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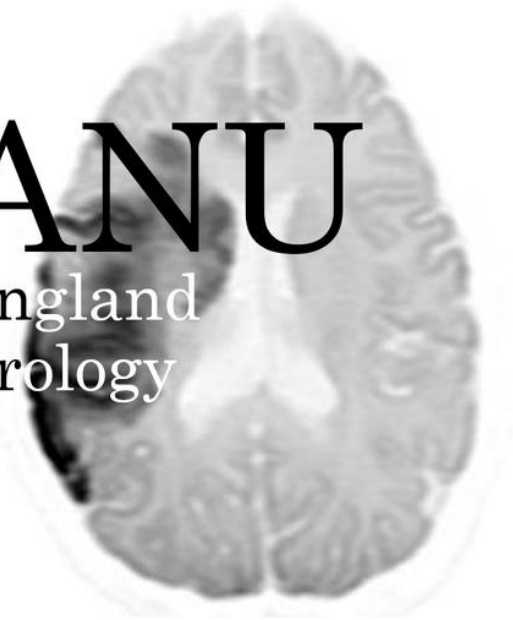
Acute Neurology
Update



Acute Headache

Chris Kobylecki

James Lilleker

MANCHESTER 1824
The University of Manchester

Manchester Centre for Clinical Neurosciences

Salford Royal NHS
NHS Foundation Trust

Objectives

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- Differential diagnosis of **acute headache**
- Common acute presentations of **primary headache** syndromes
- Diagnosis and management in **secondary headaches**
- Pitfalls and clinical tips

General principles

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- Airway
- Breathing
- Circulation
- Disability, drugs, dextrose

- History
  - Witness critical if consciousness impaired
- Examination
- Investigations

Case 1

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- 26 year old female
- 4 hour history severe headache
  - Throbbing, frontal
  - Associated nausea and vomiting
  - Photophobia and phonophobia
- Alert and orientated, in pain
- Photophobia, no neck stiffness
- No focal neurology, afebrile

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- What further information would be helpful?
- What is the likely diagnosis?
- What is your management plan?

Further information

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- Similar to usual headaches, gradual onset
- Normally occur around 2-3 times per month, worse around period
- Last all day then settle, no intercurrent headaches

Primary headache syndromes

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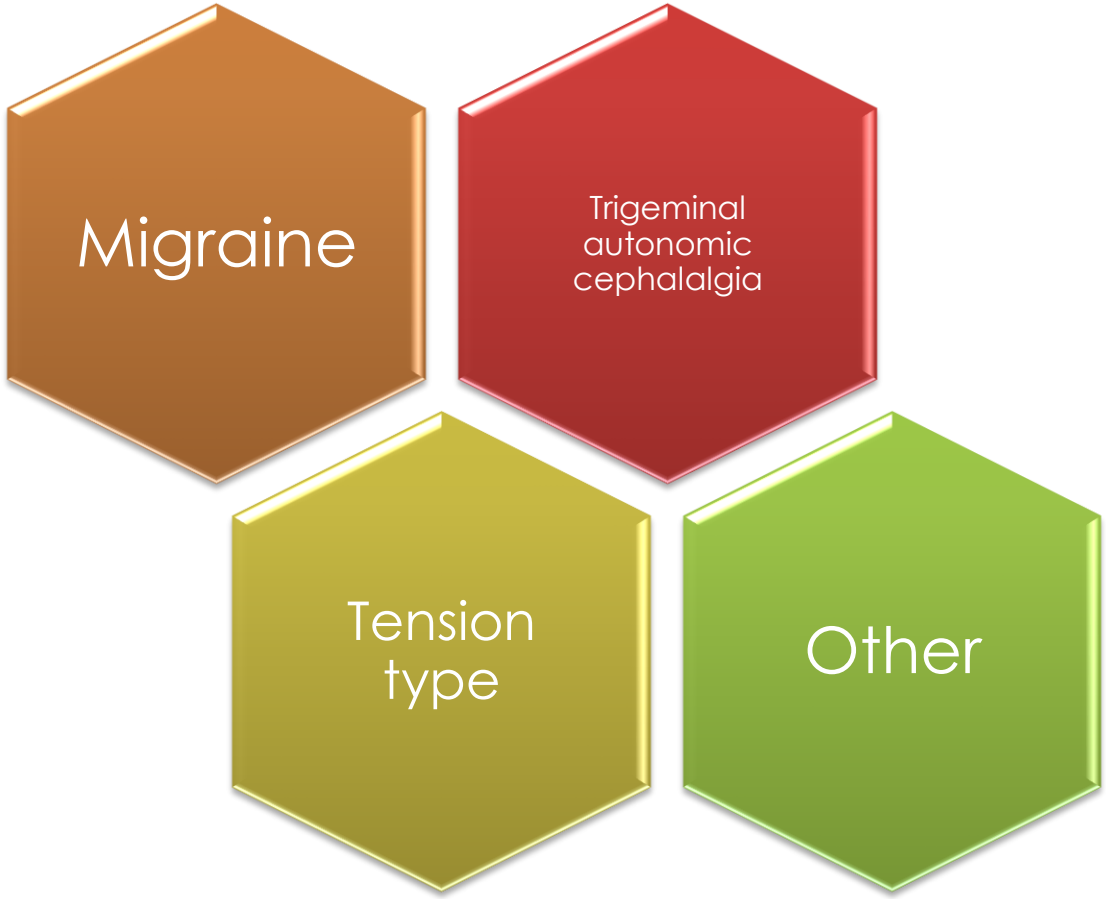

Acute headaches in ED

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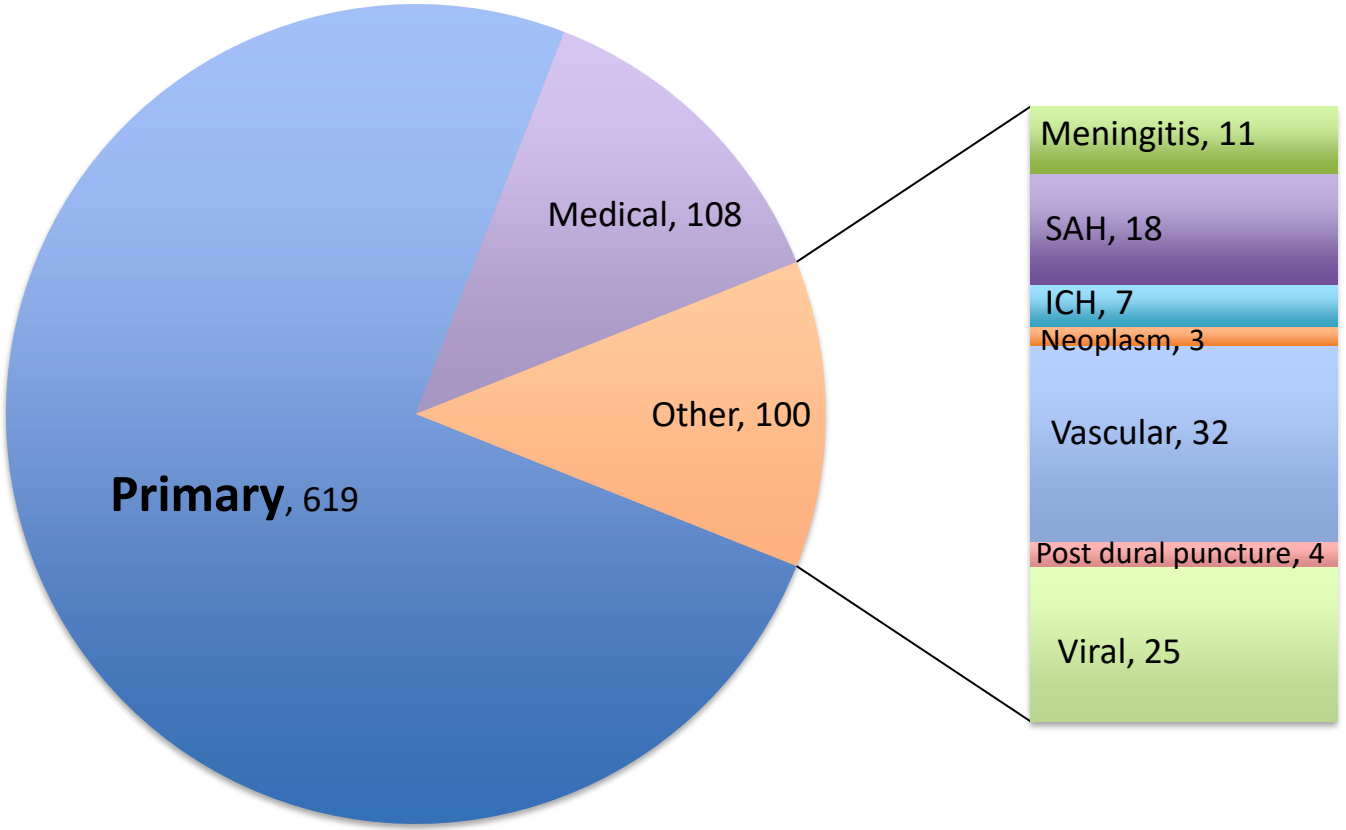

Chu KH *et al. Acad Emerg Med* 2017; 24:53-62.

