

**“SOMETHING OLD”, “SOMETHING NEW”: DIRECT RADIOLOGICAL SIGNS IN  
CEREBRAL VENOUS SINUS THROMBOSIS****Eugenia ROTA, M.D., Luciano ARENA, M.D., Roberto PASTORINO °, M.D., Lucia TESTA, M.D., Irene  
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**ABSTRACT**

Cerebral Venous Sinus Thrombosis (CVST) is a potentially life-threatening cause of stroke in young adults and although mortality has decreased in the past few decades, it is still relevant (5-10%). Moreover, despite the advances in neuroimaging techniques, the diagnosis of CVST remains challenging. Interest has grown as to the diagnostic potential of Magnetic Resonance Imaging (MRI) for Cerebral Venous Thrombosis, where "old" signs on brain Computed Tomography (CT), like the "dense triangle" (on unenhanced scans) are detectable only in about 50% of thrombosis cases in the superior sagittal sinus. Recently, the "double-track sign" on MRI axial Gadolinium-enhanced T1 weighted imaging has proven to be a highly specific and moderately sensitive direct sign to detect transverse sinus thrombosis. Herein we report a case where a "marriage" between the "old" and "new" direct radiological signs (respectively, the "dense triangle" sign on unenhanced CT scans and the "double-track sign" on MRI sequences) allowed for an early diagnosis of CVST secondary to mastoiditis, prompting treatment, with a good clinical outcome.

**KEYWORDS:** Cerebral Venous Sinus Thrombosis, Computed tomography, Magnetic Resonance (MR) venography, "double-track sign", "dense triangle sign".

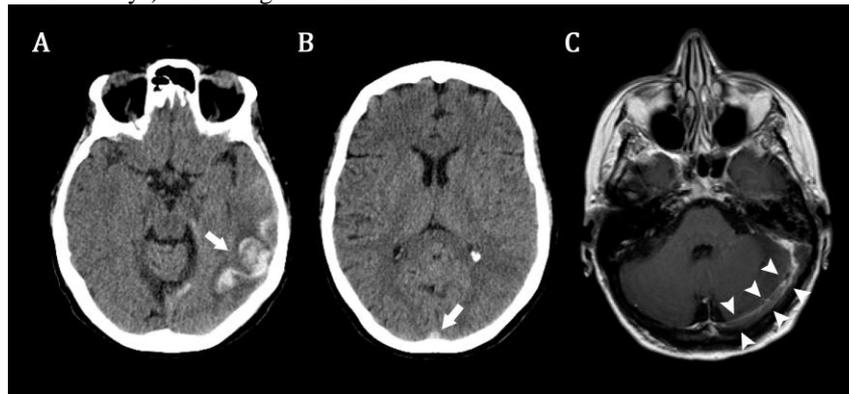
**INTRODUCTION**

Cerebral Venous Sinus Thrombosis (CVST) is a potentially life-threatening cause of stroke in young adults, where although mortality has decreased over the past few decades, is still relevant (5-10%).<sup>[1]</sup> Advances in neuroimaging techniques have made the diagnosis of CVST increasingly common. Brain Computed tomography (CT) remains the initial workout for CVST, where the direct signs, i.e. a "dense triangle" (on unenhanced scans) and "empty delta" signs (on enhanced scans), are detectable in 57.9% and 100% of thrombosis cases of the superior sagittal sinus, respectively.<sup>[2,3]</sup> However, up to 30% of initial CT scans are unremarkable and a CT or Magnetic Resonance (MR) venography is required to demonstrate lack of opacification of venous vessels, respectively.<sup>[4]</sup> Recently, axial Gadolinium-enhanced T1 weighted imaging has provided the "double-track sign", i.e. a sinus filling defect with peripheral enhancement of the dural walls. This has proven to be a highly specific and moderately sensitive direct sign to detect transverse sinus thrombosis.<sup>[5]</sup>

