Pearls and Pitfalls of Cerebral Venous Thrombosis

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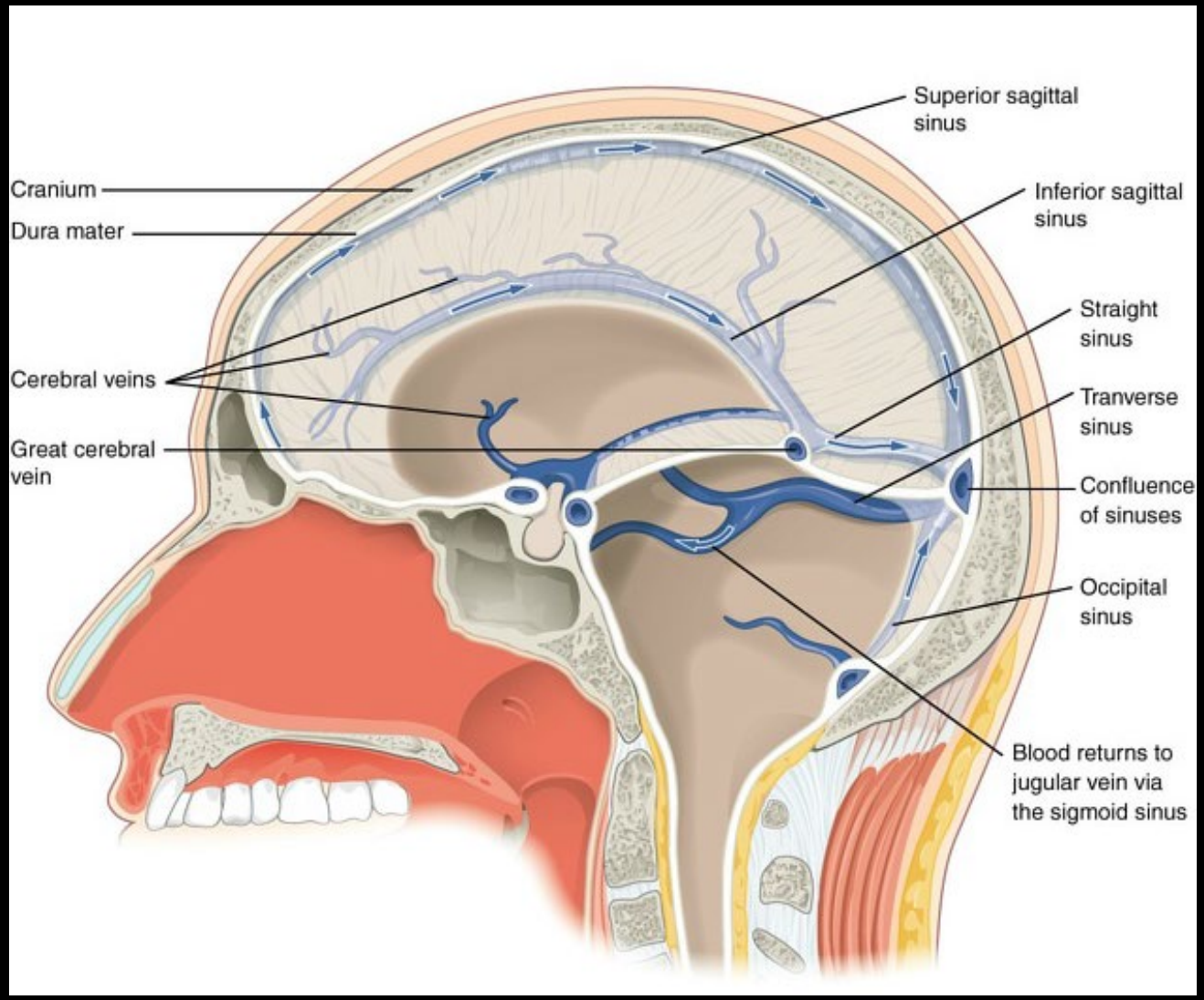
Objectives

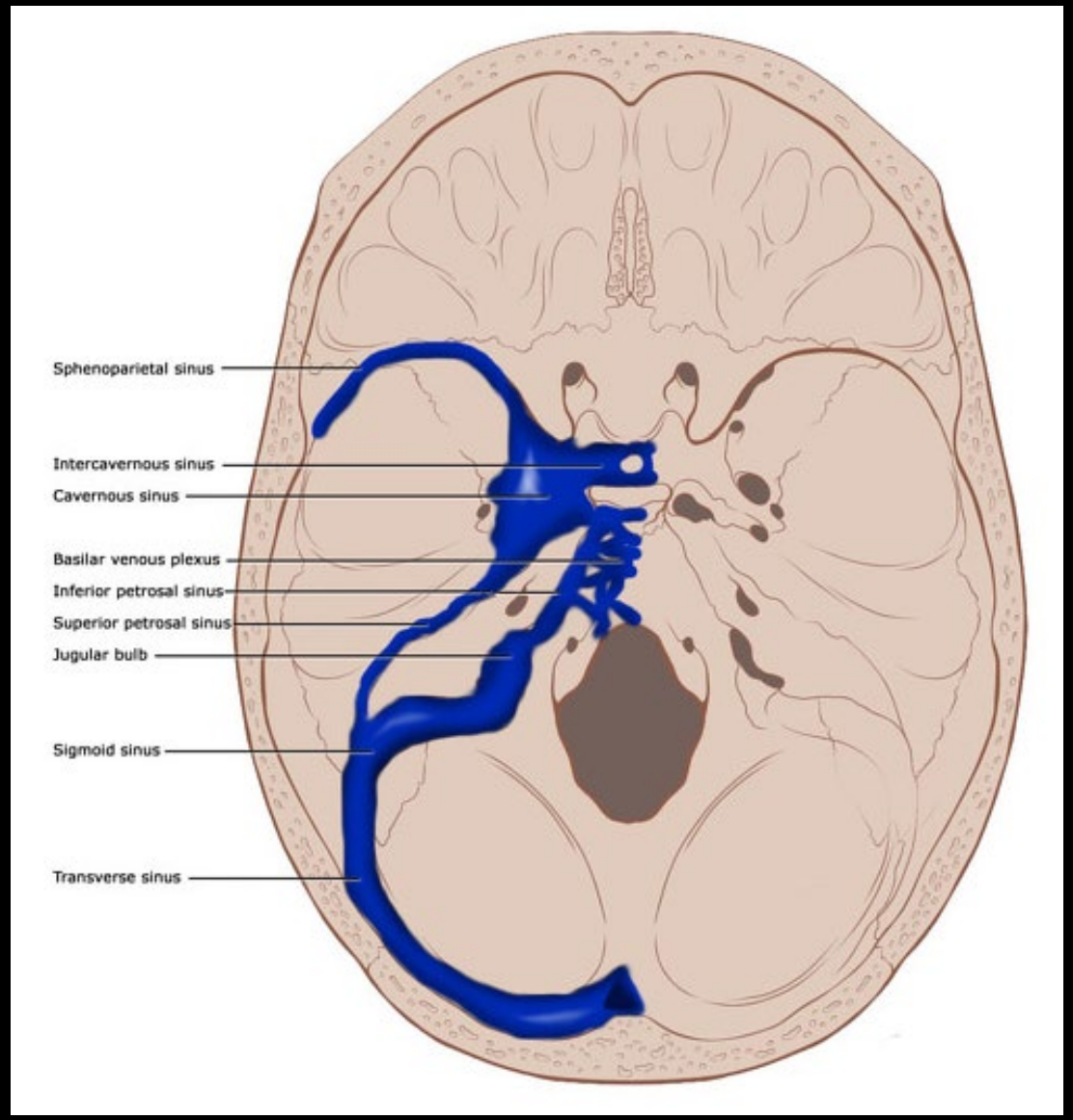
- Review basic anatomy of the cerebral venous system
- Recognize various imaging presentations of cerebral venous thrombosis
- Identify potential pitfalls and discuss troubleshooting techniques

