

# Neuroimaging Highlight

Editor: David Pelz

## Persistent Anterior Falcine Sinus: Demonstration by CT Angiography

Submitted by: Charles C. Matouk, Daniel M. Mandell, Timo Krings, Robert A. Willinsky, Karel G. terBrugge

Can. J. Neurol. Sci. 2011; 38: 760-761

### CASE REPORT

A 67-year-old man presented to medical attention with a two month history of progressively worsening shortness of breath. Subsequent investigations established a diagnosis of extranodal marginal zone B cell mucosa-associated lymphoid tissue (MALT) lymphoma. He was started on combination chemotherapy (Rituximab + cyclophosphamide, vincristine, prednisolone (CVP)) with an excellent clinical and radiographic response. After the completion of eight cycles, staging imaging was performed that included a contrast-enhanced computed tomography (CT) of the head and neck up to the level of the orbits. On the uppermost axial slices, incidental note was made of abnormal vascular channels in the region of the anterior interhemispheric fissure. A brain CT angiogram was

recommended for better evaluation (Figure). Interestingly, these abnormal vascular channels were shown to represent bilateral anterior falcine sinuses that drained the paramedian cortical veins of the frontal lobes into a prominent inferior sagittal sinus en route to the vein of Galen and straight sinus. Associated agenesis of the anterior one third of the superior sagittal sinus (SSS) was also demonstrated. Taken together, these imaging findings depict an alternative configuration of cerebral venous drainage, i.e., anterior falcine sinuses, in a neurologically intact adult patient.

### DISCUSSION

The falcine sinus is an embryonic vascular channel that normally involutes before birth<sup>1</sup>. It represents a posteriorly



**Figure:** CT angiogram (A) axial images, (B) coronal reformats, and (C) sagittal reformat demonstrating abnormal vascular channels in the region of the anterior interhemispheric fissure. Careful inspection reveals that these are bilateral falcine channels that appear to drain cortical veins of the frontal lobes, bilaterally (arrows). The sagittal reformat most clearly demonstrates the bilateral persistent anterior falcine sinuses draining frontal cortical veins into the inferior sagittal sinus with associated agenesis of the anterior third of the superior sagittal sinus.

From the The University of Toronto Brain Vascular Malformation Study Group, Departments of Surgery and Medical Imaging, The Toronto Hospital, Western Division, Toronto, Ontario, Canada.

RECEIVED MARCH 4, 2011. FINAL REVISIONS SUBMITTED APRIL 13, 2011.

Correspondence to: Charles C. Matouk, The University of Toronto Brain Vascular Malformation Study Group, Departments of Surgery and Medical Imaging, The Toronto Hospital, Western Division, 399 Bathurst Street, Toronto, Ontario, M5T 2S8, Canada.

directed dural sinus communication within the falx cerebri between the deep venous system and SSS. Its persistence is well described in the pediatric population where it is most commonly associated with other congenital (e.g., vein of Galen) malformations, or acquired (e.g., venous sinus thrombosis) anomalies<sup>2,3</sup>. More recently, a posteriorly directed persistent falcine sinus has been increasingly recognized on CT angiography and magnetic resonance venography in the adult population as an incidental finding<sup>4,5</sup>.

From an embryological perspective, Streeter described the superior and inferior sagittal sinuses as arising from a more expansive falcine venous plexus through a process of coalescence and remodeling<sup>6</sup>. This embryological model is supported by recent observations in adult autopsy specimens demonstrating falcine veins of varying sizes in all specimens<sup>7</sup>. Importantly, 63% (17 of 27 heads) had intact falcine venous communications between the superior and inferior sagittal sinuses, with the vast majority located in the posterior one third of the falx cerebri. It has been hypothesized that a falcine sinus in the adult population represents persistence, and coalescence, of these dural venous communications extending posteriorly from the deep venous system to the SSS<sup>8</sup>. In the case presented herein, it is postulated that a similar mechanism accounts for the very rare persistence of anterior falcine venous communications between the superior and inferior sagittal sinuses providing an alternative route for cerebral venous drainage of the frontal lobes. Corroboratively, in this case, there is associated agenesis of the anterior one third of the SSS consistent with an underlying developmental event.

#### ACKNOWLEDGEMENTS

The authors thank the members of the Toronto Vascular Malformation Study Group for many fruitful discussions and critical review of the manuscript.

Substantive Contributions of Individuals: Charles C. Matouk helped conceive of the study, performed a literature review, and drafted the manuscript text. Daniel M. Mandell helped finalize the manuscript text. Timo Krings, Robert Willinsky, and Karel terBrugge conceived of the study and helped finalize the manuscript text.

#### REFERENCES

1. Manoj KS, Krishnamoorthy T, Thomas B, Kapilamoorthy TR. An incidental persistent falcine sinus with dominant straight sinus and hypoplastic distal superior sagittal sinus. *Pediatr Radiol*. 2006 Jan;36(1):65-7.
2. Kesava PP. Recanalization of the falcine sinus after venous sinus thrombosis. *AJNR Am J Neuroradiol*. 1996 Oct;17(9):1646-8.
3. Sener RN. Association of persistent falcine sinus with different clinicoradiologic conditions: MR imaging and MR angiography. *Comput Med Imaging Graph*. 2000 Nov-Dec;24(6):343-8.
4. Ryu CW. Persistent falcine sinus: is it really rare? *AJNR Am J Neuroradiol*. 2010 Feb;31(2):367-9.
5. Strub WM, Leach JL, Tomsick TA. Persistent falcine sinus in an adult: demonstration by MR venography. *AJNR Am J Neuroradiol*. 2005 Apr;26(4):750-1.
6. Streeter GL. The development of the venous sinuses of the dura mater in the human embryo. *Am J Anat*. 1915;18:145-78.
7. Tubbs RS, Loukas M, Louis RG, Jr., et al. Anatomy of the falcine venous plexus. *J Neurosurg*. 2007 Jul;107(1):155-7.
8. Raybaud C. Normal and abnormal embryology and development of the intracranial vascular system. *Neurosurg Clin N Am*. 2010 Jul;21(3):399-426.