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Cerebral Sinovenous Thrombosis

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Case Summary

A child with a history of a high-grade tumor within the right posterior fossa presented to the emergency department with headache and fever. Noncontrast and contrast-enhanced magnetic resonance imaging (MRI) of the head were performed.

Imaging Findings

A noncontrast, T1 MPRAGE sequence demonstrated abnormal hyperintensity within the distal superior sagittal sinus extending into the torcula, right transverse sinus, and left transverse sinus. This was concerning for cerebral sinovenous thrombosis.

Additional imaging, including time-of-flight magnetic resonance venography (MRV), which requires no contrast, demonstrated flow-related enhancement within the superior sagittal sinus. There was a filling defect near the torcula extending into the right transverse sinus, which appeared narrowed and slightly irregular, and extended into the right sigmoid sinus and right jugular vein. The left transverse sinus demonstrated no flow-related signal, which was concerning for venous thrombosis.

Postcontrast T1 MPRAGE showed filling defects within the distal superior sagittal sinus extending into the torcula, along with partial thrombosis of the right transverse sinus. The right sigmoid sinus demonstrated normal enhancement, with no filling defect or thrombosis of the proximal right internal jugular vein. The left transverse sinus on the postcontrast, 3D T1 MPRAGE showed partial thrombosis of the left transverse sinus, which extended close to the left sigmoid sinus. The left internal jugular vein showed a potential small, distally located filling defect.

Diagnosis

Cerebral sinovenous thrombosis (CSVT)

Discussion

The incidence of cerebral sinovenous thrombosis within the pediatric population is approximately 0.67 per 100,000 per year.1 Diagnosing CSVT can be challenging depending on the age of the patient. Accurately characterizing the extent of the thrombosis is difficult due to multiple vessels and noncontrast sequences on MRI, which is prone to artifacts and unreliable signal alterations.2 Neuroimaging at diagnosis is primarily performed for estimation of thrombus burden, hemorrhage, and assessment of venous infarction.3 Follow-up neuroimaging is obtained primarily to assess for increase or decrease in thrombus, and recurrence.4 The imaging protocol may include follow-up imaging at day five after diagnosis to assess for ischemic or hemorrhagic complications, followed by imaging at six weeks to assess for early recanalization of the thrombus, and a three-month follow-up for treatment response. The additional risk in patients with infection and abscess is CSVT, where Gadolinium-based contrast agents (GBCAs) also help confirm the venous sinuses are patent.

A combination of MRV and MRI without and with contrast provides the best diagnostic sensitivity and specificity for CSVT. GBCAs are extremely helpful in cases of cerebral sinovenous thrombosis, allowing for better characterization of the extent, providing the clinical team with the information for the best treatment decision. In addition, MRI can identify acute infarcts and hemorrhage. Noncontrast MRV with MRI of the brain without and with contrast, including a postcontrast T1 3D gradient-echo sequence, is extremely helpful for characterizing CSVT.5 The postcontrast 3D MPRAGE T1 sequence is superior to MRV, as the former does not suffer from slow flow or other imaging artifacts commonly associated with MRV.5

Other options of imaging include CT venography (CTV), which can be used for cases like this to fully evaluate for cerebral sinovenous thrombosis. CTV can also be considered when MRI is not feasible; eg, the presence of magnetic hardware within a patient. However, radiation in children has a potential cancer risk and should be avoided when possible, and some of these patients might require multiple studies to follow up for treatment purposes, where MRI can provide the info without radiation. Cerebral angiography is helpful in cases of equivocal MRV or CTV results or where endovascular procedure is being contemplated.

Conclusion

The primary point in this case is if there is concern for cerebral sinovenous thrombosis on noncontrast imaging or conventional MRI, adding MRV and postcontrast 3D T1 sequences is important to obtain the best diagnostic sensitivity and specificity for CSVT.

References

1. Sebire G, et al. Cerebral venous sinus thrombosis in children: risk factors, presentation, diagnosis and outcome. Brain. 2005; 128(Pt 3): 477-489.
2. Saposnik G, et al. Diagnosis and management of cerebral venous thrombosis: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2011. 42(4): 1158-1192.
3. Jackson BF, et al. Cerebral sinovenous thrombosis in children: diagnosis and treatment. Pediatr Emerg Care. 2011; 27(9): 874-880; quiz 881-883.
4. Johnson, MC, et al. Pediatric sinovenous thrombosis. J Pediatr Hematol Oncol 2003; 25(4): 312-315.
5. Wetzel, SG, et al. Three-dimensional, T1-weighted gradient-echo imaging of the brain with a volumetric interpolated examination. AJNR Am J Neuroradiol. 2002; 23(6): 995-1002.