THUNDERCLAP HEADACHE:
A CASE BASED REVIEW

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DISCLOSURES

- Non-Declaration Statement: I have no relevant relationships with ineligible companies to disclose within the past 24 months. (Note: Ineligible companies are defined as those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.)

OBJECTIVES

- Discuss headache red flags and the SNOOP criteria to better comprehend when emergent evaluation of headache is needed
- Define TCH
- Discuss the clinical presentation and diagnostic evaluation of TCH including pertinent imaging, labs, and procedures
- Review the most common causes of TCH, as well as treatment

59 YOF with hx of HTN presents to ED with c/o HA.

Was in a meeting when she realized left leg couldn't move. This coincided w/abrupt onset of 10/10 HA that reached max intensity within 15-30 seconds.

Reported associated blurry vision and nausea. No vomiting, slurred speech, aphasia, or other focal neurologic deficit.

HEADACHE HISTORY

- Onset
- Duration
- Characterize the pain
- Associated signs and symptoms
- Aggravating factors
- Alleviating factors
- Similar symptoms in past

SNOOP CRITERIA

S - Systemic signs or symptoms of disease (fever, chills, myalgias)

N - Neurologic deficits

O - Sudden onset

O - Onset after the age of 40

P - Pattern, any change in headache pattern

SNOOP10

Systemic signs or symptoms

Neurologic Deficits

- Neoplasm History

Onset

Older

Pattern change

- Positional changes
- Precipitated by valsalva
- Papilledema
- Pregnancy/peri-partum
- Painful eye
- Post-traumatic
- Progressive
- Pathology of the immune system
- Painkiller or new med

WHAT IS A THUNDERCLAP HEADACHE?

A **sudden onset**, severe headache that begins and reaches maximal intensity within **1 minute**

CLINICAL PRESENTATION

- **Severe, rapid onset headache**, reaching maximal intensity within **60 seconds**
- Neck or back pain
- Vision changes
- Neurologic deficits
- Altered level of consciousness
- Seizures

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NOW THAT WE ARE EXPERTS…

Patient also reported headache the day prior to presentation which peaked to 7/10 within minutes of onset. It resolved after patient took Naproxen.

PHYSICAL EXAM

Vital Signs: BP: 150/99 HR: 65 RR: 16 T: 36.5 C SpO2: 97%

General: WDWN, at times tearful but NAD

MS: Awake, alert. **Disoriented to date**.

Language: Speech is slow but no dysarthria or aphasia.

CN: CN II – XII intact.

Motor: Full strength in all extremities.

Sensation: Intact to light touch in multiple dermatomes in all 4 extremities

YOU MADE THE DIAGNOSIS OF THUNDERCLAP HEADACHE.. WHAT NOW?

DIAGNOSTIC EVALUATION OF TCH

- **CT Head w/o contrast** - always first!
  - Evaluate for blood, intracranial masses, ischemic stroke, third ventricle colloid cyst
- Lumbar puncture
  - Evaluate for bleeding, infection, increased intracranial pressure, inflammation etc.

DIAGNOSTIC EVALUATION OF TCH

- If CT Head/LP are not diagnostic pursue
  - MR Brain w/wo contrast
  - Vessel imaging (CTA H/N or MRA H/N)
- CBC, CMP, CXR, Urinalysis, UDS, EKG

BACK TO OUR CASE…
AFTER MAKING THE DIAGNOSIS OF TCH, YOU ORDER A STAT CT HEAD

ETIOLOGY OF THUNDERCLAP HEADACHE

Subarachnoid Hemorrhage

Reversible Cerebral Vasoconstriction Syndrome (RCVS)

Cerebral Venous Sinus Thrombosis (CVST)

SUBARACHNOID HEMORRHAGE

SUBARACHNOID HEMORRHAGE

- Acute bleeding into subarachnoid space
- **Most common cause of TCH***
- Most commonly from **intracranial aneurysm rupture**
- Risk Factors:
  - Intracranial aneurysm (size, location, shape)
  - Hypertension
  - Age
  - Female
  - Tobacco/drug/alcohol use

SUBARACHNOID HEMORRHAGE

- Clinical presentation:
  - TCH
  - ALOC
  - Seizures
  - Focal neurologic deficits
  - +/- sentinel headache

