Infratentorial Tumors

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Risk

- Highest incidence: Age 3–12 y and 55–65 y
- Two-thirds of childhood CNS tumors; approximately 3–5:100,000/y under age 19 y
- 15–20% of adult CNS tumors; incidence lower than in children

Perioperative Risks

- Very confined space, brain tolerates tumor poorly, leading to symptoms and less forgiving with surgery than supratentorial
- CSF obstruction with hydrocephalus common; ICP tolerated poorly

Worry About

- Increasing ICP and hydrocephalus
- Impaired protective airway reflexes and aspiration
- Irregular ventilation due to brainstem compression and swelling
- Impaired level of consciousness
- Cranial nerves abnormalities

Overview

- Survival 60% in children.
- Prognosis is poor with glioblastoma, and infiltrating brainstem glioma.
- Benign lesions, such as meningioma and acoustic neuroma, have low morbidity and mortality but may recur if resection is incomplete.
- Degree of head elevation influences venous pressure and incidence and severity of air embolism (sitting (worst) > prone > park bench/lateral position).

Etiology

- Primary intraaxial lesions are generally malignant; extraaxial lesions are typically benign.
- Children: Astrocytoma, medulloblastoma, and brainstem glioma are the most common in children ages 3–12 y.
- Less than 1 y old, most common are astrocytoma, cerebellar PNET medulloblastoma ependymoma, brainstem glioma.
- Less than 2 y old, most common are are medulloblastoma and low-grade glioma (70%).
- Pediatric cystic cerebellar astrocytoma is associated with 80% survival at 20 y.
- Adult: Most primary tumors are acoustic neuroma associated with NF-II and meningioma. (most >60 y are acoustic).
- Metastases: Lung and breast most common; vasogenic so ICP common. Metastases to cerebellum forms mass lesion.
- Differentiate from AVM and aneurysms.

Usual Treatment

- Surgical removal or debulking
- CSF diversion (ventriculostomy or shunt)
- Dexamethasone to decreased peritumor vasogenic edema
- Primary or adjuvant radiotherapy

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Tonsillar herniation, cranial nerve compression	Dysphagia, change in voice tinnitus, vertigo	Gag dysfunction, hyperthermia, ipsilateral hearing impairment	Indirect laryngoscopy, hearing exam
CV/HEME	Progressive brainstem compression, ischemic cardiomyopathy		Cushing response: Htn, bradycardia, raised ICP, S_3 gallop, CHF	ECG, HCT, T&C
RESP	Progressive tonsillar herniation		Hyperventilation, irregular respirations, apnea	CT exam, MRI
RENAL/GI	Increased ICP	N/V (especially near fourth ventricle)		CT scan, MRI, glucose
CNS	Increased ICP	Listlessness, headache, nausea, drowsiness, diplopia	Papilledema, classic triad (headache, vomiting, ataxia), enlarged head, bulging fontanelle	CT scan, MRI
MS	Lesion in cerebellar hemisphere or midline	Truncal ataxia	Nystagmus hypotonia, limb ataxia intention tremor	Extraocular movement abnormalities

Key References: McClain CD, Soriano SG: Anesthesia for intracranial surgery in infants and children, *Curr Opin Anaesthesiol* 27(5):465–469, 2014; Francois A: Posterior fossa tumor surgery. In Mongan P, Soriano S, Sloan T, editors: *A practical approach to neuroanesthesia,* Philadelphia, PA, 2013, Lippincott Williams and Wilkins, pp 62–67.