Dural Venous Sinuses

Deep Cerebral Veins

Superficial Cerebral Veins

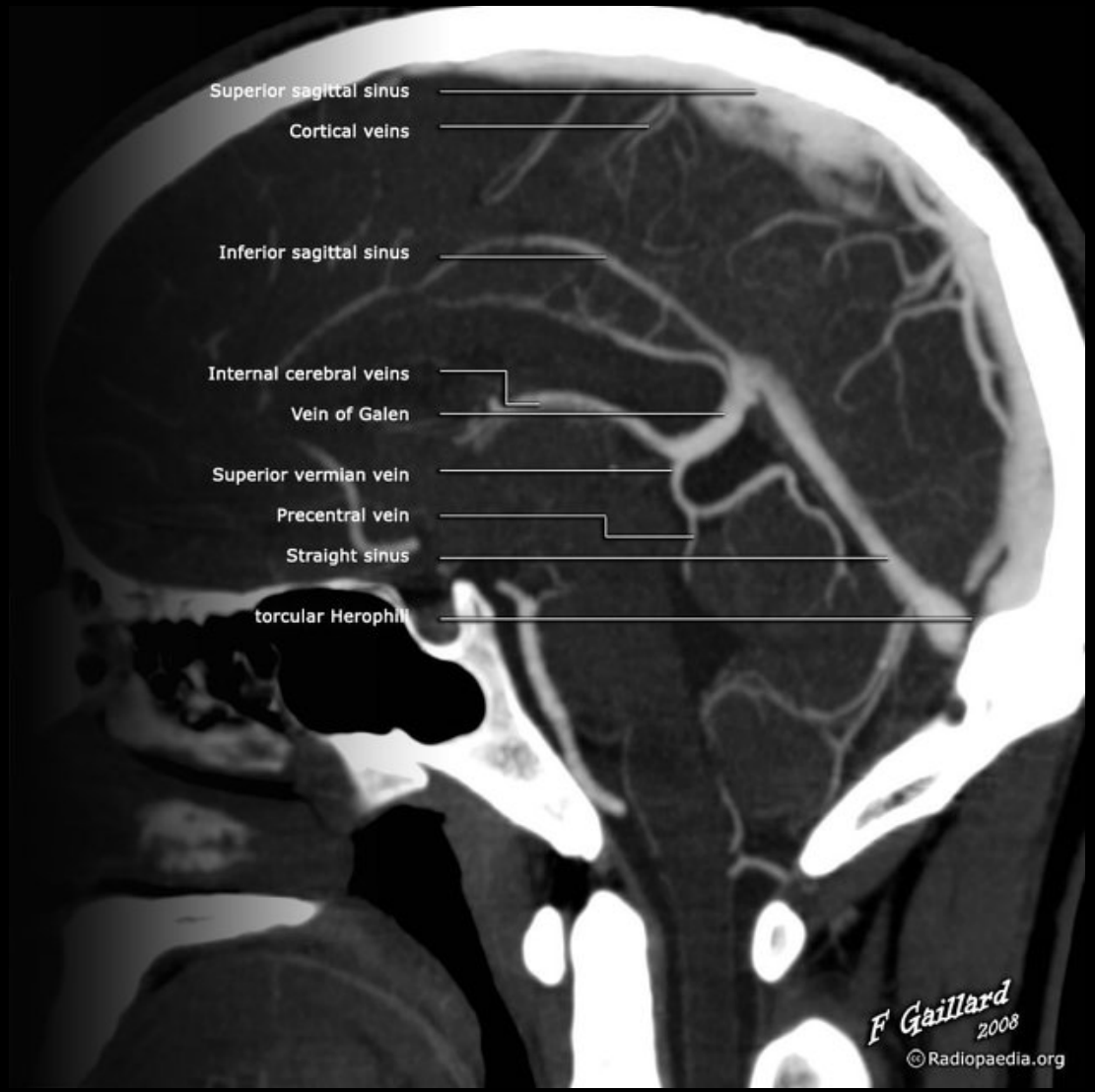




College O, Head and neck vessels (illustrations). Case study, Radiopaedia.org (Accessed on 18 Dec 2025) https://doi.org/10.53347/rID-42608

Gaillard F, Dural venous sinuses (illustration). Case study, Radiopaedia.org (Accessed on 18 Dec 2025) https://doi.org/10.53347/rID-36180

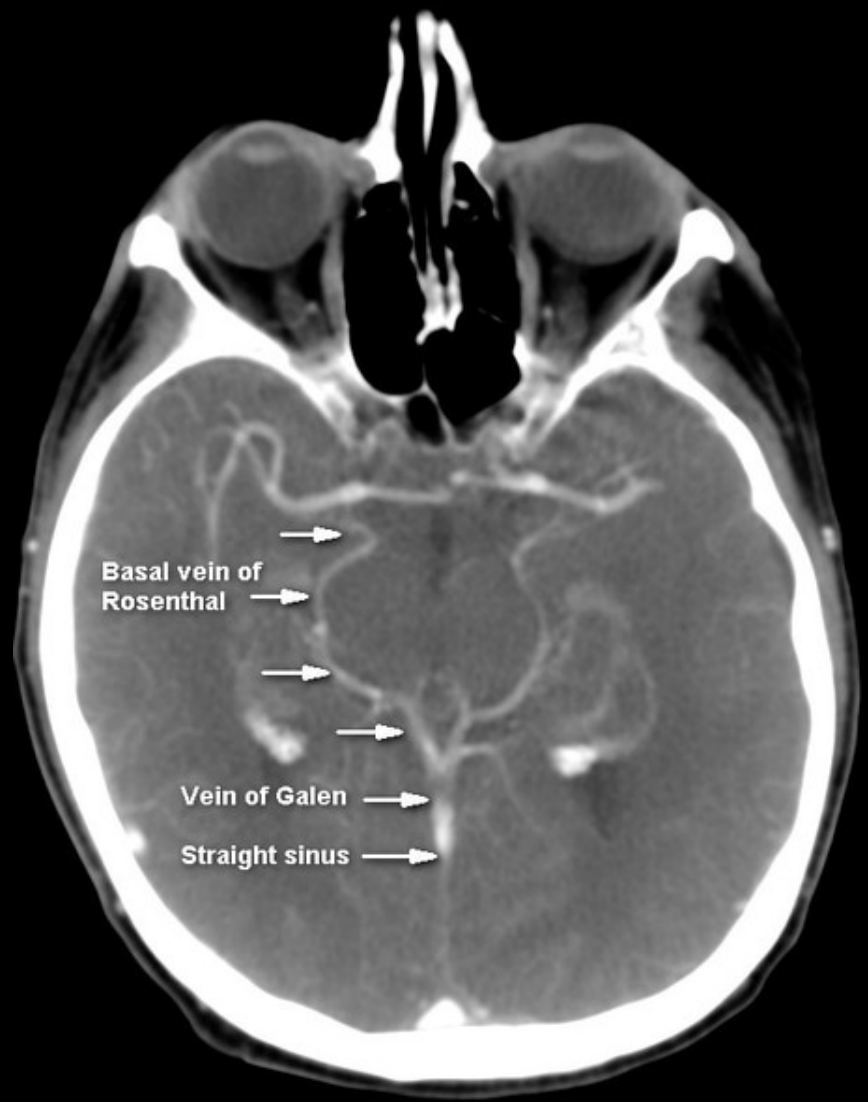
Dural Venous Sinuses



Gaillard F, Cerebral veins (diagram). Case study, Radiopaedia.org (Accessed on 18 Dec 2025) https://doi.org/10.53347/rID-36159

