Learning objectives
Do not miss subarachnoid haemorrhage

- Learn the red flags
- We will examine contrasting clinical cases of headache that may be due to potentially lethal causes such as subarachnoid haemorrhage or more benign causes such as migraine. Important features in the history include establishing the timing of onset of symptoms and using eye witnesses.
Red flags in the diagnosis of headache(1)

- Sudden onset headache
  - Subarachnoid hemorrhage
- Worsening pattern headache
  - Mass lesion, subdural hematoma
  - Medication overuse
- Headache with systemic illness
  - Meningitis, encephalitis
  - Systemic infection
  - Collagen vascular disease, arteritis
Red flags

- CNS vascular:
  - Bleeds (SAH, EDH, SDH, IPH)
  - Carotid dissection, temporal arteritis
  - Cavernous sinus thrombosis
- CNS infection:
  - Meningo/encephalitis, abscess
- Tumour
- Others:
  - Eyes (glaucoma, iritis)
  - Toxic & metabolic (CO poisoning)
  - Preeclampsia & malignant HTN

- Sudden onset headache = subarachnoid haemorrhage until proven otherwise
ASSESSMENT - HISTORY

- Pattern
  - First severe (&age), sudden onset, exertion, worst ever, steady worsening (days), significant dif. to normal HA
    - Location is not really helpful
- Associated symptoms:
  - LOC, GCS, confusion, visual problems, fever, seizures, neuro, eye & face pain
- Past history & medications
  - Esp. coagulation & immune suppression.
- Family History,
  - may help with migraine & SAH

- Is this the first episode, or a recurrent headache?
- Longstanding headaches are unlikely to be life threatening
- Unilateral headache is typical of migraine, cluster headaches, or giant cell arteritis
- Descriptions such as
- Pressure, tight, throbbing are not specific for diagnoses.
Associated symptoms

- Focal neurological symptom (migraines, space occupying lesion)
- Nausea & vomiting (migraine, infections, raised intracranial pressure)
- Alcoholism, anticoagulants (subdural haematoma)
- Recent trauma (concussion, subdural haematoma)
- Worse on waking, straining, bending over, coughing (raised ICP)
- Fever, photophobia, neck stiffness (meningitis)
- Visual disturbance (migraine, glaucoma, giant cell arteritis)
- Pain tenderness on side of head, jaw claudication – *pain on chewing* – visual disturbance (giant cell arteritis)
- Coma, seizures, focal neuro symptoms suggest significant problem
ASSESSMENT - EXAM

- Vitals – BP, PR, fever –
  - look for focus of infection
- General – face and eyes, ears, TMJ
- Meningism
  - Movement of neck or straight leg raise may cause pain
- Neuro – mental state, CN’s, motor, sensory, cerebellar
- What’s an adequate screening exam?
  - Plantar response, symmetry, pupils represent value for time signs.

- In patients over 50 years
  - Check temporal artery tenderness and intraocular pressure… and look for signs of glaucoma
  - Red eye, cloudy cornea, dilated pupil, less responsive
Case 1 - Headache

- Transferred from regional hospital 1-2 hours away
- Sudden onset of headache during intercourse, associated nausea, vomiting, neck stiffness
- Headache occipital
- No recent illness/fevers
- No history of similar
- GCS 15 throughout
- Gets occasional migraines – not this bad
- This headache different
- Pre hospital treatment tramadol and ondansetron, morphine and stemetil in AV
Case 1 - CT thought to be normal
Case 1 - CT reported normal (ED)

- Lesson – radiologist to report suspected SAH CT images

C.T. BRAIN

Non contrast enhanced examination.

There is diffuse subarachnoid haemorrhage present around the circle of Willis. There is a slight increase in haemorrhage present around the right MCA with a possible 6mm hyperdense focal region at the right MCA bifurcation. This appearance suggests a possible right MCA aneurysm.

There is mild hydrocephalus.

No other intra or extra axial collection, mass or haemorrhage. No infarct.

