INTRODUCTION:

Few topics in our specialty have inspired such dogmatic teaching, based on so little evidence, as the subject of anesthetic management of patients with an anterior mediastinal mass. There is no question that general anesthesia exacerbates mass effects within the chest (Table 1), but the precise mechanism(s) by which that occurs are less certain.

The landmark paper by Neuman, et al, based on case reports and logic (all that was available at the time), provided a management algorithm which has persisted for nearly 3 decades with little modification. This case conference shall strive to (1) concisely review the conventional teaching on this topic, (2) summarize the evidence basis, and (3) provoke a reevaluation of those recommendations, with an appreciation of the level of uncertainty and of the unanswered questions which remain.

Table 1. Anesthetic Risks Associated with Large Anterior Mediastinal Mass

- Obstruction of Major Airway
- Cardiac Compression (Tamponade effect)
- Compression of Pulmonary Artery or RVOT
- SVC Compression (SVC Syndrome)

MECHANISMS:

Induction of general anesthesia is often treated as a single event, when in fact it often involves several transitions:

1. Upright posture to supine position
2. Awake state to anesthetized state
3. Spontaneous negative pressure ventilation to positive pressure mechanical ventilation
4. Unparalyzed to paralyzed muscular tone

Mechanistically, each transition may be considered individually, and each bridge crossed sequentially in a so-called “staged induction”. While # 1 and #2 clearly reduce FRC, the mechanisms by which #3 and #4 exacerbate airway compression are less well defined.
INDUCTION OPTIONS:

Options for anesthetic induction depend on perceived risk, and include the following:
- No Induction (Local)
- Awake F.O.B / Intubate Distal to Stenosis before Induction
- Staged IV or Inhalational Induction
- Standard IV Induction

RISK ASSESSMENT:

Conventional teaching directs the clinician to judge risk based on data from the sources in Table 2, with the greatest emphasis on the presence of postural symptoms and radiographic evidence of a large AMM with encroachment on vital structures. Limited guidance is available for delineating levels of perceived risk.

Table 2. Risk Assessment for Patients with Anterior Mediastinal Mass

- Symptoms / Signs
- Radiographic Data (esp. CT Scan)
- Spirometry (esp. PEFR)
- Echocardiography (if suspected cardiac / vascular compression)

Acknowledging the uncertainties of risk stratification, one can generally identify patients as low, intermediate, or high risk (Table 3). It is appropriate for less experienced practitioners to err on the conservative. When general anesthesia cannot be avoided, the following modified algorithm is proposed based on perceived risk.
Legend: Proposed algorithm for the anesthetic approach to the patient with an AMM and threatened airway. Dashed red lines indicate response to a nonreassuring finding (such as difficulty ventilating, or worrisome finding on bronchoscopy). Green solid lines indicate response to reassuring findings. Staged induction implies the stepwise progression through each potentially exacerbating transition. Imprecision in risk assessment is acknowledged. Therefore, rescue maneuvers (Table 4) should be readily available. From Hartigan PM (Editor). Practical Handbook of Thoracic Anesthesia. Springer, 2012.
Table 3. Potential High Risk Criteria

- Significantly symptomatic (esp. orthopnea)
- Large mass by CT scan (esp. midline, distal tracheal)
- Tracheal compression to < 50% of predicted cross sectional area (children)
- PEFR < 50% predicted (children)
- SVC syndrome
- Pericardial effusion

Table 4. Rescue Options for Airway Compression from AMM

- Advance ETT to stent open the stenotic portion of airway
- Revert to prior stage (resume spont ventilation, upright posture, lighten anesthetic, etc.)
- Reposition lateral or semiprone
- Rigid bronchoscopy beyond stenosis (jet or sideport ventilation)
- CPB / ECMO if preemptively cannulated

EVIDENCE BASIS

Case reports and series constitute the principal primary literature on this topic. By their nature, they rely on recollections from stressful moments. The vast majority are pediatric patients. Complications do not invariably occur with induction, and have been reported late in the course of anesthetics, during emergence, and in the recovery period. Complications have been reported in patients who were asymptomatic, and in patients maintaining spontaneous respiration and without muscle relaxation. A limited number of studies in children have attempted to provide guidance for risk stratification based on criteria such as tracheal cross sectional area, but are of questionable applicability to adult patients.

CARDIOVASCULAR COMPRESSION

When the principle threat is to venous return and cardiac output (compression of heart, RVOT, PA, SVC), induction (if necessary) should be performed with augmentation of preload, and positioning to minimize compression of heart/vessels. Lower extremity IV access is needed if SVC compression is a risk. Spontaneous ventilation augments venous return and should be preserved in high risk patients.

Coexisting pericardial effusion clearly increases risk. Logically, any other impediment to venous return (hypovolemia, large pleural effusion, etc.) would be expected to increase induction risk. Cardiovascular compression may coexist with airway compression with a large AMM.

Should CV collapse occur, repositioning lateral may help to off-load the heart/vessels, as will emergent sternotomy. Preemptive awake, femoral cannulation for CPB is a very conservative approach, but reliance on emergent cannulation as a rescue maneuver is not recommended.
5. Blank RS, deSouza DG. Anesthetic management of patients with an anterior mediastinal mass: Continuing professional development. Can J Anaesth 2011; Published online by Springer.