Deep Cerebral Veins

Superficial Cerebral Veins

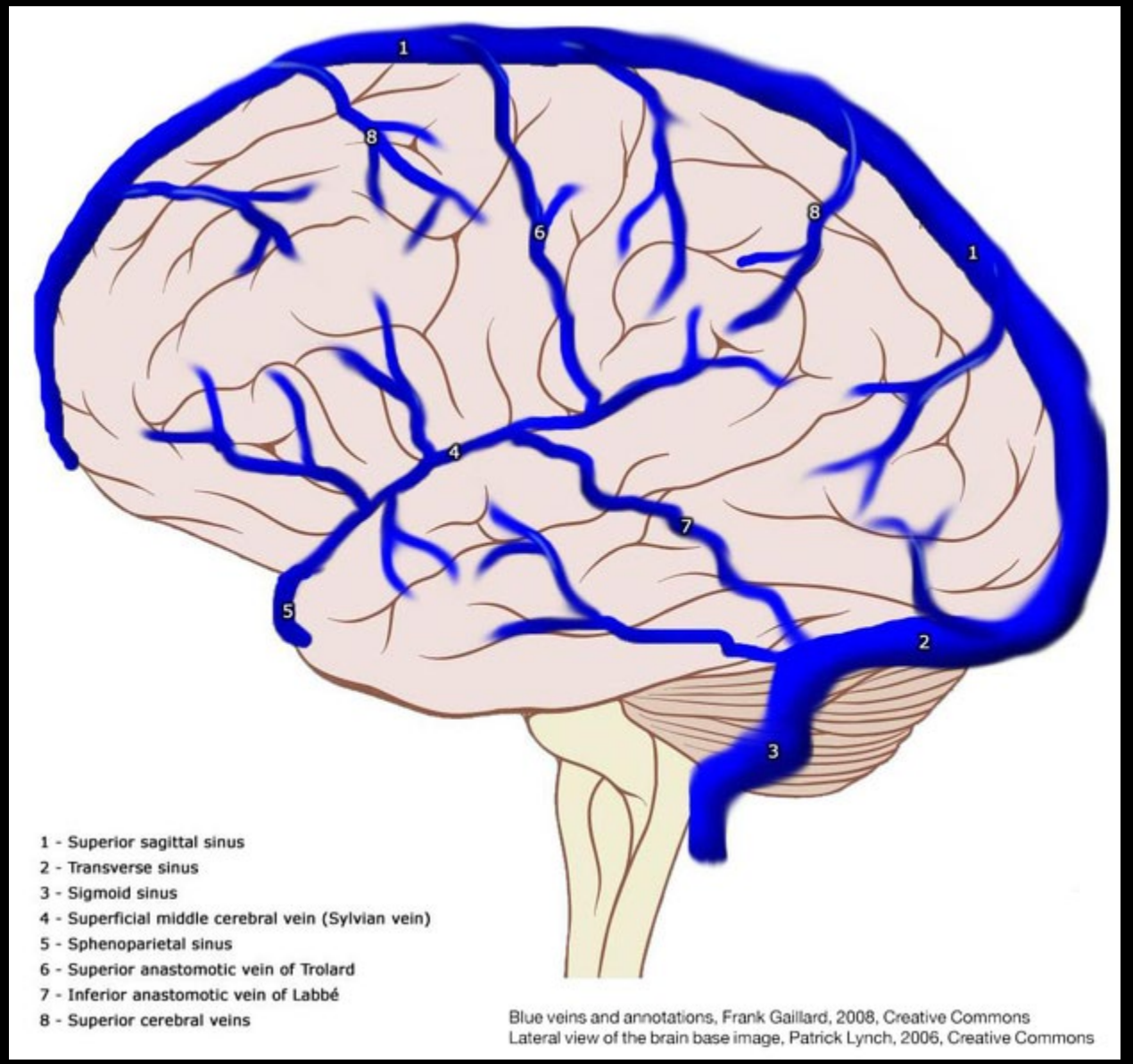


Gaillard F, Basal vein of Rosenthal (annotated image). Case study, Radiopaedia.org (Accessed on 18 Dec 2025) https://doi.org/10.53347/rID-36173

Dural Venous Sinuses

Deep Cerebral Veins

Superficial Cerebral Veins



Case 1

Presentation: 30s female with headache

Case 1

- Non-contrast CT demonstrates hyperdense superior sagittal sinus (Fig. 1)
- CT Venography (CTV) demonstrates non-opacification of the superior sagittal sinus after contrast administration, confirming presence of thrombus (Fig. 2)