CONCLUSION:

Diffuse subarachnoid haemorrhage around the circle of Willis with slight preference around the right MCA where appearances as outlined above raise the suspicion of a right MCA aneurysm near its bifurcation. Mild hydrocephalus.
Case 1 - Diagnosis on LP suggested Subarachnoid haemorrhage

- Lumbar Puncture
- Multiple attempts no success
- Then successful tap 1st pass
- Blood stained CSF
- Opening pressure 28cm H20
- Transferred
Investigation in suspected SAH

- Lumbar puncture in suspected SAH with normal CT or MRI brain

- Differentiate traumatic tap from SAH by xanthochromia (colored supernatant)
Further investigation for SAH

- 4 vessel cerebral arteriogram
- MRA (magnetic resonance angiography)
- Spiral (helical) CT angiography
SAH management

- Early discussion with neurosurgical team
- Early consideration of transport/retrieval issues
- Classification of severity and pre-existing health of patient will influence outcome
Haemorrhagic stroke

- Subarachnoid haemorrhage can be contrasted with other haemorrhagic strokes
- Haemorrhage accounts for approx 20% of all strokes
- much more severe than other strokes
- fatal > 50 percent of the time overall
Haemorrhagic stroke - causes

- Primary
  - HTN: often basal G, brainstem, cerebellum
  - Some others: amyloidangiopathy

- Secondary:
  - Trauma, coagulopathy, tumour, AVM
  - aneurysm
Indications for Transfer

- The Prognosis
- The roles of neurosurgery
Poor Outcome Predictors

- Elderly
- Large or increasing volume of hematoma
- Interventricular clot extension and/or hydrocephalus
- Communication disorder
- Low GCS on admission
- Midline shift and herniation syndromes on imaging
- Anticoagulation agents
- If GCS < 9 and haematoma volume > 60 ml, mortality at one month 90%
- GCS > 9 and haematoma volume < 30 ml, mortality at one month > 17%
The ICH Score: A Simple, Reliable Grading Scale for Intracerebral Hemorrhage

Hemphill, J. Claude III, MD; Bonovich, David C. MD

<table>
<thead>
<tr>
<th>Points</th>
<th>0</th>
<th>1</th>
<th>2</th>
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<tr>
<td>GCS</td>
<td>13-15</td>
<td>5-12</td>
<td>3-4</td>
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<tr>
<td>ICH Volume (cm³)</td>
<td>&lt;30</td>
<td>&gt;30</td>
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<td>IVH</td>
<td>No</td>
<td>Yes</td>
<td></td>
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<td>Infratentorial</td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>&lt;80</td>
<td>&gt;80</td>
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![Graph showing 30-day Mortality (%) vs ICH Score]

- Overall: n=152
- 0: n=26
- 1: n=32
- 2: n=27
- 3: n=32
- 4: n=29
- 5: n=6
Role of surgery

- Reversal of mass effect & herniation syndrome
  - Cerebellar haematoma, large haematoma
- Reversal of hydrocephalus
- Treatment of surgical aetiology
  - Aneurysm, AVM, tumours
- Other benefits (????)
  - Reduce the toxic effect of the presence of intracerebral blood
  - Promote recovery of the ischemic penumbra
Assessment features

- History: usually associated with more Nausea & Vomiting, headache, altered conscious state, seizures, sudden onset
- Medications important esp. warfarin or other anticoagulants
- Underlying functional status!!

**ROSIER tool**

Rule Out Stroke In the Emergency Room

Rosier scale to differentiate stroke and "stroke mimics"

- Has there been loss of consciousness or syncope
  - Y (-1) N (0)
- Has there been seizure activity
  - Y (-1) N (0)
- Is there a **new onset** (or waking from sleep)?
  - i. Asymmetric facial weakness
    - Y (+1) N (0)
  - ii. Asymmetric arm weakness
    - Y (+1) N (0)
  - iii. Asymmetric leg weakness
    - Y (+1) N (0)
  - iv. Speech disturbance
    - Y (+1) N (0)
  - v. Visual field defect
    - Y (+1) N (0)

**Stroke is likely if total score > 0**

Scores of < / = 0 have low probability of stroke but not excluded

Adapted from [http://handbook.muh.ie/Neurological/Stroke/rosier.html](http://handbook.muh.ie/Neurological/Stroke/rosier.html)
Management

- ABC issues: airway protect, avoid dextrose in fluids
- REVERSE WARFARIN
- Correct hypoglycaemia, keep <10
- IDC, nursing
- Consider analgesia
- HTN
  - reduce only if >180/>?90-105
  - 20% reduction, above measures first
“avoid secondary brain injury”

- Neurons need blood delivering $O_2$, removing $CO_2$, glucose
- “closed box theory”:
  - CPP = MAP – ICP
  - Autoregulation for CPP 50-150, fails in TBI
  - Normal ICP <15, 20 is bad, 40 is a disaster
- Some means can control ICP:
  - ED: head up 30, reduce strain, ‘desperation’
  - Neurosurg: insert metal drain CSF/blood
- Controversy: neuroprotective & cooling
Neurosurgical opinion - who for?

