Use of the laryngeal mask airway in managing a patient with a large anterior mediastinal mass: A case report

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This is a case presentation of a patient with a large anterior mediastinal mass in whom the airway was maintained with a laryngeal mask airway. The patient was otherwise managed in the “classic” fashion with spontaneous respiration via a light general anesthetic. In reviewing many of the potential pitfalls of anesthesia in this class of patients, the laryngeal mask airway was found to be both a valuable and viable option for airway management.

Key words: Difficult airway, laryngeal mask airway, mediastinal mass.

Introduction
The administration of anesthesia to a patient with an anterior mediastinal mass may produce severe respiratory and cardiovascular complications. All stages of the anesthetic are potentially lethal having risks including cardiac compression, superior vena caval obstruction, and/or airway obstruction. The majority of references and texts agree that spontaneous ventilation is the best approach to prevent airway obstruction in these patients. Use of a laryngeal mask airway (LMA) in this patient group, though controversial, has previously been described in a patient undergoing mediastinoscopy. We report a case in which a patient with a large anterior mediastinal mass was managed with a general anesthetic and spontaneous ventilation through a laryngeal mask airway.

Case report
A 29-year-old, 61-kg, 165-cm woman had been in her previous state of good health until 2 months earlier when she developed a persistent, nonproductive cough, which troubled her particularly at night and during exercise. She denied weight loss or night sweats but complained of dyspnea on exertion and fatigue of 2-months’ duration. Her previous medical history was unremarkable except for an untreated mild generalized pruritis of 1-year duration.

Physical examination revealed a slim young woman who experienced moderate distress in the supine position marked by coughing and a feeling of impending doom. Secondary to her pruritis, she had numerous skin excoriations on the arms and trunk. She had no cervical, axillary, or inguinal lymphadenopathy. No edema or venous engorgement of the head, neck, or upper extremities was appreciated. The heart sounds were remarkable for a nonradiating, grade II/VI systolic murmur in the aortic area. The lungs were clear, and the remainder of the examination was unremarkable. Pulsus paradoxus of 12 mmHg was noted.

The chest x-ray revealed a mediastinal mass 15 cm on the posterior-anterior projection (Figure 1). The mass entirely obliterated the anterior car-

Figure 1
Chest x-ray

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497
diac margins, portions of the hila, and the tracheal air column showed a 3-cm posterior displacement. The right and left mainstem bronchi were visualized, lungs were expanded, and the pulmonary vasculature was normal. Computed axial tomography (CAT) of the chest showed a large mass measuring 15 cm transverse by 8 cm in the lateral dimension and extending from the thoracic inlet to the level of the anterior superior pericardial border (Figures 2 and 3). The trachea, mainstem bronchi, superior vena cava, and pulmonary artery were visualized and though each structure was encircled by tumor, there did not appear to be any invasion or compression.

Preoperatively, pulmonary function tests (PFTs) including upright and supine flow volume loops were obtained (Figure 4). Bronchodilators were not used as the improvement with them is usually to be marginal with the pathology involved. PFTs revealed a forced expiratory volume at 1 second (FEV₁) of 2.2 L (75% of predicted), a forced vital capacity (FVC) of 2.5 L (68% of predicted), and an FEV₁/FVC ratio of 88%, suggestive of a moderate restrictive ventilatory defect. Flow-volume loops demonstrated a reduction in vital capacity and expiratory flow rates. The expiratory limb did not disclose any significant change between the supine and upright positions. The inspiratory limb revealed a mild diminution and flattening with a marked concavity in the supine position. This concavity may indicate partial intrathoracic obstruction. Also of note was the ratio of forced expiratory flow at 50% to forced inspiratory flow (FIF) at 50% (FEF₅₀/FIF₅₀) of 1.6. A ratio of less than one is normal, whereas a ratio greater than one suggests an extrathoracic obstruction.¹⁰

