ACR CASE: DURAL SINUS THROMBOSIS

A) Section/ Subsection/Modality: Neuroradiology/Brain/MRI,CT

B) Case Teaching Points:
   - Findings often subtle on CT and MR, Do a 2D TOF if suspected to confirm
   - Venous ischemia/edema does not usually show significant restricted diffusion
   - Venous congestion/edema will often go on to hemorrhage if unresponsive to anticoagulation or untreated

C) HISTORY: 44 year old female with headache and seizure.

D) Images Attached –

Fig 1: Noncontrast axial Head CT

Fig 2a: Sagittal T1

Fig 2b: Coronal T2

Fig 2c: Axial FLAIR

Fig 2d: Axial Diffusion

Fig 3a,b,c: AP and base MIP views and source coronal image from 2D TOF MRV

Fig 4: Axial Noncontrast CT

E) Findings

Fig 1: Noncontrast axial Head CT - There is increased density posteriorly along left tentorium. Subtle subarachnoid hemorrhage and temporal lobe edema is also seen.

Fig 2a: Sagittal T1 – Hyperintense signal is seen in the transverse sinus. This was verified on adjacent images.

Fig 2b Coronal T2 - Hyperintense signal is seen in the left transverse sinus. Normal Hypointense signal void is seen in the right transverse sinus.

Fig 2c: Axial FLAIR – Edema is seen in the left posterior temporal lobe

Fig 2d: Axial Diffusion – Questionable faint restricted diffusion identified in left posterior temporal lobe

Fig 3a,b,c: AP and base MIP views and coronal source image from 2D TOF MRV – Demonstrate occlusion of left transverse sinus
Fig 4: Axial Noncontrast CT - Despite anticoagulation, the patient progressed to a hemorrhagic venous infarct. There is new hemorrhage and progressive edema in the left temporal lobe.

F) Questions and answers
1. All of the findings may be present on Figure 1 EXCEPT:
   A. Subdural hemorrhage
   B. Subarachnoid hemorrhage
   C. Sinus thrombosis
   D. Epidural Hemorrhage
   E. Parenchymal edema

Answer: D
Rationales:
   A. Incorrect. Subdural hemorrhage along the tentorium could have this appearance.
   B. Incorrect. Subarachnoid hemorrhage is seen as linear areas of high attenuation in the sulci of the left temporal lobe.
   C. Incorrect. Thrombus in the left transverse sinus is seen as a tubular hyperdense area along the posterior tentorium.
   D. Correct. Epidural hemorrhage usually is biconcave and limited by suture lines. This is NOT seen on this CT image.
   E. Incorrect. There is sulcal effacement in the left temporal lobe.

2. Based on Figures 1, 2a-d and 3a-c, What is the correct Diagnosis?
   A. Trauma
   B. Sinus Thrombosis
   C. Hypoplastic Left transverse sinus
   D. Embolic infarct

Answer: B
Rationales:
   A. Incorrect. Classic signs of trauma are not seen on these images. This is not a typical location and distribution for these abnormalities. Additionally, there’s no soft tissue swelling or skull fracture and no history of trauma.
   B. Correct. A cord like area of high density is seen in the left transverse sinus. On MRI, normal venous signal voids are not seen in the left transverse sinus. MRV shows absent flow in the same region.
   C. Incorrect. While absence of signal in the transverse sinus on the MRV can be a pitfall in the false positive diagnosis of sinus thrombosis, the hyperintense signal in the left transverse sinus is diagnostic of sinus thrombosis in this case.
   D. Incorrect. Embolic infarcts present in an arterial distribution. The edema in the left temporal lobe is not in a typical arterial distribution, so another etiology should be sought.
3. Based on Figures 2a-d, what is the stage of venous sinus thrombosis?
   A. Acute
   B. Subacute
   C. Chronic

Answer: B
Rationales:
   A. Incorrect. Acute thrombus is isointense on T1 weighted images and hypointense on T2 weighted images. This thrombus is hyperintense on T1 and T2 weighted images.
   B. Correct. Subacute thrombus is hyperintense on T1 and T2 weighted images.
   C. Incorrect. Chronic thrombus is isointense on T1.

4. What percent of patients with sinus thrombosis progress to venous infarction?
   A. 5%
   B. 10-15%
   C. 25%
   D. 50%

Answer: D
Rationales:
   A. Nope. Venous infarction occurs much more commonly than that.
   B. Try again. Venous infarction occurs much more commonly than that.
   C. Close. It does happen a lot, but it’s even more than 25%.
   D. Correct. Untreated thrombosis and unsuccessful anticoagulation progress to venous infarction 50% of the time!

**DIAGNOSIS:**
**VENOUS SINUS THROMBOSIS**

**G) DISCUSSION:**
Venous sinus thrombosis commonly presents with clinical signs and symptoms including headache, papilledema, seizure, and/or focal neurologic deficit. Causes and associations include decreased cerebral blood flow, hypercoagulable states, dehydration, chemotherapy, malignancy, pregnancy, trauma, infection (sinusitis, mastoiditis, meningitis), intracranial neoplasm. However, no cause is identified in about 25% of cases.

Venous thrombosis progresses to infarction in about 50% of cases. Classic findings of venous ischemia/infarct are edema in the area of drainage. DWI is usually not positive unless there is progression to infarct. Usually the area of infarct is considerably smaller than the area of edema. Hemorrhage is a common component.
Imaging Findings of sinus thrombosis:
On non-contrast CT, sinus thrombosis may be seen as a **Cord sign** manifesting as increased density in the sinus involved. Following contrast, the dura may enhance but the venous sinus does not. This contrast surrounding a clot is known as the **empty delta sign**. Prominent collateral veins may also be seen.

Findings on MRI:
**T1WI**—
- Acute: isointense (absence of signal void in a vein)
- Subacute: hyperintense *potential pitfall of T1 shortening on MRV could mimic flow on time-of-flight MRV. Absence of flow can be verified with phase contrast MRV or on Spin Echo images
- Chronic: isointense

**T2WI**—
- Acute: hypointense - *potential pitfall – can mimic flow void on spin-echo images. Needs to be verified on T1 and MRV
- Subacute: hyperintense
- Chronic: becomes fibrotic, isointense

**MRV**
- Absence of flow related signal-
- Increased collaterals

**PITFALLS:**
Imaging pitfalls in addition to those mentioned above* include - anatomic variants such as a hypoplastic or aplastic transverse sinus, and arachnoid granulations protruding into the sinus lumen may mimic focal thrombosis. These are most common in the transverse sinus adjacent to venous entry sites. In addition, chronic sinus thrombosis clot which has fibrosed may enhance.

**H) References:**

**Keywords**: sinus thrombosis, hemorrhagic venous infarct, MR venogram

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