OTTAWA SUBARACHNOID HEMORRHAGE RULE

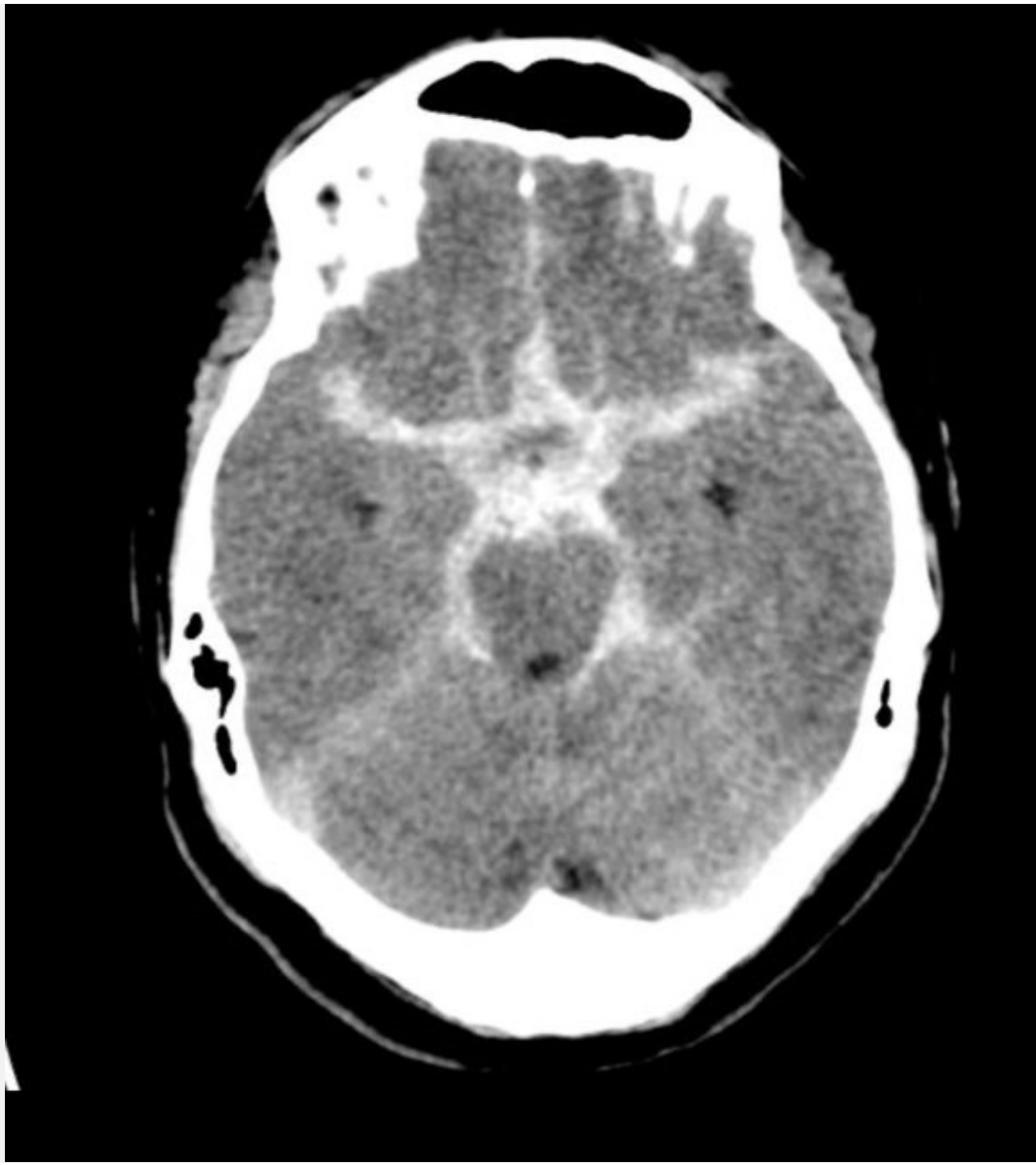
40 years old or older
Neck pain/stiffness
Witnessed LOC
Onset during exertion
TCH
Limited neck flexion/extension

If one or more of these high-risk features - investigate

SUBARACHNOID HEMORRHAGE

- Evaluation:
  - CT Head without contrast – as quickly as possible!
  - If CT head negative, proceed with lumbar puncture