Excisional biopsy for tissue diagnosis was planned through a left parasternal mediastinotomy.
under general anesthesia. The patient was premedicated with 1.5 mg of intravenous midazolam. On arrival to the operating room, the patient's heart rate was 98 BPM and blood pressure 104/50 mmHg. In addition to routine monitoring, a left radial arterial catheter was inserted. Induction was performed with 0.07 mg/kg midazolam, 1 μg/kg fentanyl, and incremental doses of propofol totaling 1.6 mg/kg, allowing continued spontaneous ventilation. With the patient supine, a no. 3 LMA was placed in the usual fashion and positioned without difficulty. Anesthesia was maintained with a propofol infusion at 100 μg/kg per minute and a 1:1 mix of N₂O and oxygen with the patient breathing spontaneously throughout the procedure. The tidal volume ranged from 300-450 cc with an end-tidal CO₂ of 40-42 and an oxygen saturation of 98-100%.

The incision was made over the third intercostal space just to the left of midline. Several biopsies were obtained. Surgical time was 76 minutes, and at the end of the case the LMA was removed when the patient opened her eyes to command. The patient was taken to the postanesthesia care unit where she had an uneventful recovery. Biopsies revealed nodular sclerosing Hodgkin’s disease. Subsequently she received both radiation and chemotherapy. At this writing, she is in remission.

Discussion

Although relative frequency varies with age, the most common etiology of an anterior mediastinal mass is thymoma, thymomegaly, teratoma or lymphoma. These patients present a variety of challenges to the anesthesia provider. The primary hazards include cardiovascular collapse (secondary to the compression of the superior vena cava, pericardium, or pulmonary artery) and complete or partial airway obstruction resulting from airway narrowing by tumor compression or invasion. Cardiorespiratory collapse can occur suddenly during induction or maintenance of an anesthetic.

Alternatives to general anesthesia include CAT guided biopsy or local anesthesia. In this case the former option was rejected because pathologists believed the tissue yield would be inadequate for accurate diagnosis and the latter because the amount of dissection required would be too extensive. Preoperative radiation was suggested to reduce tumor size, but because of its deleterious effects on tissue histology, the idea was rejected. In the absence of tissue diagnosis it is often difficult to justify empiric therapy when this may actually delay definitive diagnosis and appropriate treatment.

Multiple references and texts encourage the use of spontaneous ventilation in a patient with a mediastinal mass. Breathing spontaneously can “tent” airways open in two ways. First, the maintenance of both intrinsic chest wall and bronchial muscle tone will counter airway compression. Secondly, spontaneous diaphragmatic movement preserves the normal transpleural pressure gradient which dilates airways and acts as an opposing force to mass compression on the tracheal-bronchial tree. In this patient group there have been many reports of sudden death secondary to loss of the airway after induction of general anesthesia and/or paralysis, both of which ablate these tenting effects.

We feel that the use of the LMA offers an alternative approach to airway management of these patients. Most importantly, it allows spontaneous respiration via a comparatively noninvasive route. A face mask is a viable alternative but, because of surgical location, access to the head is often a major issue. The LMA offers ready-access to the airway without the often cumbersome paraphernalia associated with a face mask. Spontaneous ventilation can be maintained with an endotracheal tube (ETT) but tracheal intubation can, in itself, precipitate complete airway obstruction. The ETT can contact the mass forcing it into the airway, cause bleeding, or the distal end of the ETT can be blocked by abutting an acute angle in the trachea caused by mass compression.

In our practice the LMA can be inserted with lighter levels of anesthetic than an ETT thereby allowing spontaneous ventilation even during the risky induction period. In instances of difficulty, the LMA can rapidly provide a clear airway. There are numerous reports of the LMA relieving hypoxia during failed intubation and in other life-saving circumstances. The hemodynamic perturbations also appear to be limited with use of the LMA. When used in conjunction with propofol (as in this case), the response to LMA insertion is minor with only a slight increase in mean arterial pressure.

