A few Neurosurgical Emergencies

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Outline

- Neuroanatomy and physiology (85 slides 😊)
- Raised ICP considerations
- Intracranial haemorrhage
- Shunt complications
- Headache - when to worry
Raised Intracranial Pressure

Do not forget metabolic reasons/encephalopathies
Raised ICP in a nutshell

- Elevated ICP is defined as intracranial pressure $\geq 20$ mm Hg for $>5$ minutes.
- This impairs arterial blood flow, producing ischemia
- Cerebral Perfusion Pressure = MAP – ICP
- Keep CPP $>60$, ICP $<20$

PCO2 response is rapid but not sustained
Clinical signs

- Headache
- Nausea/Vomiting
- Visual disturbances
- Focal signs
- Behavioural changes
Autoregulation

- Right shift in hypertensive individuals
Raised ICP on CT
Basic and not so basic measures

- Prevent Hypoxia
- Elevation of head and trunk
- Normocapnoea, Normothermia
- Keep neck straight
- Avoid jugular vein compression (ETT tie)
- Trauma: Cervical collars not too tight
- Hypertonic saline
Intubation, Ventilation, Sedation

- Reduce coughing, pain response, enables ventilation
- Reduces fluctuations in ICP
- Decreases cerebral metabolic rate
- Can cause drop in MAP impairing CPP necessitating vasopressors
Osmodiuretics

- **7.5% Saline 4 ml / kg** (to a maximum of 250ml) of large bore peripheral cannula over 10 minutes
- **Mannitol 20% 1.5-2g/kg** (pH 6.3) over 30 min
- **If signs of actual or impending herniation**
Surgical options

- “Mass” removal
- Ventricular drainage
- Craniectomy
- (Biopsy)
Steroids and monitoring

- Steroids: oedema around tumours and abscess - **NOT** in haemorrhage/traumatic brain injury
- Intracerebral monitoring
Summary: Raised ICP

- Just about any intracerebral and many systemic pathologies can cause raised ICP
- Much can be done to optimize condition in ED
- Simple measures go a long way
Intracerebral haemorrhage

- Approximately 12-15 per 100,000/year
- 350 hypertensive haemorrhages per 100,000 elderly individuals/year

19 y old post amphetamines
Mortality

<table>
<thead>
<tr>
<th>Publication</th>
<th>Type of Study</th>
<th>Number of Subjects</th>
<th>IVH%</th>
<th>Mortality w/IVH</th>
<th>Mortality w/o IVH</th>
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<td>Steiner T, et al (2006)</td>
<td>Prospective Trial</td>
<td>n=374</td>
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<td>Bhattathiri P, et al (2006)</td>
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<td>Takahashi O, et al (2006)</td>
<td>Retrospective</td>
<td>n=347</td>
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<td>Marti-Fabregas, J, et al (2003)</td>
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<td>46.15%</td>
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<td>Cheung R, et al (2003)</td>
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<td>Hemphill J, et al (2001)</td>
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<td>Turim S, et al</td>
<td>Prospective Observational</td>
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20% are independent six months after intracerebral bleeding
Clinical signs

- The younger, the more dramatic the onset
- Alteration in level of consciousness (approximately 50%)
- Nausea and vomiting (approximately 40-50%)
- Headache (approximately 40%)
- Seizures (approximately 6-7%)
- Focal neurological deficits
Causes

- **Hypertension**
- Arteriovenous malformation
- Aneurysmal rupture
- **Cerebral amyloid angiopathy**
- Intracranial neoplasm
- Coagulopathy
- **Haemorrhagic transformation of an ischemic infarct**
- Cerebral venous thrombosis
- **Sympathomimetic drug abuse**
- Moyamoya
- Sickle cell disease
- Eclampsia or postpartum vasculopathy
- Infection
- Vasculitis
Emergency Management

- **ABC**

- AHA Scientific Statement Guidelines for the Management of Spontaneous Intracerebral Hemorrhage 2010
- European Stroke Organisation (ESO) guidelines for the management of spontaneous intracerebral hemorrhage 2014
For all of us who struggle to find CTs, ICU beds or anyone who cares……..

- Initial monitoring and management of ICH patients should take place in an intensive care unit with physician and nursing neuroscience intensive care expertise

- Rapid neuroimaging with CT or MRI is recommended to distinguish ischemic stroke from ICH
Imaging as soon as possible

Code stroke approach!
Surgery

- **Supratentorial:**
  - no evidence to support surgical intervention on a routine
  - may be of value for patients with a GCS score 9–12.
  - Early surgery versus initial conservative treatment…(STICH II): (The Lancet August 2013): *early surgery does not increase the rate of death or disability at 6 months*

- **Infratentorial:**
  - Unclear how, when, and for whom surgical evacuation should be performed in adults with infratentorial ICH.

