



Original contribution

# Anesthetic management of children with an anterior mediastinal mass

Paul A. Stricker MD (Assistant Professor)\*,  
Harshad G. Gurnaney MBBS (Assistant Professor), Ronald S. Litman DO (Professor)

*Department of Anesthesiology and Critical Care Medicine, University of Pennsylvania School of Medicine, Philadelphia, PA 19104, USA*

*Department of Anesthesiology, The Children's Hospital of Philadelphia, Philadelphia, PA 19104, USA*

Received 16 September 2008; revised 5 October 2009; accepted 13 October 2009

## Keywords:

Anesthesia, pediatric;  
Children;  
Mediastinal mass

## Abstract

**Study Objective:** To review the anesthetic management and perioperative course of children with an anterior mediastinal mass.

**Design:** Retrospective review.

**Setting:** University-affiliated children's hospital.

**Measurements:** The records of 46 children presenting with an anterior mediastinal mass between October 1, 1998 and October 1, 2006 were studied. Preoperative symptoms, diagnostic imaging and physical examination findings, anesthetic techniques, and perioperative complications were recorded.

**Main Results:** Spontaneous ventilation was maintained in 21 of 46 cases. Five patients had mild intraoperative complications, including upper airway obstruction, mild oxyhemoglobin desaturation, wheezing, partial airway obstruction, and a pneumothorax after mediastinal mass biopsy. There were no serious complications or perioperative deaths.

**Conclusions:** Children with a symptomatic anterior mediastinal mass underwent general anesthesia without serious complications. Spontaneous ventilation was preferred for all patients with severe airway compression.

© 2010 Elsevier Inc. All rights reserved.

## 1. Introduction

When a child with an anterior mediastinal mass requires general anesthesia for a diagnostic procedure, there is a risk of development of catastrophic airway compression and/or cardiovascular collapse [1–11]. Biopsy of extramediastinal sites using local anesthesia and mild sedation has been recommended in numerous reports [4,12–15]. However,

many children will require general anesthesia (GA) or deep levels of sedation for adequate tissue sampling.

An 8-year review of the anesthetic management and perioperative course of children with an anterior mediastinal mass, who presented for diagnostic or surgical intervention, was conducted. Our primary aim was to describe the anesthetic management of these children and to determine factors associated with complications.

## 2. Subjects and methods

After approval from the Institutional Review Board of the Stokes Research Institute of The Children's Hospital of

\* Corresponding author. The Children's Hospital of Philadelphia and University of Pennsylvania School of Medicine, Philadelphia, PA 19104, USA. Tel.: +1 215 590 1876; fax: +1 215 590 1415.

E-mail address: strickerp@email.chop.edu (P.A. Stricker).

**Table 1** Perioperative variables

| Dependent variables   | Independent variables  |
|---|--|
| Respiratory signs/symptoms:<br>wheezing<br>cough<br>exertional dyspnea<br>orthopnea<br>stridor<br>retractions   | Intraoperative complications:<br>airway obstruction<br>hypoxemia<br>hypotension<br>unplanned endotracheal intubation<br>unplanned change in position<br>unplanned rigid bronchoscopy |
| Cardiovascular signs/symptoms:<br>facial swelling/SVC syndrome<br>chest pain<br>syncope   |  |
| Imaging study (plain radiograph, CT, MRI, echocardiogram) results:<br>presence and degree of tracheal/bronchial compression<br>great vessel/cardiac compression |  |
| Pretreatment with chemotherapy or radiation treatment   |  |
| Intraoperative management:<br>anesthetic/sedative agents<br>mode of ventilation<br>positioning<br>neuromuscular blockade  |  |
| Surgical procedure performed  |  |
| Final postoperative diagnosis   |  |

SVC = superior vena cava, CT = computed tomography, MRI = magnetic resonance imaging.

Philadelphia, a computerized search of our automated electronic anesthesia recordkeeping system (CompuRecord, Phillips Healthcare, Bothell, WA, USA) for anterior mediastinal mass cases that occurred between January 1, 1998 and October 1, 2006 was conducted. The term “mediastinal” was searched, both in the diagnosis category as well as free text in the record. All possible inclusive charts were examined to determine eligibility, which included the presence of an anterior mediastinal mass as a new diagnosis. Children with previous anesthetic encounters with the same diagnosis were excluded from analysis. Eligible patient records were examined and, in addition to demographic characteristics, dependent and independent variables were recorded (Table 1).

