

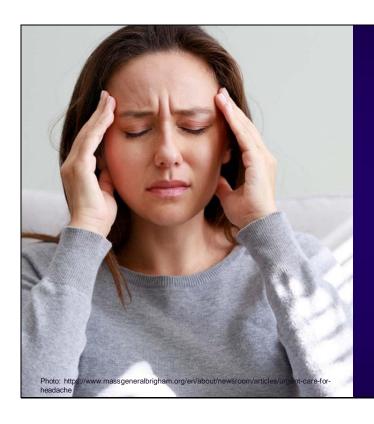
Disclosures

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.)

Educational Objectives

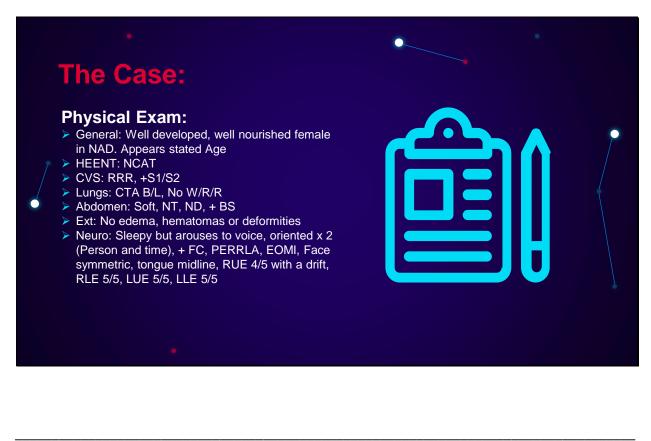
At the conclusion of this session, participants should be able to:

- Examine the risk factors associated with the development of cerebral venous sinus thrombosis.
- Explore diagnostic assessments that aid in identifying a cerebral venous sinus thrombosis.
- Distinguish CT scan findings that indicate cerebral venous sinus thrombosis from those typically indicative of an intracranial hemorrhage.
- Discuss both pharmacologic and nonpharmacologic interventions available for managing cerebral venous sinus thrombosis.



The Case:

A 42-year-old female with a PMHx of HTN, DM and Breast Ca is brought to the emergency room by EMS after suffering multiple witnessed seizures. Per family, she had been complaining of a severe headache over the last two days and then while eating dinner she has a generalized tonic-clonic seizure. EMS was called. The seizure had resolved by the time EMS arrived. Upon arrival to the ER, patient was lethargic and post-ictal but protecting her airway.



Initial Differential Diagnosis?

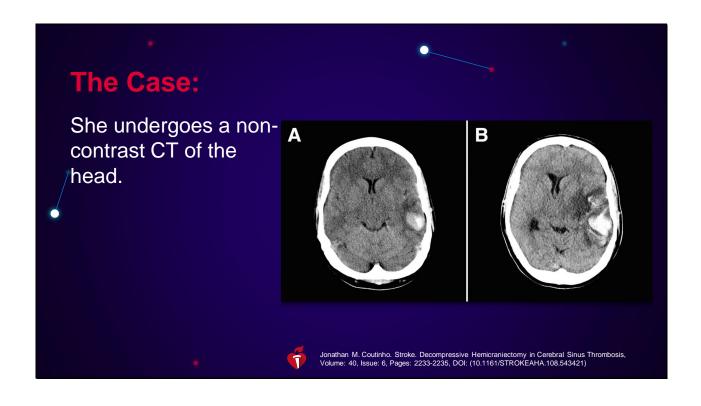
- ► Status Epilepticus
- ► Ischemic Stroke
- ► Hemorrhagic stroke
- ➤ Drug Use/Abuse
- ► Meningitis/Encephalitis
- ► Metabolic abnormality





For this patient, which of the following is the initial diagnostic study of choice?