Acute headache: *history*

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- General
  - Head trauma, systemic disease, dental/sinus problems
  - Medications e.g. illicit drugs, analgesia
- Headache
  - Onset, duration, frequency, previous headaches
  - Location, severity
  - Associated symptoms e.g. autonomic, neck stiffness, vomiting
  - Raised ICP features e.g. precipitated by coughing/straining, early morning onset, visual obscurations, pulsatile tinnitus
  - Systemic features

Acute headache: *Examination*

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- Conscious level
  - Restless/agitated/encephalopathic?
- Cranial nerves
  - Fundi
  - Eye movements (VI nerve palsy?)
  - Pupils
- Limbs
  - Sensory/motor deficit?
  - Pyramidal signs?

Acute migraine

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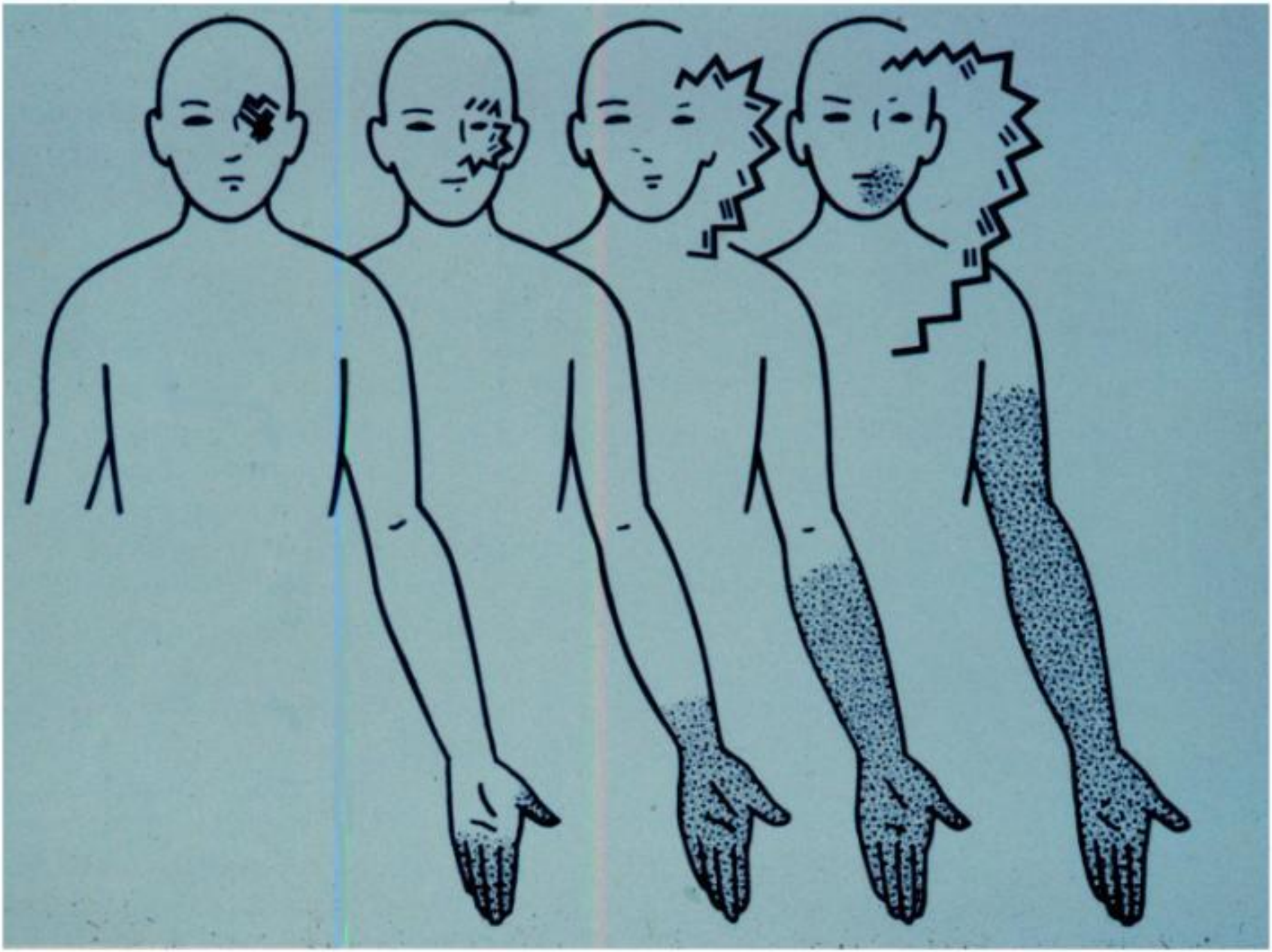
- Definition
  - Headaches lasting 4-72h
  - Typically unilateral, throbbing/pulsatile
  - Aggravated by physical activity
  - Nausea/vomiting, photophobia, phonophobia
- Migraine aura
  - Evolves over >5 min typically
  - Reversible positive>negative visual symptoms
  - Reversible positive>negative sensory features
  - Reversible speech disturbance (dysphasia)



Acute migraine treatment

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- NSAIDs
  - Aspirin 600 mg prn
  - Naproxen
- Paracetamol
- Antiemetics
  - Consider metoclopramide
  - Caution: acute dystonic reactions especially young women

Triptans

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- 5-$HT_{1B/D}$ agonist drugs
  - Blocks release of vasoactive peptides
  - Cranial vasoconstriction
  - Blocking release of neurotransmitters in dorsal horn of spinal cord
  - Nasal/buccal/sc if marked nausea

Migraine prevention: when?

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- Three or more headaches/month
- Significant interference with ADLs
- Acute medications ineffective, contraindicated or overused
- Patient preference

Migraine prevention: what?

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Category	Example	Cautions
Beta-blockers	Propranolol	Asthma Safe in pregnancy up to 40 mg bd
Anti-epileptics	Topiramate	Teratogenic Interaction with OCP
Anti-depressants	Amitriptyline	Sedating, cognitive effects
Anti-hypertensives	Candesartan	Hypotension, renal impairment
Botulinum toxin	BOTOX	Chronic migraine only
CGRP monoclonal antibodies	Erenumab	Specialist services only

Migraine: key points

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- Migraine is **most common** headache type
- Commonly presents to acute services
- Accurate **history** key to diagnosis
- Appropriate acute and preventive treatment can minimise acute presentations and improve quality of life

Case 2

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- 28 year old male
- Longstanding migraines
- "Nothing has ever worked"
- Getting increasingly agitated – has hit his head against wall during headache
- Currently on topiramate. Previously used propranolol, amitriptyline, candesartan, sodium valproate, gabapentin

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Case 2:

What would you do next:

- POLL

Take a history…

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- Pain always on left, esp behind eye
- Left eye becomes red and runs
- Restless during pain
- Bouts lasting 60 mins several times per day
- Periods where he headache free

- Diagnosis?

Trigeminal autonomic cephalalgias

- **Unilateral** head pain
- Prominent ipsilateral cranial **autonomic** features:
  - Lacrimation
  - Conjunctival injection
  - Nasal congestion

		Cluster headache	Paroxysmal hemicrania	SUNCT/SUNA
Sex ratio		3M:1F	1M:1F	1.5M:1F
Pain		Sharp, stabbing, very severe, V1>C2>V2>V3		
Attacks/day		1-8	11	100
Attack duration (min)		30-180	2-30	0-2
Triggers	Alcohol	**+++**	+	-
	Cutaneous	-	+	**+++**
Agitation/restlessness		**90%**	**80%**	65%
Periodicity		**Present**	Absent	Absent
Treatment	O_2	**70%**	Nil	Nil
	Sumatriptan	**90%**	20%	<10%
	Indometacin	Nil	**100%**	Nil
Migraine features	Nausea	50%	40%	25%
	Photo/phono-phobia	65%	65%	25%

Goadsby PJ. *Continuum* 2012;18:883-95.

Acute management of CH

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- High flow O_2
- Injectable sumatriptan (up to 6mg x2 per day)
- +/- Occipital nerve block
- +/- Short course of prednisolone

- Prevention: Verapamil
  - Titration up to 960 mg/day may be required
  - Regular ECGs with dose titration
- Other prophylactic options
  - Lithium, topiramate, melatonin

TACS

- Always ask headache patients about **TAC features:**
  - Shorter duration / periodic pain
  - Autonomic activation
- Treatment approach differs from migraine
- Indometacin trial can be life changing

Medication overuse headache

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- Chronic headache ≥15 days/month
- Regular overuse for > 3 months:
  - Ergotamine, triptans, opioids or combination analgesics on ≥10 days/month
  - Simple analgesics or medications above for ≥15 days/month
- More likely to occur in patients with migraine
- Requires weaning of analgesics with prophylaxis
  - Migraine-specific medications for acute headache
  - Consider short course steroid treatment

Prevention of MOH

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- Encourage quick and optimal treatment of episodic headache
  - NSAID use preferable to paracetamol/codeine
  - Migraine prophylaxis
- Avoid opioid-based treatments and regular paracetamol

Primary headaches: key points

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- Vast majority of acute headache presentations are **primary headaches**
- Can be diagnosed with careful **history**
- Appropriate management is key, imaging **usually not needed**
- Appropriate prophylaxis should reduce emergency attendance

Case 3

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- 42 year old female
- Sudden onset severe occipital headache
- Vomiting, photophobia
- Still present 2 hours post onset

What more information do you need?

