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Recanalization of the Falcine Sinus after Venous Sinus Thrombosis

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Summary: Thrombosis of the straight and transverse sinuses associated with a large hemorrhagic venous infarct developed in an infant with large chronic subdural fluid collections after drainage of the subdurals. CT and MR studies obtained before and after the onset of venous sinus thrombosis showed interval widening of a segment of the posterior falx between the vein of Galen and the superior sagittal sinus. MR angiography confirmed a recanalized falcine sinus.

Index terms: Children, injuries; Thrombosis, dural sinus

The falcine sinus is a dural venous channel connecting the vein of Galen to the posterior portion of the superior sagittal sinus. Although this dural sinus may normally be present during fetal life, it rarely persists beyond birth (1, 2). This report illustrates the imaging findings in an infant in whom a persistent falcine sinus recanalized after thrombosis of the straight sinus.

Case Report

The patient, a premature twin girl born at 34 weeks' gestational age, first presented 2 months after birth with seizures. A computed tomographic (CT) scan of the head showed bilateral subdural hematomas and areas of parenchymal hemorrhage in locations typical for shear injury. Further examination revealed a long bone fracture, rib fractures, and retinal hemorrhages consistent with nonaccidental trauma. The patient spent the next 2 months in foster care. On a follow-up examination at 4 months of age, the patient was found to have an enlarging head size and papilledema. Repeat CT and magnetic resonance (MR) imaging examinations of the head revealed interval enlargement of the now chronic subdural fluid collections (Fig 1A and B). Two days later, bilateral subdural drainage catheters were placed through the anterior fontanelle. Seizures developed the next day. A follow-up head CT study showed reduction in size of the subdural fluid collections, but it also revealed a large left frontoparietal hematoma, thrombosis of the straight and transverse sinuses, and widening of a segment of the posterior falx between the vein of Galen and the posterior superior sagittal sinus (Fig 1C). The widened segment of the posterior falx exhibited a signal void on MR images that was confirmed to represent a falcine sinus by a sagittal two-dimensional phase-contrast MR angiogram (Fig 1D and E).

Discussion

The falcine sinus is a normal transient vascular channel between the two dural layers of the falx cerebri that is often observed in fetal life (1). When the falcine sinus persists after birth, it is usually associated with a vein of Galen malformation (3). Huang et al (2) described a case of a falcine sinus in an adult in whom the straight sinus was obstructed by a falcotentorial meningioma. They postulated that recanalization of this remnant fetal sinus occurred in order to provide alternative venous drainage in response to the gradual obstruction of the straight sinus by a slow-growing tumor.

Although the falcine sinus is known to exist normally in the fetus, its embryology is not well understood. Streeter (4) described the development of the dural venous sinuses in detail on the basis of his study of human embryos. In the 20-mm embryo, the primitive falx cerebri consists of loose dural tissue interposed between the two developing cerebral hemispheres. This loose dural tissue contains the sagittal plexus, a mesh of anastomotic loops from which the superior sagittal sinus and straight sinus eventually develop. On the dorsal aspect of the developing falx, the dominant venous channel of the sagittal plexus eventually becomes the superior sagittal sinus and the smaller channels disappear. The posterior aspect of the superior sagittal sinus may be formed by the coalescence of more than one channel. The inferior sagittal sinus and straight sinus develop in a similar manner along the ventral aspect of the falx. As the occipital poles extend posteriorly with growth,

