Neuroanaesthesia & Critical Care
KEY TOPICS

• Traumatic Brain Injury and ICP Management
• Brain death physiology and optimisation
• Brain stem testing and organ donation
Topics that have come up

• Posterior fossa craniotomy
• Sitting position and air embolism
• Acromegaly and pituitary surgery
• Scoliosis and spinal cord monitoring
• Sub Arachnoid Haemorrhage
• Neurological associated sodium disorders
Severe Traumatic Brain Injury

TBI Initial Management

• Targeted resuscitation in the pre hospital setting
• Aim for tertiary trauma centre
• Cervical immobilisation
• Avoid hypotension and hypoxia
• Early tracheal intubation if GCS <8
• Avoid hypoxia pO2> 11kPa. Maintain pCO2 4.5-5.0kPa
• Hyperventilation 4-4.5kPa for impending herniation only
• Appropriate volume resuscitation (Blood products)
• MAP >90mmHg
• Head elevation and avoid venous restriction
• Sedation, paralysis and normothermia
• Prompt trauma CT scan with prompt neurosurgical involvement
• Balanced needs of the complex poly trauma patient
• Anaesthesia for Subdural and Extradural
Who should have ICP Monitoring?

• ICP should be monitored in all salvageable patients with a TBI (GCS 3-8 after resuscitation) and an abnormal CT scan.

• ICP monitoring is indicated in patients with severe TBI with a normal CT scan if 2 of the following features are noted at admission:
  - age > 40 years
  - unilateral or bilateral motor posturing
  - SBP <90 mm Hg.
Pressure Parameters

• Maintaining SBP >100 mmHg for middle aged (50 to 69 years old)
• Maintain SBP > 110 mmHg or young and old (15 to 49yrs or >70 years old)
• Treat ICP > 22mmHg
• CPP between 60 and 70 mmHg
• PaCO2 4.5-5kPa
- Normal value 7-14mmHg
- P1,P2,P3 Waves (derived from arterial pressure)
- Y axis pressure mmHg x axis time (secs)
- Greater than 20mmHG is very abnormal
- Monroe Kellie doctrine
- CPP = MAP – ICP
- Pathological Lundberg A waves
- Types of herniation: Uncal, Tonsillar, Subfalcine, Upward cerebellar
Management of Raised ICP

- Meticulous application of basic measures
- Mannitol / Hypertonic saline
- Sedation + paralysis - propofol 4mg/kg/hour, midazolam and atrocurium infusion
- Cerebral EEG monitor - seizures / burst suppression
- CT head scan – surgical options?
- No place for hypothermia
- Thiopentone infusion (if not burst suppressed)
- Make a decompressive craniotomy decision
Physiological changes at brain death

- No Blood Pressure
- High Urine Output
• ‘Good ICU’ - think systems
• Vasopressin
• +/- Desmopressin for DI
• Methylpred
• Temperature
• Standard ICU
• ICU care bundles

Organ Donation Past, Present and Future
Death

- Irreversible loss of consciousness
- Irreversible loss of capacity to breath

- Somatic
- Circulatory
- Neurological
• Apnoea and in a Coma

• Evidence of irreversible drain damage of known aetiology

• Red Flags

• Exclusion of reversible causes of coma and apnoea

• Test for absent brain stem function
  • Brain stem reflexes (cranial nerve)
  • Apnoea Test
Red Flags

- Testing < 6 hours
- Testing < 24 hours (Hypoxic)

- Hypothermia
- Neuromuscular disorders
- Brain stem or posterior fossa pathology

- Steroids
- Fentanyl infusions
Exclusion parameters

• Cardiorespiratory

• Pharmacological

• Metabolic and electrolyte

• Temperature & Endocrine
6 cranial nerve tests

1) Pupils
2) Corneal reflex
3) Supraorbital pressure
4) Vestibular cephalic reflex
5) Gag
6) Cough
Apnoea Test

- Pre oxygenate
- Reduce reparatory rate
- PaCO2 > 6 kPa and pH < 7.4 to begin with
- Water’s circuit/Oxygen Catheter - NOT VENT
- 5 minutes – no breathing
- Confirm PaCO2 increased by 0.5kPa

Ancillary Tests Reminder
• Donation after circulatory death (DCD)
• Donation after brain death (DBD)
Deciding to ride your bike without a helmet is a beacon of hope for those in need of new organs.
Neuroanaesthesia

‘A good anaesthetic’

- Endotracheal tubes (Armoured/Secured)
- Arterial line /Central access
- Positioning
- Big drip – blood loss sometimes
- Long procedure
- Sodium Chloride Fluid
- Pins
- Tight ventilation control
- Tight blood pressure control
- Elective – Propofol TCI/TIVA
- Emergency – Volatile -1MAC- Sevo>DES>ISO
- No Nitrous/Suxs/Ketamine
- ICP principles
- Neuroradiology
- Neuromuscular monitoring
- Coughing
- Heads and spines
- Severe surgical complications
Neurosurgical Operations

- Craniotomy (Tumour/Biopsy/Abscess/Clipping)
- Craniotomy- Evacuation of haematoma (Sub/Extra/Intra)
- Craniectomy (Stroke/Head Injury)
- Pituitary surgery
- VP Shunt
- Awake craniotomy
- Posterior Fossa Surgery inc Acoustics
- Neuro angio procedures (coiling)
- Spines (scoliosis surgery)
Patient Positioning
Posterior Fossa Surgery

• Important bits of brain – physiological impact
• Restricted Space
• Lines – preparation
• CSF flow – 4th ventricle
• Patient position and surgical access – Venous air embolism
• Monitoring - Brainstem evoked potential/Facial nerve in acoustic neuromas
Pituitary Surgery

- Trans-sphenoidal hypophysectomy
- Head up, throat pack, Moffet’s
- Hormones or mass effect (Sight saving)
- Acromegaly/Cushing’s Syndrome
- Lumbar drain/CSF Rhinorrhaea
- Major haemorrhage (Carotids/Cavernous sinus)
- Diabetes Insipidus common. Pan hypopituitarism
Cerebral Aneurysm

Commonest sites for Saccular Aneurysms

- Anterior Communicating Artery 30%
- Middle Cerebral Artery 20%
- Internal Carotid Artery 40%
- Basilar and Vertebral Arteries 5-10%

Fig. 3: Flowchart depicting the commonest sites of saccular aneurysms related to the circle of Willis.

[Images of brain scans and angiograms showing different views of cerebral arteries and aneurysms.]
SAH

- Female 40-60yrs
- WFNS Grading 1-5 (1=15/15 5=3-6)
- Hydrocephalus
- Nimodipine
- Delayed neurological deficit (DND) peak 3-14d
- Hypertension Hypervolaemia Haemodilution
- Intra arterial treatment for vasospasm
- Cardiac failure and neurogenic pulmonary oedema
- Disorders of Sodium
- CSW vs SIADH vs DI
- Anaesthesia in neuro interventional radiology
- Surgical Complications
Summary

• Traumatic Brain Injury and ICP Management
• Brain death physiology and optimisation
• Brain stem testing and organ donation
• Key aspect of Neuroanaesthesia