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- Never normally has headaches
  - Severe episode of sudden onset headache 2 weeks before
- Pain intensity 10/10
- Past medical history
  - Hypertension, on ramipril
  - Smokes 15/day
- No family history acute headaches/ICH/stroke

History is critical!

Examination

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- Airway ok, resps 20/min, BP 180/90, HR 55/min
- GCS 15/15, responding appropriately
- Photophobic++, neck stiffness
- Cranial nerves normal
- Tone normal, power 5/5 all 4 limbs
- Reflexes symmetrical, plantars downgoing

CASE 3:

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What is the likely diagnosis?

POLL

When to consider SAH in acute headache

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Table 2. Ottawa SAH rule

Search for SAH if ≥ 1 of the following risk variables present
Age 40 ≥ years
Neck pain or stiffness
Witnessed loss of consciousness
Onset during exertion
Thunderclap headache
Limited neck flexion on examination

SAH, subarachnoid hemorrhage.

Chen C-Y and Fuh J-L. *Curr Opin Neurol* 2021;34:356-362.

What is the next step?

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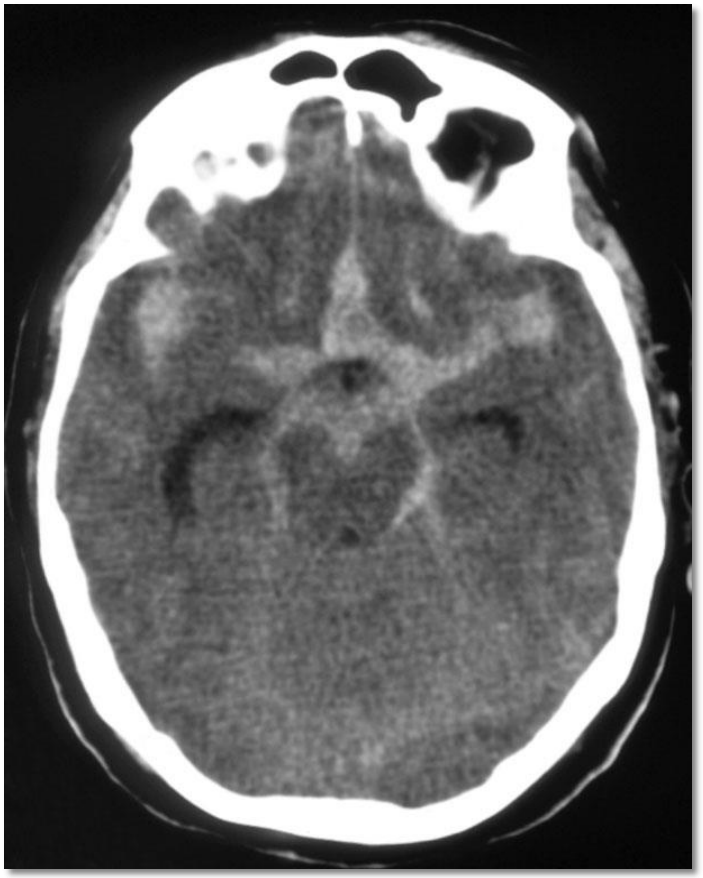

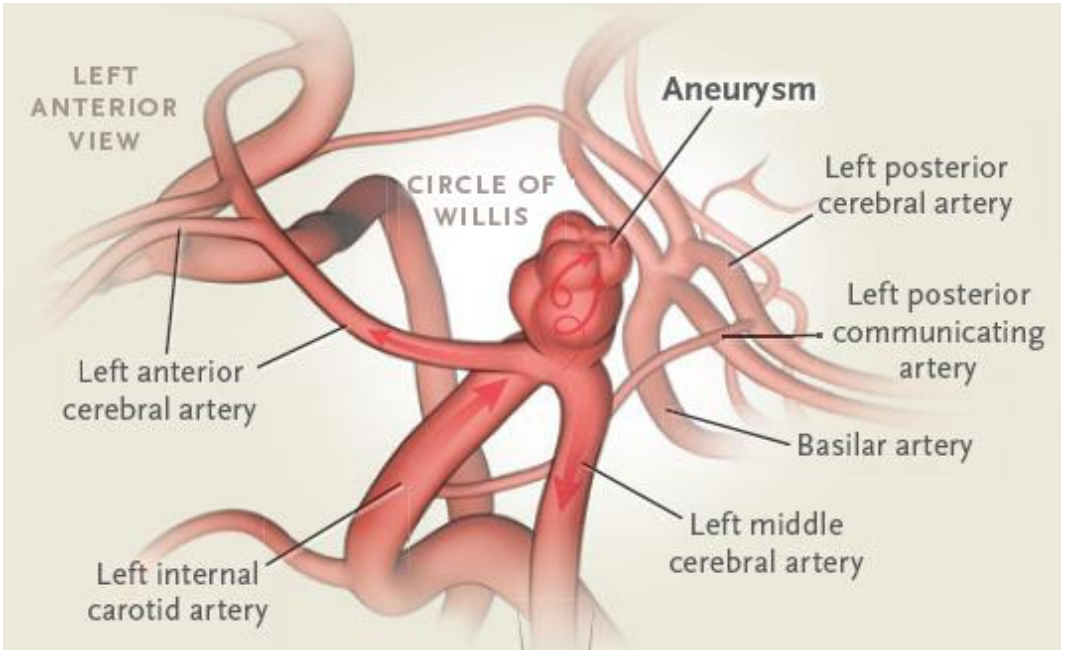

Lawton MT and Vates GE. *NEJM* 2017;377:257-266.

Investigation of suspected SAH

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- Urgent CT brain
  - Sensitivity close to 100% within 6h
  - 50% after 5-7 days
- Confirm diagnosis or alternatives
- Assess for complications
  - ICH, IVH
  - hydrocephalus

Lumbar puncture in suspected SAH

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- Lumbar puncture **mandatory** if CT negative
- Possibility of other diagnosis eg meningitis
- Should be performed >12 h after ictus
  - Fresh sample for microbiology, protein, glucose
  - CSF spectrophotometry (protect from light)
  - Opening pressure (differential diagnosis includes CVST and intracranial hypotension)
- CT angio can be preferred if clinical suspicion of alternative diagnosis to SAH low

Management of SAH

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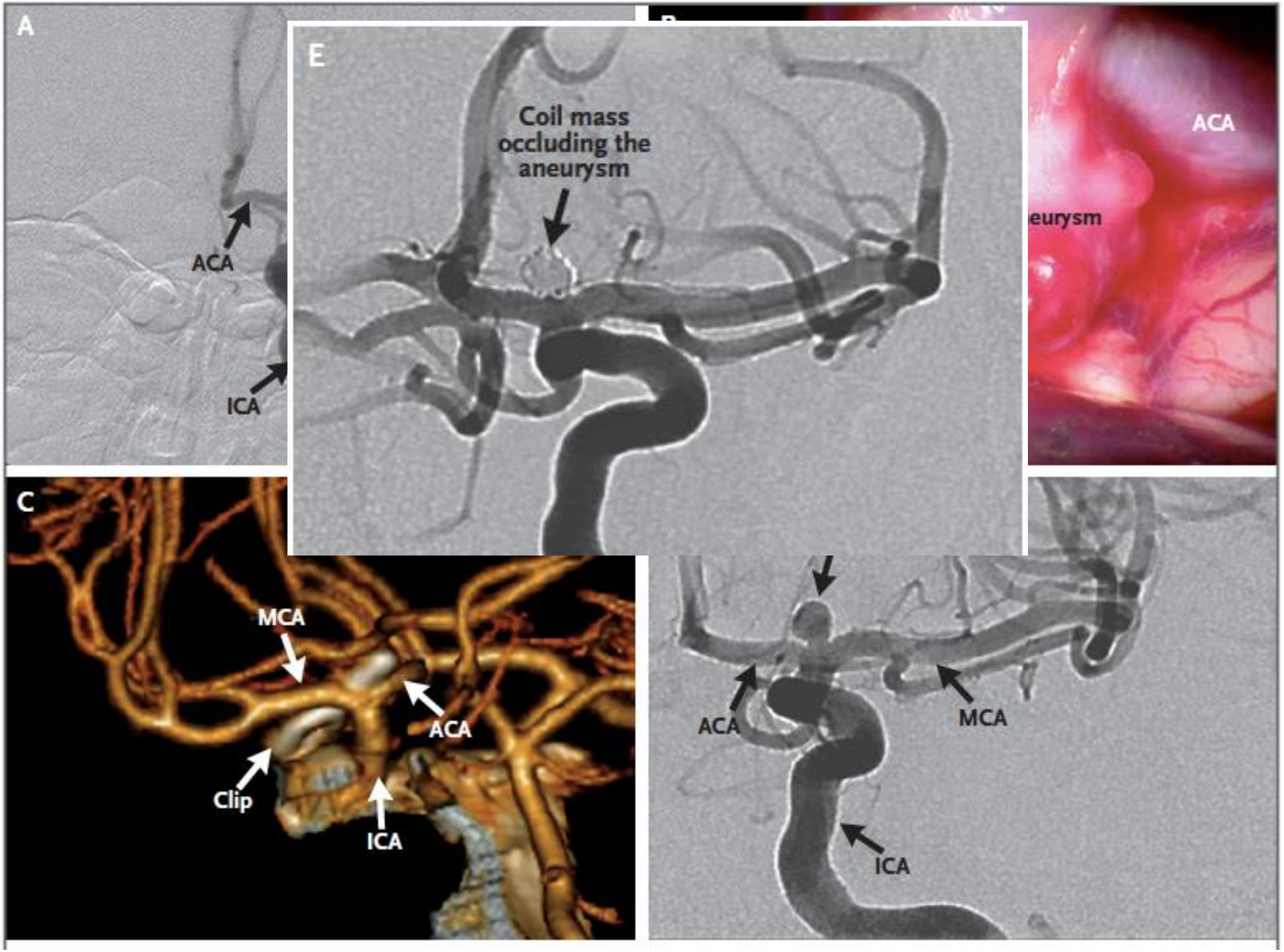
- Discuss with regional neurosurgery service
  - Will need CT angiogram ± catheter angiogram
- Nimodipine
- Regular neuro observations
- Late deterioration
  - Rebleed
  - Hydrocephalus
  - Ongoing seizures
  - Vasospasm and cerebral ischaemia