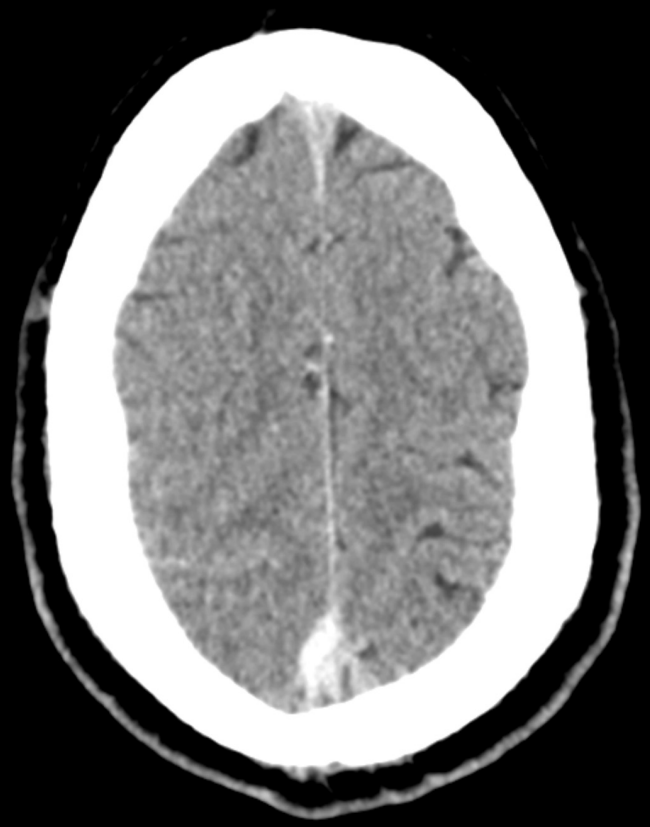


Fig. 1

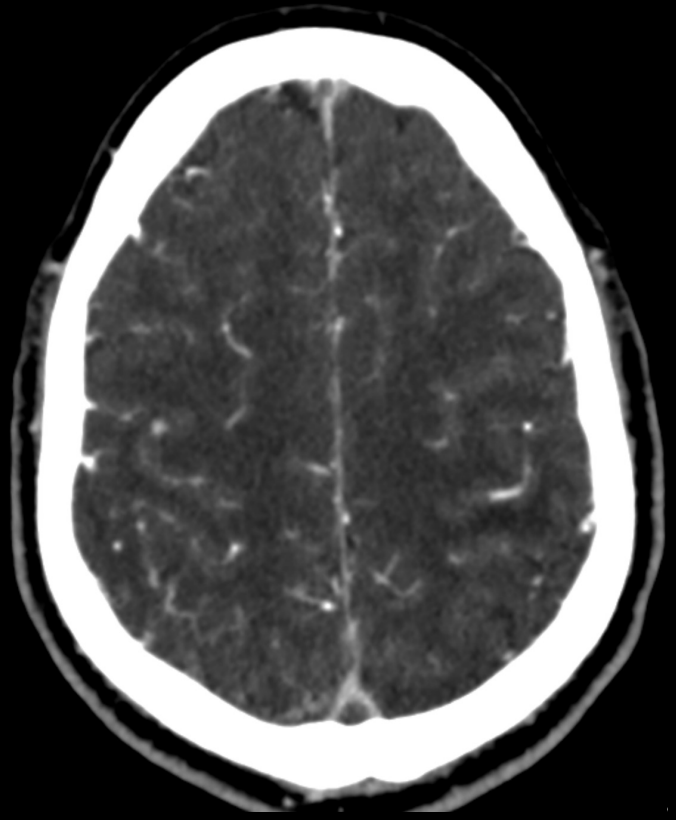


Fig. 2

Dense Vein Sign

- **Dense vein sign** = hyperattenuating thrombus within a vein (red arrow)
  - Analogous to the dense MCA sign in acute stroke

Fig. 1

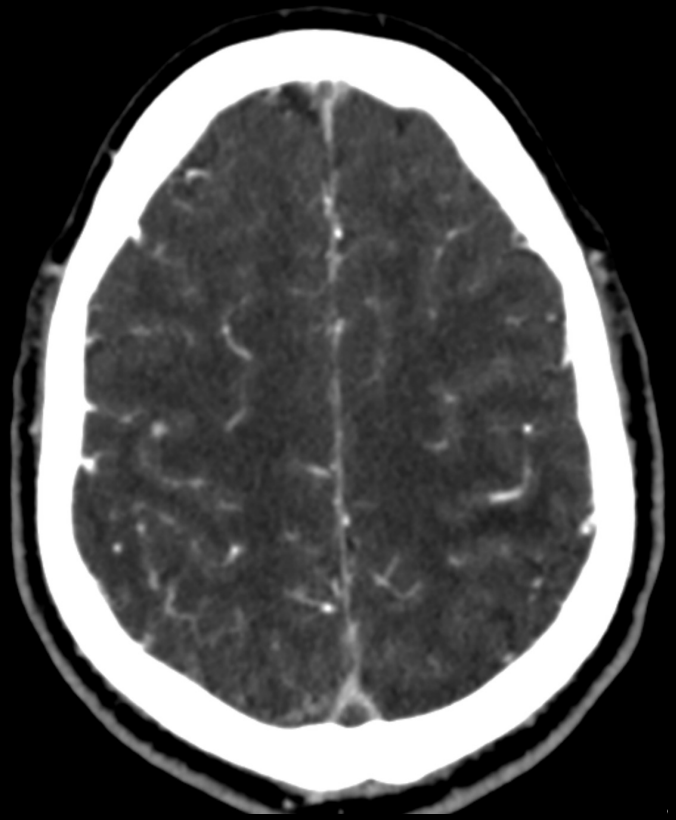


Fig. 2

Potential Pitfall: hyperdense venous sinuses are a common and normal finding in infants and young children secondary to higher hematocrit. Troubleshooting → CTV or MRV.

Case 2

Presentation: 6-year-old presenting after a fall; hit head on tile floor

Case 2

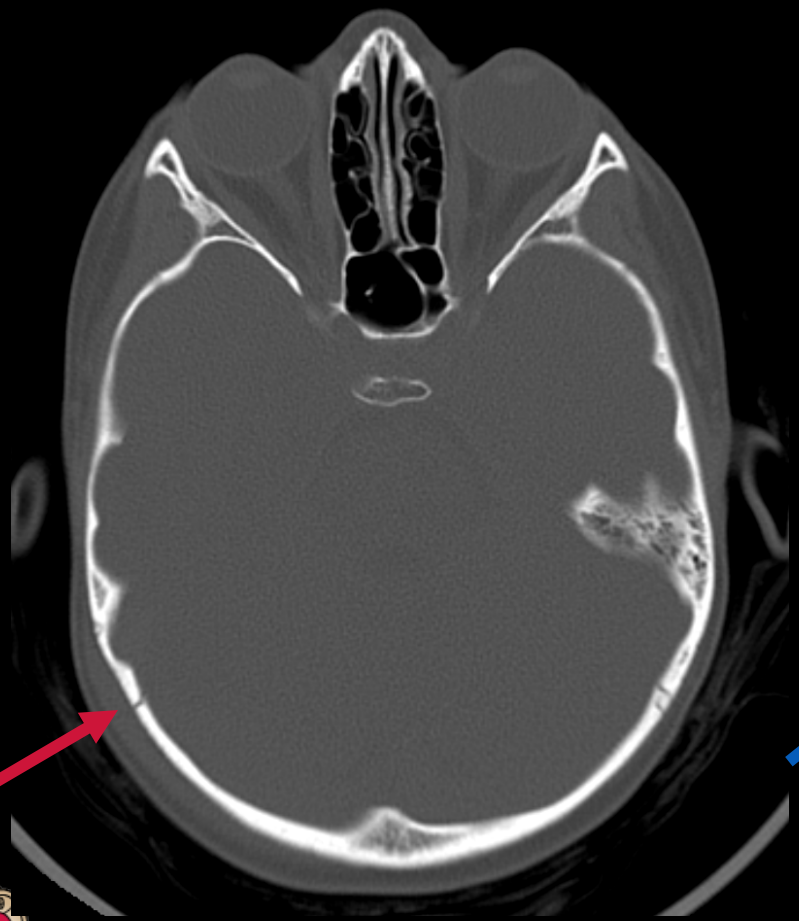


Fig. 1a

Fig. 1b

- Bone window CT demonstrates subtle diastasis of the right lambdoid and occipitomastoid sutures (Fig 1a, red arrow)
- Soft tissues window demonstrates hyperdense epidural hematoma adjacent to the right sigmoid sinus (Fig 1b, blue arrow)
- Next step → MRI/MRV