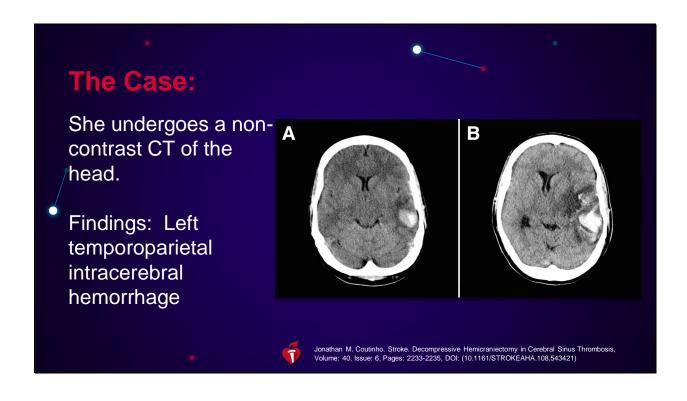
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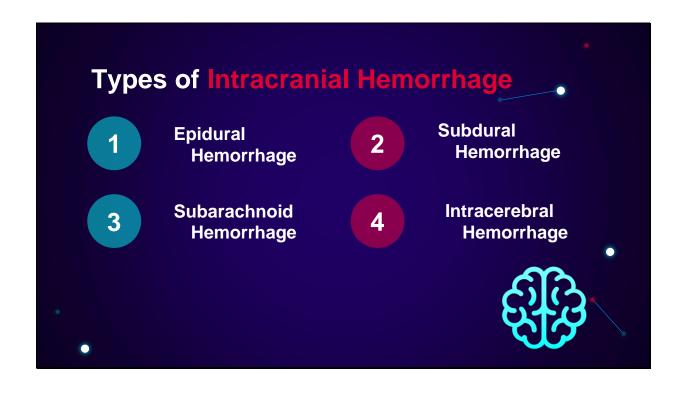




Which of the following is seen on the CTH above?

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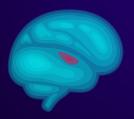


Intracerebral Hemorrhage



 A type of stroke where a hematoma forms within the brain parenchyma

• Can be with or without extension into the ventricles



2 Etiolgy						
Traumatic	•					
Spontaneous	Comprise 10-15% of all Strokes (4)					
	Primary: Account for 85% of all ICH ⁽⁴⁾ • Hypertension • Cerebral Amyloid Angiopathy					
	Secondary: • Bleeding diathesis • Vascular Disorders • Neoplasm • Hemorrhagic Transformation • Drug Abuse					



The Case:

PMHx:

HTN, DM and Breast Ca (Dx 2010-Treated with radiation and chemotherapy, remission since 2015)

PSHx:

> Right radical mastectomy (2014)

Medications:

- Amlodipine 10mg PO Daily
- > Metformin 500 mg PO BID

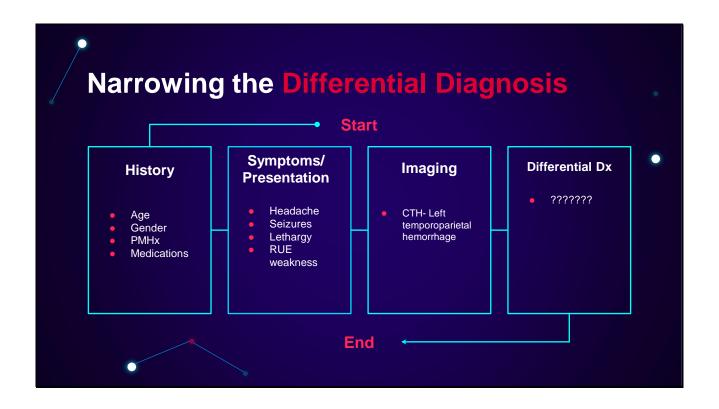
Allergies:

> NKDA

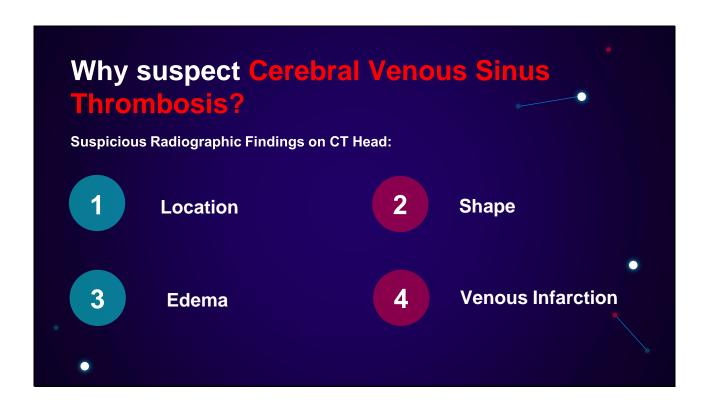
SHx:

