Management of Refractory Intracranial Pressure

Jennifer D. Robinson, MS, APRN, RN, CNRN

KEYWORDS

• Intracranial pressure • Monitoring • Nursing • Neurocritical care

KEY POINTS

- Refractory intracranial pressure (ICP) is a medical emergency and requires immediate attention from medical and nursing staff.
- ICP management is based on a 3-tier approach: medical therapy, metabolic suppression, and surgery.
- Expert nursing assessment and intervention are of vital importance to optimize clinical outcomes in patients with refractory ICP.

OVERVIEW

Intracranial pressure (ICP) is defined as greater than 20 mm Hg sustained for more than 5 minutes in a nonstimulated patient.[1] Common diagnoses that result in elevated ICP include traumatic brain injury, intracranial hemorrhage, and ischemia.[2] Intracranial hypertension is potentially life threatening if not immediately corrected. Refractory intracranial hypertension leads to a reduction of cerebral perfusion.[3] In the most severe cases, refractory intracranial hypertension will result in a complete lack of cerebral perfusion and cause brain death.[3] Utmost importance must be given to effective treatment to correct the abnormality to best improve both patient morbidity and mortality. Bedside nurses should be aware of patients who could potentially develop elevated ICPs and may benefit from an ICP monitor (**Box 1**).[2]

Nurses should be on alert for signs and symptoms of pending intracranial hypertension. Signs and symptoms can be variable and based on the location of the intracranial abnormality; however, the most common symptom is worsening of mental status.[4] Patients often become increasingly more somnolent with elevated ICPs and will progress to coma. Patients should have a baseline head computed tomographic (CT) scan and a repeat head CT scan within 24 hours, and new imaging should be obtained if the patient has an examination change.[5] Patients with brain damage have a 2-fold insult: the initial or primary injury that is irreversible and secondary injury that occurs hours to days after the primary injury.[6] The focus of medical and nursing intervention for these

Neuroscience, Yale New Haven Hospital, 360 State Street #1207, New Haven, CT 06510, USA
E-mail address: jennifer.robinson@yale.edu

Crit Care Nurs Clin N Am 28 (2016) 67–75
http://dx.doi.org/10.1016/j.cnc.2015.09.004 **ccnursing.theclinics.com**
0899-5885/16/$ – see front matter

Box 1
Common diagnosis resulting in elevated intracranial pressure

Diagnosis
Traumatic brain injury
Large territory ischemic stroke
Intraparenchymal hemorrhage
Subarachnoid hemorrhage
Subdural hematoma
Epidural hematoma
Encephalopathy causing cerebral edema

patients is on prevention or minimizing the secondary injury. A great reference for nurses is the Brain Trauma Foundation guidelines that were most recently revised in 2007. Hospitals that strictly adhere to these evidence-based guidelines have shown improved mortality and outcomes.[7]

An ICP monitor is commonly placed in patients with a poor neurologic examination and for those at risk for developing elevated ICPs.[8] The particular type of monitor may vary from institution to institution, and the most frequently used devices will be reviewed in this article. An external ventricular drain (EVD) sits in a lateral ventricle and both drains cerebrospinal fluid (CSF) and monitors ICP. An EVD is usually placed in the nondominant hemisphere to minimize potential damage caused in the event of a catheter-induced hemorrhage.[2] An intraparenchymal monitor resides in brain tissue, continuously measures ICP, and can be sophisticated enough to measure brain temperature, brain tissue oxygenation, and other variables but does not drain CSF. **Table 1** further illustrates the differences between an EVD and an intraparenchymal monitor.

The brain is composed of 3 components: brain, blood, and CSF. Reduction of 1 of the 3 is necessary to reduce ICP and forms the basis of the Monro-Kellie hypothesis.[3] CSF drainage via an EVD is the least invasive way to reduce overall brain volume; consequently, an EVD is the most commonly placed device. Consideration is also given to the cerebral perfusion pressure (CPP). CPP is calculated by subtracting ICP from the mean arterial pressure (MAP): CPP = MAP − ICP. Maintaining a CPP ideally 60 to 80 mm Hg but not lower than 50 mm Hg is also a strategy used by some institutions.[2]

Table 1
Differences between an external ventricular drain and an intraparenchymal monitor

Device Type	Location	CSF Drainage	Challenges	Continuous ICP Monitoring
EVD	Lateral ventricle ideally in nondominant hemisphere	Yes	Hard to place in patients with small ventricles	No; either drains or monitors; must turn stop cock for accurate reading
ICP monitor	Intraparenchymal (1 cm depth) in same hemisphere as most damaged area	No	No ability to drain CSF	Yes; plus capability to monitor brain tissue oxygen and temperature