Case 2

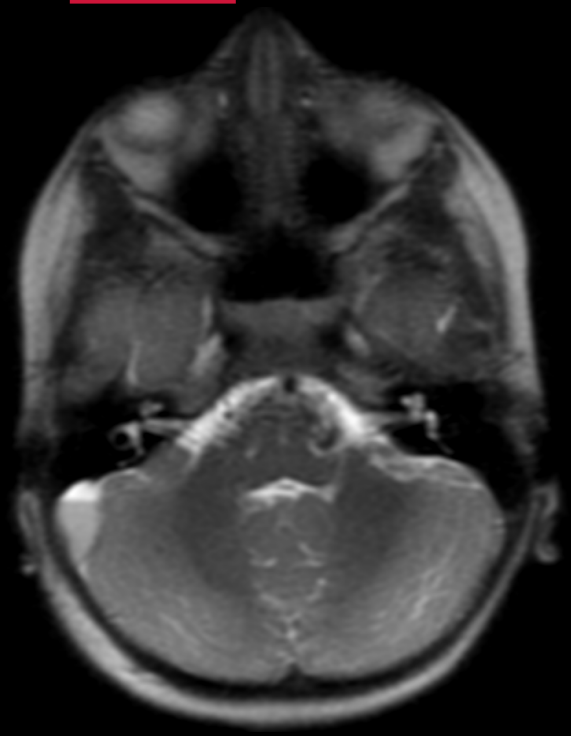


Fig. 2a

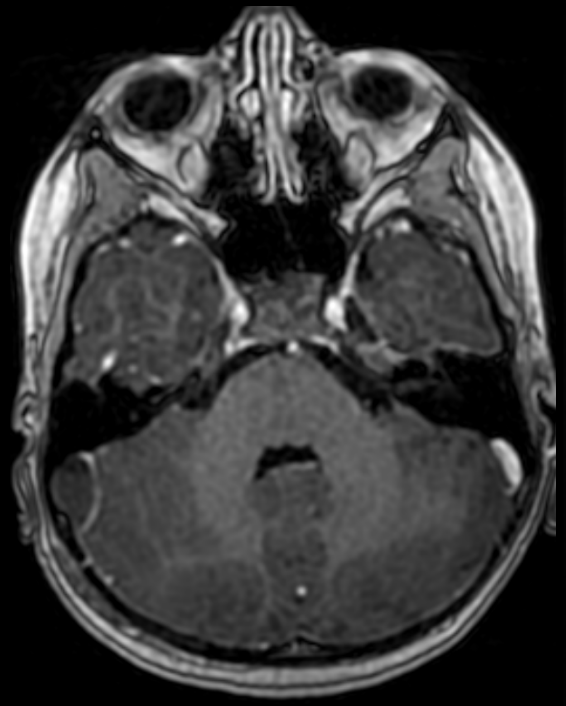


Fig. 2b

Fig. 2c

- T2 demonstrates a fluid level at the right sigmoid sinus with mass affect on the adjacent brain parenchyma (Fig 2a)
- T1 post-con demonstrates occlusion of the right sigmoid sinus (Fig 2b)
- MRV also demonstrates lack of normal filling of the right sigmoid sinus (Fig 2c)
- Diagnosis: traumatic venous epidural hematoma with occlusion of the right sigmoid sinus

Pearl: When you see evidence of trauma near a dural venous sinus, raise your index of suspicion for venous injury and consider recommending additional imaging.

Case 3

Presentation: 20s female presenting with dehydration and headache

Case 3

- Non-contrast CT demonstrates hypodensity in the left greater than right bilateral thalami (Fig 1) and the right temporal lobe
- Differential Diagnosis: toxic-metabolic encephalopathy, vascular etiology, neoplasm, etc.
- Next step → MRI

Fig. 1

Case 3

- T2/FLAIR hyperintensity of the thalami and right temporal lobe (Fig 2a and 2b)
- Intrinsic T1 hyperintensity in the right temporal lobe indicative of hemorrhage (Fig 2c)
- T1 post-contrast with linear filling defect in the right sigmoid sinus (Fig 2d)
- Diffusion restriction in the left thalamus indicative of infarct (Fig 2e DWI and 2f ADC)
- Diagnosis: deep cerebral vein thrombosis (not shown) and right sigmoid sinus thrombosis resulting in multifocal ischemia and right temporal lobe hemorrhage