Denies ETOH, Tobacco and illicit drugs

Noncontributory



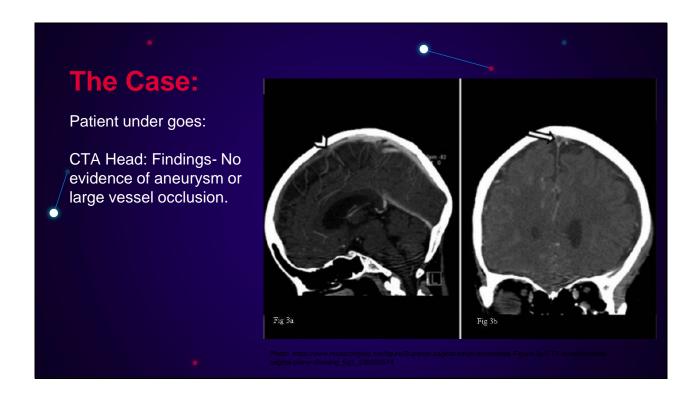
What is the differential diagnosis? Hemorrhagic **Metastasis Traumatic Hypertensive** Hemorrhage Hemorrhage **Dural Arteriovenous Fistula** Arteriovenous **Moyamoya Disease Malformation Cerebral Venous Sinus Thrombosis**





Which of the following would be the next diagnostic study of choice for the continued work-up of this patient?

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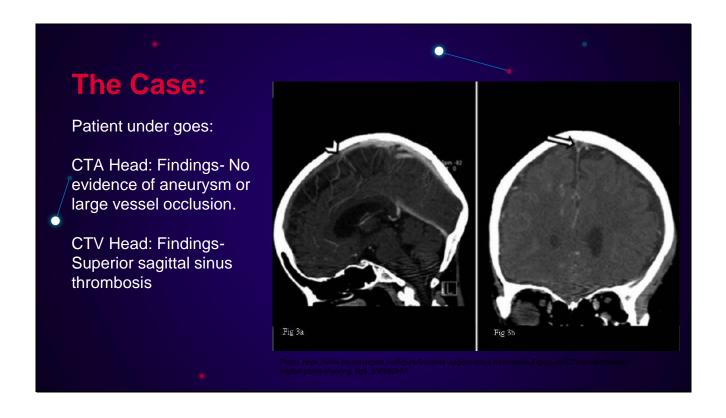


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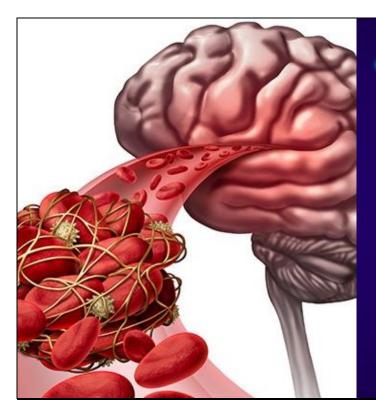


Which of the following is seen on the CTV above?

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Cerebral Venous Sinus Thrombosis

Definition: a blood clot that forms in the venous sinuses of the brain

Pathophysiology:

- A clot begins to form and prevents blood from draining out of the brain.
- Increasing pressure build up in the blood vessels.
- Resulting in swelling and bleeding (hemorrhage) in the brain.