SUBARACHNOID HEMORRHAGE



Case courtesy of David Puyó, Radiopaedia.org, rID: 22377

HUNT AND HESS SCALE

Grade	Hunt and Hess Scale
1	No sx, mild HA, +/- nuchal rigidity
2	Mod - severe HA, nuchal rigidity, CN palsy
3	Mild AMS, +/- mild focal neuro deficit
4	Stupor and/or hemiparesis
5	Comatose and/or decerebrate rigidity and/or no motor response

SUBARACHNOID HEMORRHAGE

- Once SAH confirmed, urgent vascular imaging performed to look for vascular malformation
  - CTA 90-97% sensitivity in detecting intracranial aneurysm
  - **Digital subtraction angiography is the gold standard**

SUBARACHNOID HEMORRHAGE

- Emergent stabilization if needed
  - Airway, breathing, circulation
  - Blood pressure management
- Monitoring in ICU/PCU
  - Secondary complications
  - Monitor for cardiac and pulmonary complications, electrolyte abnormalities

SUBARACHNOID HEMORRHAGE

- Treatment
  - Endovascular versus surgical options
  - Timing for treatment balances risk of rebleeding/complications
  - Management of complications
    - Calcium channel blockers, initiation of AEDs for seizures

REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME

REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME (RCVS)

- Multifocal intracranial arterial vasoconstriction
- **Most common cause of TCH***
- Diagnosed based on key clinical features
  - TCH or severe, recurrent headache
  - Cerebral vasoconstriction in at least 2 different arteries
  - Resolution of vasoconstriction within 3 months
  - Rule out primary angiitis of the CNS and SAH

REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME (RCVS)

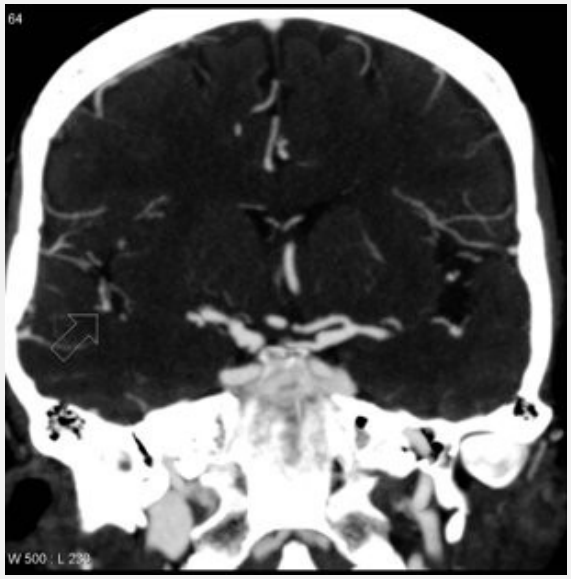
- Clinical Presentation:
  - TCH (one or recurrent)
  - Nausea/vomiting
  - Light/sound sensitivity
  - Altered LOC, seizures, focal neuro deficits
- Risk Factors:
  - Pregnancy, post-partum
  - Oral contraceptive
  - Vasoconstrictive agents

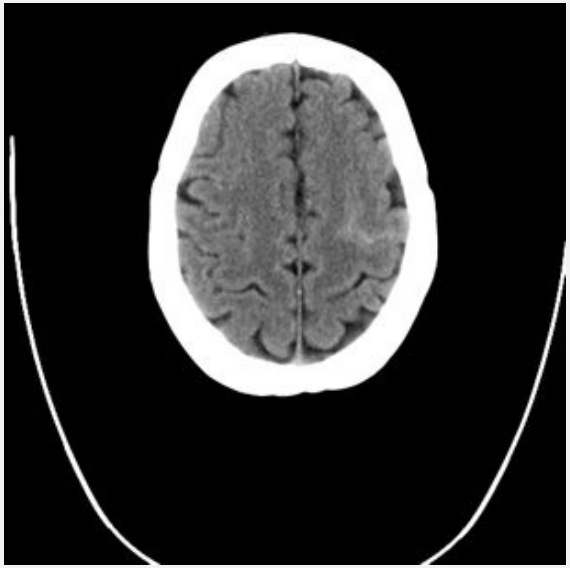
REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME

- Evaluation:
  - CTA will note multifocal vasoconstriction in intracranial arteries
    - **"String of Beads" appearance**
    - **DSA remains gold standard** for diagnosis, often reserved for diagnostically challenging cases
  - CTH, CTA and MR Brain are often normal