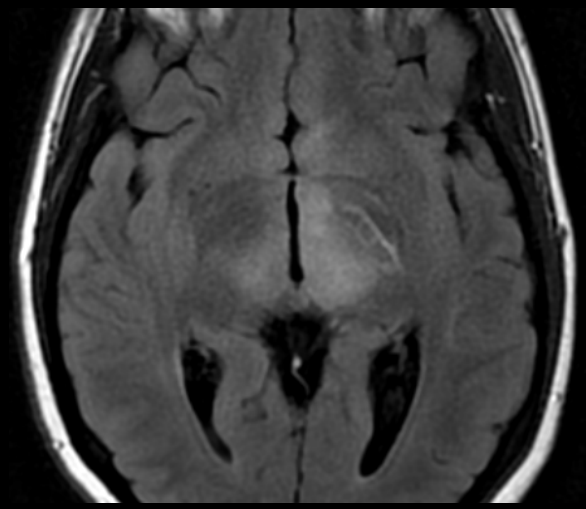


Fig. 2a

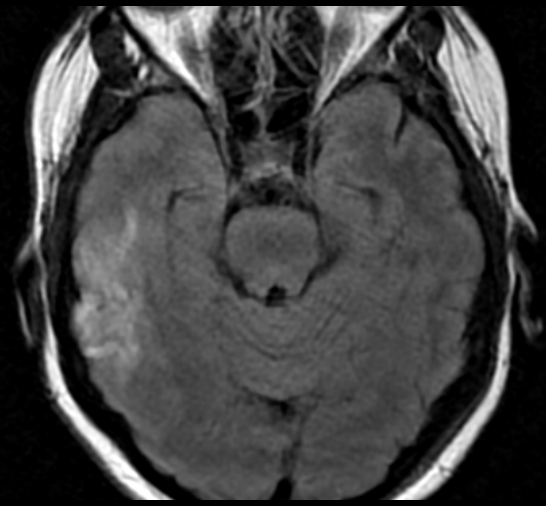


Fig. 2b

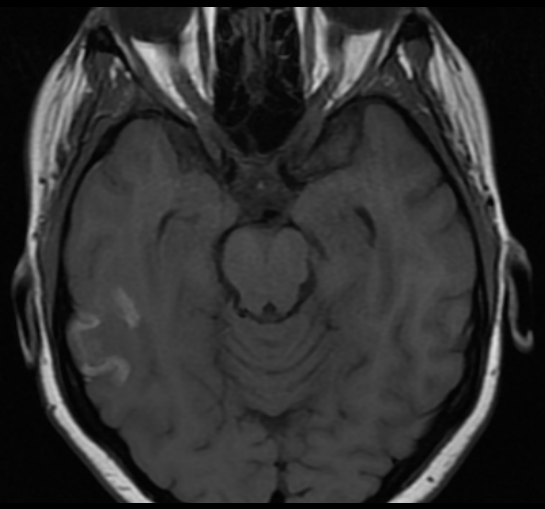


Fig. 2c

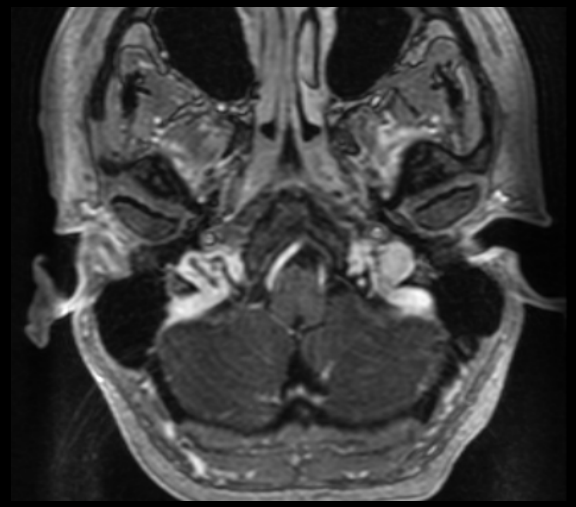


Fig. 2d

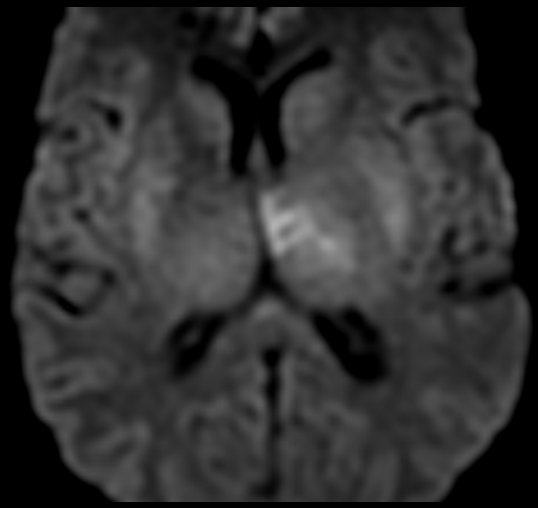


Fig. 2e

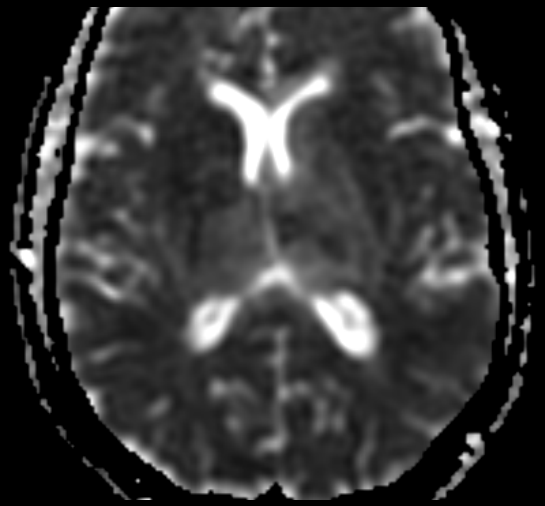


Fig. 2f

Pearl: Deep cerebral venous thrombosis can result in ischemia in a non-arterial vascular distribution. Understanding venous anatomy and territories is key.

Case 4

Presentation: 20s male presenting with one month of headaches, now worsened over the past 2 days with new nausea and vomiting

Case 4

- Non-contrast CT demonstrates hyperdense superior sagittal sinus and hemorrhage in the right frontal lobe (Fig 1)
- Post-contrast CT demonstrates increased size of now bilateral frontal hemorrhage, and non-opacification of the superior sagittal sinus (Fig 2)
- Diagnosis: superior sagittal sinus thrombosis complicated by bilateral frontal lobe hemorrhage

Fig. 1

Fig. 2

Empty Delta Sign

- Empty delta sign = triangular filling defect of the superior sagittal sinus on contrast-enhanced CT, which represents thrombus (Fig 2, red arrow)

Fig. 2

Pearl: The dense vein sign on non-contrast CT and empty delta sign on contrast-enhanced CT are important imaging findings to recognize venous sinus thrombosis.

Case 5

Presentation: 70s female, “neuro deficit, acute stroke suspected”

Case 5

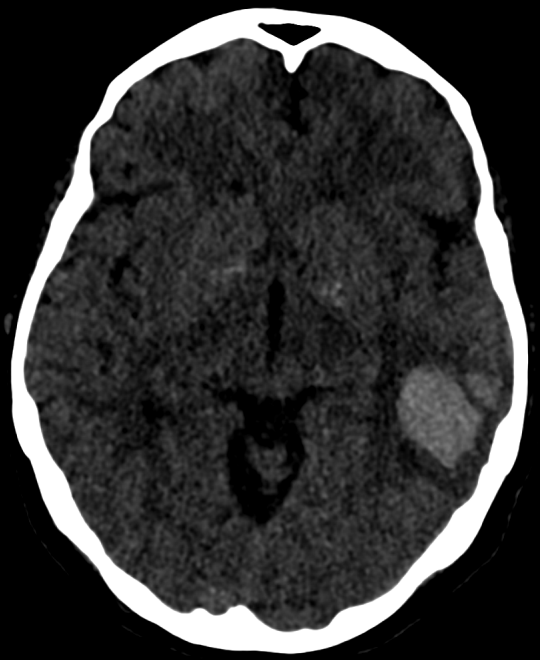


Fig. 1a

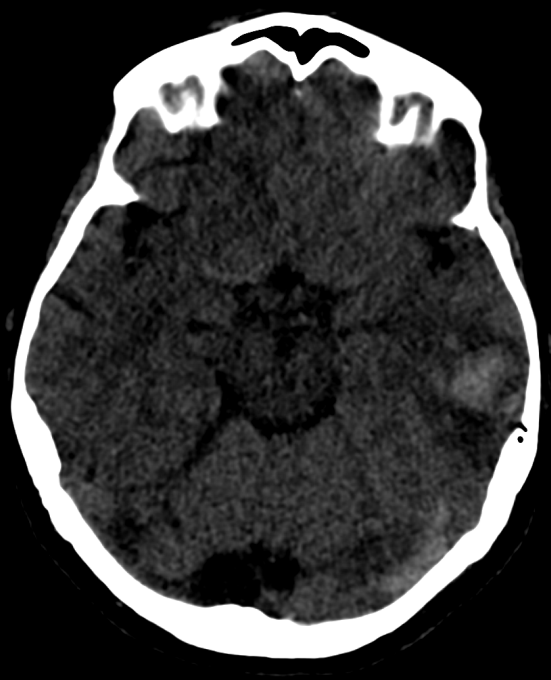


Fig. 1b

Fig. 2

- Non-contrast CT demonstrates left temporal lobe hemorrhage (Fig 1a) and hyperdensity in the left transverse sinus (Fig 1b)
- CTA demonstrates left transverse sinus filling defect (Fig 2)
- Diagnosis: dural venous sinus thrombosis of the left transverse sinus complicated by intraparenchymal hematoma of the left temporal lobe

Pearl: Hemorrhage is a relatively common complication of cerebral venous thrombosis.

Case 6

Presentation: 40s female presenting with fall/seizure

Case 6

- Non-contrast CT demonstrates linear, peripheral hyperdensities along the left frontal convexity (Fig 1, red arrows)
- CTV demonstrates normal contrast filling of multiple right cortical veins, and lack of contrast filling of left cortical veins (Fig 2)
- Diagnosis: left frontal superficial venous thrombosis