Lawton MT and Vates GE. *NEJM* 2017;377:257-266.

Thunderclap headache

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Cause	Clinical	Brain CT	LP	Brain MRI
RCVS	Recurrent thunderclap headaches	Normal or convexity SAH	Mild increase in WBC	Multifocal narrowing on MRA
Carotid/vertebral dissection	Neck pain, features of stroke, Horners syndrome	Normal or ischaemic stroke	Normal	Dissection on MRA
CVST	Focal neurological deficits, altered mental status	Normal Hyperdense sinus Venous haemorrhage	Elevated opening pressure	Normal Venous infarct/ haemorrhage
Spontaneous intracranial hypotension	Postural headache	Normal Subdural collection	Low opening pressure	Meningeal enhancement

Adapted from Schweat TJ, *Continuum* 2015;21:1058-71.

Learning points

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- CT is the investigation of choice for thunderclap headache
- LP is indicated if CT is normal
- If SAH excluded, search for alternatives
  - MR and vessel imaging useful in these cases

Case 4

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- A 20 year old female attends MAU due to worsening headache over 2 days.
- She has generalised head and neck pains that are worse when she moves about. She has been sick twice. She felt increasingly hot and tired so came to A+E with a friend
- She is normally fit and well; her only medication is the oral contraceptive pill

- What are the other important features from the history that you want to know?

- What important physical signs will you be looking for on examination?

Case 4 continued

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- Felt feverish all day. No recent illnesses or contacts
- Worsening throbbing headache with pain in neck and sensitivity to light
- GCS 15, but slightly drowsy, will answer Qs
- Temp 38.3^{o}C, Pulse 98bpm, BP 105/70, sats 96%, no rash
- Neck stiffness, no papilloedema. Normal CN, UL and LL

What do we think?

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CASE 4:

What is the likely diagnosis?

- POLL

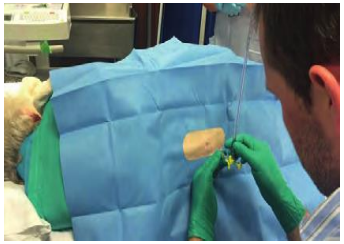
British Infection Association | Public Health England | The Royal College of Emergency Medicine | intensive care society | Association of British Neurologists | sam | Meningitis Research Foundation

Early Management of Suspected Meningitis and Meningococcal Sepsis in Immunocompetent Adults

3rd Edition
Jan 2016

Early recognition is crucial

Consider meningitis or meningococcal sepsis if ANY of the following are present:



- Headache
- Fever
- Altered Consciousness
- Neck Stiffness
- Rash
- Seizures
- Shock

Immediate Action

- **A**irway
- **B**reathing - Respiratory rate & O_2 saturation
- **C**irculation - Pulse; capillary refill time; urine output; blood pressure (hypotension occurs late)
- **D**isability - Glasgow coma scale; focal neurological signs; seizures; papilloedema; capillary glucose
- **S**enior review +/- Critical Care review if any Warning Signs are present

Warning Signs

The following signs require urgent senior review +/- Critical Care input:

- Rapidly progressive rash
- Poor peripheral perfusion
  - Capillary refill time > 4 secs, oliguria or systolic BP < 90mmHg
- Respiratory rate < 8 or >30 / min
- Pulse rate < 40 or >140 / min
- Acidosis pH < 7.3 or Base excess worse than -5
- White blood cell count < 4 x 10^9/L
- Lactate > 4 mmol/L
- Glasgow coma scale <12 or a drop of 2 points

Suspected Meningitis

(meningitis without signs of shock, severe sepsis or signs suggesting brain shift)

- Blood cultures
- Lumbar puncture
- Dexamethasone 10mg IV
- Ceftriaxone OR Cefotaxime 2g IV immediately following LP* (see also alternative initial antibiotics)
- CT scan normally not indicated
- Careful fluid resuscitation (avoid fluid overload)

*If LP cannot be done in the first hour, antibiotics must be given immediately after blood cultures have been taken

Suspected meningitis with signs suggestive of shift of brain compartments secondary to raised intracranial pressure

- Get Critical Care input
- Secure airway, high flow oxygen
- Take bloods including Blood Cultures
- Give Dexamethasone 10mg IV
- Give Ceftriaxone OR Cefotaxime 2g IV immediately after blood cultures taken
- Delay LP
- Arrange neurological imaging (once patient is stabilised)

Signs of severe sepsis or a rapidly evolving rash

(with or without symptoms and signs of meningitis)

- Get Critical Care input
- Secure airway and give high flow oxygen
- Fluid resuscitation
- Blood Cultures
- Ceftriaxone OR Cefotaxime 2g IV immediately after blood cultures taken
- Delay LP

Follow Surviving Sepsis Guidelines at: http://www.survivingsepsis.org/guidelines

- Poor response to initial fluid resuscitation

Delay LP

if any of the following are present:

- Signs of severe sepsis or rapidly evolving rash
- SEVERE respiratory/ cardiac compromise
- Significant bleeding risk
- Signs suggesting **shift of brain compartments** (CT scan before LP is warranted, as long as patient is stable)
  - Focal neurological signs
  - Presence of papilloedema
  - Continuous or uncontrolled seizures
  - GCS ≤12

Alternative initial antibiotics

Box 5. Indications for neuroimaging before lumbar puncture (LP) in suspected meningitis*.

- Focal neurological signs
- Presence of papilloedema**
- Continuous or uncontrolled seizures
- GCS ≤ 12***

*to exclude significant brain swelling and shift that may predispose to cerebral herniation post LP.
**inability to view the fundus is not a contraindication to LP, especially in patients who have had a short duration of symptoms.
*** LP without prior neuroimaging may be safe at levels below this.

Is raised ICP a contraindication to LP?

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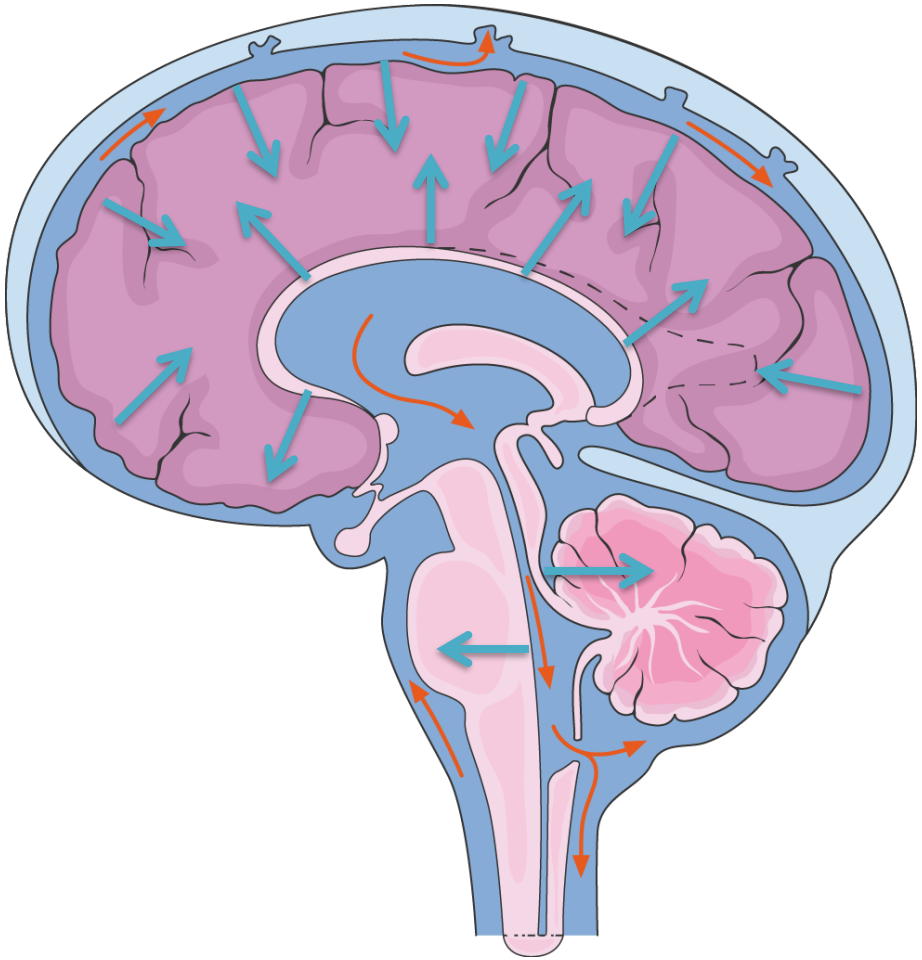

