Intracranial Hypertension

Anesthesia Guidelines
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Department of Anesthesiology and Pain Medicine

The Procedure

Pre-operative

1) Check:
   - CT or MRI for peritumoral edema, enlarged ventricles, mass >3 cm or brain shift.
   - Check for previous lumbar puncture – note CSF pressure.
   - Check for brain shift on cerebral angiogram.
   - Check with surgeon for patient position, need for muscle relaxants to be avoided (motor testing), controlled hypotension, risk of increased ICP.
   - Check Dilantin level, dose of last Decadron, timing of antibiotics.

2) Patients usually Rx with steroids and fluid restriction. Occasionally patients are intubated and hyperventilated. Osmotic diuretics are usually reserved for intraoperative use. Use of ventriculostomy varies. Usually placed in patients with large posterior fossa tumors and showing mid-line shifts.

3) Pre-op Sedatives: none unless patient alert, has small tumor without any signs of increased ICP. In these patients, may use Midazolam 1-2 mg.

Intraoperative

Avoid hypertension and compression of jugular veins both of which inevitably result in increased ICP. Also avoid hypercapnia, hypoxia and coughing.

1) Large gauge I.V. with normal saline or Ringers Lactate (2-4 cc/kg/hr), arterial catheter, BP cuff, neuromuscular blockade monitor (surface electrodes) (preferably all on best side for accessibility). End-tidal CO₂.

2) Preoxygenation with voluntary hyperventilation. Avoid pressing mask on face while patient is awake.

Induction

- Some recommend 1/10 of intubating dose of nondepolarizing muscle relaxant, i.e., vecuronium or equivalent short acting nondepolarizer to reduce muscle rigidity.
- Sufentanil 0.5 mcg/kg, fentanyl 2-3 mcg/kg, or remifentanil 0.1-0.5 mcg/kg/min then propofol 2 mg/kg.
- Vecuronium 0.1 mg/kg or equivalent short acting nondepolarizer.
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- Following induction of anesthesia, start the antibiotic. Antibiotics should not be given more than 1 hour prior to incision. The exception is vancomycin, which can be given up to 120 minutes prior to incision.

Note: Except for emergency intubation, succinylcholine should be avoided. Interested reader should review references on this area.

1) Manual hyperventilation ASAP, use oral airway PRN only. Large tidal volumes (12-15 cc/kg) required as mask increases dead space.

2) Additional sufentanil 0.5 mcg/kg, or fentanyl 2-3 mcg/kg or remifentanil 0.1-0.3 mcg/kg/min.

3) Additional propofol as needed plus lidocaine 1.0-1.5 mg/kg I.V. 1 ½ min prior to laryngoscopy.

4) When no twitch can be elicited, carry out gentle and rapid laryngoscopy and intubate.

Maintenance

1) Hyperventilate to PaCO2 of 30 mmHg or low 30s (discuss with surgeon). If desired, may use N2O:O2 (60-70:40-30).

2) Start sufentanil infusion at 0.1-0.3 mcg/kg/hr, fentanyl infusion 1-3 mcg/kg/hr or remifentanil 0.1-0.3 mcg/kg/min; along with opioid infusion add either propofol infusion at 50-250 mcg/kg/min or, after 10 minutes of hyperventilation, isoflurane 0.4-0.6 percent inspired or sevoflurane 0.6-1.0 percent inspired.

3) If surgeon complains of tight dura or says the brain is swollen or if ICP is being monitored and there is any significant increase, consider:

   - Give I.V., 50-250 mg of propofol or thiopental (or lidocaine), small dose of nondepolarizing muscle relaxant, Lasix, and turn off N2O and all inhalational anesthetics, replacing with propofol infusion 50-250 mcg/kg/min.
   - Check peak airway pressure, ABG, and patient head position. Brain bulk can be reduced by relieving any obstruction to cerebral venous outflow and by placing patient in a more head up position.

4) IV fluids – normal saline or Ringers Lactate at maintenance levels plus ½ urine output. Treat hypovolemia with blood.

5) Mannitol 0.5–1.0 gm/kg given I.V. over 10 minutes or mannitol preceded by 5-10 mg lasix. Check with surgeon for dose and timing of administration.

Extubation

1) Discontinue narcotic infusion 45 to 60 minutes prior to extubation if using sufentanil or fentanyl.

2) Techniques of extubation vary. Some prefer, if mass removed, not extubating until patient ventilating spontaneously and others prefer to extubate deep to avoid coughing. If you extubate deep, the patient will build up PaCO2 and if you extubate light, the patient may cough. May precede head wrapping with I.V. lidocaine 1.5 mg/kg and/or propofol.

3) After extubation, some routinely give naloxone 0.05 mg I.V. to eliminate depressant effects of residual narcotic.

Note: The ability of one dose of naloxone to prevent late postoperative respiratory depression as manifested by a decreased CO2-ventilatory response curve 10 is not known. Leave written post-op order to give naloxone 0.1 mg I.V. plus 0.2 mg I.M. with any decrease in consciousness or respiratory rate below 10.