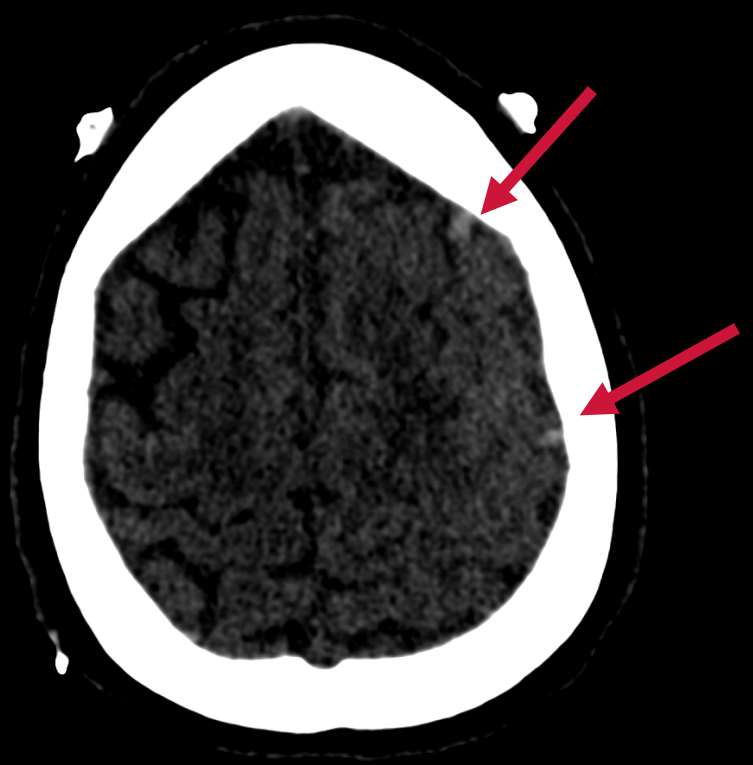


Fig. 1

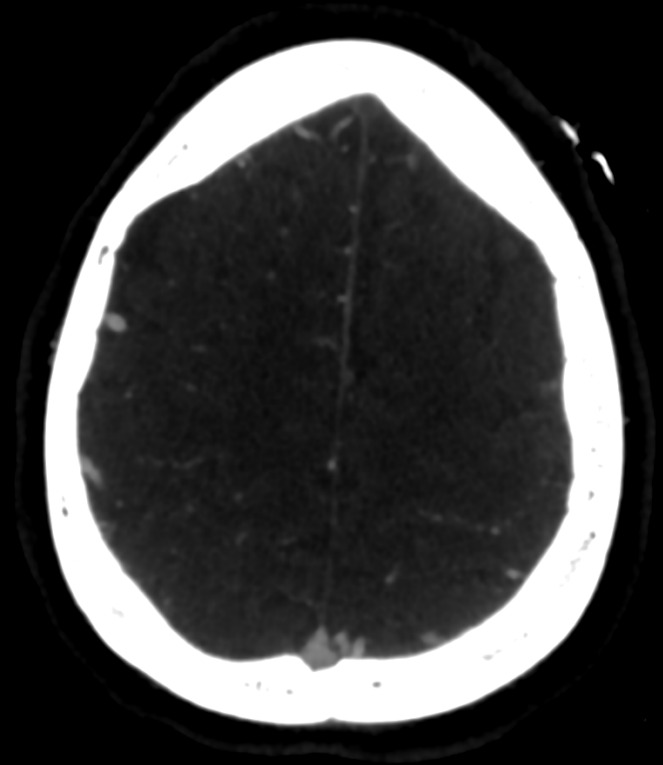


Fig. 2

Cord Sign

- Cord sign = hyperattenuation of thrombosed superficial cerebral veins on non-contrast CT

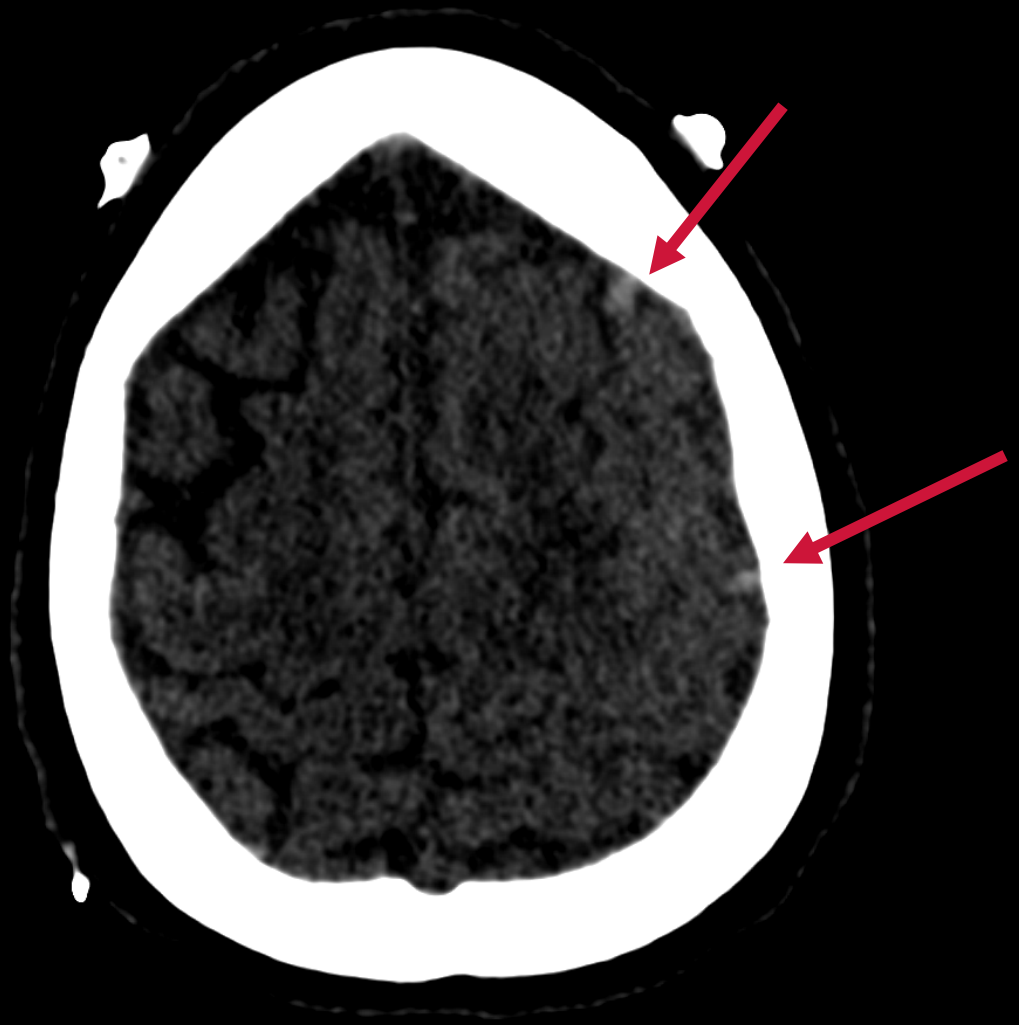


Fig. 1

Case 7

Presentation: 50s female presenting with headaches; concern for venous sinus thrombosis

