

# THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF CANADA

## *Objectives of Training and Specialty Training Requirements in Anesthesia*

### WESTERN UNIVERSITY'S VASCULAR 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 the following:

#### 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-centred 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 anatomy, physiology, pharmacology and 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 vascular surgery
  - Demonstrate competence in **BCLS, ACLS and ATLS**
  - Anatomy, Physiology and Pathophysiology of the Peripheral Circulation
  - **Vascular Disease: Epidemiologic, Medical, and Surgical aspects**
    - Pathophysiology of Atherosclerosis
    - Natural History of Patients with Peripheral Vascular Disease
    - Medical Therapy of Atherosclerosis

- The Role of Statins in Perioperative Outcome
- **Preoperative Evaluation and Preparation of the Vascular Patient**
  - Clinical Predictors of Increased Perioperative CVS Risk
  - Type of Surgery
  - ACC/AHA Guidelines on perioperative cardiovascular evaluation care of patients undergoing noncardiac surgery
  - Assess and Optimize coexisting disease
    - Hypertension
    - Coronary artery disease
    - Heart failure
    - Cardiac valvular disease
    - Diabetes mellitus
    - COPD and tobacco abuse
    - Renal failure
    - Cerebrovascular disease
  - Coronary revascularization before noncardiac surgery ⇔ risks vs. benefits
  - PTCA and stenting before noncardiac surgery ⇔ Implications and optimal timing of noncardiac surgery after PTCA and stenting
- **Pharmacological Agents Used in Vascular Patients**
  - Nitrates
  - $\beta$ -adrenergic receptor antagonists
  - ACE inhibitors
  - Angiotensin II receptor antagonists
  - Digoxin
  - Loop and thiazide diuretics
  - Spironolactone
  - Calcium channel blockers
  - Clonidine
  - Hydralazine
  - Insulin and oral hypoglycemics
  - Cholesterol lowering agents
  - Epinephrine and norepinephrine
  - Dopamine and dobutamine
  - Milrinone
  - Vasopressin
  - Heparin
  - Low Molecular Weight Heparin
  - Anticoagulants
- **Perioperative Myocardial Ischemia**
  - Etiology and Prevention
  - Perioperative stress response and risk of myocardial ischemia
  - Perioperative medical management of coronary artery disease
    - Nitrates
    - $\beta$ -adrenergic blockade
    - $\alpha$ 2-Agonists
    - Calcium channel blockers

- Statins
- ACE Inhibitors

➤ **Perioperative Renal Protection**

- Cardiac performance and perfusion pressure
- Fluid management
- Mannitol
- N-acetylcysteine
- Fenoldopam

➤ **Hematologic Considerations in Vascular Surgery**

- Normal hemostasis
- Laboratory evaluation
- Congenital bleeding disorders
- Acquired bleeding disorders
- Platelet defects
- Hypercoagulable States and Venous Thrombosis
  - Antithrombin III deficiency
  - Protein C deficiency
  - Protein S deficiency
  - Defects in fibrinolysis
  - Venous thrombosis
- Anticoagulant Therapy
  - Heparin
  - LMWH and heparinoids
  - Coumadin
  - Platelet inhibitors
  - Herbal therapy
  - Thrombolytic therapy
  - Pentoxifylline
- Procoagulant Therapy
  - Tranexamic Acid
  - Desmopressin
- Intraoperative blood loss and replacement
- Postoperative bleeding and reoperation

➤ **Monitoring During Vascular Anesthesia**

- **Electrocardiography**
  - Arrhythmias
  - Conduction defects
  - Myocardial ischemia
- Three electrode system
- Modified three electrode system
- Five electrode system

- Pulse Oximetry
  - Capnometry
  - Noninvasive blood pressure monitoring
  - Body temperature
  - Invasive and non-invasive hemodynamic monitoring
  - ***Advantages, indications, contraindications and complications of the following:***
    - Arterial pressure monitoring
    - CVP monitoring
    - Pulmonary artery catheterization
    - Cardiac output
    - TEE and TTE
- **Abdominal Aortic Reconstruction**
- Etiology, Epidemiology and Pathophysiology of AAA and Aortoiliac Occlusive Disease
  - Natural History and Surgical Mortality
  - Pathophysiology of Aortic Occlusion and Reperfusion
    - Cardiovascular Changes
    - Renal Hemodynamics and Renal Protection
    - Humoral and Coagulation Profile
    - Visceral and Mesenteric ischemia
    - Central Nervous System and Spinal Cord Ischemia and Protection
  - Clamp Level
    - Infrarenal
    - Suprarenal
    - Supraceliac
  - Anesthetic Management
    - Monitoring
    - Vascular access
    - Autologous Blood Procurement
    - Cell saver
    - Anesthetic Drugs and Techniques
    - Thoracic Epidural
- **Thoracoabdominal Aortic Aneurysm Surgery**
- Etiology
  - Preoperative Preparation and Monitoring
  - Crawford Classification of TAAA's
  - Morbidity and Mortality
  - Neurologic Complications
    - Anatomy and blood supply of spinal cord
    - Artery of Adamkiewicz
    - Cerebrovascular accidents
    - Spinal cord infarction – paraplegia
    - Crawford's classification of TAAA's and incidence of paraplegia
  - Spinal Cord Protection
    - Limitation of cross-clamp duration
    - Reattachment of critical intercostal arteries
    - Maintenance of proximal blood pressure