RCVS on Imaging

Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 4533





Case courtesy of Prof Peter Mitchell, Radiopaedia.org, rID: 34462

REVERSIBLE CEREBRAL VASOCONSTRICTION SYNDROME

- Management:
  - Withdrawal of vasoactive agents, analgesia, observation
  - Initiation of calcium channel blocker
    - Treatment duration varies, usually 4-8 weeks
    - Goal: resolution of vasoconstriction on imaging
  - Manage secondary complications of RCVS
  - Avoidance of headache triggers
  - RCVS is a self-limited course

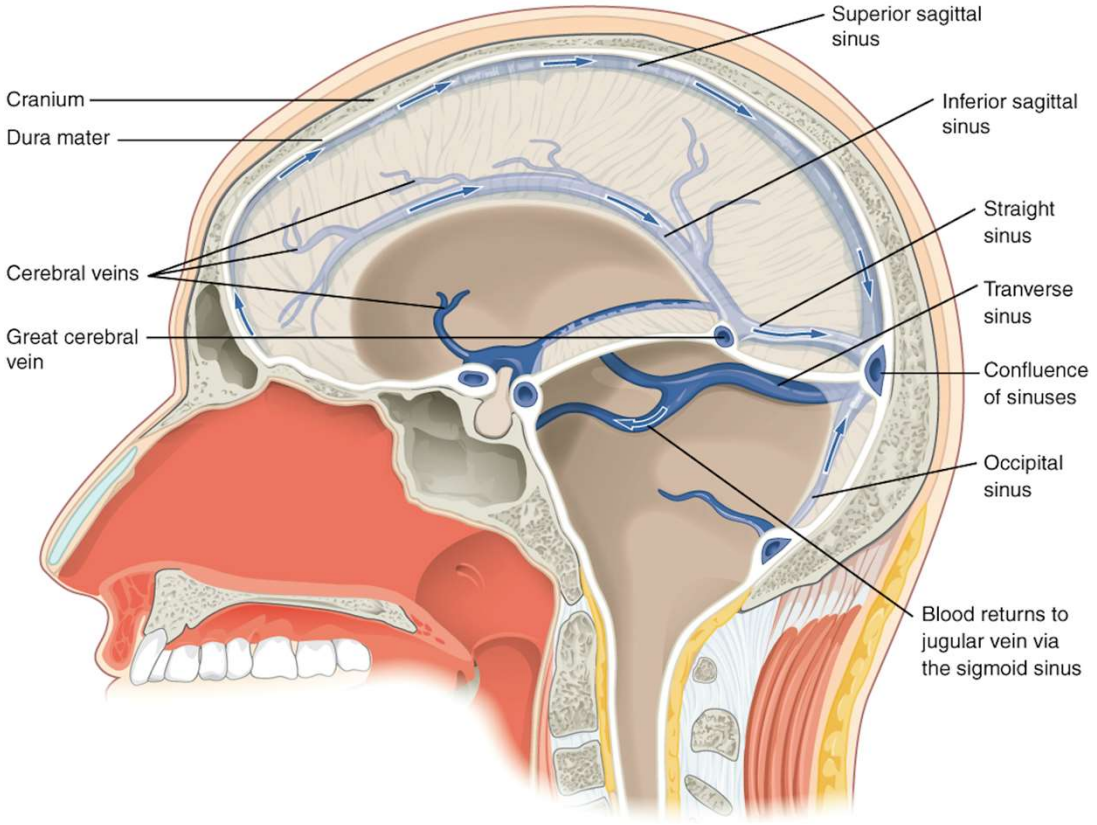
CEREBRAL VENOUS SINUS THROMBOSIS

CEREBRAL VENOUS SINUS THROMBOSIS

- Blood clot in the cerebral venous system
  - Leads to slowed or inability of blood to drain from brain
  - Elevated intracranial pressure
    - HA, vision changes, ICH
  - Infarction
    - Focal neurologic deficits