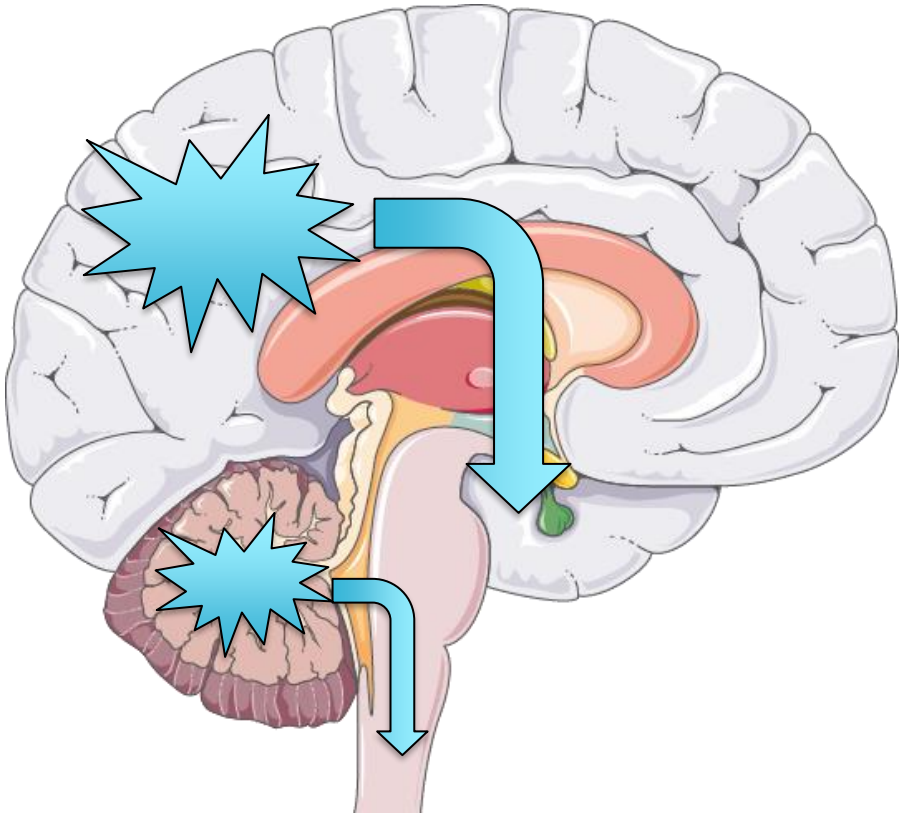

Why can't we do a LP if they're having seizures?

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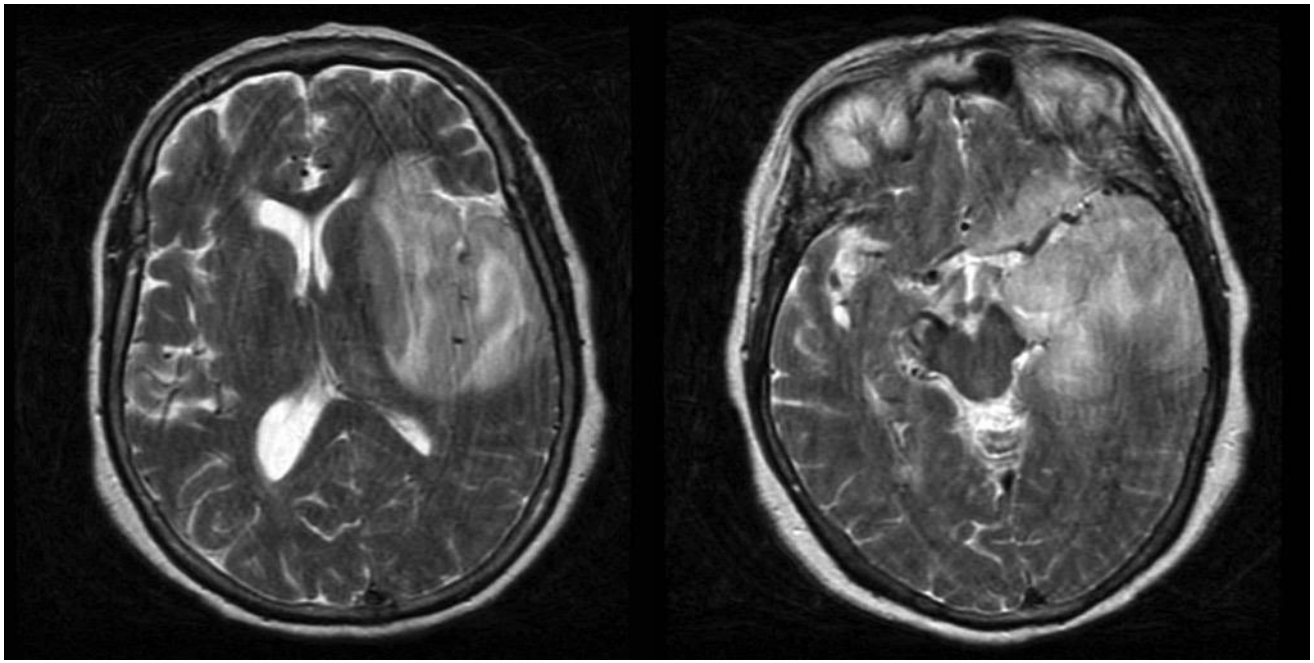
- Headache
- Fever
- Meningism

→ Defines meningitis

+



encephalitis

Case courtesy of A.Prof Frank Gaillard, Radiopaedia.org, rID: 9164

Case 5

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- 45 year old male
- 4 day history worsening headache
- Present on waking
- Worse on lying down/coughing/Valsalva
  - Intermittent blurred vision at those times

What more information do you need?

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- Never normally has headaches
- Past medical history
  - Ulcerative colitis, recent flare
  - Takes sulphasalazine/prednisolone
  - Non-smoker
- No family history acute headaches/ICH/stroke
  - No family history VTE

Examination

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- Airway ok, resps 12/min, BP 140/85, HR 85/min
- GCS 14/15, intermittently confused
- No meningism
- Both optic discs swollen
- Tone normal, power 5/5 all 4 limbs
- Reflexes brisk, plantars flexor

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CASE 5:

What is the most likely diagnosis?

- POLL

What is the next step?

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- CT brain normal

- Now what?

CT venogram

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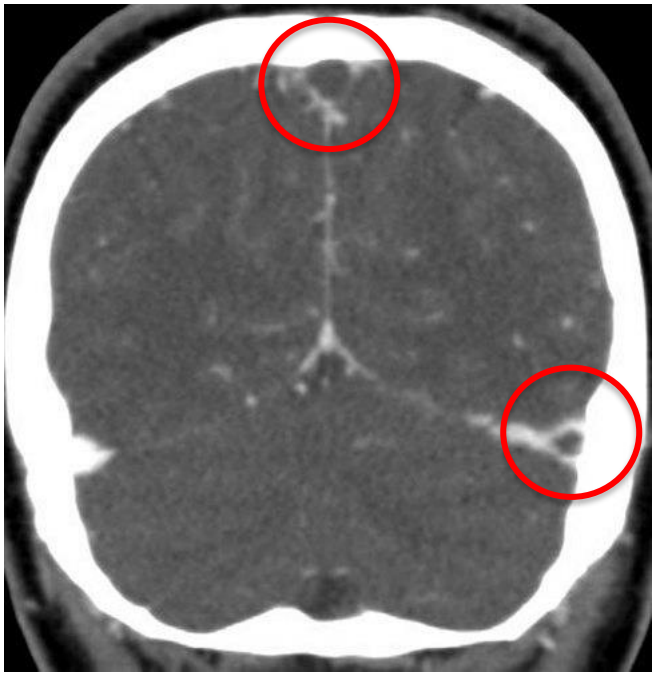