- Avoid hyperglycemia
- CSF drainage
  - Indications
  - Best practice guidelines for insertion and management
  - Technique of insertion
  - Complications
- Moderate hypothermia
- Naloxone infusion
- Intrathecal papaverine
- Left atrial-to-distal aortic bypass with retrograde perfusion
- Avoid perioperative hypotension
- Spinal cord ischemia monitoring and detection
  - Motor and Sensory Evoked Potentials
- Renal Ischemia and protection
- Coagulation and Metabolic Management
- One lung ventilation
- Anesthetic Management
  - End organ monitoring and protection

#### ➤ **Endovascular Aortic Repair**

- Stent – Graft Devices and Approval
- Patient Selection
- Preoperative Diagnostic Imaging of Aneurysm, Surrounding Anatomy and Device Sizing
- Endovascular Technique for EVAR and TEVAR
- Adjunctive Debranching Surgical Procedures when coverage of LSCA or LCA is necessary to provide an adequate proximal fixation site for the stent
- Anesthetic Management – Regional vs. General
- Radiation Safety
- Indications for CSF Drainage in TEVAR
- Complications
  - Damage to Access Vessels
  - Types of Endoleaks
  - Graft Migration
  - Renal Ischemia
  - Paraplegia
  - Stroke
  - Aorto - esophageal Fistula
  - Conversion to Open
- Lifelong Radiological Surveillance and Costs
- Patient Outcomes – OPEN vs. ENDOVASCULAR

#### ➤ **Lower Extremity Revascularization**

- Epidemiology and Natural History of Peripheral Vascular Disease
- Pathophysiology of Atherosclerosis
- Medical Therapy for Atherosclerosis and Complications of Medical Therapy
- Chronic Medical Problems and Risk Prediction in Peripheral Vascular disease Patients

- Acute Arterial Occlusion
- Chronic Arterial Occlusion
- Surgical Management
- Preoperative Preparation and Monitoring
- Regional versus General Anesthesia
- Neuraxial Anesthesia and Agents Affecting Hemostasis
- Risk of Spinal or Epidural Hematoma
- Anesthetic Management
- Postoperative Considerations

➤ **Carotid Endarterectomy**

- Surgical indications
- Perioperative Cardiovascular Morbidity and Mortality
- Preoperative Evaluation
- Anesthetic Management
  - General vs. Regional vs. Local
    - Advantages and disadvantages of each
    - Superficial and Deep cervical plexus block
    - Carbon dioxide and glucose management
- Neurologic Monitoring and Cerebral Perfusion
  - Neurologic assessment of awake patient
  - Assessment of cerebral blood flow
    - Stump pressures
    - <sup>133</sup>Xe washout
    - Transcranial Doppler (middle cerebral artery flow)
- Cerebral electrical activity
  - electroencephalography ± computer processing
  - SSEPs
  - Cerebral oxygenation
  - Jugular venous oxygen saturation
  - Cerebral oximetry
- Postoperative Considerations
  - Neurologic injury
  - Postoperative hyperperfusion syndrome
  - Blood pressure liability
  - Cranial nerve and carotid body dysfunction
  - Airway and ventilation problems
  - Cardiac ischemia/MI
- Endovascular Treatment of Carotid Disease: Carotid Angioplasty and Stenting

➤ **Postoperative Management of Vascular Patients**

- Postoperative Pain Management
  - Preemptive analgesia
  - PCA
  - Epidural
  - Nerve blocks
- Mechanical ventilation and invasive monitoring in ICU for some patients
- Complications

- Complications of invasive monitoring
- Complications of surgical procedure
- Stroke following CEA
  - Hemodynamic instability following CEA
  - Cranial nerve injury following CEA
  - Spinal cord injury
  - Acute renal failure
  - Sexual dysfunction
  - Bleeding
  - Low cardiac output syndrome
  - Sepsis
- Respiratory complications
- Risk factors
  - Pulmonary disease
  - Cardiac disease
  - Emergency surgery
- Monitoring and preservation of end organ function

➤ **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, one-lung ventilation and insertion of spinal drains and CSF monitoring for thoracic aneurysm repair
- Be skilled in starting large bore intravenous infusions, arterial lines, CVP and PA lines in vascular 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 VASCULAR ANESTHESIA ROTATION**

1. Cardiac Anatomy and Physiology; Chapter 10; p. 239-262; Clinical Anesthesia (7<sup>th</sup> Edition); Edited by Barash P.G.; Cullen B.F.; Stoetling R.K.; Cahalan M.K.; Stock M.C.; Ortega R. 2013.
2. Anesthesia for Vascular Surgery; Chapter 39; p. 1112-1143; Clinical Anesthesia (7<sup>th</sup> Edition); Edited by Barash P.G.; Cullen B.F.; Stoetling R.K.; Cahalan M.K.; Stock M.C.; Ortega R. 2013.

3. Cardiac Physiology; Chapter 20; p.473-491; Physiology; Chapter 15; p.473-491; Miller's Anesthesia (8<sup>th</sup> Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.
4. Inhaled Anesthetics: Cardiovascular Pharmacology; Chapter 28 p.706-751; Miller's Anesthesia (8<sup>th</sup> Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.
5. Cardiovascular Monitoring; Chapter 45; p.1345-1395; Miller's Anesthesia (8<sup>th</sup> Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.
6. Electrocardiography, Perioperative Ischemia, and Myocardial Infarction; Chapter 47; p.1429-1459; Miller's Anesthesia (8<sup>th</sup> Edition); Edited by Ronald D. Miller, Lars I. Eriksson, Lee Fleisher, Jeanine P. Wiener-Kronish, William L. Young . 2015.
7. Anesthesia for Vascular Surgery; Chapter 69; p.2106-2157; Miller's Anesthesia (7<sup>th</sup> 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 (8<sup>th</sup> 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.