoscopy, Recurrent spontaneous pneumothorax.

INTRODUCTION

Spontaneous pneumothorax is a relatively common problem. Its incidence is about 17,000 cases per year in the United States.¹⁻³ It is more common in males than females, with a ratio of 5:1, and is seen more commonly in young, thin, tall males.¹ Spontaneous pneumothorax has been classified as primary when there is no underlying disease and secondary when it occurs in association with other lung conditions such as chronic obstructive lung disease and cystic fibrosis.^{2,4,5} Long-term recurrence has been reported in 23% to 52% of patients.^{1,3,6} Ipsilateral recurrence is about 16% after the first episode and 80% after the third.⁷ The management of recurrent spontaneous pneumothorax includes observation with or without oxygen therapy, needle aspiration, tube thoracostomy, chemical or mechanical pleurodesis, thoracoscopy and thoracotomy.¹⁻⁹ In the present report, we describe our experience with four adolescent patients with recurrent spontaneous pneumothorax managed effectively with video-assisted thoracoscopy.

PATIENTS AND METHODS

Between 1995 and 1997, four adolescent patients with recurrent spontaneous pneumothorax were treated at our institution (**Table 1**). Three had primary pneumothorax with no underlying pulmonary disease and one had secondary spontaneous pneumothorax associated with cystic fibrosis. Two were on the right side and the other two on the left side. Ages varied from 14 to 17 years. There were three males and one female.

Two patients had spontaneous pneumothorax twice. A 14-year-old female with persistent air leak had multiple apical blebs demonstrated by computerized tomography (CT) of the chest. A 15-year-old male developed large tension pneumothorax twice and required emergency chest tube placement.

The two other patients had spontaneous pneumothorax three times. A 16-year-old male who was a very active outdoorsman and engaged in hiking had a spontaneous pneumothorax that needed tube thoracostomy on two occasions. A 17-year-old male with advanced cystic fibrosis had a spontaneous pneumothorax three times.

Department of Surgery, New York Medical College, Westchester County Medical Center, Valhalla, NY (Dr. Stringel).

Department of Pediatrics, New York Medical College, Westchester County Medical Center, Valhalla, NY (Drs. Amin and Dozor).

Address reprint requests to: Gustavo Stringel, MD, Department of Surgery/Munger Pavilion, Westchester County Medical Center, New York Medical College, Valhalla, NY 10594, USA.

Table 1.
Patient Characteristics and Clinical Outcomes.

Age (yr)	Sex	No. of recurrences	Previous treatment		Days in hospital		Follow-up (yr)
			(no.)	Complications	Pre-op	Post-op	
14	F	2	Tube thoracostomy (1)	None	12	4	3
15	M	2*	Tube thoracostomy (2)	None	15	5	2
16	M	3	Tube thoracostomy (1)	None	15	5	1
17	M	3†	Tube thoracostomy (2)	None	25	6	1

*Large tension pneumothorax.

†Pneumothorax secondary to cystic fibrosis.

The latter patient needed chest tube drainage on two occasions and required prolonged hospitalization because of persistent air leak. In this patient, CT of the chest demonstrated apical blebs as well as blebs in the superior segment of the left lower lobe.

Preoperative hospital stay varied from 12 to 25 days (mean, 15 days). Postoperative stay varied from 4 to 6 days (mean, 5 days).

SURGICAL TECHNIQUE

Video-assisted thoracoscopy was performed under general endotracheal anesthesia, with a single lumen endotracheal tube. A three-port technique was used with two 5 mm ports and one 12 mm port for the endoscopic automatic stapler. The first port was placed in the seventh intercostal space midaxillary line. The second port was a 5 mm port in the fourth intercostal space anterior axillary line. The third port was a 12 mm port in the fourth or fifth intercostal space posterior axillary line. The 12 mm port was used for the endostapler and for retrieval of the specimen.

Sufficient space was provided in between the ports to allow for triangulation. The entire lung in each case was carefully inspected using a 0-degree scope or, if necessary, a 30-degree scope. (The 30-degree scope is always available in the operating room.) The lung was collapsed with low-pressure CO₂ (6 to 8 mm Hg). The blebs were identified in the apex of the lung or superior segment of the lower lobe. The blebs could be grasped and elevated and then removed with the endoscopic automatic stapler. More than one pass is usually necessary.

Mechanical pleurodesis was done using the electrocautery pad cleaner, which requires careful and methodical use because it is very abrasive and can produce pleural bleeding. The electrocautery pad cleaner was folded over to make it cylindrical and to allow for its introduction through the 12 mm port incision. A #1 silk suture was placed through the pad in order to facilitate retrieval if accidentally lost inside the chest. The pad was grasped with an endoscopic grasping forceps and the parietal pleura rubbed firmly, starting in the apex and continued as far down as possible. Multiple-level intercostal blocks and intrapleural bupivacaine were administered for pain control. Finally, a chest tube of appropriate size was placed through the lowest port. In the two younger patients, a size 24 French catheter was used; in the two older patients, a size 28 French catheter was used.

