

# **UNIVERSITY OF MASSACHUSETTS MEDICAL SCHOOL**

## **ANESTHESIOLOGY RESIDENCY PROGRAM**

### **NEUROANESTHESIA CA-2/CA-3 REQUIRED**

This document addresses the general and specific expectations of residents rotating in neuroanesthesia., through required one month rotations in both the CA-2 and CA-3 years. The CA-2 resident spends the rotation gaining an understanding of the basics of neuroanesthesia care with an emphasis on neurosurgical entities such as discectomy; supratentorial tumor excision; VP shunt repair and neurointerventional procedures. The CA-3 experience adds increasing complexity in the form of neurovascular, posterior fossa and unstable spine cases. Many of these procedures utilize electrophysiologic monitoring, including SSEP, EEG, and EMGs.

### **COMPETENCIES**

The goal of training in neuroanesthesia is that the trainee in anesthesia be able to administer anesthesia safely to patients with neurologic disease who are undergoing neurologic or non-neurologic surgery, diagnostic procedures requiring anesthesia or non-surgical interventions requiring anesthesia.

#### **I. MEDICAL KNOWLEDGE**

At the conclusion of the CA-2 rotation, the resident should be able to:

- Describe the basic anatomy of the nervous system, including blood supply to the brain and spinal cord, the organization of the motor and sensory tracts within the spinal cord, and the ventricular system and normal flow of CSF
- Discuss the effects of anesthetic induction and maintenance agents on ICP and cerebral blood flow
- Discuss the rationale for choice of anesthetic induction and maintenance techniques
- Have a general knowledge of cerebral blood flow (CBF) and factors that affect it, including normal cerebral blood flow autoregulation, cerebral blood flow response to CO<sub>2</sub>, and cerebral metabolism.
- Discuss the pharmacology of inotropes and vasodilators with respect to their effects on the neurovascular system
- Understand the general use of fluids including crystalloid, colloid, dextrose-containing solutions and osmotic and non-osmotic diuretics in patients with intracranial pathology.
- Understand the general principles, advantages and disadvantages of the prone, lateral, 3/4 prone supine head turned away positions. Understand the hemodynamic and respiratory consequences of the prone and lateral positions.
- Understand the pathophysiology of acute and chronic spinal cord injury at any level, its disruption of normal CNS, hemodynamic and respiratory physiology (with particular attention to autonomic dysreflexia), and what impact this disruption has on anesthetic management.
- Understand general concepts of cerebrospinal fluid physiology (formation, reabsorption, flow).
- Describe management of increased ICP for craniotomy

- Describe the presentation and treatment of common postoperative problems in the neurosurgical patient, including the effect of neurosurgical disease on the social functioning of the patient and the patient's family

At the conclusion of the CA-3 rotation, the resident should:

- Be able to describe the following types of spine surgery and know the degree of complexity: anterior and posterior cervical laminectomy, foraminotomy and fusion, laminectomy for spinal cord tumors or lumbar/thoracic fusions, corpectomy, foraminotomy.
- Know the differential of intracranial hypertension ("tight brain") and treatment alternatives.
- Know the basic acute changes caused by a subarachnoid hemorrhage on the cerebral physiology and its potential effects on other organ systems.
- Understand the natural history of aneurysms (the rationale of timing of aneurysm surgery), the Hunt-Hess classification of neurologic grading, the physiology of transmural pressure in aneurysms and factors that predispose to rupture or cerebral ischemia.
- Understand the consequences of the sitting position with respect to the hemodynamic, neurologic and respiratory dysfunction that can occur.
- Understand venous air embolism - its prevention, diagnosis and treatment in both the sitting and prone positions.
- Understand the basic differences between infratentorial, supratentorial and pituitary tumors, and the implication of their size and speed of growth in management.
- Understand the basics of neuro-physiologic monitoring in spine surgery, the appropriate effects of anesthetics and the use of intraoperative "wake up" tests for motor evaluation.
- Have a basic knowledge of neurointerventional techniques, as well as the anesthetic challenges involved
- Anticipate the preoperative and intraoperative considerations in patients for "awake" craniotomy in patients undergoing resection of tissue near eloquent areas
- Understand the different types of monitors for use in prediction of ischemia in carotid surgery, including EEG, evoked potentials, transcranial Doppler, and awake neurologic exam.
- Understand the indications and uses of evoked potential monitoring - visual, brainstem, somatosensory potentials: what they look like and what they monitor (ie., what their neural generators are).
- Understand the general measurements of motor evoked potentials (latency and amplitude) as well as the effects of temperature, hypoperfusion, ischemia and anesthetic agents on the evoked potential.
- Understand the significance of arteriovenous malformations and the pathophysiology of their blood flow characteristics in the preoperative, operative and postoperative period.
- Be able to identify basic anatomy in a cerebral angiogram and identify obvious lesions, such as aneurysms and AVMs.