## 2.1. Statistical analysis

Descriptive analysis was performed to evaluate the data. All continuous variables are reported as means  $\pm$  standard deviation. A logistic regression analysis of the independent variables was attempted to evaluate their association with preoperative findings.

## 3. Results

A total of 45 charts met the inclusion criteria. Lymphoma was the final diagnosis in the majority of the cases reviewed (Table 2). Of the 45 patients, 34 (76%) had preoperative

signs or symptoms suggestive of cardiopulmonary compromise (Table 3). Of the 34 patients with signs or symptoms suggesting cardiopulmonary compromise (hereafter referred to as “signs/symptoms”), 26 (76%) had radiologic evidence of respiratory or cardiovascular compression (Fig. 1). Muscle relaxant was avoided in 18 of these 26 patients (69%); anesthetic management consisted of sedation with spontaneous ventilation and a natural airway in 17 of these cases (94%).

There were three complications in this group of patients. One child developed mild hypotension after sedation with ketamine, which resolved with the onset of surgical stimulation. This patient was a two year-old boy with an undifferentiated neuroblastoma who underwent biopsy of a cervical mass. Preoperatively, he complained of cough and abdominal pain; preoperative imaging showed airway

**Table 2** Tissue diagnosis of anterior mediastinal mass

| Diagnosis       | # of Patients |
|-----------------|---------------|
| Lymphoma        | 28            |
| Normal thymus   | 3             |
| Foregut cyst    | 2             |
| Lymphangioma    | 2             |
| Neuroblastoma   | 2             |
| Teratoma        | 2             |
| Germ cell tumor | 2             |
| Lipoblastoma    | 1             |
| Other           | 3             |



was intubated for a rigid bronchoscopy; he showed evidence of distal tracheal compression on bronchoscopy.

We cannot comment on the depth of sedation in these patients, as it was not documented in the electronic medical record. The general practice among our colleagues is to maintain minimal to moderate sedation for patients with significant airway compression. No patient required the use of a rigid bronchoscope to bypass airway obstruction.

A logistic regression analysis was not performed. We were unable to perform such an analysis due to the small number of mediastinal mass-related complications in the review.

#### 4. Discussion

In this review no mortality and little morbidity occurred. Of the 5 complications noted, one was due to the surgical procedure. This patient had pneumothorax and hypoxemia, which resolved with placement of a chest tube. One patient had wheezing with increased peak inspiratory pressures and another had upper airway obstruction during deep sedation with spontaneous ventilation; it is unclear if these symptoms were related to mediastinal pathology. A brief occurrence of hypotension in another patient resolved with surgical stimulation. Finally, the patient with partial airway obstruction during inhalational induction did not have significant ventilatory compromise.

Recommendations for preoperative evaluation of children with an anterior mediastinal mass include assessment of compressive signs and symptoms from the anterior mediastinal mass, CT imaging, echocardiography, and pulmonary function testing to assess for dynamic airway compression [4]. While radiotherapy or corticosteroid treatment before biopsy may improve perioperative risk, they also may adversely impact diagnostic histological accuracy [16]. Patients with greater than 50% tracheal compression as shown on CT scan may be at high risk for airway complications and may benefit from preoperative irradiation and/or corticosteroid therapy if general anesthesia is required [17]. In this review, three patients had greater than 50% tracheal compression and were maintained with spontaneous ventilation. Four patients received preoperative corticosteroid treatment, while none received radiotherapy. Spontaneous ventilation with a natural airway was used in three of the 4 patients.

Absence of radiological evidence and/or clinical signs/symptoms does not necessarily imply absence of risk [9]. Of 30 patients with documented evidence of respiratory tree or cardiovascular compression, 4 were asymptomatic. Conversely, 8 patients had symptoms potentially referable to mass effect who had no radiologic evidence of respiratory or cardiovascular compression. This discordance between symptoms and mediastinal compression underscores the importance of using a combination of history, physical examination, and diagnostic imaging studies when making perioperative management decisions.