The LMA avoids complications of tracheal intubation while maintaining airway control. It provides easy access should the need for intubation and more definitive airway management arise. A properly positioned LMA will guide the placement of an ETT directly through the vocal cords. Numbers three and four LMA allow the easy passage of a 6-mm ETT. In this fashion, the trauma and hemodynamic perturbations of laryngoscopy can also be avoided.

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(Cook Critical Care, Bloomington, Indiana) will also pass easily through a no. 3 or no. 4 LMA. However, the exchange catheter may be unsuitable for placing an ETT. Because of its rigidity, the catheter tends to pass into the esophagus. Its long length also makes it very difficult to detect endtidal CO₂ adding to the difficulty of confirming position.

A direct route for visualization with a fiberoptic bronchoscope is also available through the LMA providing an even higher success rate for intubation. By acting as an insulating conduit, an LMA allows the passage of the bronchoscope with minimal stimulation to the upper airway, thus avoiding the need for excessive sedation which could arrest spontaneous ventilation. The LMA has proven value in the event of airway obstruction in a patient undergoing diagnostic fiberoptic tracheobronchoscopy.

There are drawbacks with use of the LMA. If improperly placed, it may not yield direct access to the cords, and its actual placement may cause coughing and “buckling.” If the need for intubation presents, the LMA is not always conducive to ETT placement. Because the length of the LMA is comparable to most ETTs, one can literally run out of room in passing an ETT through the LMA. Actually taping two ETTs together to confer added length to the system has been described during intubation through an LMA. Should the need for intubation arise, it may be easier to simply remove the LMA and intubate conventionally. Intubating through the LMA may only be of benefit in the patient with a known difficult laryngoscopy.

Anesthetizing patients with an anterior mediastinal mass presents a variety of challenges to the anesthesiologist. Airway management is the paramount issue, and several options and back-up plans must be available to handle these patients safely. These secondary options can include those outlined above but should also contain alternatives, such as use of a rigid bronchoscope, the ability to alter the patient’s position to a point where mass compression is minimal, and the capability of cardiopulmonary bypass.

Spontaneous ventilation during general anesthesia represents a safe and tested approach to airway maintenance. With minimal physiologic trespass, the LMA allows spontaneous ventilation with the benefit of airway control and direct access should more invasive manipulations be necessary. It should be stressed that use of the LMA for this type of procedure is an advance use of the device and should not be utilized by the inexperienced. The LMA is a useful addition to our armamentarium when dealing with a mediastinal mass.

REFERENCES


AUTHORS

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This paper was a Grand Rounds presentation at the Annual Meeting of the Society of Cardiovascular Anesthesiologists in Philadelphia on May 10, 1995.
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References
Even as the 1996 AANA Annual Meeting fades into history, plans are in full swing for the 5th World Congress of Nurse Anesthetists to be held April 26-30, 1997 at the Hofburg Imperial Palace in Vienna, Austria.

A special invitation to AANA members to attend is extended by the Congress’ planners, including Ronald F. Caulk, CRNA, Executive Director of the International Federation of Nurse Anesthetists (IFNA). The IFNA organizes the Congress in conjunction with the Österreichischer Berufsverband für Anaesthesie und Intensivpflege.

Deadline for registration for the Congress is March 20, 1997. After that date registration will take place on site. The fee for those who register by December 1, 1996, is $300 USD for participants and $50 USD for those who accompany them; starting December 2, the fees are $350 USD for participants and $50 USD for those who accompany them.

The schedule for the Congress includes sessions on anesthesia in open heart surgery, transplantation, neurosurgery, traumatology, and emergency medicine; hygiene; blood management; pain; new agents and techniques; and intensive care. A session will also be held on the practice of nurse anesthesia worldwide that features presentations by representatives from Scandinavia, Switzerland, Zaire, and from developing countries such as Tunisia.

The $50 USD for those who accompany Congress attendees includes admission to the opening ceremony and concert, as well as a guided city tour of historic Vienna.