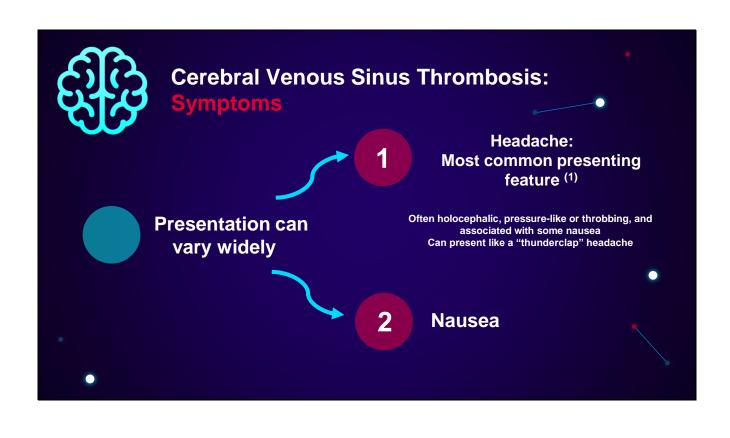
Photo: https://www.emra.org/emresident/article/cvst

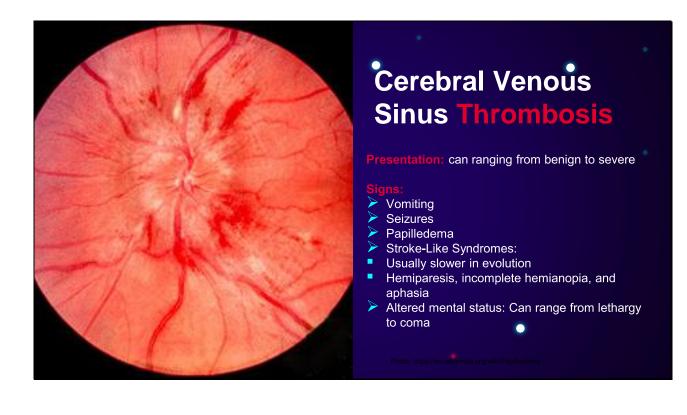
Cerebral Venous Sinus Thrombosis 3-4 per million **Epidemiology:** Estimated incidence(1) More common in young adults (30's-40's)(1) of those affected are women (1) of all strokes (1)

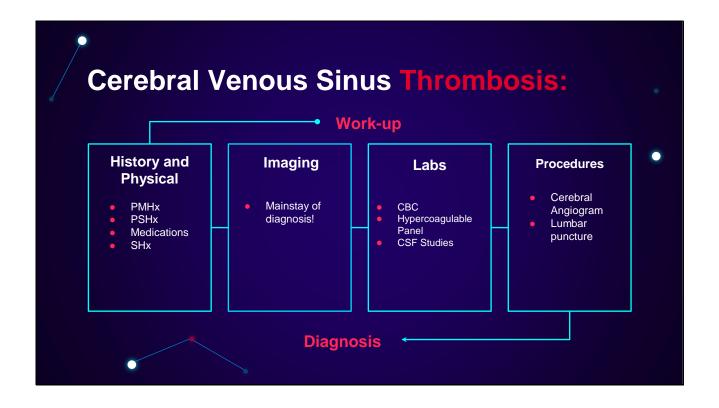
Cerebral Venous Sinus Thrombosis:

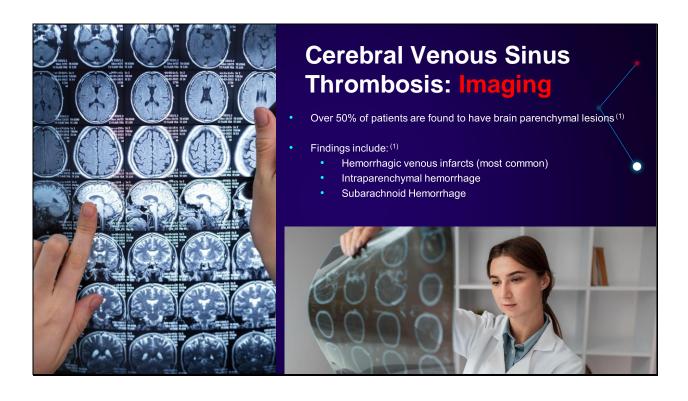
Risk factors

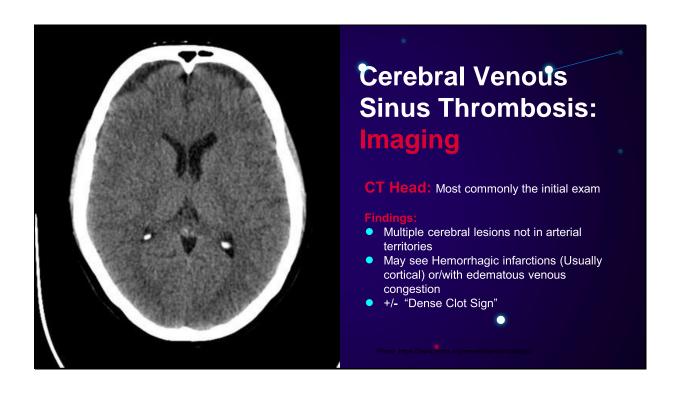
Risk factors	Causes	Description
Infectious	Meningitis, ear/sinuses infections, etc.	
Noninfectious	Postpartum	Highest risk of developing CVST is immediately postpartum
	Hypercoagulable states	Cancer, Sickle cell disease, antiphospholipid antibody syndrome, Behçet factor V Leiden, protein S or C deficiency, polycythemia, etc.
	Postoperative State	
	Drugs	Tamoxifen, Erythropoietin, Birth control pills, etc.
	SARS-CoV-2 vaccines	ChAdOx1 nCov-19 (Oxford-AstraZeneca) and Ad26.COV2.S (Janssen/Johnson & Johnson
	Head Injury	



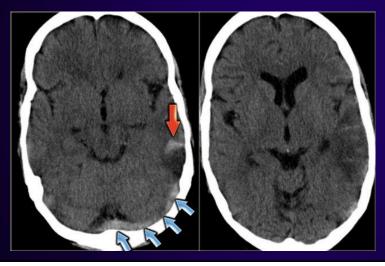








Cerebral Venous Sinus Thrombosis: Imaging



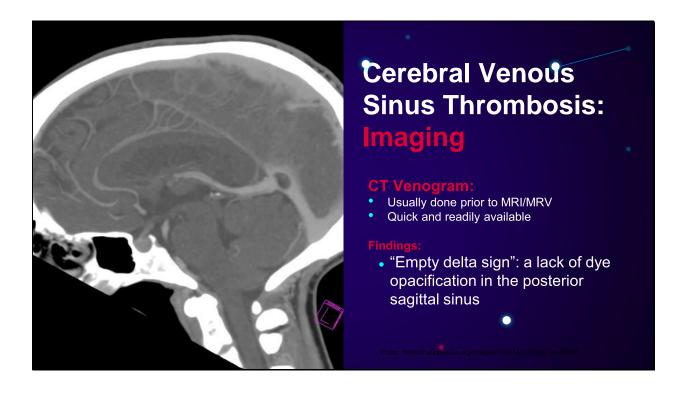
CT Head:

- Hemorrhagic infarction in the temporal lobe (red arrow).
- Dense Clot Sign: Dense transverse sinus due to thrombosis (blue arrows).

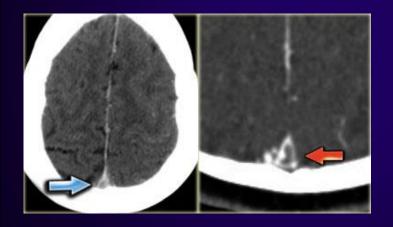
Photo: Simons, B., Smithuis, R. and Lycklama a Nijeholt, G. (no date) Cerebral venous sinus thrombosis, The Radiology Assistant: Cerebral Venous Sinus Thrombosis. Available at: https://radiologyassistant.nl/neuroradiology/sinus-thrombosis/cerebral-venous-thrombosis (Accessed: 11 September 2023).

	al venous Sinus anial Hemorrha		nbosis and	
hemorrhag	of patients with cerebral venouge (2) ors include (2):	us sinus thromb	osis present with an int	racranial
Risk facto	Female ^(1,2)	2	Older Age	•
3	Pregnancy and Period	4	Chronic HTN	

Cerebral venous Sinus Intracranial Hemorrha Presenting Signs and Symptoms (2):	
Higher rate of seizures and focal neurologic deficits	2 Higher rates of venous infarcts
Lower rates of Headaches	More commonly affects the superior sagittal sinus (2,1)
•	