Due to the small sample size and the low number of complications, a cause-and-effect relationship between anesthetic technique and perioperative complications could not be shown. It was unclear if decisions to administer deep sedation or general anesthesia were based on the degree of airway compression evident on CT scan. Some complications may have been avoided in the patients in whom spontaneous ventilation was maintained throughout the anesthetic. Patient selection by oncology providers for procedures performed during anesthesia also may have influenced our experience.

Many questions remain unanswered regarding the evaluation and care of pediatric patients with anterior mediastinal masses. This diverse patient population is not amenable to study by randomized trial. Treatment algorithms based on existing data, however, can be validated in prospective observational studies. The clinicians appeared to incorporate the evolving body of knowledge regarding management of patients with anterior mediastinal mass into their practice, and the outcome continues to improve for these high-risk patients. While the data are encouraging, continued caution is warranted in the care of these patients.

#### References

- [1] Azizkhan RG, Dudgeon DL, Buck JR, et al. Life-threatening airway obstruction as a complication to the management of mediastinal masses in children. *J Pediatr Surg* 1985;20:816-22.
- [2] Bray RJ, Fernandes FJ. Mediastinal tumour causing airway obstruction in anaesthetised children. *Anaesthesia* 1982;37:571-5.
- [3] Ferrari LR, Bedford RF. General anesthesia prior to treatment of anterior mediastinal masses in pediatric cancer patients. *Anesthesiology* 1990;72:991-5.
- [4] Hammer GB. Anaesthetic management for the child with a mediastinal mass. *Paediatr Anaesth* 2004;14:95-7.
- [5] Keon TP. Death on induction of anesthesia for cervical node biopsy. *Anesthesiology* 1981;55:471-2.
- [6] Levin H, Bursztein S, Heifetz M. Cardiac arrest in a child with an anterior mediastinal mass. *Anesth Analg* 1985;64:1129-30.
- [7] Prakash UB, Abel MD, Hubmayr RD. Mediastinal mass and tracheal obstruction during general anesthesia. *Mayo Clin Proc* 1988;63:1004-11.
- [8] Shamberger RC. Preanesthetic evaluation of children with anterior mediastinal masses. *Semin Pediatr Surg* 1999;8:61-8.
- [9] Viswanathan S, Campbell CE, Cork RC. Asymptomatic undetected mediastinal mass: a death during ambulatory anesthesia. *J Clin Anesth* 1995;7:151-5.
- [10] Vas L, Naregal F, Naik V. Anaesthetic management of an infant with anterior mediastinal mass. *Paediatr Anaesth* 1999;9:439-43.
- [11] Todres ID, Reppert SM, Walker PF, Grillo HC. Management of critical airway obstruction in a child with a mediastinal tumor. *Anesthesiology* 1976;45:100-2.
- [12] Perger L, Lee E, Shamberger R. Management of children and adolescents with a critical airway due to compression by an anterior mediastinal mass. *J Pediatr Surg* 2008;43:1990-7.
- [13] Ricketts RR. Clinical management of anterior mediastinal tumors in children. *Semin Pediatr Surg* 2001;10:161-8.
- [14] Pullerits J, Holzman R. Anaesthesia for patients with mediastinal masses. *Can J Anaesth* 1989;36:681-8.

- [15] Neumann GG, Weingarten AE, Abramowitz RM, Kushins LG, Abramson AL, Ladner W. The anesthetic management of the patient with an anterior mediastinal mass. *Anesthesiology* 1984;60: 144-7.
- [16] Loeffler JS, Leopold KA, Recht A, Weinstein HJ, Tarbell NJ. Emergency prebiopsy radiation for mediastinal masses: impact on subsequent pathologic diagnosis and outcome. *J Clin Oncol* 1986;4: 716-21.
- [17] Shamberger RC, Holzman RS, Griscom NT, Tarbell NJ, Weinstein HJ. CT quantitation of tracheal cross-sectional area as a guide to the surgical and anesthetic management of children with anterior mediastinal masses. *J Pediatr Surg* 1991;26:138-42.