

Lung Cancer

Lung cancer is the leading cause of cancer deaths. Anesthetic considerations are predominantly based on the following factors: location of tumor burden, underlying lung function, presence of paraneoplastic syndromes, and the general health of patient. Alternatively, can use 4 "M"s approach described by Miller 7th (Table 59-3).

ANESTHETIC CONSIDERATIONS:

- Location of tumor burden
 - Large vs peripheral airways vs. mediastinal mass
 - Resectability of lesion (wedge resection vs. lobectomy vs. pneumonectomy)
 - Implication for regional procedures
 - Surgical approach and complications (VATS vs. thoracotomy vs. mediastinoscopy)
- Underlying pulmonary function
 - Can patient tolerate one-lung ventilation, pneumonectomy, etc.
- Presence of coexisting paraneoplastic syndrome
- Side effects of cancer therapies (chemotherapy, radiation)
- Adrenal suppression related to systemic corticosteroids (may require stress dose)
- Increased risk of venous thromboembolism
- Comorbid medical conditions

ANESTHETIC CONSIDERATIONS (4 "M"s, ALTERNATE):

- **Mass effects**
 - Obstructive pneumonia, lung abscess, superior vena cava syndrome, tracheobronchial distortion, Pancoast's syndrome, recurrent laryngeal nerve or phrenic nerve paresis, chest wall or mediastinal extension
- **Metabolic effects**
 - Lambert-Eaton syndrome, hypercalcemia, hyponatremia, Cushing's syndrome
- **Metastases**
 - Particularly brain, bone, liver, adrenal
- **Medications**
 - Chemotx agents, pulmonary toxicity (bleomycin, mitomycin C), cardiac toxicity (doxorubicin), renal toxicity (cisplatin)

ANESTHETIC GOALS:

- Thorough pre-operative work-up and investigations
- Strict aseptic technique
- Maintain perioperative hemodynamic stability
- Preserve lung function and cardiorespiratory status post-operatively

HISTORY

- Enquire about underlying symptoms of cough, wheezing, stridor, and degree of hemoptysis if present
- Be wary of patient with SOB lying down... concern re: mediastinal mass
 - Mediastinal masses may also have hoarseness related to recurrent laryngeal nerve compression, SVC syndrome, arrhythmias, CHF (pericardial effusion and tamponade)
- Previous pneumonias and antimicrobial therapy
- Previous resections, surgeries and therapy (chemotx, radiotx, etc.)
- Current smoking status

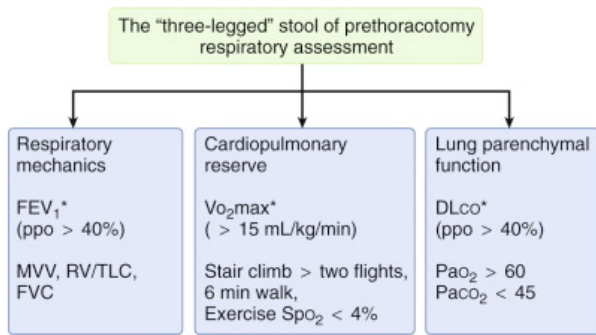
PHYSICAL

- General appearance and health
- Full Vital Signs
- Particular attention to cardiorespiratory status
 - ?Difficult a/w
 - Presence and current degree of pulmonary embarrassment (wheezes, cough, stridor, hoarseness, hemoptysis, etc.)
 - Symptoms when lying supine and other signs of symptomatic mediastinal mass
 - Concern for arrest on induction of GA and unable to intubate/ventilate patient due do compression of large airways/trachea
 - Distended neck veins, etc. indicating SVC syndrome

INVESTIGATIONS

- Bloodwork – general panel with particular attention to coagulation status, metabolic derangements secondary to malnourishment or paraneoplastic syndromes
- ECG – R heart strain, RAD, P pulmonale, arrhythmias (Afib, MAT, etc.), low voltages/electrical alternans (effusion/tamponade)
- CXR – mass location, mediastinal encroachment, atelectasis, pneumonia, blebs/pneumothorax, large PA arteries on lateral (pulmonary arterial hypertension – PAH), pleural effusions
- CT chest – (see CXR)
 - +/- CT of other areas for tumor staging, mets, etc.
- PFTs – especially FEV1, FVC, MVV, RV/TLC ratio
- Sputum analysis – for cytology
- +/- Bronchoscopy (with washings, brushings, biopsies, etc.) for diagnosis
- +/- Echo – ?pericardial effusions, PAH, etc.
- +/- R heart cath - ?PAH

LUNG REDUCTION SURGERY/ THORACOTOMY ASSESSMENT (RISK OF POSTOPERATIVE VENTILATION):



Mechanics:

- Predicted postoperative FEV1 <30% (high risk; less risk if VATS or thoracic epidural technique); 30-40% (intermediate risk); >40% (low risk)
- RV/TLC ratio > 50%
- Absolute FEV1 <0.8 (used to be absolute contraindication to lung resection but now, controversial)
- FVC <50% predicted or <1.5cc/kg
- Absolute VC <2L
- MVV <50% predicted

Cardiopulmonary Reserve:

- VO₂ max <15mL/kg/min by laboratory exercise testing
- 6 minute walk test <610m correlates with VO₂ max <15cc/kg/min

Parenchymal Function:

- ABG PaO₂ <60mmHg or PaCO₂ >46mmHG on FiO₂ 0.21
- DLCO <80% predicted consider VQ scintigraphy
- DLCO <40% associated with high risk of postoperative complications
- DLCO <20% associated with unacceptably high rate of perioperative mortality

OPTIMIZATION

- Try to ensure pt at baseline function
- Bronchodilators pre-op
- Usual analgesia pre-op
- Avoid excessive sedation pre-op as may have tenuous pulmonary status
- Optimized paraneoplastic syndrome

ANESTHETIC OPTIONS

- Local
 - Consideration if tenuous pulmonary status and just performing small open peripheral lung biopsy (alternative would be radiologically-guided FNA)
- Regional
 - Epidural or paravertebral blocks if thoracotomy
 - Intercostal nerve block if VATS or unplanned thoracotomy (may do epidural after awake if unplanned thoracotomy)
- General – majority
 - Double lumen oral endotracheal intubation for lung isolation/OLV

ANESTHETIC SETUP

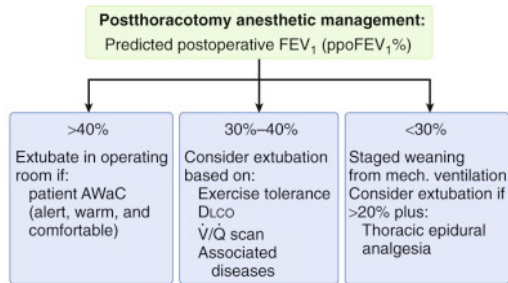
- Usual emergency drugs
 - Consider iNO, prostacyclins, phosphodiesterase inhibitors, etc. if PAH
- Double lumen tubes (or bronchial blockers, etc.) of varying sizes
- Arterial line – awake or asleep depending on pre-op status
 - Left radial A-line and pulse oximeter on right if mediastinoscopy (due to potential brachiocephalic trunk/innominate artery compression)
- 2 large bore IVs
- Consider central line – depending on pre-op status/function and intra-op hemodynamic monitoring/infusion requirements
- Chest tube tray, large angiocatheter and appropriate equipment in room if emergent chest decompression needed (i.e. if patient has underlying bullae)
 - If underlying pneumothorax (PTX), consider chest tube *before* induction (i.e. have discussion with surgeon as to optimal management)
 - However, chest tube may effectively cause bronhopleuralcutaneous fistula and may be the path of least resistance and significant loss of tidal volumes
 - Just make sure chest tube isn't clamped before induction (i.e. risk tension PTX)

MANAGEMENT OF ANESTHESIA

- **Induction**
 - Technique based on underlying location of tumor
 - Spontaneous ventilation for mediastinal masses
 - Awake fiberoptic intubation if difficult airway
 - Consideration for one-lung ventilation/lung isolation (double-lumen tube, Univent, bronchial blocker, etc.)
 - Considerations for pulmonary hypertension if present
- **Maintenance**
 - Balanced anesthesia with volatiles, opioids and neuromuscular blockade
 - Avoidance of nitrous, especially if underlying blebs/pneumothoraces
 - Consideration for FiO₂ 1.0, CPAP (<10cm H₂O) to non-ventilated lung, PEEP (<10cm H₂O) to dependent lung, etc. if necessary and one lung ventilation

- **Emergence**

- Some may require post-operative ventilation depending on pre-existing pulmonary function and degree of lung resection



- Maintain head-flexed if tracheal resection (may need sutures from mentum to chest wall)

DISPOSITION & MONITORING

- Consider high intensity obs unit/ICU

COMPLICATIONS

Hemorrhage

- Can be encountered with mediastinoscopy

Brachiocephalic artery compression

- Compression from mediastinoscope
- Detected by loss of pulse oximetry on right hand
- May lead to hypoperfusion on right common carotid
- Notify surgeon immediately to relieve compression
- Be wary of post-operative neurologic dysfunction secondary to this complication

Pneumothorax

- Usual signs/symptoms
- Needle decompression and chest tube insertion

Bradycardia

- Due to stretching of vagus or tracheal compression by mediastinoscope
- Notify surgeon +/- vagolytic

PATHOPHYSIOLOGY

- Non-small cell lung cancer (squamous cell, adenocarcinoma, large cell) – 75% of new cases lung Ca
 - Squamous cell carcinoma
 - Typically arises in major bronchi or their primary divisions
 - Tend to grow slowly
 - Adenocarcinomas
 - Usually arise in lung periphery
 - May have subpleural nodules and have tendency to invade pleura
- Small-cell carcinomas
 - Central bronchial origin with early lymphatic invasion
 - Often prominent mediastinal lymphadenopathy
 - Marked propensity to produce polypeptides and ectopic hormones (i.e. *paraneoplastic syndromes*)

REFERENCES

- Stoelting's Coexisting 5th, Barash 6th, Miller 7th