# 41 year old female with headache Elena G. Violari MD and Leo Wolansky MD















## Dural Venous Sinus Thrombosis with Hemorrhagic Venous Infarct





Acute intraparenchymal hematoma measuring ~3 cm in diameter centered in the right temporal lobe with surrounding vasogenic edema.

There is mass effect upon and effacement of the adjacent cortical sulci and negligible midline shift



Non-contrast CT, axial view



Hyperdensity is seen in the right transverse sinus (yellow arrow) in comparison with the normal left transverse/ sigmoid sinus junction (orange arrow)

Non-contrast CT, axial view





#### Acute/Hyperacute hematoma









Acute/Hyperacute hematoma in the right temporal lobe with a hematocrit effect (yellow arrow). The posterior portion of the hematoma (blue arrow) demonstrates hypointense signal intensity on T2-weighted images, typical of dependently layering RBC's. The anteriormost portion is hyperintense on T2-weighted images (plasma). There is surrounding vasogenic edema (orange arrows).





Filling defect seen on the volumetric contrastenhanced T1-weighted images, typical of acute thrombus involving the right transverse sigmoid sinus junction (yellow arrow).



#### T1 CORONAL POST





Filling defect seen on the volumetric contrast-enhanced T1-weighted images typical of acute thrombus throughout the right transverse sinus (blue arrows) & sigmoid sinus (violet arrow) extending into the jugular bulb (orange arrow). Compare with nonthrombosed left sigmoid and jugular (yellow arrows). Superiorly (not shown), there was extension into a cortical vein probably representing the anastomotic vein of Labbe, which coursed immediately superficial to the hematoma and is thought to represent the immediate cause of the hemorrhage.



Non-contrast CT, axial view

Non-contrast CT, coronal view

Asymmetric hyperdensity of thrombus (yellow arrows) is visible on CT when compared with healthy sinus contralaterally (orange arrows).

### **Dural Venous Sinus Thrombosis**

#### **Clinical Manifestations**

- 1. Symptoms vary depending on the extent, location, and acuity of the venous thrombotic process as well as the adequacy of venous collateral circulation.
- 2. Generalized neurologic symptoms (eg,headache, experienced by 75%–95% of patients) and focal neurologic deficits, including seizure, may result.
- 3. Focal neurologic symptoms are more often seen in patients with parenchymal changes observed at imaging than in those without such changes.
- 4. Because thrombosis and endogenous thrombolysis and recanalization may occur concurrently, the clinical manifestations may fluctuate in as many as 70% of patients, adding to clinical uncertainty.
- 5. Intracranial hypertension occurs in 20%–40% of patients with cerebral venous thrombosis and should be excluded inpatients with the specific complex of symptoms



### **Dural Venous Sinus Thrombosis**

Underlying predisposing factors are identified in the majority of cases (87.5%) with many patients having more than one coexistent risk factors:

- 1. <u>Hormonal</u>:
  - oral contraceptive pill: very common cause in female patients <50 y/o
  - Pregnancy
  - Puerperium
  - Steroids
- 2. Pro-thrombotic hematological conditions:
  - local factors
  - skull abnormalities/trauma
  - compressing mass
  - infection: especially mastoid sinus
- 3. <u>Systemic illness</u>:
  - dehydration: e.g. gastroenteritis
  - cigarette smoking
  - sepsis
  - malignancy
  - connective tissue disorders
  - idiopathic: ~12%



### **CT of Dural Venous Sinus Thrombosis**

#### -- Non-contrast CT:

- cord sign cordlike hyperattenuation within a dural venous sinus on non-contrast enhanced CT of the brain. The sign is most commonly seen in the transverse sinus because along the origin of the tentorium it runs approximately in the axial plane such that it is visible on one image.
- dense vein sign
  - a potential pitfall is interpreting the distal superior sagittal sinus as being hyperdense near the torcula herophili; it is important to appreciate that normal blood within the dural sinuses is usually of slightly increased density relative to brain parenchyma and that true hyperdensity is the key to recognizing thrombosis
  - The walls at this location can be thick, measuring up to 2-3 mm
- cerebral/cortical edema: secondary to venous hypertension
- unilateral or bilateral cortical hemorrhage (venous hemorrhagic infarct)



### **CT of Dural Venous Sinus Thrombosis**

#### -- Contrast-enhanced CT (preferably CT venogram):

- empty delta sign (specific to a superior sagittal sinus thrombosis)
- filling defect
- gyral enhancement
- prominent intramedullary vein



### **MR of Dural Venous Sinus Thrombosis**

#### Absence of normal flow voids in the dural sinuses.

- Clot acutely is isointense on T1 and hypointense on T2 (this can mimic a flow void).
- Subacute clot becomes hyperintense on T1.
- The most sensitive conventional MRI sequence for detection of the clot is susceptibility sequences such as SWI or GRE
- Contrast-enhanced 3D T1WI GRE is the most sensitive and specific MRI sequence in the detection of DVST; MRV will demonstrate a lack of flow.

#### **MRI Staging of Severity:**

Dural venous thromboses can result in parenchymal edema and ischemia in its watershed area; the severity of which can be graded as follows:

- type 1: no imaging abnormality
- type 2: high T2
- **type 3:** high T2 with enhancement
- type 4: hemorrhage or infarction



### **References:**

- 1. Radiopedia
- 2. Leach JL, Fortuna LB, Jones BV, Gaskill-Shipley MF. Radiographics. 2006; 26:S19–S43.
- 3. Lee EJ. The empty delta sign. Radiology. 2002;224 (3): 788-9.
- 4. Schell CL, Rathe RJ. Superior sagittal sinus thrombosis. Still a killer. West. J. Med. 1988;149 (3): 304-7.
- Rodallec MH, Krainik A, Feydy A et-al. Cerebral venous thrombosis and multidetector CT angiography: tips and tricks. Radiographics. 2006;26 Suppl 1 (suppl\_1): S5-18.
- Virapongse C, Cazenave C, Quisling R et-al. The empty delta sign: frequency and significance in 76 cases of dural sinus thrombosis. Radiology. 1987;162 (3): 779-85.