Perioperative Implications

Preoperative Preparation

- Neurologic exam: Cranial nerve deficits
- Presence and status of EVD or VP shunt
- Patent foramen ovale avoid sitting position
- Assess volume status from decreased intake, vomiting, diuresis (will increase risk of hypotension if sitting)
- Avoid narcotic premedication or any respiratory depressants if risk of increased ICP
- Note use of steroids to reduce peritumoral edema
- Note: NF-I and -II, tuberous sclerosis, Von Hippel Lindau
- Surgical position, prone, sitting, lateral
- Tumors versus microvascular decompressions

Monitoring

- Goals are maintenance of adequate CNS perfusion and cardiorespiratory stability, detection and treatment of air embolism, and surgical brainstem compression.
- Monitor CPP (MAP-ICP), radial artery cath, transducer at ear level; watch for hypotension when sitting.
- Capnography, precordial Doppler US, right atrial cath for air embolism detection and retrieval (TEE if available).
- Auditory brainstem responses and facial nerve monitoring may reduce neural morbidity. SSEP, MEP, and multiple cranial nerves often monitored.
- Watch for deep breath from brainstem compression respiratory center, watch for Htn or BP decreases and arrhythmias from brainstem compression.
- ECG and pulse oximetry to watch for arrhythmias (bradycardia common but other sudden changes can be as diagnostic) from manipulation of brainstem cranial nuclei and dura (innervated by vagus nerve). Avoid treating with anticholinergic as eliminate heart rate as monitor of brainstem.
- If sitting position, precordial Doppler and CVP with tip at right atrium needed.
- Watch eyes if prone for pressure and prep solutions.
- Head flexion: Ensure two fingers' minimum distance from chin to chest.

Airway

- Verify appropriate ETT position after final positioning; avoid oral airways or large bite blocks to minimize tongue and soft tissue compression, postop airway swelling.
- Soft bite block between molars with MEP.
- Watch for ETT kinking with neck flexion (armored tube if indicated).

Induction

- Hypotension on induction can be offset by preinduction IV hydration.

Maintenance

- Positioning: Protect eyes, avoid kinking of jugular vein, carotid, vertebral artery when turning head.
- Preserve autonomic reflexes; avoid long-acting vasodilators.
- Monitor for changes in electrolyte balance due to loop and osmotic diuretics; replace diuresis if needed.
- Maintain normothermia, normovolemia, normotension, and normonatremic fluids.
- Watch for hypothermia with prolonged case (neuroendoscopy).
- Avoid hyperglycemia and hyperthermia.
- Controlled PPV; adequate hydration decreases risk of air embolism.
- Avoid NMB with cranial nerve and MEP monitoring.
- Limited inhalational agents <0.5 MAC with SSEP and MEP and consider TIVA if EP signals are weak.
- Consider infusions of short-acting opioids especially in cases of TIVA.
- Secure EMG leads for cranial nerves.
- Dose and redose antibiotics.
- Avoid anticholinergics and beta-blockers to mask CV changes with brainstem compression.

Extubation

- Pt should be awake, following commands, and showing return of protective airway reflexes (swallow); note possibility vocal cord paresis (CN X)

Adjuvants

- Short-acting vasopressors or vasodilators for maintenance of CV stability
- Antiemetics

Postoperative Period

- Suspect brainstem compression or hematoma if postop Htn or profound bradycardia persists in previously normotensive pt.
- Suspect brainstem injury if persistent hypotension or apnea.
- Avoid potent opioids that may produce ventilatory depression (hypercarbia) and decreased intracranial compliance.

Anticipated Problems/Concerns

- Intraop air embolism: Notify surgeon who should flood field and use bone wax; turn off N_2O if on; acute CPAP may help to find source; lay head down to level of heart if needed.
- Pts with higher-grade malignancy have greater likelihood of postop brain swelling.
- Postop inability to protect airway (loss of lower cranial nerves); watch for swallowing prior to extubation; use NG if question.
- Loss of resp drive with injury to brainstem resp center.
- Delayed awakening from pneumocephalus (tension possible requiring relief); also supratentorial hemorrhage when sitting.
- Massive tongue swelling and cervical spinal cord ischemia if sitting position.
- Loss of facial nerve (corneal ulceration from failed eye closing).
- Aseptic meningitis (blood irritating meninges).