Dural Venous Sinus Thrombosis

Case:  This case is of a 30 year old pregnant female who was found to have acute thrombosis of the superior sagittal sinus, right transverse sinus, right sigmoid sinus and right internal jugular vein.

Findings:  On the unenhanced CT images there is hyperattenuation in the region of the right transverse sinus and superior sagittal sinus.  This hyperattenuation is due to acute thrombosis and is known as the “dense clot sign.”  Had a contrast enhanced CT been performed, the same images would show the thrombosis as a filling defect with an enhancing rim, known as the “empty delta sign.”  On the axial T1 weighted image, in the region of the superior sagittal sinus there is replacement of signal void by thrombus.  On the sagittal T1 image, there is abnormal isointense signal in the region of the superior sagittal sinus.  This correlated with areas of decreased signal intensity on T2 and FLAIR.  On the MR venography below, absence of flow is seen in the superior sagittal sinus and extends into the right transverse sinus, right sigmoid sinus and right internal jugular vein.

Discussion:

Epidemiology:

Though the incidence of cerebral venous thrombosis is relatively rare, there are more than 100 documented causes.  Some of the associated factors include:

- Local Disease – Trauma, Tumor, Infection
- Systemic – Pregnancy and Puerperium, Dehydration, Nephrotic Syndrome
- Drugs – OCPs, Androgens, Ecstasy
- Blood Dyscrasias – Leukemia, Thrombocytopenia, Sickle Cell Trait
- Coagulopathies – Protein C, S, antithrombin III deficiency, Factor V Leiden, Antiphospholipid antibody

Clinical Presentation:

Presenting symptoms can be quite varied but most commonly:

- Headache (75-95%)
- Focal Seizures (37-47%)
- Paresis – Uni or bilateral (34-43%)
- Papilledema (41-49%)
- Mental Status Changes (30-39%)

Radiographic Findings:

On unenhanced CT, direct signs of cerebral vein thrombosis such as the “dense clot sign” are uncommon and only present in about one third of cases.  Another direct sign of cerebral vein thrombosis is a dense cortical vein known as the “cord sign.”  Other indirect signs include:  subcortical hemorrhagic infarction, diffuse brain swelling and small ventricular size.  The empty delta sign on enhanced CT may be seen 5 days to 2
months after insult. Other indirect signs on enhanced CT include: contrast enhancement of the falx and tentorium due to venous stasis and hyperemia of the dura matter. Overall in 10 to 30% of cases, findings are negative on both unenhanced and enhanced CT images.

Other modalities for further investigation in highly suspicious cases include CT venography and MRI with MR venography. CT venography will show a filling defect in the region of thrombus. On MRI, patent venous sinuses will normally demonstrate a flow void. Therefore, on T1 weighted images areas of acute thrombus will show high signal intensity filling the sinuses. To note, the signal intensity of the thrombus will change over time with the normal evolution of hemoglobin seen on MR. MR venography is performed either with gadolinium or without contrast utilizing either time-of-flight or phase contrast techniques. Similar to CT venography, MR venography will demonstrate a filling defect in the region of thrombus.

Potential Pitfalls:

Unenhanced CT –
- Hyperdense blood such as in patients with polycythemia or dehydration may have a similar appearance as hyperdensity seen with a cerebral venous clot.
- Subdural hematoma - mimics
- Retained contrast from a previous study in patients with extremely slow cerebral venous flow

Enhanced CT –
- Intrasinus septation or a split/fenestrated dural sinus may mimic an empty delta sign

MRI –
- Split/fenestrated dural sinus
- Acute or early subacute hemorrhage may have low signal on T2 and appear the same as normal flow void.
- Signal loss on MR venography may also be due to in-plane flow, extremely slow flow or complex flow.

References:

