Raised Intracranial Pressure and Hydrocephalus

Raised Intracranial Pressure
500ml/day CSF made to replenish volume of 150ml.
ICP = MAP - CPP. Normal ~10mmHg. Raised = >20mmHg sustained for >15min.
ICP monitoring if severe HI & coma, intracerebral haemorrhage, Reye’s, hydrocephalus

Causes of raised intracranial pressure
Localised mass lesions: traumatic haematomas (extradural, subdural, intracerebral)
Neoplasms: glioma, meningioma, metastasis
Abscess
Focal oedema secondary to trauma, infarction, tumour
Disturbance of CSF circulation: obstructive hydrocephalus, communicating hydrocephalus
Obstruction to venous sinuses: depressed fractures overlying venous sinuses, cerebral venous thrombosis
Diffuse brain oedema or swelling: encephalitis, meningitis, diffuse head injury, SAH, Reye’s syndrome, lead encephalopathy, water intoxication, near drowning
Idiopathic intracranial hypertension

Presentation
Headache: nocturnal, on waking, worse on coughing/moving head
↓LOC: lethargy, irritability, slow decision making, abnormal behaviour → stupor, coma and death
Vomiting
Eye changes: irregularity or dilatation in one eye. Unilateral ptosis or III and VI nerve palsies. In later stages, ophthalmoplegia and loss of vestibulo-ocular reflexes.
Papilloedema: blurring of disc margins, loss of venous pulsations, disc hyperaemia, flame haemorrhages. Later, obscured disc margins and retinal haemorrhages.
Cushing reflex: (↑BP, widened pulse pressure and ↓HR).
Other: Late hemiparesis

Investigations
CT/MRI
Check and monitor ABG, blood glucose, renal function, electrolytes and osmolality.

Management
Aim to prevent secondary brain injury.
Be aware that actions that lower the MAP will also lower CPP.
Full monitoring T, BP, heart monitor, RR, SaO2, ETCO2, art BP, CVP
Posture: elevate head of bed 30o
Intubate: better control of pO2, pCO2 - premed fentanyl 2mcg/kg to blunt sympathetic & ICP rises
Analgesia and sedation: to prevent gagging on ETT
Neuromuscular blockade: reduces rises in ICP from muscle activity
Hyperventilation: Aim for low normal pCO2 35-40mmHg
Osmotic reduction if acute deterioration/herniating: Mannitol 20% 0.5-1g/kg, 3% saline 5ml/kg over 15min
Maintain oxygenation, normal vascular volume, osmolarity, MAP 80mmHg, normoglycaemia, Na 140-145
Temperature: avoid pyrexia & shivering as will ↑ICP & ↑pCO2
Seizures: treat aggressively or prophylactically with phenytoin loading (controversial)
Surgery, shunt
**Hydrocephalus**
An increase in the volume of cerebrospinal fluid (CSF) occupying the cerebral ventricles secondary to either impaired absorption or, less commonly, increased production of fluid.

**Types**
- Communicating - communication between ventricles and subarachnoid space. Usually due to ↑CSF production, occasionally due to ↓absorption or ↓drainage
- Non-communicating - CSF flow obstructed within ventricles or between ventricles and subarachnoid space.

**Causes**
- Congenital causes in infants and children: Stenosis of aqueduct of Sylvius, Dandy-Walker malformation/Arnold-Chiari malformation type 1 and type 2, Congenital toxoplasmosis
- Acquired causes in infants and children: Mass lesions, Intraventricular haemorrhage, Infections, venous thrombosis, iatrogenic - e.g. hypervitaminosis A, Idiopathic
- Causes in adults: SAH, ⅓ idiopathic, head injury, tumours, iatrogenic (posterior fossa surgery), meningitis, normal pressure hydrocephalus

**Presentation**
- Features in Infants - Poor feeding, irritability, reduced activity, vomiting, Rapid increase head circumstance, Setting-sun sign, Increased limb tone
- Features in Older Children and Adults - Papilloedema, Failure of upward gaze, Unsteady gait due to spasticity in the legs, Large head, Unilateral or bilateral sixth nerve palsy secondary to increased ICP
- Features Specific to Adults - Cognitive deterioration, Neck pain, vomiting, Blurred vision, Incontinence

**Normal pressure hydrocephalus**
- Classic triad of wet, wacky, wobbly (incontinence of urine, altered, ataxia)
- Failure to reabsorb the CSF is compensated by reduced production

**VP shunt obstruction**
- Need to compare to old CT to see if obstruction; can be shunt break/disruption evident on xray

**Idiopathic Intracranial Hypertension**
- Formerly “pseudotumor cerebri”
- Chronic headaches (ICP pattern-worse in morning, improved with standing)
- Young obese women, can go blind, papilledema
- CT normal, lumbar puncture diagnostic and therapeutic
- Associated with hypercoagulable state (continuum with dural venous sinus thrombosis)

**Investigations**
- CT or MRI; Ultrasound - through the ant fontanelle used in infants.

**Management**
- Temporizing measure: Frusemide and acetazolamide ↓secretion of CSF. Isosorbide ↑absorption.
- Surgery - treat underlying cause, Insertion of a shunt