THORACIC ANESTHESIA BLOCK

THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF CANADA
Objectives of Training and Specialty Training Requirements in Anesthesia

Specific Objectives in CanMEDS Format

ROTATION OBJECTIVES
At the completion of training, the resident will have acquired the following competencies and will function effectively as:

Medical Expert/Clinical Decision-Maker

General Requirements
The resident will:
- Demonstrate knowledge of general internal medicine with particular reference to the cardiovascular, respiratory, renal and coagulation systems, blood transfusion, fluid, electrolyte and acid-base balance.
- Demonstrate knowledge of the principles and practice of anesthesia as they apply to patient support during thoracic surgery.
- Demonstrate competence in BCLS, ACLS and ATLS.

Specific Knowledge Requirements
The resident will demonstrate knowledge and competence in the following:
- Anatomy/Physiology (Thoracic cavity, Airway, Mediastinum, Pulmonary vasculature, Bronchial vessels, Lymphatic system, Work of breathing, Physiology of lung collapse, Cough reflex)
- Preoperative evaluation of the patient undergoing thoracic surgery, including:
  - History (Dyspnea, Cough, Cigarette smoking, Exercise tolerance, Risks factors for acute lung injury: Preoperative alcohol abuse, Pneumonecctomy, Intraoperative high ventilatory pressures and excessive amounts of fluid administration).
  - Physical examination (Respiratory pattern, Respiratory rate and pattern, Breath sounds).
  - Diagnostic studies (EKG, CXR, ABG).
  - Assessment of respiratory function (Respiratory mechanics and volumes: Spirometry, Flow-volume loops; Lung parenchymal function: Diffusing capacity for carbon monoxide; Cardiopulmonary interaction: Maximal oxygen consumption; Ventilation-Perfusion scintigraphy, Split-lung function studies).
Concomitant medical conditions, including:
  - Cardiovascular disease – cardiac complications represent the second most common cause of perioperative M&M in the thoracic surgical population (Ischemia, Arrhythmia).
  - Age – rate of respiratory complications are double and cardiac complications are triple in elderly patients undergoing thoracotomy, when compared to younger patients.
  - Renal dysfunction after pulmonary resection is associated with a perioperative mortality rate of 19%.
  - COPD (Respiratory drive – elevated PaCO2 at rest, Nocturnal hypoxemia, Right ventricular dysfunction, Bullae, Flow limitation, Auto-peep).
  - Restrictive pulmonary disease.
  - Primary thoracic tumors (Tobacco smoke is responsible for 90% of all lung cancers).
    - Non-small cell lung cancer (Squamous cell carcinoma, Adenocarcinoma, Large cell undifferentiated carcinoma)
    - Small cell lung cancer
    - Carcinoid tumors
    - Pleural tumors
  - Anesthetic considerations in lung cancer patients (Mass effects, Metabolic effects, Metastases, Medications, Intrathoracic metastatic manifestations, Extrathoracic metastatic manifestations, Extrathoracic nonmetastatic manifestations).

Preoperative preparation of the patient undergoing thoracic surgery, including:
  - Premedication
  - Treat bronchospasm, atelectasis, infection and pulmonary edema preoperatively
  - Hydration and removal of bronchial secretions, physiotherapy, smoking cessation

Monitoring during thoracic anesthesia.
  - Oxygenation (pulse oximetry, ABGs), Capnometry, invasive hemodynamic monitoring (Arterial line, CVP, PAC, TEE, Continuous spirometry).

Positioning (Lateral position).
  - Neurovascular injuries, physiologic changes in ventilation and perfusion.

Physiology of One - Lung Ventilation.
  - Lateral position, awake, breathing spontaneously, chest closed.
  - Lateral position, awake, breathing spontaneously, chest open.
  - Lateral position, anesthetized, breathing spontaneously, chest closed.
  - Lateral position, anesthetized, breathing spontaneously, chest open.
One Lung Ventilation.
  - Indications, methods of lung separation.
    - Double-lumen tubes (Design, Size selection, Insertion methods, Positioning, Complications, Contraindications), Univent tube, Bronchial blockers.
  - Management and Strategies to Improve Oxygenation during One-Lung Ventilation.
    - FiO2 of 1.0, Ventilate with a TV of 6-8ml/kg, Plateau airway pressure < 25cm H2O, verification of tube position, optimize hemodynamics, maintenance of normocapnia, recruitment maneuver of ventilated lung to eliminate atelectasis, dependent-lung PEEP, selective nondependent-lung CPAP, differential PEEP/CPAP, intermittent two lung ventilation, TIVA, selective nondependent-lung high-frequency ventilation, clamping the PA of non-ventilated lung.

Anesthetic Management and Techniques.
  - General anesthesia, Regional anesthesia, combined epidural blockade and general anesthesia, fluid management, nitrous oxide, temperature, prevention of bronchospasm, CAD.

Hypoxic Pulmonary Vasoconstriction.
  - Mechanisms, effects of anesthetics, nitric oxide.

Anesthetic Management for Common Surgical Procedures
  - Flexible fiberoptic bronchoscopy, rigid bronchoscopy (Apneic oxygenation, Apnea and intermittent ventilation, Sanders injection system, Mechanical ventilator, HFPPV), Mediastinoscopy, VATS, Thoracotomy, complications, postoperative concerns.