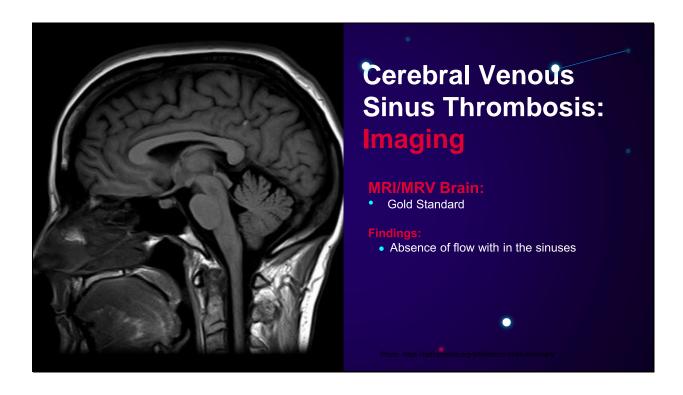
Cerebral Venous Sinus Thrombosis: Imaging



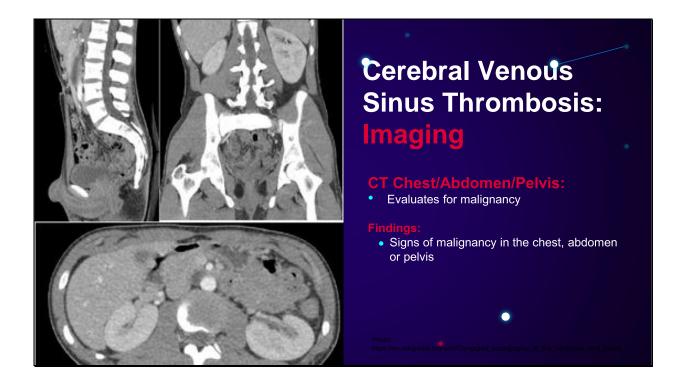
CTV Head:

The "Empty Delta" sign consists of a triangular area of enhancement with a relatively low-attenuating center, which is the thrombosed sinus.

Simons, B., Smithuis, R. and Lycklama a Nijeholt, G. (no date) Cerebral venous sinus thrombosis, The Radiology Assistant: Cerebral Venous Sinus Thrombosis. Available at: https://radiologyassistant.nl/neuroradiology/sinus-thrombosis/cerebral-venous-thrombosis (Accessed: 11 September 2023).



Cerebral Venous Sinus Thrombosis: Imaging WRV Brain: Venous sinus thrombosis. Coronal (left) and sagittal (right) magnetic resonance venogram demonstrating absence of flow in the superior sagittal and left transverse sinuses (arrows). Note that the straight sinus and right transverse sinuses remain patent. Copyright © McGrow-Hill Education, All rights reserved.



The Case:

- After the findings on the CTV, the patient was admitted to the Neurointensive Care Unit.
- She was loaded with 4g of Keppra and start on maintenance of 1g BID for her seizure. She was also placed on video EEG.
- She underwent a CT of the chest/abdomen/pelvis which was negative for any evidence of metastatic disease
- Further neurologic work-up included:
 - MRI of the brain: Findings-Absent opacification of the superior sagittal sinus compatible with dural venous sinus thrombosis. Left temporoparietal hemorrhage likely representing hemorrhagic venous infarctions.
 - Cerebral Angiogram: demonstrating cerebral venous thrombosis
- · Work-up complete. How do we treat?



Photo:https://healthmanagement.org/products/view/40-channel-electroencephalograph-vide

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Which of the following is the considered the first-line therapy for a patient diagnosed with a cerebral venous sinus thrombosis?

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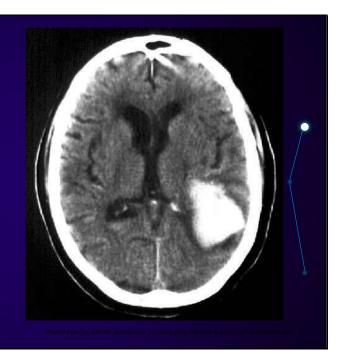
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The Case: The patient was started on a heparin gtt. A CTH, hospital day 2, showed stable intracranial hemorrhage.