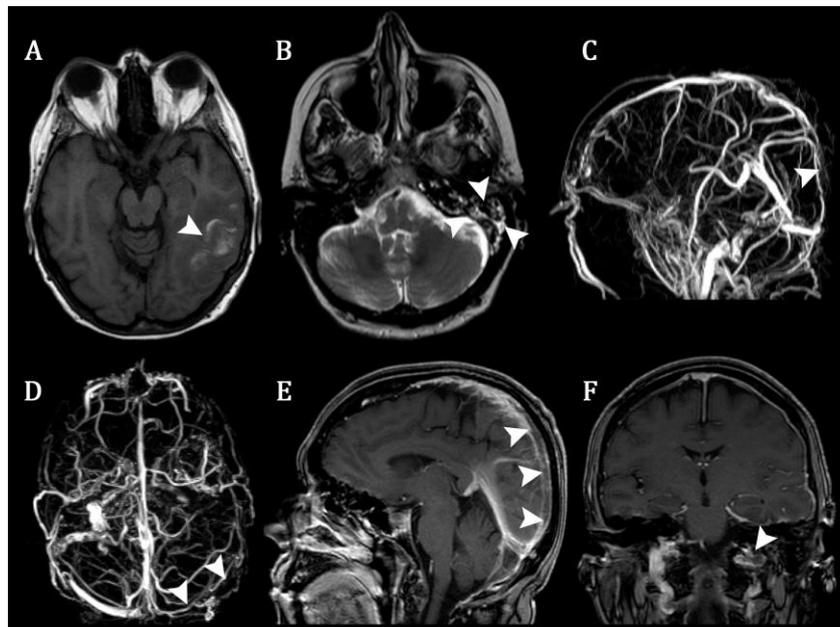
**CASE REPORT**

A 63-year-old female was referred for an urgent neurological examination eight days after hip replacement, due to subacute onset of headache over the left temporo-occipital region and speech disturbance (afasia nominum). Physical examination evidenced tenderness to palpation over the left mastoid. A brain CT scan revealed hyperdensity in the cortical-subcortical, posterior temporal region, along with a hyperdense superior sagittal sinus, consistent with the "dense triangle" sign (Figure 1, a-b). A brain MR was performed due to the strong suspicion of CVST, supported also by an increase in d-dimer levels (10.49 mg/dl; upper normal limit: 0.50). It evidenced left mastoid fluid-filled cells, consistent with mastoiditis (Figure 2, b), on axial T2 weighted imaging and a "double-track" pattern on T1-weighted sequences after Gadolinium, consistent with the "double-track" sign (Figure 1, c). The MR venography (Phase Contrast technique), provided evidence of thrombosis of the superior sagittal sinus, left transverse sinuses, straight sinus, sigmoid sinuses and proximal internal jugular vein (Figure 2, c,d,e,f). Treatment was started with intravenous antibiotics and anticoagulation with low weight molecular heparin,

followed by warfarin, with a rapid decrease in d-dimer levels (3.6 mg/dl after 6 days) and a good clinical recovery.



**Fig. 1:** Unenhanced CT scan of the brain showing: (a) cortical-subcortical hemorrhagic lesion in the left posterior temporal region; (b) hyperdensity of superior sagittal sinus, i.e. the “dense triangle sign”. MR imaging of the brain showing, on axial gadolinium-enhanced T1-weighted imaging : (c) a hyperintense signal of the transverse sinus without enhancement of the lumen, i.e. the “double-track sign”.



**Fig. 2:** MR Imaging of the brain showing: (a) on axial T1-weighted imaging, an inhomogeneous haemorrhagic lesion in the left posterior temporal region; (b) on axial T2-weighted imaging, left mastoid fluid-filled cells. Unenhanced MR-venography (Phase Contrast technique) and Maximum Intensity Projection (MIP) reconstructions, showing: (c) (e) partial thrombosis of the superior sagittal sinus; (d) complete thrombosis of the left transverse sinus; (f) thrombosis of the left sigmoid sinus and jugular vein.

## DISCUSSION

Despite the advances in neuroimaging techniques, an early clinical and radiological diagnosis of CVST remains challenging, owing to the wide range of symptoms and the low sensitivity of the unenhanced brain CT scans. MRI represents an interesting and very useful tool for the diagnosis of CVST. However, MR venography without gadolinium, which is influenced by the amount and velocity of the venous flow, may mistake a transverse sinus hypoplasia for a thrombosis.<sup>[6]</sup> Direct radiological signs show an “anatomical” reliability on both CT and MR, as demonstrated in our case, where a

“dense triangle” was the first hallmark of superior sagittal sinus thrombosis on unenhanced CT scans and rose the diagnostic suspicion. CVST was then confirmed, firstly, by the MR hyperintensity of the left transverse sinus on axial T1-weighted imaging and then by the presence of the “double-track sign” after gadolinium administration. This “double-track sign” is the result of the distribution of the contrast agent in the affected dural sinus wall, presenting with two hyperintense linear tracts of gadolinium, separated by the signal of the thrombus within the dural sinus. This sign seems to have high specificity and moderate sensitivity for the radiological diagnosis of transverse sinus thrombosis.<sup>[5]</sup>

Noteworthy is the fact that, in our case, the hyperdensity in the posterior temporal region detected by the CT scan, and, above all, the direct radiological MR signs, allowed for an early recognition of CSVT and prompt treatment, allowing for a good outcome.

### CONCLUSIONS

Although the radiological diagnosis of CVST still remains challenging, the case reported herein shows how a *marriage* between the “old” and “new” direct radiological signs (the “dense triangle” sign on unenhanced CT scans and the “double-track sign” respectively) allowed for an early diagnosis of CVST secondary to mastoiditis, prompting treatment and obtaining a good clinical outcome.

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