- Definitely useful in SAH
- Posterior fossa/cerebellar:
  - Clearly improves outcomes
- Brainstem ICH has poor outcome
- Supratentorial ICH:
  - Possible to evacuate blood, shunt and ICP monitor
  - Doesn’t improve outcome
    - STICH study Lancet 2005
Aneurysmal haemorrhagic stroke

- Aneurysms are common
- Prevalence in lifetime is 4-6%
- Most will not rupture
- Risk of 1st SAH averages 0.1% per year
- Surgery has significant M&M
- Not for surg if <10mm unless post SAH
- 10-25 risk is still < 1% per year
- >25mm risk approx 6% or more p.a.
- Position also important
Case 2 - Headache

- Presents with headache for many days & Vomiting
- Pain on back of head
- O/E occipital shingles.
Case 2 - Headache

- Examination CNS normal
- Old neuro signs of weakness
- Paracetamol, ketorolac 30mg IM, chlorpromazine 12.5mg IV
- Plan… exclude…
Case 2 - Headache Further clinical

- Headache spreads down left side of face down to neck
- Throbbing, 8/10, constant
- Nausea, x1 vomit
- After the LP & CT...
- Neck stiffness and photophobia...

HERPES VIRUS PCR
Specimen type: CSF

Test Description:
A polymerase chain reaction (PCR) screening specifically for Herpes simplex type 1 & 2 (HSV 1 & 2) and Varicella Zoster viral DNA.

Result:
Herpes Simplex virus type I DNA Not Detected
Herpes Simplex virus type II DNA Not Detected
Varicella Zoster virus DNA DETECTED

Comments:
This result has been notified to the Victorian Department of Health.
NOTIFICATION BY THE REFERRING DOCTOR is also required under the Public Health and Wellbeing Regulations 2009.
Or phone 1300 651 160.

HERPES VIRUS PCR
Specimen type: Blister swab

Test Description:
A polymerase chain reaction (PCR) screening specifically for Herpes simplex type 1 & 2 (HSV 1 & 2) and Varicella Zoster viral DNA.

Result:
Herpes Simplex virus type I DNA Not Detected
Herpes Simplex virus type II DNA Not Detected
Varicella Zoster virus DNA DETECTED

Comments:
This result has been notified to the Victorian Department of Health.
NOTIFICATION BY THE REFERRING DOCTOR is also required under the Public Health and Wellbeing Regulations 2009.
Or phone 1300 651 160.
Case 3

- 2-3 days of frontal headache
- Also dizzy, nausea, vomiting
- Pulled over by police, not driving well
- Past history of Aortic Valve Replacement
- Medications – Warfarin. INR 3.1 recent
- Temp 37
- GCS 14 or 15
- Normal neurological exam
Case 3 - CT
Case 3 – CT report

CT BRAIN

INDICATION

Headache, nausea and vomiting for two days. On warfarin. Drowsy.

TECHNIQUE

Non contrast CT from the vertex to the skull base.

FINDINGS

Bilateral subdural haematomas are demonstrated. These are low density anteriorly and dependently of increased density consistent with recent bleeding. No mid line shift, there is however crowding of the basal cisterns. No herniation of cerebellar tonsils or obvious significant mass effect on the mid brain. No hydrocephalus or intraventricular blood.

Prominent anterior falx ossification with no evolving infarct or parenchymal haemorrhage.

CONCLUSION

Bilateral subdural haematomas with some mass effect crowding the basal cisterns. Density is consistent with acute or subacute bleeding. Maximal depth over the left parietal convexity is 8mm and over the right 8mm.
Case 4 -

- 3 days ago was pedestrian, struck by car and hit head
- Now confused
- Diabetic, hypertension
- MVA was low speed, was getting better, now more headaches and confused

- Unusual behaviour
- Note previously seen in ED and discussed with senior ED doc.
Case 4 - CT
Case 4 – CT Report

C.T. BRAIN

Non contrast enhanced examination.