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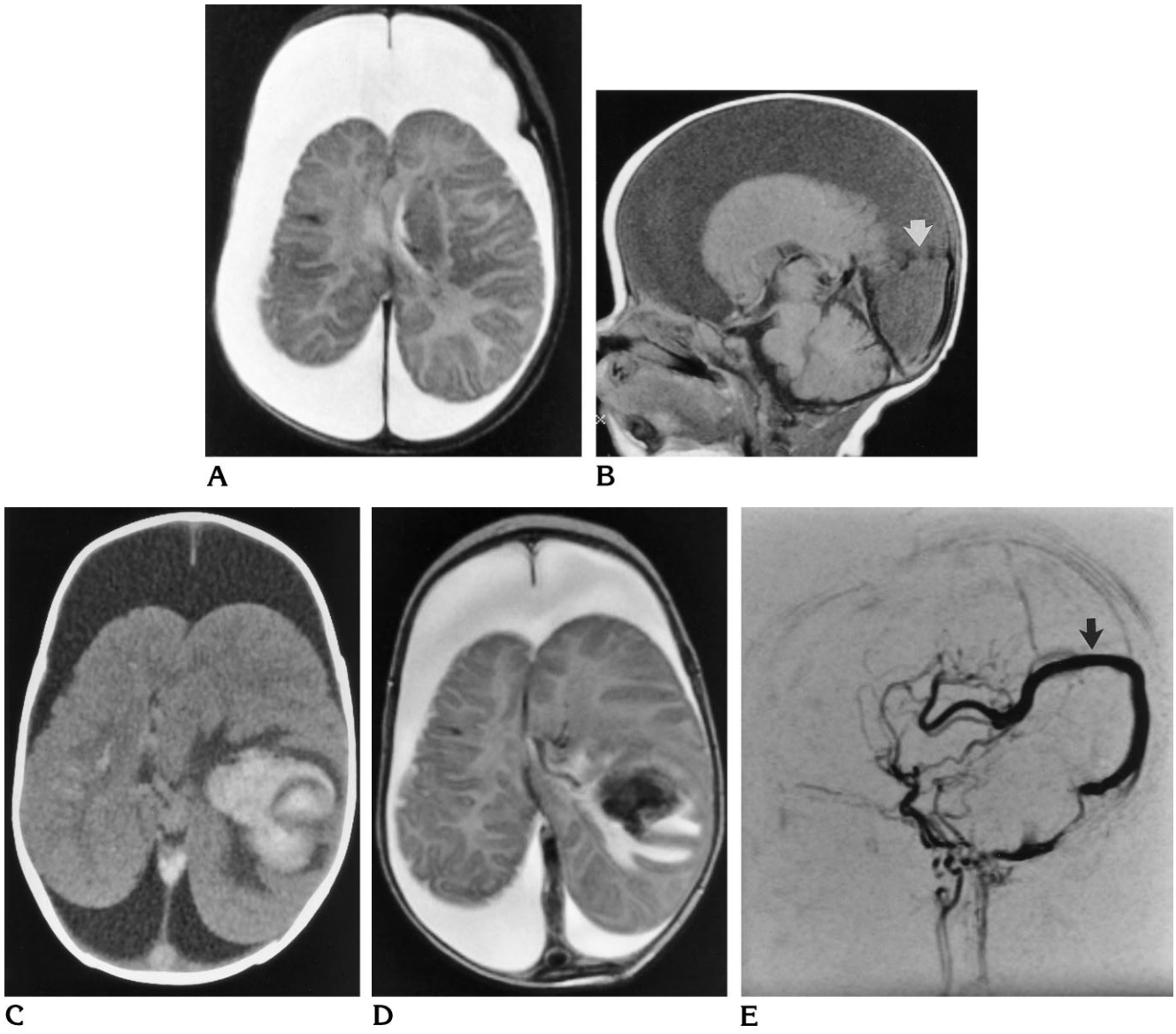

Fig 1. Two-month-old girl with seizures.

A, Axial fast spin-echo T2-weighted MR image shows large bilateral chronic subdural fluid collections related to nonaccidental trauma. Note normal thickness of posterior falx.

B, Sagittal T1-weighted MR image shows patent flow void in straight sinus. Subtle flow void in a persistent falcine sinus is also present (*arrow*).

C–E, Follow-up CT and MR studies obtained 7 days after *A* and *B*.

C, Unenhanced CT scan shows high-density thrombus within straight sinus. Large left frontoparietal hematoma caused by hemorrhagic venous infarct is also shown.

D, Axial fast spin-echo T2-weighted MR image at similar level as in *A* shows signal void in thickened segment of posterior falx. Acute hematoma with surrounding edema is also seen in left frontoparietal region.

E, Contrast-enhanced sagittal two-dimensional phase-contrast MR angiogram (velocity-encoding value = 20 cm/s) confirms flow in persistent falcine sinus (*arrow*). No flow is present in expected position of straight sinus.

the superior sagittal and straight sinuses elongate by recruiting the more caudal loops of the sagittal plexus. Although it is not known for certain, it is conceivable that the falcine sinus represents persistence of one of the caudal anastomotic loops of the sagittal plexus. In a cadaveric study, Kaplan et al (5) found a vascular channel joining the caudal end of the inferior sagittal sinus with the superior sagittal sinus in 16 (21%) of 78 specimens of all ages. They also found small freely anastomosing plexiform channels throughout the falx. Under appropriate conditions, these channels could potentially function as collateral pathways. The young age of our patient may also have played a role in the rapid recruitment of the falcine sinus as a route of collateral drainage.

The findings observed in this case may have important implications for the management of venous sinus thrombosis in children (particularly infants). Recently, there has been a trend toward treating diffuse venous sinus thrombosis with thrombolytic therapy in addition to heparin. Our case demonstrates that collateral venous pathways may open up and provide adequate venous drainage, which raises the question of whether a trial of time should be included to allow alternative venous drainage to develop before pursuing aggressive therapy, such as thrombolysis.

In summary, the embryonic falcine sinus is a potential route for collateral drainage when normal drainage of the deep cerebral venous system through the straight sinus is obstructed. This venous channel can be detected on CT scans and confirmed with MR imaging and MR angiography.

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