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

WESTERN UNIVERSITY'S THORACIC ANESTHESIA BLOCK: SPECIFIC OBJECTIVES IN CanMEDS FORMAT

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

1) MEDICAL EXPERT

Definition: **As Medical Experts, physicians integrate all of the CanMEDS Roles, applying medical knowledge, clinical skills, and professional attitudes in their provision of high-quality and safe patient-centred care. Medical Expert is the central physician Role in the CanMEDS framework and defines the physician's clinical scope of practice.**

- Practice medicine within their defined clinical scope of practice and expertise
  - Carry out professional duties in the face of multiple, competing demands
  - Recognize and respond to the complexity, uncertainty, and ambiguity inherent in medical practice
- Perform a patient-centered clinical assessment and establish management plans appropriate for their specialty
- Plan and perform interventions for the purpose of assessment and/or management
  - Obtain and document informed consent, explaining the risks and benefits of, and the rationale for, the proposed options
  - Prioritize procedures, taking into account clinical urgency, potential for deterioration, and available resources
  - Perform procedures in a skillful and safe manner, adapting to unanticipated findings or changing clinical circumstances
- Recognize when care should be transferred to another physician or health care provider
- Recognize and respond to adverse events and near misses
- Contribute to a culture that promotes the continuous improvement of health care quality and patient safety
- Demonstrate knowledge and competence in the following:
  - 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**
  - **Pulmonary Anatomy and Physiology**
    - Thoracic cavity
    - Airway
    - Mediastinum
    - Pulmonary vasculature
    - Bronchial vessels

- Lymphatic system
- Work of breathing
- Physiology of lung collapse
- Cough reflex
- Definitions
    - Alveolar-arterial O2 gradient
    - Shunt fraction
    - Ventilation/perfusion match

- **Preoperative Evaluation of the Patient Undergoing Thoracic Surgery**
    - ***History***
        - Dyspnea
        - Cough
        - Cigarette smoking
        - Exercise tolerance
        - Risks factors for acute lung injury
            - Preoperative alcohol abuse
            - Pneumonectomy
            - 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**
    - Cardiovascular Disease – cardiac complications represent the second most common cause of perioperative M& M in the thoracic surgical population
        - Ischemia
        - Arrhythmia
    - Acute and chronic respiratory failure
    - 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%
- Obstructive lung diseases
    - COPD
        - Work of breathing increases
        - Lung volumes (RV, FRC, TLC) are increased
        - FEV1 decreases
        - FEV1/VC ratio is decreased
        - Respiratory drive – elevated PaCO2 at rest
        - Nocturnal hypoxemia
        - Right ventricular dysfunction
        - Bullae
        - Flow limitation
        - Auto-peep
    - Asthma
- Restrictive pulmonary disease
- Primary thoracic tumors
    - Tobacco smoke is responsible for 90% of all lung cancers
    - Classification
        - 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 non - metastatic manifestations

Preoperative Preparation of the Patient Undergoing Thoracic Surgery

- Premedication
- Treat bronchospasm, atelectasis, infection , pulmonary edema and pulmonary hypertension 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
  - FloTrac

- **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
  - Lateral position, anesthetized, paralyzed, chest open
  - Lateral position, OLV, anesthetized, paralyzed, chest open

- **One Lung Ventilation**
  - Indications
  - Methods of Lung Seperation
    - 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 hemodymanics
  - 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
  - Management of Cor Pulmonale

- **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

- **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
    - Management of airway fires
  - Complications

- **Anesthesia for Patients Undergoing Lung Transplantation**
  - Pathophysiology of the transplanted lung
  - Preoperative assessment and patient selection
  - Donor selection and procurement
  - Preoperative preparation
  - Postoperative analgesia
  - Operation for single-lung transplantation
  - Bilateral sequential single-lung versus double-lung transplantation
  - Postoperative management

- **Anesthesia for Patients with Mediastinal Masses**
  - Causes
  - Signs and symptoms
  - Diagnostic evaluation
    - Flow-volume loop
      - Extrathoracic variable lesion reduces the area of inspiratory limb.
      - Intrathoracic variable lesion reduces the area of expiratory limb
  - Anesthetic implications and management
    - Airway obstruction
    - Vascular/cardiac compression
    - Superior vena cava syndrome
    - Keep the patient spontaneously breathing
    - Be prepared to manage complete airway obstruction upon induction of general anesthesia

- **Anesthesia for Patients with Thoracic Outlet Syndrome**

- **Anesthesia for Patients undergoing Thymectomy: Myasthenia Gravis**
  - Clinical features
  - Medical therapy
  - Anesthetic considerations
  - Postoperative concerns and respiratory failure

- **Myasthenic Syndrome**

- **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

- **Complications of Thoracic Surgery and their Management Strategies**
  - 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.