There is a very extensive right subdural haematoma that surrounds the entire right cerebral hemisphere. It measures 2cm in maximal true depth. The right subdural collection is hyperdense posteriorly and isodense with brain anteriorly. Findings are in keeping with an acute on chronic subdural haematoma. There is no parenchymal haemorrhage demonstrated. There is significant positive mass effect from the subdural haematoma with effacement of the right lateral ventricle and approximately 12mm of midline shift from right to left.

There is also a small left extra axial collection. It is likely to represent a small subdural collection given that it crosses the left coronal suture. It measures approximately 3mm in maximal depth and 5cm in maximal length. It does not have significant positive mass effect.

No ventricular or parenchymal haemorrhage. No infarct. The basal cistems are open.

CONCLUSION:

Large extensive acute on chronic right subdural haematoma measuring up to 2cm in maximal depth but surrounding the entire right cerebral hemisphere. Associated 12mm of midline shift.

Very small left subdural haematoma that does not have positive mass effect.
Primary headache syndromes

- Purpose is to confidently diagnose:
  - Investigation unnecessary
  - Focus shifts to treatment
- There is some good evidence regarding Rx
Migraine

- Classical history:
  - Aura = spreading depolarisation
  - Strong family history

- Treatment (NICS 2006)
  - Narcotics not effective (pethidine<56%)
  - Ketorolac possibly worse
  - Chlorpromazine and tryptans best
Migraine treatment

- First line - if nothing taken:
  - aspirin 900mg & maxalon 10mg
  - Paracetamol 30/kg / ibuprofen 600-800mg

- First line – failed pt meds / vomiting:
  - Metoclopramide 10mg / CPZ 12.5mg im

- Moderate-severe:
  - CPZ 25mg in N/S 1litre 30-60/60
  - OR prochlorperazine 12.5iv
  - OR sumatriptan 6mg s/c
Sumatriptan

- Selective 5HT Ag. (1D) blood vessels
- Intranasal 20mg/oral 50mg/ sc 6mg
- Adverse = HTN, drowsy, dizzy, flushed, rash
- Contraindications are IHD, HTN
- Not if concurrent ergotamines
- 18% of people are non-responders
Cluster Headache

- Recurrent brief sudden and severe unilateral periorbital pain
- Brief changes Rx options
- Idiopathic (experimental imaging hypothalamic dysfunction)
- Pain from precarotid/cavernous sinus
- 0.4% males (male:female = 5)
- Duration 5/60 to 3H
Cluster Headache - clinical

- Very distressed patients
- Prominent autonomic phenomena
  - Including ipsilateral congestion and rhinorrhea, lacrimation, conjunctivitis, facial diaphoresis, palpebral edema, and complete or partial Horner syndrome
- Tachycardia is a frequent finding.
Cluster Headache - types

Episodic versus Chronic:
- **Episodic**: in clusters, from a week to a year; pain-free intervals > 2 weeks. Typically last 2 weeks to 3 months.
- **Chronic CH**: more than 1 year without remission or remissions <2 weeks
- **Chronic CH** difficult to treat & resists standard prophylactic agents.
Cluster Headache - treatment

- Abortive:
  - O₂:
    - High-flow, concentrated O₂ extremely effective in aborting attacks
    - mechanism of action poorly understood
  - Ergot alkaloids
    - Ergotamine (o/pr) or dihydroergot. (im/iv)

- Preventative options inc:
  - anticonvulsants, mood stabilisers, CCB
Other causes of headache
Benign Intracranial HTN

- (also ‘pseudotumourcerebri’)
- Idiopathic raised ICP
- Mostly obese young women (20-40)
- May see CN VI lesions, HA with N&V
- CSF and CT may be normal
- ICP is raised
- Rx: LOW, diuretics, drain CSF
HIV and headache

- It is important to remember that some patient groups, e.g. those with immunosuppression, may have different & unique presentations:
  - Toxoplasmosis
  - CNS abscesses more common
  - CNS lymphoma
Useful references freely available

- Tintanelli [www.sjem.org/files/39586667.ppt](http://www.sjem.org/files/39586667.ppt)