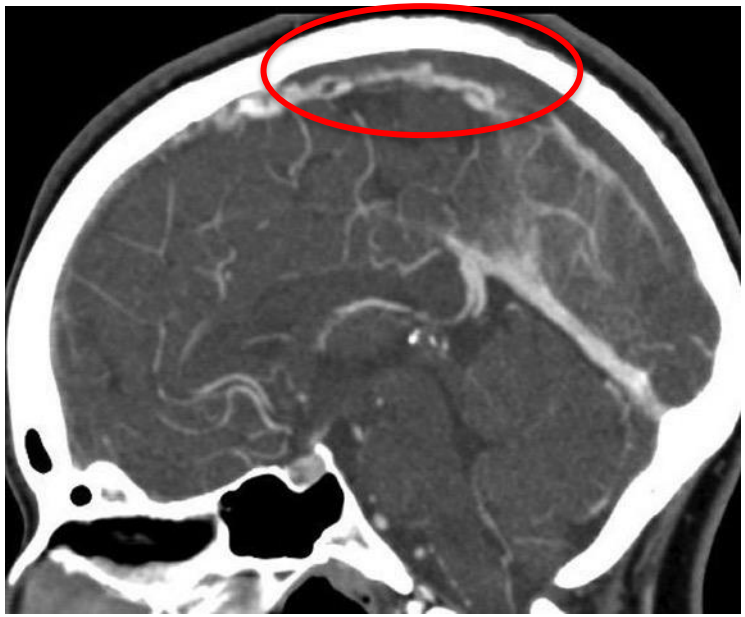

Courtesy of Dr Amit Herwadkar, Consultant Neuroradiologist, SRFT

Cerebral venous sinus thrombosis: aetiology

- Pregnancy/post-partum
- Local infection
  - Mastoiditis, sinusitis
- Dehydration
- Thrombophilia
- Haematological malignancy
- Drugs
  - Oral contraceptives
- Inflammatory conditions
  - **IBD**
  - SLE
  - Behçet's disease
- Head injury
- Recent neurosurgery
- COVID-19 infection
- COVID vaccines

Presentation of CVST

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- Acute (<48 hrs)
  - 56% patients
- Sub-acute (48 hrs to 30 days)
  - 37%
- Chronic (>30 days)
  - 7%

Presentation of CVST

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- Raised intracranial pressure (80%)
  - Headache (isolated in <25%)
  - Papilloedema
  - Diplopia (false localising sign)
  - Reduced conscious level, coma

Presentation of CVST

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- Focal neurological symptoms/signs
  - Hemi motor-sensory symptoms
  - ‘mass effect’ pressure
  - Seizure
  - Higher cortical signs
  - Coma (especially thalamic involvement)
- Mixed raised ICP/focal signs

Examination findings

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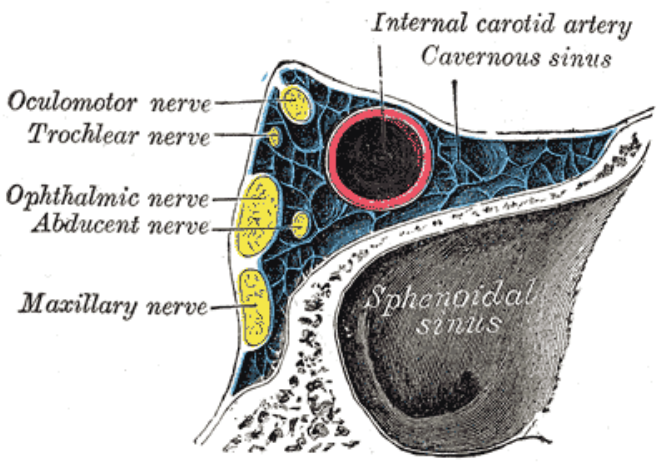
- Raised ICP
  - Papilloedema
  - Isolated VI nerve palsy
- Cavernous sinus thrombosis
  - Unilateral chemosis, proptosis
  - Ophthalmoplegia
  - CN Va, Vb involvement
- Pathophysiology
  - Cerebral vein thrombosis – local dysfunction
  - Large sinus thrombosis– raised ICP



When to suspect CVST in acute headache

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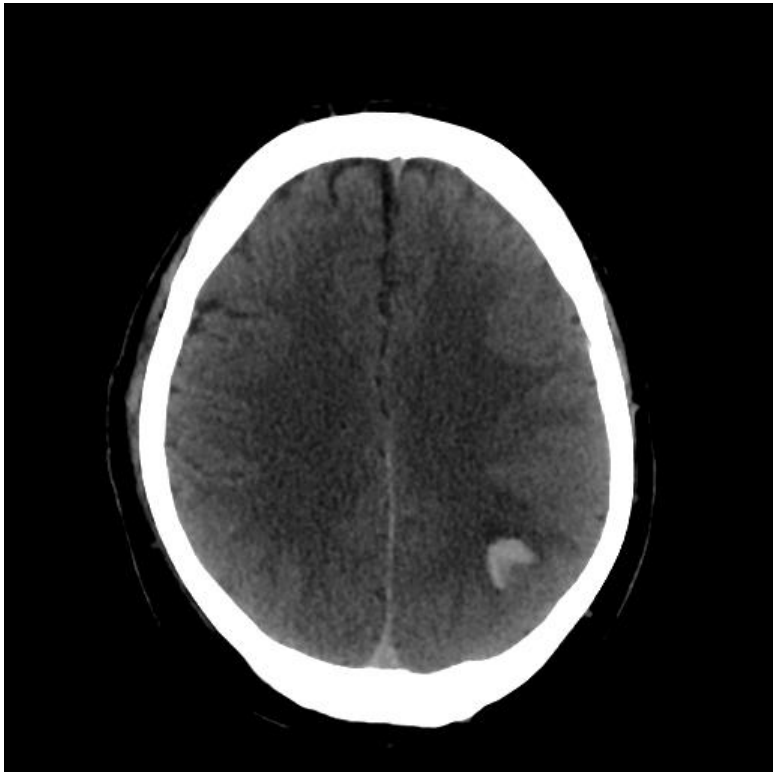
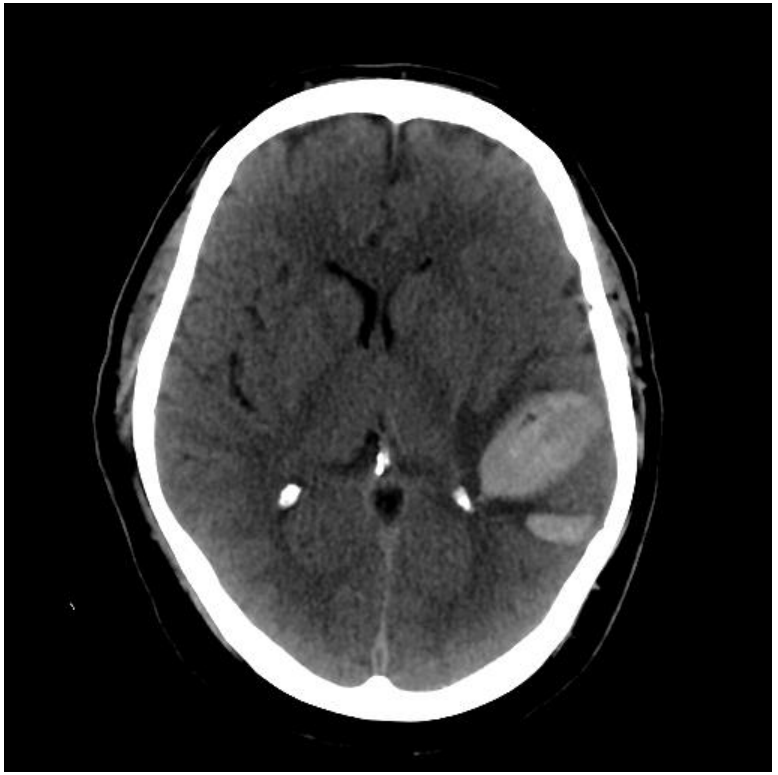
Ulivi L *et al. Pract Neurol* 2020;20:356-367.

