Principles of Neuro-anesthesia in Neurosurgery for Intensive Care Unit Nurses

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KEYWORDS

• Neuro-anesthesia • Monitoring • Intraoperative management • Complications
• Positioning

KEY POINTS

- Induction of anesthesia is a critical period of time because of the physiologic effects of direct laryngoscopy and endotracheal intubation, which can cause large increases in blood pressure.
- Motor evoked potentials (MEPs) are used to monitor spinal cord tracts spinal surgery. MEPs monitoring is a prognosticator of a patient's postoperative motor function.
- Intraoperative techniques used to lower an elevated intracranial pressure include hyperventilation, cerebral spinal fluid drainage, administering hyperosmotic drugs, diuretics, corticosteroids, and vasoconstricting anesthetic drugs, such as barbiturates and propofol.
- It is important to prevent and manage hypertension during emergence from anesthesia, as this has been linked to postoperative hematoma formation.
- When transferring a patient from the operating room to the intensive care unit, the clinical handoff ensures care continuity and patient safety, as communication failures can lead to uncertainty in decisions about patient care and result in suboptimal care.

INTRODUCTION

As neurosurgical interventions and procedures are advancing, so is the specialty of neuro-anesthesia. Neuro-anesthesia is different than other anesthetic specialties because both the anesthetist and surgeon are focusing on the same organ during a single surgical case.[1] Throughout the surgery, the main priorities of the neuro-anesthetist are patient safety, patient well-being, surgical field exposure, and patient positioning.[2] For the duration of the surgery, neuro-anesthesia requires continuous provider vigilance and frequent intervention.[2] Although each provider has his or her own respective

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roles and responsibilities, cooperation and communication between the anesthetist and neurosurgeon can significantly improve the outcome of the surgery.[2]

Furthermore, other goals of neuro-anesthesia include sustaining an acceptable cerebral perfusion to prevent ischemia while making sure that intracranial pressure (ICP) is not increasing or elevated.[1] Lastly, neurosurgery can be categorized into excision of intracranial mass lesions, decompression procedures, spinal procedures, and aneurysm clippings.

PREOPERATIVE EVALUATION

Every neurosurgical patient should be evaluated for signs and symptoms of elevated ICP, which include nausea/vomiting, headache, changes in vision, altered level of consciousness, irregular breathing patterns, hypertension, or bradycardia. The preoperative evaluation should include a review of pertinent medical and surgical histories, medications, allergies, laboratory tests, preoperative fluid and electrolyte status, and airway assessment. Patients' cardiac status should be thoroughly assessed. If patients are thought to be at risk for a cardiac event, an echocardiogram or a cardiac catheterization may be indicated before surgery. In addition, there should be a clear understanding of the intracranial pathology as well as the issues associated with it during anesthesia and surgery. This understanding is essential for proper planning and management of the case. All potential problems, such as airway management, intravenous (IV) line sites, central line sites, and patency of radial artery, should be addressed.[3]

Neurosurgical patients should have 2 peripheral IV lines, one reserved for medication administration and the other for volume management. Moreover, it may be beneficial to insert a central venous catheter if the case indicates it. Cases that would indicate placement of a central line would be cases that the surgeon anticipates a large blood loss or fluid shifts. A central line would allow the anesthetist to rapidly transfuse fluids, blood products, and vasoactive medications to an unstable patient. The central line is helpful to the neuro-anesthetist for monitoring and trending central venous pressures that can be used to guide intravascular volume status and for administering potent cardiovascular medications. Mannitol, which is a commonly used osmotic diuretic, is used for acute control of increased ICP.[3] Mannitol pulls water from the brain and tissues into the intravascular space.[1] However, mannitol can cause local inflammation on injection when administered through a peripheral IV. Administering large or frequent doses of mannitol through a central line is preferable and decreases the local inflammation.[3]

The topic of premedication for a neurosurgical procedure is up for debate. Certain premedications, such as narcotics, should be avoided. Narcotics cause a decrease in respiratory drive, which leads to an increase in $Paco_2$, resulting in an increase in cerebral blood flow and cerebral blood volume.[4] Increased cerebral blood flow and cerebral blood volume may be harmful to neurosurgical patients, especially to patients with aneurysmal subarachnoid hemorrhage.[4] However, many patients may benefit from a benzodiazepine before the induction of anesthesia to decrease their anxiety level.

If the case is an emergency, an abbreviated preoperative evaluation will need to be completed, including major health problems, past surgeries, neurologic status, airway assessment, allergies, last oral intake, and adequate IV access.

INDUCTION CONSIDERATION

Induction of anesthesia is a critical period of time because of the extremely stimulating effects of direct laryngoscopy and intubation. These events can lead to hypertension, tachycardia, and increased ICP. Induction may be followed a short time later with