Patient's exam remained stable, but patient continued to suffer from frequent seizures despite escalation of antiepileptic medications. On hospital day 5, repeat CTH showed worsening left parietal ICH with mass effect. She underwent a CTV head, which showed unchanged superior sagittal sinus thrombosis.

What do we do now?



Cerebral Venous Sinus Thrombosis:

Treatment

Refractory Cases/Severe Cases: stupor or coma with significantly elevated intracranial pressure, etc.

Local infusion of tPA

Has been used, but has not been subjected to the same randomized testing

 No consensus on the type of thrombolytic drugs, does or admission rate due to lack of adequate number of studies (3) 2

Mechanical thrombectomy

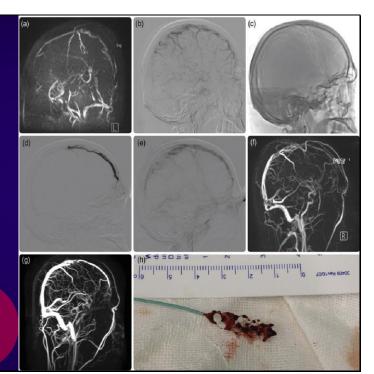
- Rare cases refractory to anticoagulation
- Can be considered as a salvage treatment in severe CVST patients refractory to heparin (3)

Cerebral Venous Sinus Thrombosis:

Treatment

The preoperative magnetic resonance venography reveal thrombosis in the superior sagittal sinus and the transverse sinus (a). The intraoperative internal carotid angiography reveals a venous filling defect (b). The angiography shows the deployment of Solitaire AB stent (c). After the thrombectomy, the intra-sinus angiography by micro-catheter confirm a recanalization of venous sinus (d). After the thrombectomy, the angiography via internal carotid artery confirm a recanalization of venous sinus (e). The magnetic resonance venography at discharge show the recanalization of venous sinus (f). The follow-up magnetic resonance venography 6 months after thrombectomy confirm a better recanalization (g). The thrombosis was removed by Solitaire AB stents (h).





	ebral Venous Si	nus II	nrombosis:
Trea	atment		
Risk	factors for Severe Clinic	al Course	(3):
الم	Lower GCS on presentation	on ⁽³⁾	
•	Average of 13.5		Seizures on Presentation (3)
(%) 1	Thrombosis of the Superio	r Sagittal S	inus ⁽³⁾
	Usually with complete o	cclusion	

Cerebral Venous Sinus Thrombos *Prognosis	is:
Overall inpatient mortality ranges from 3.9-8.3% (8)	
 Older age, seizures and intracranial bleeding were associated with increased risk of inpatient mortality. (8) 	
 If a patient survives the acute phase, long-term prognosis is generally satisfactory (3) 	
Good prognosis was associated with (3):	
Shorter length of ClotHigher GCS on presentation	
Trigher GCS on presentation	H

Cerebral Venous Sinus Thrombosis: Prognosis



- ► Poor Prognosis associated with:
 - ► Presence of ICH (2,5)
 - ► Lower rates of excellent outcome measured by a 90-day mRS 0
 - ► Higher rates of 90-day mortality
 - ► Thrombosis of Superior Sagittal Sinus (3)
 - ► Lower GCS/Coma on presentation (3)
 - ► Seizure Activity (3)
- ► Coma and multiple cerebral hemorrhages are usually fatal

Take Home Points

- 1. Cerebral venous sinus thrombosis is a rare but serious neurologic condition
- 2. Should be considered in younger patients who present with intracerebral hemorrhage and a hypercoagulable risk factor
- 3. CT scan findings of hemorrhages in abnormal locations, bilateral hemispheres, significant edema; or infarctions in non-arterial distributions should prompt consideration for a CTV
- 4. Intravenous heparin is the first-line treatment, even in patients who present with an intracerebral hemorrhage.
- 5. Mechanical thrombectomy or local infusion of tPA can be considered in patients with severe disease refractory to IV heparin

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