- **Minimally Invasive Surgery:** Work in progress
External Ventricular Drains

- No RCTs, about how, when, and for whom to place an EVD in
- Outcome of patients with intraventricular haemorrhage worse
Admitted with “Labyrinthitis” 0400. “asleep”- 0925 GCS 6
Blood pressure management in ICH - suggestions, but check local protocols

- In acute ICH within 6 h of onset
- **intensive blood pressure reduction** (systolic target <140 mmHg in <1 h) is safe and may be superior to a systolic target <180 mmHg.
- No specific agent can be recommended.

- (Rapid Blood-Pressure Lowering in Patients with Acute Intracerebral Hemorrhage NEJM 2013: over 2800 patients (INTERACT 2))
Blood pressure management in ICH: check local protocols

- **Antihypertensive Treatment in Acute Cerebral Hemorrhage (ATACH) trial:** ATACH II currently recruiting

- **Eg Labetalol, Esmolol, SNIP, (Nicardipine, Enalapril)**

- **Local protocols/guidelines**
Summary: ICH

- Anyone with “stroke symptoms” could have a bleed
- Early imaging
- Management of blood pressure
- Still poor prognosis with high mortality and morbidity
- No straightforward surgical pathways
VA and VP shunts

Obstruction
Disconnection
Infection
Indications for ventriculoperitoneal Shunts

- **Hydrocephalus (congenital/acquired)**
- Brain tumour (benign or malignant)
- **Spina bifida**
  - Congenital aqueductal stenosis
  - Craniosynostosis
  - Dandy-Walker syndrome
  - Arachnoid cyst
  - Idiopathic intracranial hypertension
Shunt obstruction

- 50% of all shunt failures due to obstruction. ventricular catheter blockage is by far the most common
- Symptoms are generally the same, raised ICP
- clinical picture influenced by the aetiology of the hydrocephalus and the patient's age.
Shunt obstruction

- Children with myelomeningocele have greatest variability of clinical manifestations,

- 9-29% of possibilities of underestimating a shunt malfunction only on clinical grounds

- One third of patients with shunt malfunction may have "normal" imaging data
Imaging

Occasional cause of neurological deterioration with shunt
Common Pathogens Associated With Ventriculoperitoneal Shunt Infections

- Early Infection (85%) (Within Weeks of Shunt Placement or Revision)
  - Coagulase-negative Staphylococci (ie, S. epidermidis)—50%
  - Staphylococcus aureus—33%

- Late Infection (15%) (Several Months After)
  - Stenotrophomonas
  - Serratia marcescens
  - Candida albicans
  - Pseudomonas aeruginosa
Diagnosis

- High index of suspicion
- Trust the patient, parents and carers
- Initially no specific neurological signs or signs of raised ICP
- Cerebrospinal fluid for analysis
- Imaging
VP shunt tap
Treatment

- Often includes shunt revision
- Intraventricular vancomycin
- Systemic antibiotics
Summary: Shunts

- Patients with shunts often have comorbidities that make diagnosis complex
- Imaging not always reliable
- High index of suspicion
- Expert advice
And now to a crowd favourite

....... 

- 0600 am. A 49-year-old woman (could be me 😊) comes in complaining about a “terrible headache” following an argument.
developed over approximately 15 minutes
much better since she took two oxycodone tablets
mild photophobia without any focal neurological signs
minimal neck pain (gardening yesterday)
.... but wait there is more

- The headache is almost like her typical migraine. Neurologically normal

- CT? LP? Oral/IM /IV pain meds
- Discharge?
- Or should I hand her over to the morning shift........
Headaches in ED

- 4.5% of presentations
- Overwhelmingly benign headache syndromes (tension, migraine, cluster etc)
Characteristics of headache with serious underlying pathology

**History**

- **Explosive onset and severe at onset**
- **No similar headaches in the past (2 edged sword)**
- **Concomitant infection**
- **Altered mental status**
- **Headache with exertion**
- **Illicit drugs - particularly amphetamines and cocaine**
- **Family history**
- **Age over 50**
- **Immunosuppression**
Characteristics of headache with serious underlying pathology

Physical examination
- Neurologic abnormalities
- Decreased level of consciousness
- Meningismus
- Toxic appearance
- Papilledema
What is a sudden headache?

- Severe persistent headache
- Reaches maximal intensity within seconds or only a few minutes
- Always warrants investigation
- If CT negative - LP
LOW-RISK PATIENTS

- prior headaches without substantial change to normal
- who present to the emergency department due to failure of their standard therapy regimen
STOP!

I has a headache!
Summary: Headaches

- Systematic approach
- Risk stratify
- Every patient warrants thorough assessment - patients with migraines get SAH
- If sudden headache - negative CT warrants LP
Thank you