

Chapter 7

Managing Intracranial Pressure

Signs of Increased Intracranial Pressure

- Decreased level of consciousness
- Papilledema
- Tachycardia
- Hypotension
- Vomiting
- Irritability
- Photophobia
- Bulging fontanelle
- Split sutures
- Sunset eyes (chronic)
- Irregular respirations or apnea
- Widened pulse pressures
- **Cushing's triad (hypertension, bradycardia, abnormal respirations) is a preterminal event!**

Etiologies of Increased Intracranial Pressure

- Meningitis
- Encephalitis
- Head trauma
- Intracranial mass lesions
- Child abuse (eg, shaken baby)
- Status epilepticus
- Shock leading to hypoxic-ischemic encephalopathy

Treatment

- Assess and maintain airway, breathing, and circulation (ABCs)
 - Rapid sequence induction/intubation therapy may be necessary if airway protection is needed (eg, Glasgow Coma Scale score ≤ 8)
- Maintain cerebral perfusion pressure (CPP) = mean arterial pressure – intracranial pressure (ICP)

- Appropriate CPP is age dependent, as follows:
 - ▶ < 2 years: 50 mmHg
 - ▶ 2–6 years: 55 mmHg
 - ▶ 7–10 years: 65 mmHg
 - ▶ 11–16 years: 70 mmHg
 - ▶ > 16 years: 70–90 mmHg
- If ICP monitoring is unavailable, use goal CPP as the minimally acceptable value for mean arterial pressure
- Avoid hypercarbia
 - Keep partial pressure of carbon dioxide (PCO₂) between 30 and 35 mmHg
 - Hyperventilation to PCO₂ below mid-30s mmHg should be reserved for temporary treatment of major ICP spikes
- Keep the partial pressure of oxygen in arterial blood (PaO₂) at 100 mmHg, or saturations at 97%–100%
- Keep patient's head midline and elevated to 30°
- Avoid free water; use isotonic fluid (normal saline) as the base solution for intravenous (IV) hydration
- Anticipate norepinephrine, dopamine, or epinephrine needs to maintain CPP once patient is euvolemic
- If patient is anxious and agitated while intubated, sedate with midazolam and fentanyl
 - Use paralysis if patient is persistently agitated
 - Sedation will alter neurological examination
- Avoid excess noise, vibration, light, and noxious stimulation that may increase ICP
 - Sedate with midazolam IV, fentanyl IV, or lidocaine IV, or via endotracheal tube before suctioning
- Treat seizures aggressively
 - Muscle relaxants will mask seizure activity
 - Consider prophylactic phenytoin for penetrating head injuries
- Keep patient cool and treat hyperthermia aggressively
 - Patient may need neuromuscular blockade to avoid shivering
- Monitor blood glucose
 - Add dextrose to IV fluids only after serum glucose ranges between 80 and 110 mmHg
- Place Foley catheter

- Monitor central venous pressure if available or indicated; maintain at 5–8 mmHg
- If increasing signs of ICP appear or if pupils suddenly dilate, administer hypertonic saline or mannitol (3% saline is preferred because it does not create an osmotic diuresis or result in hypovolemia)
 - **3% saline:** 2–4 mL/kg IV bolus for increased ICP
 - ▶ 10 mL/kg for herniation
 - ▶ 0.5 mL/kg/h for continuous infusion (range 0.1–1 mL/kg/h)
 - ▶ Patients will tolerate serum sodium rising to the 160 range, as long as the rise and eventual decline occurs gradually
 - **Mannitol:** 0.5–1 g/kg IV given over 20 minutes ; use in-line 5- μ m filter for concentrations \geq 20%
 - Consider **furosemide** 0.5–1 mg/kg IV slow push if patient is hypervolemic (maximum of 40 mg/dose)
 - Thiopental (3 mg/kg IV) may be given for continued evidence of increased ICP
 - ▶ Barbiturates are negative inotropes and vasodilators; watch for hypotension

