HMP5: Unconscious Patient

Causes:

- Structural – e.g. trauma (focus of this session)
- Cardiovascular
- Respiratory
- Neurological
- Infective
- Metabolic
- Toxic

Intracranial Pressure (ICP)

Normal ICP 5-13mmHg; relatively well tolerated to ~20mmHg; loss of consciousness beyond ~40mmHg.

Pathophysiology

Skull is a (mostly) closed box, containing:

- Brain 1400ml (80%)
- Blood 150ml (10%); 750ml/min usual flow
- CSF 150ml (10%); 0.3-0.4ml/min production

Increase in one compartment (hydrocephalus, tumour, bleed) leads to reduction in one or both of others; when this ceases ICP will rise (Monro-Kellie). Compression of ventricles and venous sinuses usually occurs first, but clearly limited scope (~100ml) to compensate before pressure rises sharply.

As pressure rises, brain itself will be shifted – leads to various areas of herniation:

- Uncal herniation (temporal lobe below tentorium cerebella) – III nerve palsy
- Tonsillar herniation (cerebellar pedunclesthrough foramen magnum) – brain stem compression with Cushings triad (hypertension, bradycardia, Cheyne-Stokes respiration)
- Subfalcine herniation (medial aspect of frontal lobe below free edge of falx cerebri) – compression of anterior cerebral artery

As pressure continues to rise, CPP drops and brain death ultimately occurs.

Measurement

Can measure ICP directly (bolt, EVD); if MAP also recorded can calculate CPP (usual 70-90mmHg). Can also estimate oxygen extraction by jugular bulb oxygen saturation or use transcranial Doppler to measure cerebral blood flow – not typically done in acute resuscitation phase.

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Management

Aim to reduce secondary brain injury.

- Intubate and protect airway; ensure adequate oxygenation and ventilation (B@EASE checklist)
- Consider other causes and correct (always check blood glucose)
- Early imaging and involvement of neurosurgeon
- Optimise CPP by:
    - Reducing ICP
        - CSF:
            - EVD
        - Blood:
            - Head up position (spine permitting)
            - Remove collar
            - Tapes not ties
            - Controlled ventilation; limit PEEP
            - Sedation
            - Surgery – remove haematoma
        - Brain:
            - Mannitol (0.5g/kg)
            - Hypertonic saline (3ml/kg 5%)
            - Dexamethasone (oedema – usually with tumour)
    - Increasing MAP
        - Fluids
        - Blood transfusion
        - Vasopressors
        - Caution in polytrauma (balance of systemic bleed vs CPP)

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