## II. PATIENT CARE

At the conclusion of the CA-2 rotation, the resident should:

- Be able to perform an appropriate preoperative evaluation review of patients; be able to define the type and severity of their major neurosurgical problem(s), and present to attending
- Select and correctly use appropriate patient monitors
- Recognize which patients with spinal cord pathology may require special techniques such as awake intubation and positioning.
- Recognize which patients would be suitable for extubation considering CNS, neuromuscular and other organ system pathology.
- Manage an elective craniotomy, understanding the rationale for the choice of agents.
- Be able to rapidly set up, induce, monitor and manage emergent craniotomy trauma with assistance.
- Have knowledge of airway management and sedation requirements, as well as potential complications in patients undergoing stereotactic surgery, under general or monitored anesthesia care.
- Understand the differences between CT and MRI imaging, and be able to evaluate images for obvious abnormalities, such as epidural and subdural hematomas, large strokes or masses.

At the conclusion of the CA-3 rotation, the resident should be able to:

- Manage, under direction, spine surgery including those cases with potential for massive transfusion.
- Manage cases in the sitting position, with minimal to moderate assistance.
- Manage patients requiring neurointerventional procedures, both scheduled and emergent, with minimal assistance
- Manage craniotomy for neuro-endocrine disorders, with minimal assistance.
- Have a working knowledge of placement and indications of a precordial Doppler, and recognition of air entrainment.
- Plan an anesthetic to afford rapid reversal with a minimum of hemodynamic change after craniotomy to assess neurologic function quickly postoperatively.
- Accomplish the various methods of placing a right atrial catheter for diagnosis and management of air embolism.
- Perform awake laryngoscopy, fiberoptic laryngoscopy, utilize fast-track LMA or in-line traction and understand their use in patients with spinal cord injury, with assistance.

### **III. COMMUNICATION AND INTERPERSONAL SKILLS**

At the conclusion of the rotations, the resident should:

- Understand the principles aforementioned and be able to deliver a rationale for the use of agents in anesthetic management of the routine craniotomy and spine case.
- Deliver concise, organized case presentations to the staff that include pre-anesthetic concerns and management.
- Correctly identify the procedure, positioning needs and special issues in consultation with the neurosurgery team
- Communicate effectively between the surgery team and the neurophysiologic monitoring technicians
- Participate in the planning for postoperative care in critically ill neurosurgical patients
- Be able to provide a rationale for the choice of anesthetic in all neurosurgical cases in which the resident is involved

### **IV. PROFESSIONALISM**

At the conclusion of the rotation, the resident will be able to:

- Recognize the urgency of various neurosurgical cases, and proceed efficiently while also recognizing the needs of patient, family, and surgical team

### **V. PRACTICE-BASED LEARNING**

At the conclusion of the rotation, the resident should be able to:

- Demonstrate an understanding of the anesthesia provider's role in any adverse outcomes that develop, as well as to discuss the learning points gained from such an experience

### **VI. SYSTEMS-BASED PRACTICE**

At the conclusion of the rotation, the resident should:

- Understand the system requirements needed to handle neurosurgical emergencies, including emergency room, radiologic and operating room involvement
- Understand the issues involved in providing anesthesia care for off-site neurointerventional procedures, including staffing and timing
- Describe the presentation and treatment of common postoperative problems in the neurosurgical patient, including the effect of neurosurgical disease on the social functioning of the patient and the patient's family