Anesthesia for Patients undergoing Bronchoalveolar Lavage
  - Treatment for symptomatic pulmonary alveolar proteinosis, intraoperative management.

Anesthesia for Patients with Bronchopleural Fistula and Empyema (etiology, surgical management, ventilation, anesthetic management).

Anesthetic Implications of Spontaneous Pneumothorax Anesthesia for Patients undergoing Bullectomy and Volume Reduction Pneumoplasty.
  - Surgery, anesthetic considerations, postoperative ventilation.

Anesthesia for Patients undergoing Decortication and Pleurodesis Procedures.
  - Clinical features, anesthesia management.

Anesthesia for Patients Undergoing Esophageal Surgery.
Esophagoscopy, Zenker's Diverticulum, Achalasia, Hiatus Hernia, Esophagectomy.

- Anesthesia for Patients Undergoing Laser Surgery of the Airway.
  - Physics of lasers, laser surgery of the airway, intraoperative considerations, complications.

- Anesthesia for Patients Undergoing Lung Transplantation.

- Anesthesia for Patients Undergoing Tracheal Resection and Trancheobronchial Reconstruction.
  - Surgical considerations, perioperative management issues, modes of ventilation.

- Anesthesia for Patients undergoing Urgent Surgery.
  - Anesthesia for patients with massive hemoptysis, anesthesia for patients undergoing removal of foreign body from the airways, anesthesia for patients undergoing endoscopy for ingested foreign bodies.

  - Respiratory failure and management of postoperative mechanical ventilation, atelectasis, pneumothorax, cardiac herniation, cardiac ischemia and arrhythmias, low cardiac output syndrome, hemorrhage, nerve injuries (Brachial plexus, Sciatic nerve, Peroneal nerve).

- Postoperative Pain Management.
  - Systemic analgesia (PCA – Opioids, NSAIDS, Ketamine, Dexmedetomidine, Pregabalin/gabapentin), local anesthetics/nerve blocks (Intercostal nerve blocks, Intrapleural analgesia, Thoracic paravertebral block, Epidural analgesia).
shoulder pain, post-thoracotomy neuralgia and chronic incisional pain, management of opioid tolerant patients (Multimodal analgesia).

- **Technical Skills.**
  - Be proficient in the provision of thoracic epidural analgesia for upper abdominal and thoracic surgical procedures
  - Be skilled in airway management for bronchoscopy, mediastinal masses and one-lung ventilation
  - Be skilled in starting large bore intravenous infusions, arterial lines, CVP and PA lines in thoracic surgical patients.

**Communicator**

The resident will:
- demonstrate effective communication with patients and families of description of procedures, informed consent and anesthetic options and risks.
- demonstrate effective communication with OR team (thoracic surgeons, nurses and other members of the health care team) and postoperative team (ICU, PACU).
- provide clear and concise written consultation and anesthetic records.

**Collaborator**

The resident will:
- seek perioperative consultation with colleagues when required.
- contribute effectively to other interdisciplinary team activities.
- demonstrate ability to function in the clinical environment using the full abilities of all team members.

**Manager**

The resident will be able to:
- manage OR time by efficiently conducting the anesthetic, continuing education and personal activities.
- utilize information technology to optimize patient care and lifelong learning.

**Health Advocate**

The resident will be able to:
- provide patient advocacy for various perioperative issues (i.e., patient safety, analgesia, postoperative monitoring).
Scholar
The resident will:
- demonstrate commitment to continuing personal education.
- be able to critically review thoracic anesthesia literature and describe the principles of research relevant to this population.
- assist in education of other members of the OR team.

Professional
The resident will:
- demonstrate a sense of responsibility, integrity, honesty and compassion when caring for patients.
- demonstrate respect for patients and colleagues.
- deliver highest quality care to patients.
- practice medicine ethically consistent with the obligations of a physician.
- respect the opinions of fellow consultants and referring physicians in the management of patient problems and be willing to provide means whereby differences of opinion can be discussed and resolved.
- show recognition of limits of personal skill and knowledge by appropriate consulting other physicians and paramedical personnel when caring for the patient.

READING LIST
Recommended Material:
4. Respiratory Physiology; Chapter 15; p.361-392; Miller’s Anesthesia (7th Edition); 2010.
5. Pulmonary Pharmacology; Chapter 22; p.561-594; Miller’s Anesthesia (7th Edition); 2010.
6. Nitric Oxide and Inhaled Pulmonary Vasodilators; Chapter31; p. 941-956; Miller’s Anesthesia (7th Edition); 2010.
7. Anesthesia for Thoracic Surgery; Chapter 59; p.1819-1887; Miller’s Anesthesia (7th Edition); 2010.
8. Respiratory Care; Chapter 93; p. 2879-2898. Miller’s Anesthesia (7th Edition); 2010.
10. Seminars in Cardiothoracic and Vascular Anesthesia.
11. Anesthesiology Clinics; Volume 26, Issue 2, Pages 241-398 (June 2008); Thoracic Anesthesia; Edited by Peter Slinger.

Updated: August 2011, Dr. Granton & Dr. Nicolaou