RESULTS

There were no operative or postoperative complications. In all patients, the chest tube was removed after the air leak ceased in three to five days after surgery. Postoperative pain was controlled with an average of three intramuscular or intravenous Meperidine injections and with oral analgesics, as needed, usually acetaminophen. Three patients had apical blebs. The patient with cystic fibrosis had left apical and also superior segment blebs. All blebs were easily removed with the automatic endoscopic stapling device. Follow-up ranged from one to three years with no recurrences to date. The cosmetic results were excellent in all patients.

DISCUSSION

The treatment of spontaneous pneumothorax includes observation with or without oxygen therapy, simple aspiration, tube thoracostomy with or without sclerosing agents, thoracoscopy and thoracotomy.¹⁻⁹ When the pneumothorax is small (<20%) and asymptomatic, it can be managed with observation and oxygen therapy. Generally, oxygen therapy is recommended because it accelerates the pleural absorption of air about four times.¹⁰ The treatment of larger pneumothoraces includes simple needle aspiration and tube thoracostomy. This line of treatment has a high incidence of recurrence (~80%) after the third episode.⁷

Injection of a sclerosing agent to promote pleurodesis has been used successfully by some authors.^{2,3,6} However, others have reported disappointing results.^{1,5,7,11} The main sclerosing agent has been tetracycline. The parenteral form of this antibiotic is no longer available, and other alternatives have not been as successful as described in the original reports.^{1,2} Silver nitrate has been effective, but it is extremely painful and produces excessive postinstillation drainage.³ Furthermore, sclerosing agents do not work in the presence of a bronchopleural fistula.^{2,3} Talc is rarely used in younger patients and is generally reserved for the treatment of secondary pneumothorax in older patients or patients with malignancies.

Thoracoscopy and thoracotomy have been previously used with good results mainly in the adult population for excision and plication of blebs as well as mechanical pleurodesis. This technique has lower recurrence rates.^{2,7,9,11} Thoracotomy has produced excellent results,^{2,5} but it has been used sparingly in children and young adults because of the trauma of the thoracotomy and poor cosmetic results.¹¹

The ideal treatment for recurrent spontaneous pneumothorax entails the identification and closure of air leak with maximal lung tissue preservation and permanent adhesion of the visceral and parietal pleurae.⁷ Video-assisted thoracoscopy fulfills this criteria, since it provides excellent visualization of the blebs and air leaks. The source of pneumothorax can be taken care of, and mechanical pleurodesis can also be done with this approach. In the four patients we treated, the pulmonary blebs were identified and removed, and mechanical pleurodesis was easily achieved.

The identification of blebs by CT has not been universally successful. It has been reported in the literature to have a success rate of about 80%.² In our series, the identification of blebs was definite in two patients, and in the two others it was only suggestive.

The identification of blebs by thoracoscopy has varied from 51% to 100% in different series.⁸ It has been postulated that the demonstration of blebs and bullae is influenced by the method of inspection of the lung.⁸ The blebs were easily identified in three of the patients we treated, and, in the fourth patient, the area of rupture of a bleb was seen only after careful examination of the lung.

The period of hospitalization is often very long in patients with spontaneous pneumothorax, depending on the method of treatment.^{1,2,5,6} In the four patients we treated, the preoperative hospital stay varied from 12 to 25 days. This lengthy hospitalization was due to the persistence of nonoperative treatment.

Although simple aspiration when successful allows for early hospital discharge, patients with a chest tube are usually admitted to the hospital. This is especially true in the pediatric population. It has been recommended that patients treated with tube thoracostomy with persistent air leaks after seven days should have surgical treatment.^{2,5}

The postoperative recovery in our series was excellent. The chest tubes were removed three to four days after surgery, and the mean postoperative stay was five days. Postoperative pain was well tolerated with minimal use of narcotics. Activity was resumed very rapidly. The cosmetic results of three small ports were excellent.

Thoracoscopic bleb removal or plication has been done by suturing, stapling and laser therapy.^{7,9,11-14} The use of automatic endoscopic staplers was successful in the patients we treated. It is fast and accurate, and it provides hemostasis and good pulmonary seal without air leakage.

CONCLUSIONS

Based on our experience, we agree with other authors that thoracoscopy should be the first line of treatment in recurrent spontaneous pneumothorax.¹¹ Nonoperative management should be reserved for first-time patients with minimal or no respiratory distress. Tube thoracos-

tomy should be used as an emergency treatment in patients with larger pneumothorax and respiratory distress. Sclerosing agents should be reserved for selected patients. Thoracotomy should be done only in patients who have failed thoracoscopy.

We recommend the use of video-assisted thoracoscopy in pediatric patients with recurrent pneumothorax, as well as in those patients with persistent air leak of more than seven days despite adequate chest tube drainage and those with a first episode of tension pneumothorax. The early use of this technique may prevent lengthy hospitalization, unnecessary pain and anxiety. In addition, it is a safe and effective procedure with excellent cosmetic results.

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