CEREBRAL VENOUS SINUS THROMBOSIS

Anatomy



Case courtesy of OpenStax College, Radiopaedia.org, rID: 42608

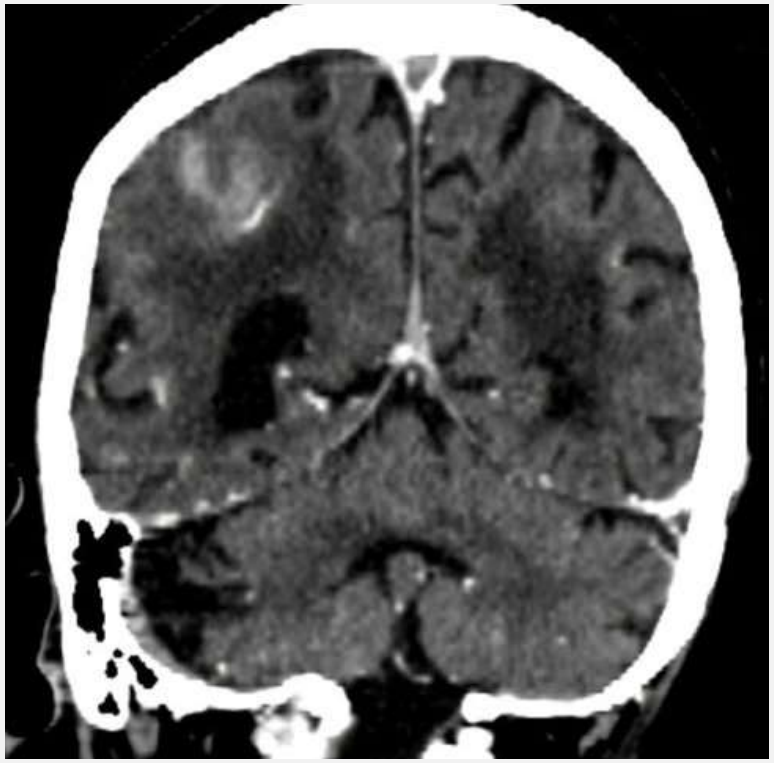
CEREBRAL VENOUS SINUS THROMBOSIS

- Risk Factors:
  - Exogenous hormones (OCP, hormone replacement)
  - Pregnancy, post-partum period
  - Malignancy
  - Infection
  - Thrombophilias

CEREBRAL VENOUS SINUS THROMBOSIS

- 66% of patients with CVST present with HA
  - **5% will present with thunderclap headache**
- Clinical presentation:
  - Headache (daily headaches or TCH)
  - Vision changes, papilledema on exam
  - Focal neurologic deficits, seizure
- CT or MR venogram to evaluate for CVST
  - **Empty Delta Sign**

Imaging Examples of CVST



Case courtesy of Dr Nikos Karapasias,
Radiopaedia.org, rID: 25388

Case courtesy of Dr Michelle Foo,
Radiopaedia.org, rID: 91329

CEREBRAL VENOUS SINUS THROMBOSIS

- Management of CVST:
  - **Anticoagulation**
    - Initially with LMWH or Unfractionated Heparin
    - Transition to oral vitamin K antagonists
    - Duration depends on etiology of CVST
  - Monitor for secondary complications

BACK TO OUR CASE…

SUBARACHNOID HEMORRHAGE

- CTA to assess for aneurysm:
  - L cervical ICA w/focal area of luminal expansion and irregularity
- EVD placed to manage hydrocephalus
- Cerebral angiogram - R ICA aneurysm
  - Flow Diverting Embolization performed
- Initiated Nimodipine 60 mg q4hours
- Daily TCDs to assess for vasospasm

CLINICAL PEARLS

- Know headache red flags – remember SNOOP criteria
- Know the diagnostic criteria for TCH – warrants emergent evaluation
- Know where you can refer patient to obtain stat CT Head if warranted
- TCH has a broad differential – know what needs to be ruled out emergently

COMPLETE THUNDERCLAP HEADACHE DIFFERENTIAL

- Subarachnoid Hemorrhage*
- RCVS*
- CVST
- Cerebral Infection
- Cervical Artery Dissection
- Complicated Sinusitis
- Hypertensive Crisis
- ICH
- Ischemic stroke
- Spontaneous Intracranial Hypotension
- Subdural Hematoma
- Brain Tumor
- Cardiac Cephalgia
- Giant Cell Arteritis
- Pituitary Apoplexy
- Pheochromocytoma
- Retroclival Hematoma
- Spontaneous Spinal Epidural Hematoma
- Third Ventricle Colloid Cyst
- Primary or Idiopathic Thunderclap Headache
- Unruptured Intracranial Aneurysm
- Aqueductal Stenosis

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