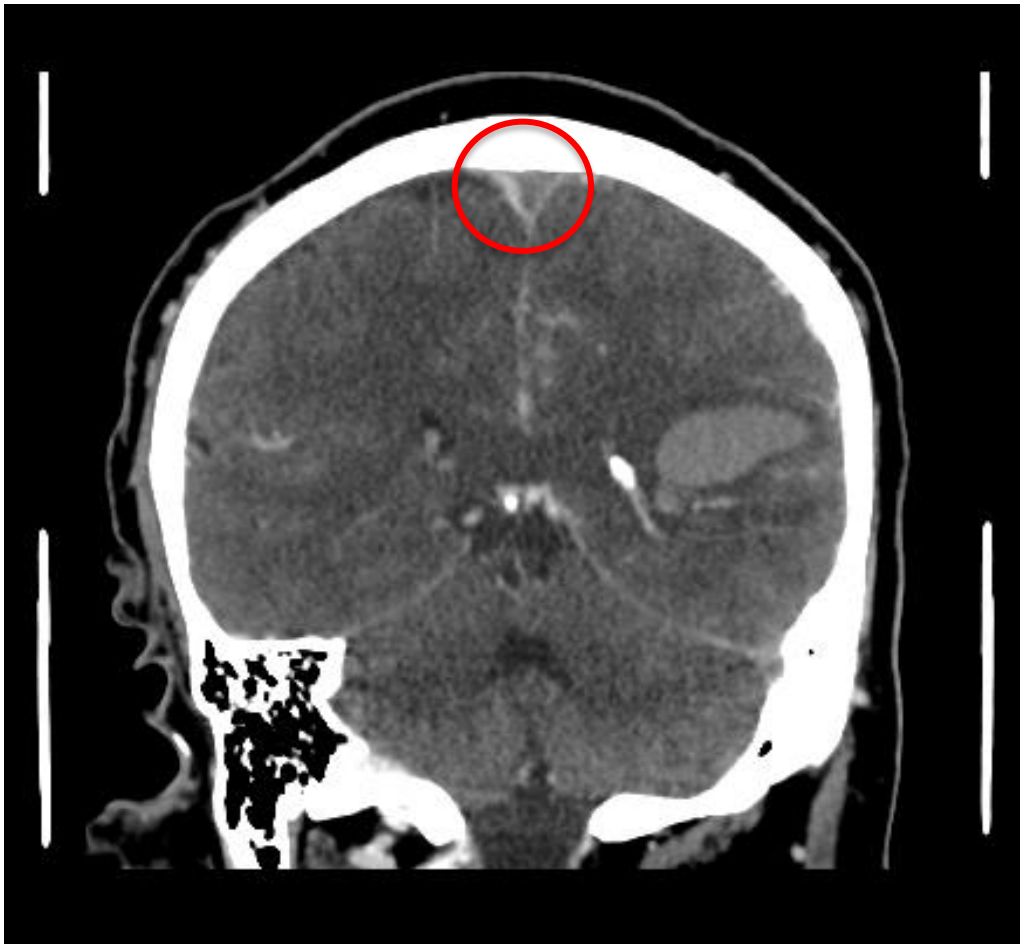
Imaging in CVST





Plain CT often normal

Imaging in CVST



Delta sign Δ

Management of CVST

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- Resuscitation – ABC, correct dehydration/infection
- Anticoagulation
  - LMWH in acute phase
  - Maintenance warfarin for 3-6 months if idiopathic or if transient underlying cause
  - Lifelong if recurrent or thrombophilia present
  - Consider DOAC (evidence base evolving, lack of monitoring useful in pandemic situation)
- Antiepileptic drugs
  - Acute seizures/focal parenchymal lesions
- Lumbar puncture
  - Pre-heparin if optic nerve compromise
  - May require VP shunt if persistent raised ICP

Vaccine induced CVST

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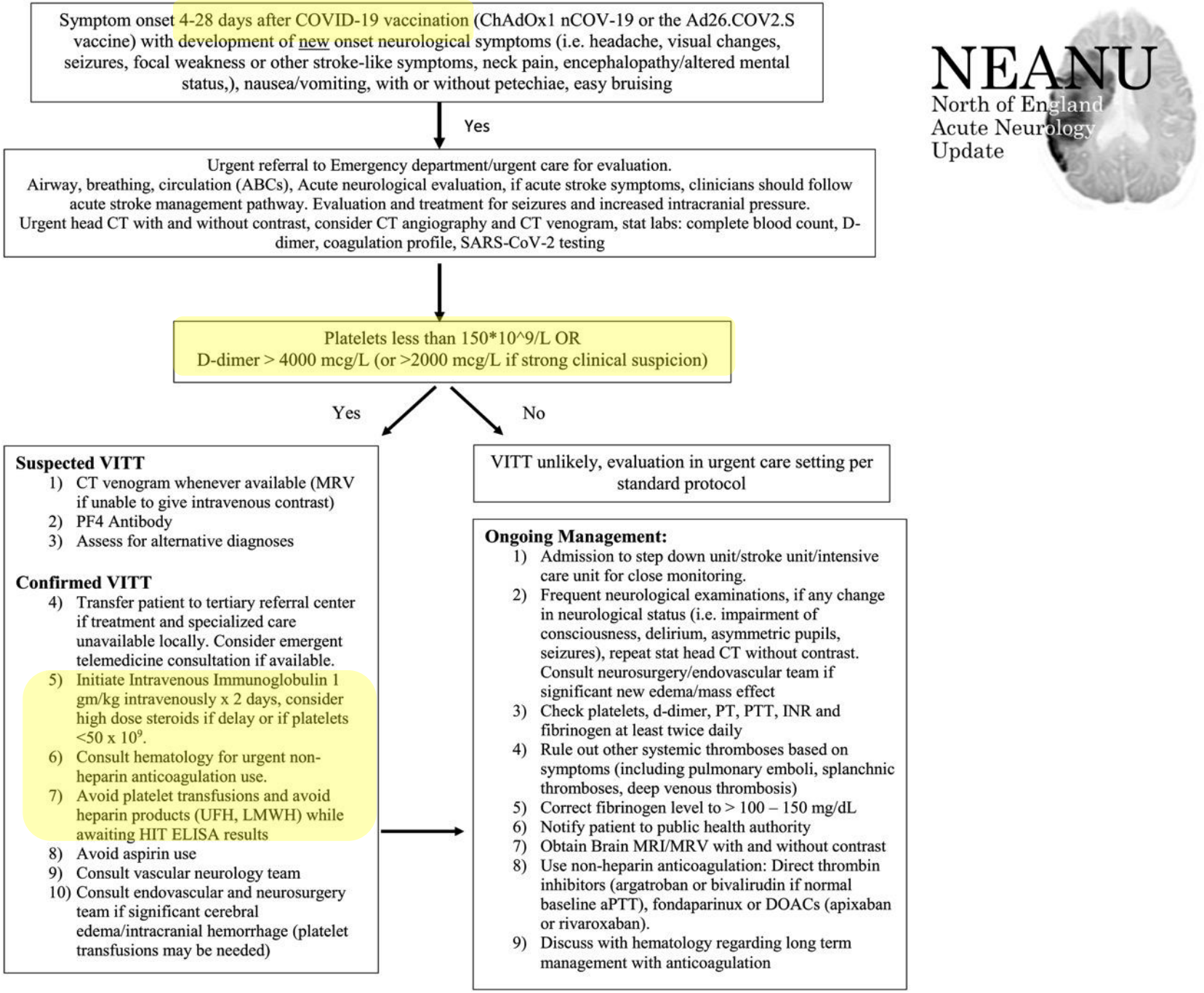
- Reports of thrombotic events with AstraZeneca ChAdOx1-S vaccine
  - Norwegian/Danish epidemiology study
  - 11 excess VTE events per 100,000 doses
  - 2.5 excess CVST[1]
- Key features include thrombocytopenia, anti-platelet factor 4 antibodies

1. Pottegård A *et al. BMJ* 2021;373:n1114



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North of England Acute Neurology Update

Thakur K *et al.* *Journal of the Neurological Sciences* 2021 427DOI: (10.1016/j.jns.2021.117532)

Learning points

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- Subacute headache+raised ICP (+/- focal neurology) – think CVST
- Plain CT is insensitive, consider CT or MR venogram
- Early diagnosis and treatment =potential for better outcomes
- Be alert to vaccine induced thrombosis– important differences in investigation/management

Case 6

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- 23 year old male
- Presents to ED
- Worsening headache and confusion
- Last 3 days
- Episode of loss of consciousness
  - Preceded by abdominal sensation
  - Become stiff, then shaking in all 4 limbs for 2 min
  - Confused, combative afterwards

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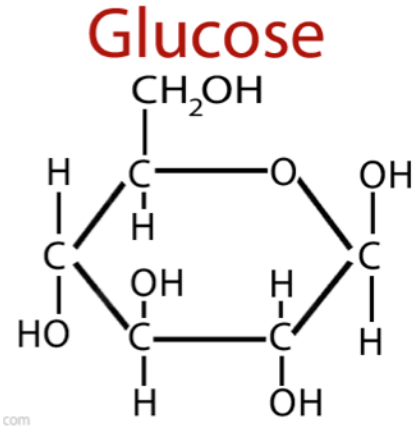
What do you need to know?

