Journal of Pediatric Surgery (2005) **40**, 838–841

ELSEVIER

Journal of Pediatric Surgery

www.elsevier.com/locate/jpedsurg

# Can we predict the failure of thoracostomy tube drainage in the treatment of pediatric parapneumonic collections?

**Muhammad Jamal, Stacy C. Reebye, Mohammed Zamakhshary, Erik D. Skarsgard, Geoffrey K. Blair***

*Department of Surgery, British Columbia Children's Hospital, and the University of British Columbia, Vancouver, Canada BC V6H 3V4*

**Index words:**
Empyema;
Parapneumonic effusions;
Chest tube;
Thoracoscopy

**Abstract**

**Background/Purpose:** Tube thoracostomy is a standard method of treating pediatric parapneumonic collections. Despite recent work denoting thoracoscopy as a superior method of treatment, few studies have looked at factors predictive of tube thoracostomy failure. We reviewed parapneumonic collections initially treated with tube thoracostomy to identify such factors.

**Methods:** Nontuberculous parapneumonic collections treated initially with tube thoracostomy over a 10-year period were reviewed. A "failed primary tube thoracostomy" was defined as the presence of worsening clinicoradiological signs requiring a further chest procedure (ie, thoracoscopy, thoracotomy, or second thoracostomy).

**Results:** Fifty-eight patients were identified. Forty-three percent failed primary tube thoracostomy. Within group F (failure group), 32% of patients had a concomitant medical condition ($P < .001$). Sixty percent of group F patients had duration of symptoms for more than 1 week compared with only 24% of group S (successful group) ($P < .001$).

**Conclusions:** Our results suggest that primary treatment of parapneumonic collections with tube thoracostomy is likely to be unsuccessful in patients who are symptomatic for more than a week or who have a concomitant medical condition.

A more aggressive primary surgical intervention is suggested for this group.



A parapneumonic effusion is defined as a pleural effusion associated with bacterial pneumonia, lung abscess, or bronchiectasis. It results from increased permeability of the visceral pleura because of inflammation. As many as 40% of patients with pneumonia develop an effusion during the course of their illness [1]. Many parapneumonic effusions resorb with early treatment of the pneumonia with antibiotics only, and in only 10% of patients with effusion is surgical intervention required to drain the fluid [1].

If treatment is not started early in the course of an ongoing parapneumonic effusion, empyema thoracis may result wherein the pleural fluid is infected. Differentiating a parapneumonic effusion clinically or radiologically from a

Presented at the 36th Annual Meeting of the Canadian Association of Pediatric Surgeons, Winnipeg, Manitoba, Canada, September 30 to October 3, 2004.

* Corresponding author. Division of Pediatric General Surgery, K0-110 ACB, Vancouver, Canada BC V6H 3V4. Tel.: +1 604 875 2345x7583; fax: +1 604 875 3213.

*E-mail address:* eskarsgard@cw.bc.ca (E.D. Skarsgard).

0022-3468/$ – see front matter © 2005 Elsevier Inc. All rights reserved.
doi:10.1016/j.jpedsurg.2005.01.053

developing empyema may be difficult. Empyema is associated with significant morbidity in pediatric population, although the mortality rate is not as high as seen in the adult population [2,3].

Clinicians commonly face the challenge of identifying those parapneumonic effusions that will resolve with antibiotic treatment alone versus those that need surgical intervention. Controversy also surrounds the surgical decision in choosing between tube thoracostomy and more aggressive approaches such as thoracoscopy or thoracotomy.

Despite the reported high failure rate of chest tube thoracostomy [4,5], it is still the commonest management option used in the treatment of pediatric parapneumonic collections [5]. In this study, we try to gain more insight on the possible factors that may predict failure of this widely used management option.

## 1. Methods

An institutional review board approved the retrospective review of all cases of parapneumonic collections treated initially by tube thoracostomy between January 1, 1992, and December 2002 at the British Columbia Children's Hospital.

### 1.1. Definitions

(1) A parapneumonic collection was defined as a pleural fluid collection associated with an underlying pneumonia, lung abscess, or bronchiectasis. Thus, all patients with a parapneumonic effusion or empyema secondary to open cardiothoracic surgery, malignancy, or trauma were excluded.
(2) Empyema was defined as pleural effusion that met 1 or more of the following criteria: (i) grossly purulent fluid, (ii) positive pleural fluid culture or Gram stain.
(3) A complicated parapneumonic effusion was defined as a parapneumonic effusion with 1 or more of the following criteria: (i) pH less than 7, (ii) lactate dehydrogenase (LDH) level greater than 1000 U/L, and/or (iii) glucose level less than 40 mg/dL.
(4) Invasive chest procedures were defined as video-assisted thoracoscopy, thoracotomy, or tube thoracostomy.

Patients were then further subdivided into 2 clinical groups:

(1) Group S: patients with successful primary management with tube thoracostomy only and
(2) Group F: patients in whom primary tube thoracostomy tube failed to resolve their effusion and symptoms.

Patients were assigned to group F if there were deteriorating clinicoradiological signs (eg, an increasing or persistent effusion on radiology, persistence of fever, and/or respiratory distress) despite the presence of chest tube in place which then necessitated a further invasive chest procedure. Death was also regarded as a criterion of a failed chest tube.

Thoracostomy tubes in our institution are usually inserted in the operating room with an anesthesiologist present. Light general anesthesia (GA) is administered in the majority of cases with sedation at the discretion of the anesthesiologist.

Data collected from the charts included age, sex, concomitant medical conditions, side of effusion, duration of prehospital admission symptoms, time from admission to first invasive chest procedure, pleural fluid biochemistry (lactate dehydrogenase, glucose, pH, and cell count [total and differential]), total number of invasive chest procedures per patient, total length of antibiotic course, number of hospital days following the first invasive chest procedure, length of intensive care unit (ICU) stay, duration of pyrexia after the first invasive chest procedure, total number of general anesthetics required per patient, number and type of imaging procedures required per patient, and total length of hospital stay. A detailed review of the radiological parameters was not done for this study.

## 2. Results

Fifty-eight patients (34 boys, 59%) had tube thoracostomy as the first intervention for treatment of empyema and complicated parapneumonic effusions over the 10-year period. The age range was 1 month to 17 years (mean age 6 years). There were 33 (57%) right-sided parapneumonic collection and 25 (43%) left-sided parapneumonic collection. In all patients, pneumonia was the predisposing condition for their effusion/empyema. Four patients had bilateral pneumonia. Nine (15%) patients had a concomitant nonpneumonitic medical disease.

Of the 58 children, 33 (57%) were treated successfully with tube thoracostomy (group S), and in 25 (43%) patients, the chest tube failed (group F).

### 2.1. Group S

Within the successful group, 17 (52%) patients had empyema, and 16 (48%) patients had a complicated parapneumonic effusion. Only 1 patient had a concomitant nonpneumonitic medical condition (varicella). Two (6%) patients had bilateral pneumonia in group S. The median duration of symptoms in group S before hospital admission was 5 days. Twenty-five (76%) patients had duration of symptoms for 7 days or less, whereas 8 (24%) patients had duration of symptoms for more than 7 days. The median time from admission to surgical referral was 2 days.

Pleural fluid cultures were positive in 12 (36%) patients with group A streptococcus as the commonest bacteria grown. Gram stain of pleural fluid was positive in 2 (6%) patients. Blood cultures were positive in 4 patients who had a negative pleural fluid culture.