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Case 7

Fig. 1a

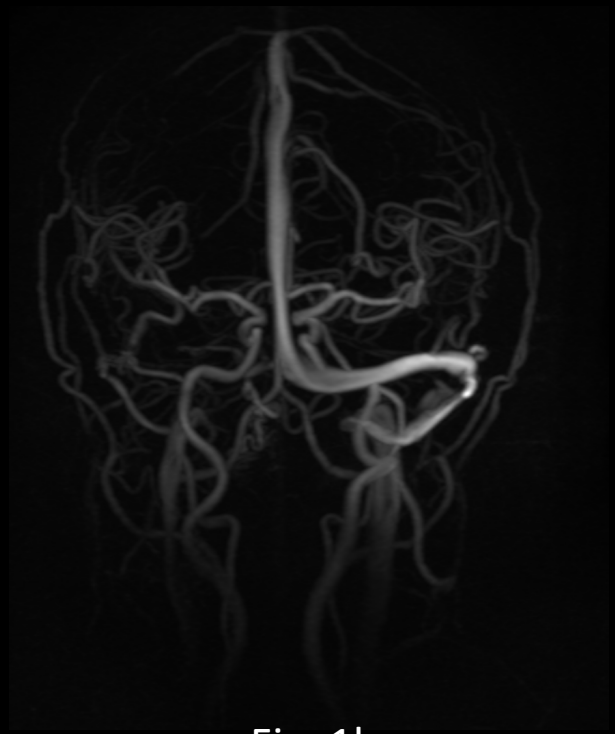

Fig. 1b

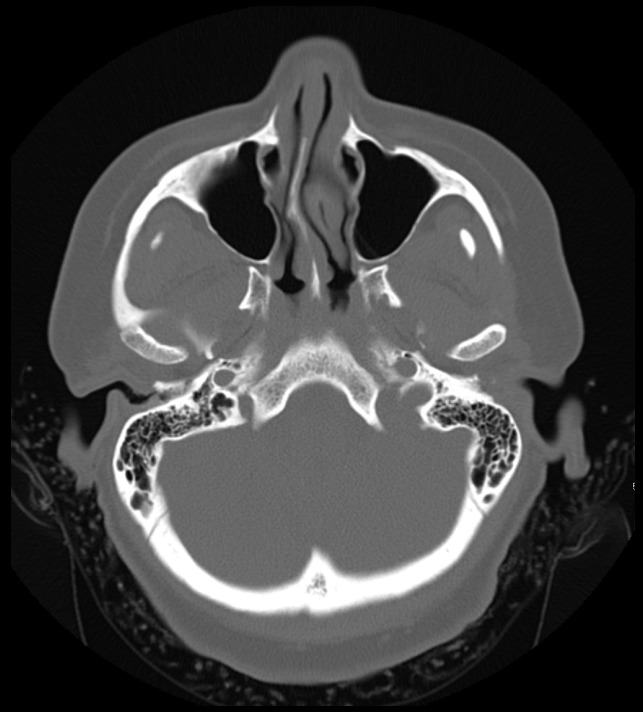

Fig. 2

- T1 post-con contrast image and MRV demonstrate diminutive right transverse sinus (Fig 1a and 1b), which may be confused for partial thrombus
- CT demonstrates that the right jugular foramen is much smaller than the left (Fig 2), confirming congenitally left-dominant sinuses
- Diagnosis: hypoplastic right transverse sinus

Pitfall: Hypoplastic transverse/sigmoid sinus is very common and can mimic venous thrombosis. The size of the jugular foramina can be useful for confirmation.

Companion Case

- Bone window CT demonstrates that the jugular foramina are similar in size, indicating that there is not a hypoplastic sinus (Fig 1a)
- Post-contrast CT demonstrates a true filling defect in the right sigmoid sinus and jugular bulb (Fig 1b)

Fig. 1a

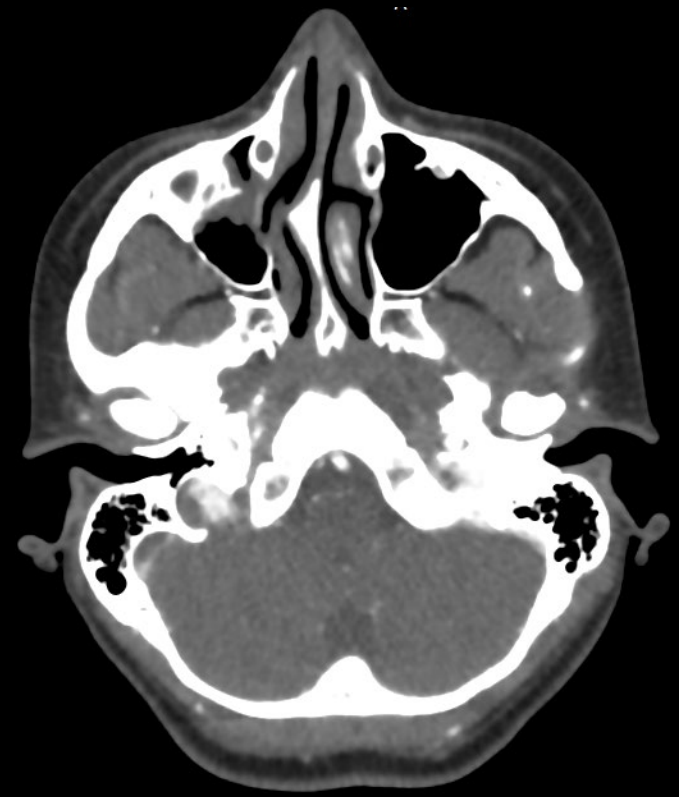

Fig. 1b

Case 8

Presentation: 20s male presenting with headache brought on by exercise

Case 8

- T1 post-contrast image shows small filling defects in the bilateral transverse sinuses (Fig 1a)
- T2 image shows T2 hyperintensities corresponding to the filling defects (Fig 1b, red arrows)

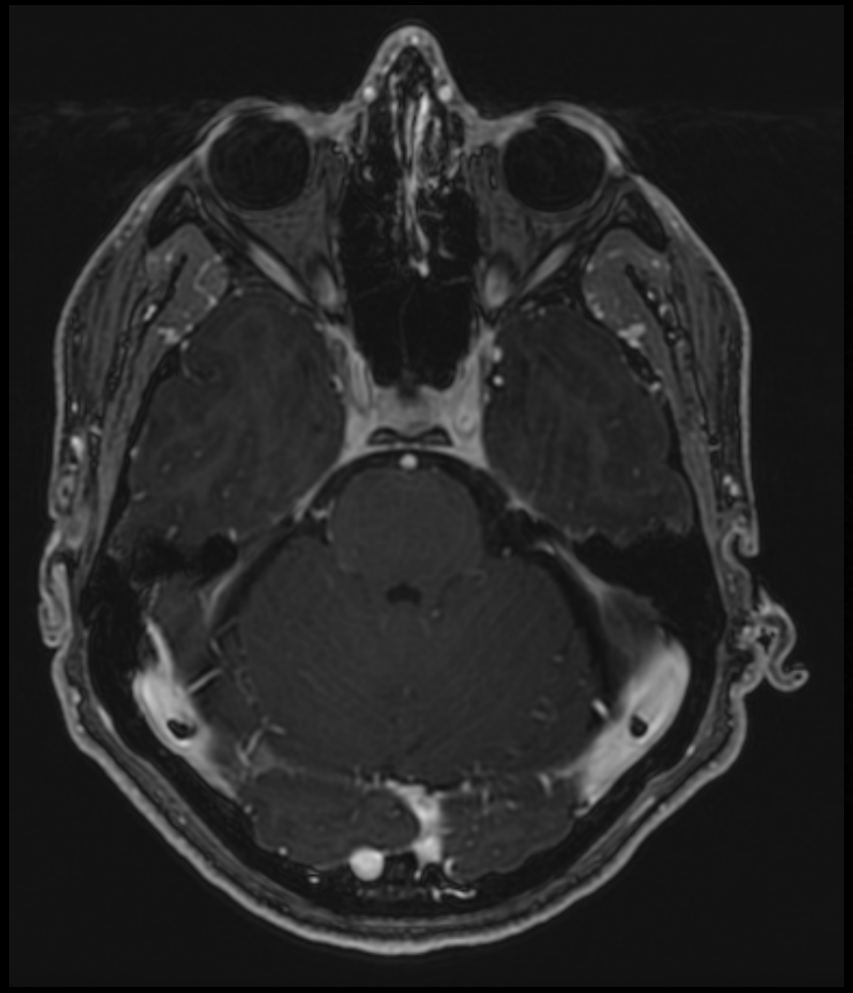

Fig. 1a

Fig. 1b

Pitfall: Arachnoid granulations are commonly seen and can be a mimicker of dural venous sinus thrombosis. The T2 sequence is useful for differentiating from thrombosis.

Teaching Points:

- Cerebral venous thrombosis can result in many imaging appearances on CT and MR (empty delta sign, cord sign, hemorrhage, edema)
- There are many etiologies of venous occlusion including trauma, infection, OCPs, dehydration, and other hypercoagulable states
- Some potential pitfalls include normal variants such as hypoplastic transverse sinus and arachnoid granulations. When in doubt:
  - Compare to prior imaging
  - Look for symmetry
  - Use other sequences for clues
  - Consider additional imaging such as CTV or MRV

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