- Normally well, no history of epilepsy
- No medication changes, drug use

- T 38.5°C, BP 130/80, HR 70
- Capillary blood glucose 5.4
- Neurological exam normal



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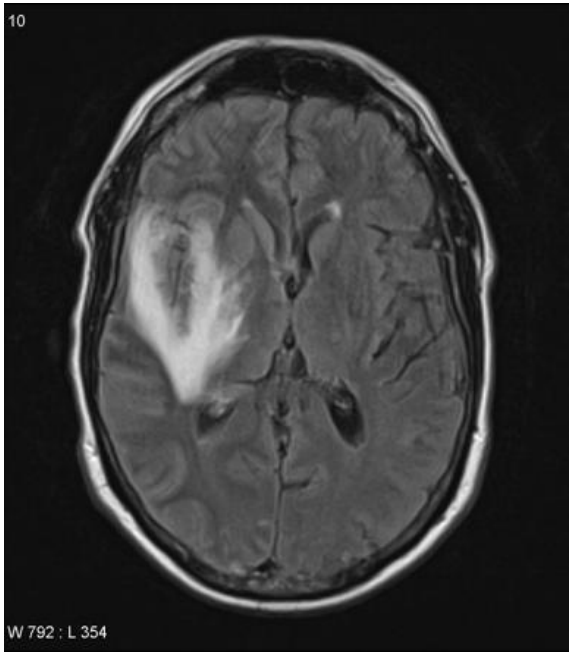
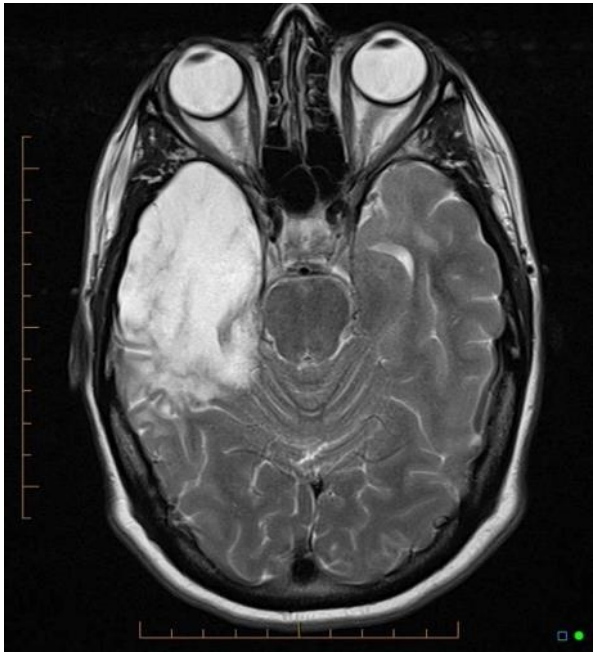
What is the clinical syndrome?

What are the next steps?

- “Any adult with a seizure in the context of febrile illness…must be investigated for possible CNS infection”





Viral encephalitis

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- Common viral pathogens
  - HSV1, HSV2*, HHV-6*
  - VZV*, EBV, echo/parechovirus, CMV*, enterovirus
  - HIV, measles, mumps
- Clinical features
  - Flu-like prodrome
  - Severe headache, nausea, encephalopathy, dysphasia
  - Fever on admission in 90%
  - Seizures in 30%
  - May follow subacute course in immunocompromised

*more common in immunocompromised

Management

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- Resuscitation – ABC, assess conscious level
- Management of seizures
- General examination
  - Genital ulcers – HSV2
  - Signs of HIV-related illness
- Investigation
  - Lumbar puncture – micro, protein, glucose, OP
  - Include samples for CSF viral PCR
  - May need to repeat after 24-48h if non-diagnostic
  - HIV serology
  - Refer to guidelines

Management

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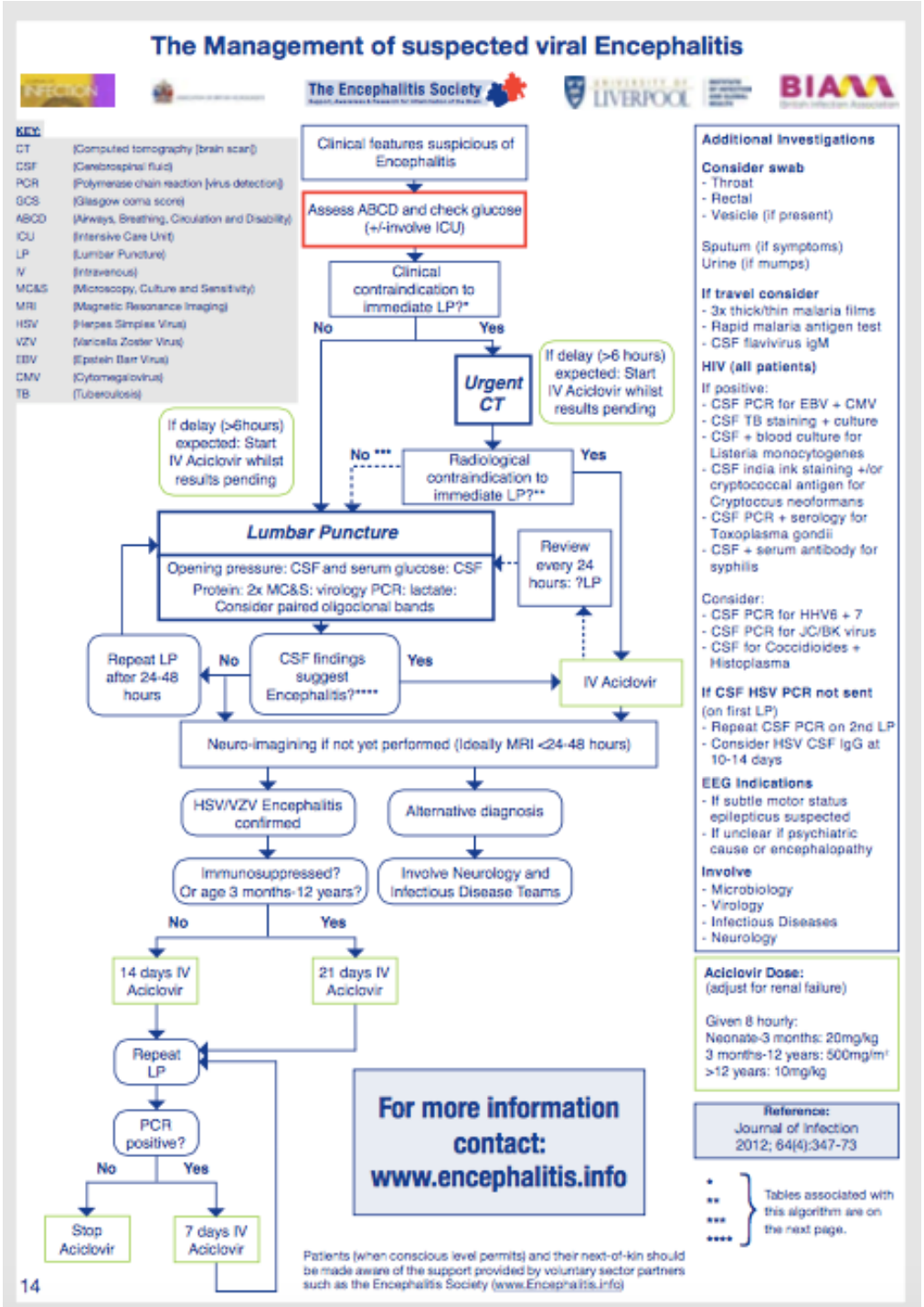
- Antiviral therapy
  - Start aciclovir if viral encephalitis suspected
  - Reduces mortality from 70 to 20%
  - 10 mg/kg for 14-21 days then repeat LP
- MRI brain
- EEG if altered behaviour/encephalopathy/ ongoing or suspected subclinical seizures



Journal of Infection (2012) 64, 347–373

ELSEVIER

BIAMM British Infection Association

www.elsevierhealth.com/journals/jinf

Management of suspected viral encephalitis in adults — Association of British Neurologists and British Infection Association National Guidelines

T. Solomon [a,b,*,u], B.D. Michael [a,b,l,u], P.E. Smith [c,m], F. Sanderson [d,n], N.W.S. Davies [e,o], I.J. Hart [f,p], M. Holland [g,q], A. Easton [h,r], C. Buckley [i,s], R. Kneen [j,t], N.J. Beeching [k,p], On behalf of the National Encephalitis Guidelines Development and Stakeholder Groups

Conclusions

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- Majority of acute presentations are **primary headaches**
- **History** critical to diagnosis
- Appropriate management can improve headache burden and reduce acute presentations

Conclusions

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- **Red flags** important to diagnose secondary headaches
- **Appropriate** use of imaging and CSF studies helpful for differential diagnosis
- Early diagnosis critical to minimise risk of mortality and morbidity

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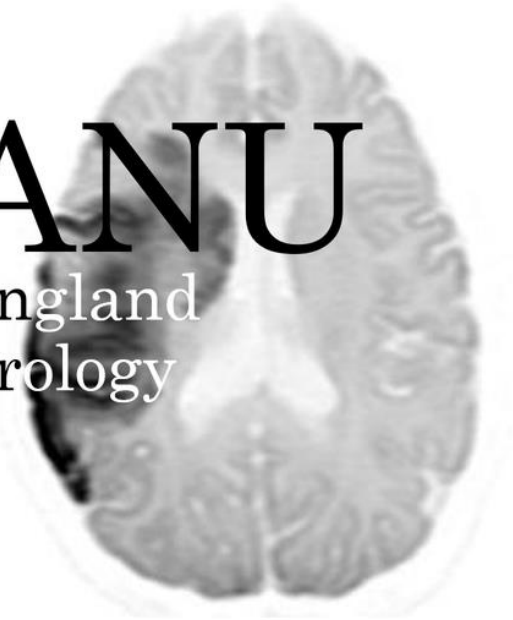

Thanks and Questions?

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