A full complement of special events during the Congress, as well as a side trip to Salzburg on May 1 and 2, has been planned to enable attendees and their guests to more fully explore the history and natural beauty of the Austrian countryside.

For an official program, meeting registration, hotel and travel reservation materials, and other information concerning the Congress, contact: Elisabeth Lottes, IFNA 1997, c/o Wiener Medizinische Akademie, Alser Strasse 4, A-1090 Vienna, Austria.
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2. Xylocaine 10% Oral Spray should be used with caution in patients with known drug sensitivities. Patients allergic to para-aminobenzoic acid derivatives (procaine, benzocaine, etc.) have not shown cross sensitivity to lidocaine.

3. Many drugs used during the conduct of anesthesia are considered potential triggering agents for familial malignant hyperthermia. Since it is not known whether amino-type local anesthetics may trigger this reaction and since the need for supplemental general anesthesia cannot be predicted in advance, it is suggested that a standard protocol for management should be available. Early unexplained signs of malignant hyperthermia, tachycardia, tachypnea, labile blood pressure, and metabolic acidosis may precede temperature elevation. Successful outcome is dependent on early diagnosis, prompt discontinuance of the suspect triggering agents and institution of treatment, including oxygen therapy, indicated supportive measures and dantrolene (consult dantrolene sodium intravenous package insert before using).

4. Information for Patients: When topical anesthetics are used in the mouth, the patient should be aware that the production of topical anesthesia may impair swallowing and thus enhance the danger of aspiration. For this reason, food should not be ingested for 60 minutes following use of local anesthetic preparations in the mouth or throat area.

5. This is particularly important in children because of their frequency of eating.

6. The safety and effectiveness of lidocaine depend on proper dosage, correct technique, adequate precautions, and readiness for emergencies. Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use. (See WARNINGS and ADVERSE REACTIONS.) The lowest dosage that results in effective anesthesia should be used to avoid high plasma levels and various adverse effects. Repeated doses of lidocaine may cause significant increases in blood levels with each repeated dose because of slow accumulation of the drug or its metabolites. Tolerance varies with the status of the patient. Sedated, elderly patients, acutely ill patients, and children should be given reduced doses commensurate with their age and physical status. Lidocaine should also be used with caution in patients with severe shock or heart block.

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3. Patients with Safety and effectiveness in children below the age of 12 years have not been established.

OVERDOSE

Acute emergencies from local anesthetics are generally related to high plasma levels encountered during therapeutic use of local anesthetics. (See ADVERSE REACTIONS, WARNINGS, and PRECAUTIONS.)

Management of Local Anesthetic Emergencies: The first consideration is prevention, best accomplished by careful and constant monitoring of cardiovascular and respiratory vital signs and the patient's state of consciousness after each local anesthetic administration. At the first sign of change, oxygen should be administered. The first step in the management of convulsions consists of immediate attention to the maintenance of a patent airway and assisted or controlled ventilation with oxygen and a delivery system capable of permitting immediate positive pressure airway mask. Immediately after the institution of these ventilatory measures, the adequacy of the circulation should be evaluated, keeping in mind that drugs used to treat convulsions sometimes depress the circulation when administered intravenously. Should convulsions persist despite adequate respiratory support, and if the status of the circulation permits, small increments of an ultra-short acting barbiturate (such as thiopental or thiamylal) or a benzodiazepine (such as diazepam) may be administered intravenously. The clinician should be familiar, prior to use of local anesthetics, with these anticonvulsant drugs. Supportive treatment of circulatory depression may require administration of intravenous fluids and, when appropriate, a vasopressor as directed by the clinical situation (e.g., epinephrine).

If not treated immediately, both convulsions and cardiovascular depression can result in hypoxia, acidosis, bradycardia, arrhythmias and cardiac arrest. If cardiac arrest should occur, standard cardiopulmonary resuscitative measures should be instituted.

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