2) COMMUNICATOR

Definition: **As Communicators, physicians form relationships with patients and their families that facilitate the gathering and sharing of information essential for exemplary health care.**

- Communicate using a patient-centered approach that encourages patient trust and autonomy and is characterized by empathy , respect and compassion
- Optimize the physical environment for patient comfort, dignity, privacy, engagement, and safety
- Demonstrate effective communication with patients and families of description of procedures, informed consent and anesthetic options and risks
- Elicit and synthesize accurate and relevant information along with the perspectives of patients and their families
- Engage patients and others in developing plans that reflect the patient's health care needs and goals
- Demonstrate effective communication with OR team (thoracic surgeons, nurses and other members of the health care team) and postoperative team (ICU, PACU)
- Document and share written and electronic information about the medical encounter in an accurate, complete, timely, and accessible manner, in compliance with legal and regulatory requirements in order to optimize clinical decision-making, patient safety, confidentiality and privacy.

3) COLLABORATOR

Definition: **As Collaborators, physicians work effectively with other health care providers to provide safe, high-quality patient care**.

- Work effectively with other physicians and other health care professionals to prevent misunderstandings, manage differences, and resolve conflicts
- Engage in respectful shared decision-making
- Seek perioperative consultation with colleagues when required
- Effectively and safely hand over care, using both verbal and written communication, to an appropriate health care professional.

4) LEADER

Definition: **As Leaders, physicians develop, in collaboration with other health care leaders, a vision of a high-quality health care system and take responsibility for effecting change to move the system toward the achievement of that vision**.

- Contribute to the improvement of health care delivery in health care teams, organizations, and systems
- Utilize information technology to optimize patient care and safety
- Engage in the stewardship of health care resources

- Demonstrate leadership in professional practice
- Manage their practice and career
  - Set priorities and manage time to balance practice and personal life
  - Manage career planning, finances, and health human resources in a practice
  - Implement processes to ensure personal practice improvement.

5) HEALTH ADVOCATE

***Definition*: As Health Advocates, physicians responsibly contribute their expertise and influence to improve health by working with the patients, communities, or populations they serve to determine and understand needs, develop partnerships, speak on behalf of others when needed, and support the mobilization of resources to effect change.**

- Respond to individual patients' complex health needs by advocating with them in the clinical or extra-clinical environment
- Provide patient advocacy for various perioperative issues (i.e., patient safety, analgesia, postoperative monitoring).

6) SCHOLAR

***Definition*: As Scholars, physicians demonstrate a lifelong commitment to excellence in practice through continuous learning, the teaching of others, the evaluation of evidence and other resources, and contributions to scholarship.**

- Engage in the continuous improvement and enhancement of their professional activities through ongoing learning
- Facilitate the learning of students, residents, other health care professionals, the public and other stakeholders
- Integrate best available evidence, contextualized to specific situations, and integrate it into real-time decision-making
- Critically evaluate the integrity, reliability, and applicability of health-related research and literature
- Contribute to the dissemination and/or creation of knowledge and practices applicable to health.

7) PROFESSIONAL

***Definition:* As Professionals, physicians are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behaviour, commitment to the profession, profession-led regulation, and maintenance of personal health.**

- Demonstrate a commitment to patients by applying best practices and adhering to high ethical standards
  - Exhibit appropriate professional behaviours and relationships in all aspects of practice, reflecting responsibility, honesty, integrity, commitment, compassion, respect, altruism, respect for diversity, and maintenance of confidentiality

  - Demonstrate a commitment to excellence in all aspects of practice and to active participation in collaborative care
- Demonstrate a commitment to society by recognizing and responding to the social contract in health care
  - Demonstrate a commitment to maintaining and enhancing competence
- Demonstrate a commitment to the profession by adhering to standards and participating in physician-led regulation
- Demonstrate a commitment to physician health and well-being to foster optimal patient care
- 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.

RECOMMENDED READING MATERIAL TO BE COVERED BY RESIDENTS DURING THEIR THORACIC ANESTHESIA ROTATION

1. Respiratory Function in Anesthesia; Chapter 11; p. 263-286; Clinical Anesthesia (7th Edition); Edited by Barash P.G.; Cullen B.F.; Stoetling R.K.; Cahalan M.K.; Stock M.C.; Ortega R. 2013.

2. Anesthesia for Thoracic Surgery; Chapter 37; p.1030-1075; Clinical Anesthesia (7th Edition); Edited by Barash P.G.; Cullen B.F.; Stoetling R.K.; Cahalan M.K.; Stock M.C.; Ortega R. 2013.

3. Respiratory Physiology and Pathophysiology; Chapter 19; p.444-472; Miller's Anesthesia (8th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

4. Inhaled Anesthetics Pulmonary Pharmacology; Chapter 27; p.670-705; Miller's Anesthesia (8th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

5. Respiratory Monitoring; Chapter 51; p.1541-1579; Miller's Anesthesia (8th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

6. Anesthesia for Thoracic Surgery; Chapter 66; p.1942-2006; Miller's Anesthesia (8th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

7. Respiratory Care; Chapter 103; p. 3063-3083. Miller's Anesthesia (7th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

8. Nitric Oxide and Inhaled Pulmonary Vasodilators; Chapter 104; p. 3084-3097; Miller's Anesthesia (8th Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.

9. Journal of Cardiothoracic and Vascular Anesthesia.

10. Seminars in Cardiothoracic and Vascular Anesthesia.