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Thoracoscopy in Children: Is a Chest Tube Necessary?

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Abstract

Purpose—Historically, a chest tube or drain has been left following a thoracic operation to allow drainage of air or fluid in the postoperative period. However, in patients undergoing thoracoscopy, the tube is often the greatest source of postoperative pain. We began excluding chest tubes several years ago and therefore are reviewing our experience to evaluate the safety and efficacy of this approach.

Methods—A retrospective review of the medical record was performed on patients undergoing thoracoscopy at two centers from 1993 to 2007. Patients who left the operating room without a chest tube were included in this series. Patient demographics, type of operation, and outcome were recorded.

Results—A total of 333 thorascopic procedures were performed at the two institutions without the use of a chest tube. Ages ranged from 1 week to 39 years. Weight ranged from 1.3 kg to 117 kg. The cases performed included aortopexy, congenital diaphragmatic repair, excision of a bronchogenic cyst, exploratory thoracoscopy, lung biopsy, resection extralobar sequestration, Nuss procedure, patent ductus arteriosus ligation, resection/biopsy of mediastinal lesions, resection of esophageal duplication, excision of parathyroid adenoma, hiatal hernia repair, esophagomyotomy, and thymectomy. Within this group of thoracic operations, 176 patients underwent lung biopsy. Pulmonary lobectomy or segmentectomy patients were excluded. All patients had a chest radiograph in the recovery room. Only one developed a postoperative pneumothorax, which occurred on postoperative day 2 following reintubation for respiratory failure. This patient required repeat thoracoscopy.

Conclusions—The use of routine chest tubes following thoracoscopy in children appears to be unnecessary as the absence of a chest tube in our series resulted in an intervention in one patient (0.3%). Elimination of the chest tube will allow for a much more tolerable postoperative course in most children.

Introduction

A historical tenant of thoracic operations has been placement of a chest tube or drain after the procedure to prevent symptomatic accumulation of air or fluid in the pleural space. The

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greatest postoperative concern driving pleural drainage is the development of a potentially life-threatening tension pneumothorax from air leaking from the biopsy site or staple line. However, in patients undergoing thoracoscopy, the tube is often the greatest source of postoperative pain. Early in our experience, patients typically had their chest tubes removed as soon as no air leak was present. It became apparent that most patients had no air leak after surgery. We began excluding the use of postoperative chest tubes several years ago and therefore are reviewing our experience to evaluate the safety and efficacy of this approach.

Methods

A retrospective review of medical records was performed on patients undergoing thoracoscopy at two centers from 1993 to 2007. The two centers involved in the study were the Rocky Mountain Hospital for Children in Denver, Colorado and the Children's Mercy Hospital in Kansas City, Missouri. Only patients with minimal lung manipulation were left without a chest tube. Patients who underwent major lung resections or extensive mediastinal dissection had a chest tube placed and were not included in this study. In most cases, the patients had a chest tube placed at the completion of the case to evacuate the CO₂ and to assess for air leak or excessive bleeding. This tube was then removed prior to waking the patient if no air leak was present. All patients had a chest radiograph in the recovery room. Only patients who left the operating room without a chest tube were included in this series. Patient demographics, type of operation, and outcome were recorded.

Results

A total of 333 thoracoscopic procedures were performed at the two institutions without the use of a postoperative chest tube. Ages ranged from 1 week to 39 years. Weight ranged from 1.3 kg to 117 kg. The cases performed included aortopexy, congenital diaphragmatic repair, excision of a bronchogenic cyst, exploratory thoracoscopy, lung biopsy, anterior spinal fusion, Nuss procedure, patent ductus arteriosus ligation, resection/biopsy of mediastinal lesions, resection of esophageal duplication, excision of parathyroid adenoma, hiatal hernia repair, esophagomyotomy, and thymectomy (Table 1). Lung biopsy was the most common operation. One patient developed a postoperative pneumothorax, which occurred on postoperative day 2. This child was 2 years old and required a lung biopsy for respiratory failure. The child developed respiratory distress postoperatively but had no pneumothorax on chest X-ray. The patient required reintubation and developed a pneumothorax the next day. He was taken back to the operating room for a repeat thoracoscopy where an air leak was identified separate from the biopsy sites. This site was ligated and the patient had no recurrent episodes of pneumothorax. The final diagnosis was "interstitial lung disease."

Discussion

Since the advent of thoracic surgery, the placement of a thoracostomy tube or drain has been the standard of care. Usually the tube is left to prevent the accumulation of either air or blood in the pleural space. The accumulation of air could be life-threatening if a tension pneumothorax develops, underscoring the reason most surgeons leave a chest tube after thoracic procedures.

With the advent of thoracoscopy and the use of 3- to 10-mm incisions, the chest tube now may be the major source of pain after thoracoscopic surgery. In fact, pain from the chest tube may lead to decreased inspiratory effort postoperatively and can lead to atelectasis and or pneumonia. Therefore, if it could be demonstrated that the chest tube is unnecessary in certain cases, this may improve outcomes.

Several authors have recently published data suggesting that early removal of chest tubes in certain thoracoscopic procedures is safe,¹⁻³ including a prospective, randomized trial.³ In these cases, chest tubes were removed between within the first 8 hours after the operation. The authors were working under the premise that if no air leak exists shortly after the procedure, then it is unlikely that a delayed pneumothorax will develop.

We have simply taken the issue one step further and proposed that if there is no air leak immediately postoperatively in the operating room, it is unlikely that a delayed pneumothorax will develop. We proposed that the extra 1 to 24 hours does not offer any more safety than immediate removal, and removal of the tube puts the child through a traumatic painful experience of chest tube removal while awake. In this report, we have demonstrated that removal of the chest tube in the operating room is safe. If no air leak is present in the operating room at the completion of the case, there may be no need to leave a chest tube postoperatively. Others have noted similar findings but this is the largest reported series.^{4,5}

It important to bring attention to the fact that we leave no tube after procedures in which there was little lung manipulation or tissue dissection. Any patient undergoing a lung resection beyond a simple biopsy or extensive dissection had a chest tube left in place. Patients undergoing thoracic procedures with little lung manipulation or tissue dissection are unlikely to have extravasation of enough air or fluid into the pleural space to become symptomatic. This is especially true if no air leak is demonstrated at the end of the case. On the other hand, in patients undergoing a lung resection, a delayed bronchial leak may occur, which could be catastrophic if no chest tube were present.

Nearly all patients were observed overnight following their thoracic procedure. Some authors have argued that these patients may be sent home after surgery.^{1,6} Now that we have shown the complication rate without a chest tube in select thoracoscopic procedures to be low, the next step may be converting these to outpatient procedures.

Conclusions

The use of routine chest tubes following thoracoscopy in children appears to be unnecessary as the absence of a chest tube in our series resulted in an intervention in only one patient (0.3%). Elimination of the chest tube will allow for a much more tolerable postoperative course for most children.

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Table 1

Thoracoscopic Procedures Performed Without a Chest Tube

Procedure	Number
Lung biopsy	176
Patent ductus arteriosus ligation	66
Nuss procedure	32
Congenital diaphragmatic repair	20
Resection/biopsy of mediastinal lesions	9
Thymectomy	8
Anterior spinal fusion	5
Aortopexy	4
Resection of esophageal duplication	4
Excision of a bronchogenic cyst	3
Esophagomyotomy	3
Exploratory thoracoscopy	1
Excision of parathyroid adenoma	1
Hiatal hernia repair	1