Thoracostomy tubes are routinely placed at the time of cardiothoracic surgery to drain blood, fluid, and air from the pleural space [1]. Following chest tube removal, a small number of patients develop pneumothorax (PTX) [2, 3]. At our medical center and elsewhere, conventional medical practice is to obtain chest radiographs (CXR) in all patients following chest tube removal to assess for possible PTX [4]. We hypothesize that clinical signs and symptoms may be a sensitive indicator of PTX following chest tube removal, and hence routine CXRs in asymptomatic patients may not be necessary. We retrospectively reviewed reports of all CXRs obtained from cardiac surgical pediatric patients following chest tube removal to determine the incidence of PTX. We then researched the clinical status of those patients with radiographically defined PTX to determine...
whether these patients could have been identified clinically without the use of routine radiography.

**Materials and methods**

We retrospectively reviewed reports of all CXRs obtained from pediatric patients following chest tube removal after cardiothoracic surgery over a 1-year period to determine the incidence of PTX and to attempt to determine what proportion of those patients with PTX demonstrated clinical signs and symptoms.

A computerized search of the pediatric cardiac surgical database at our hospital revealed 374 children (age 0–18 years) who underwent cardiothoracic surgery with pleural chest tube placement during a 1-year period between 1998 and 1999. For patients undergoing chest tube removal more than once, only the first episode was evaluated.

All patients had routine CXRs obtained within 6 h of chest tube removal. PTX was described in 51 children following chest tube removal. Radiographs with positive findings were reviewed to quantify the PTX following the method of L. Axel [5]. Briefly, the change in the linear dimensions, height and width, of the lung at the time of PTX is charted on a graph that relates linear dimensions to fractional lung volume to assign a numerical value to the size of the PTX. A large PTX was defined as greater than 40% collapse of the lung, an intermediate PTX as 20–40% collapse, and a small PTX as less than 20% collapse. Measurements were initially made by one observer, and subsequently reviewed by a second, with disagreement resolved by consensus.

The medical records of all patients with a PTX were then reviewed to determine if relevant symptoms or signs (such as chest pain, tachypnea, dyspnea, hypoxia, hypotension, or worsening arterial blood gas) were present at the time of chest radiography, and to determine whether a major clinical intervention was undertaken.

![Fig. 1 a](image1.png) AP portable chest radiograph of a 1-month-old infant following cardiac surgery and removal of a right thoracostomy tube shows a moderate pneumothorax. At this time the infant showed respiratory distress including tachypnea. b One day later, after insertion of a right-sided pigtail catheter, the pneumothorax is resolved as is the respiratory distress.

![Fig. 2 a, b](image2.png) Untreated moderate pneumothorax. a AP chest radiograph of a 7-day-old postoperative infant following thoracostomy tube removal shows a moderate (36%) left pneumothorax. Despite the presence of clinical tachypnea, this pneumothorax was not treated. b Twenty-four hours later the pneumothorax had spontaneously decreased in size.