

## Case Report

## Two Cases with Persistent Falcine Sinus as Congenital Variation

Myoung Soo Kim, M.D.,<sup>1</sup> Ghi Jai Lee, M.D.<sup>2</sup>

Departments of Neurosurgery,<sup>1</sup> Diagnostic Radiology,<sup>2</sup> Seoul Paik Hospital, Inje University College of Medicine, Seoul, Korea

The falcine sinus is an abnormal anatomic structure located in the falx cerebri that is closed after birth and is rarely observed. We describe two cases of persistent falcine sinus. A 60-year-old woman presented with headache. An 11-year-old girl presented with intermittent headache and a palpable scalp mass in the middle of the high parietal area. The straight sinuses were absent in both patients. In both patients, drainage of the galenic system took place through a sinus within the falx, also known as a falcine sinus. Suspicious dysplastic tentorium cerebelli was observed in one patient. It can be concluded that a mesenchymal disorder can be the primary cause for a persistent falcine sinus.

**KEY WORDS :** Falcine sinus · Straight sinus · Encephalocele · Tentorium cerebelli.

### INTRODUCTION

Persistent falcine sinus has largely been described in the literature. In children, Sener<sup>11)</sup> found that a persistent falcine sinus can be an incidental finding; however, it is more commonly seen with conditions such as malformations of the vein of Galen, arteriovenous malformations, absence of the corpus callosum, osteogenesis imperfecta, acrocephalosyndactyly, and absent or dysplastic tentorium cerebelli<sup>1,12)</sup>. The pathogenesis of persistent falcine sinus remains poorly understood. Many researchers suggested a congenital basis for persistent falcine sinus<sup>1,2,7,11)</sup>. Recently, more persistent falcine sinuses are being detected than previous reports using computed tomography-angiography<sup>10)</sup>.

Here, we describe two cases of persistent falcine sinus associated with atretic encephalocele, an absent straight sinus, and suspicious dysplastic tentorium cerebelli, with discussion of its pathogenesis.

### CASE REPORT

#### Case 1

A 60-year-old woman visited an out-patient department of internal medicine for headache. Physical examination results were normal. On neurological examination, she showed no abnormality. She underwent a brain magnetic resonance (MR) imaging examination. Axial T2-weighted imaging showed an abnormal signal void in the interhemispheric space (Fig. 1A). Sagittal T2-weighted imaging showed an abnormal flow void continuous from the internal cerebral vein (Fig. 1B). Coronal T1-weighted imaging suggested a low position and suspicious partial agenesis of the tentorium cerebelli (Fig. 1C). MR venography showed an absent straight sinus and a persistent falcine sinus (Fig. 1D).

#### Case 2

An 11-year-old girl presented to our out-patient department with intermittent headache and palpable scalp mass in the middle of the high parietal area. Since her birth, a soft tissue mass was observed in the middle of the high parietal area. This mass had increased during the previous several months. Physical examination results were normal except for an elevated and mild tender soft mass located in the scalp. The scalp showed moderate alopecia around the scalp mass.

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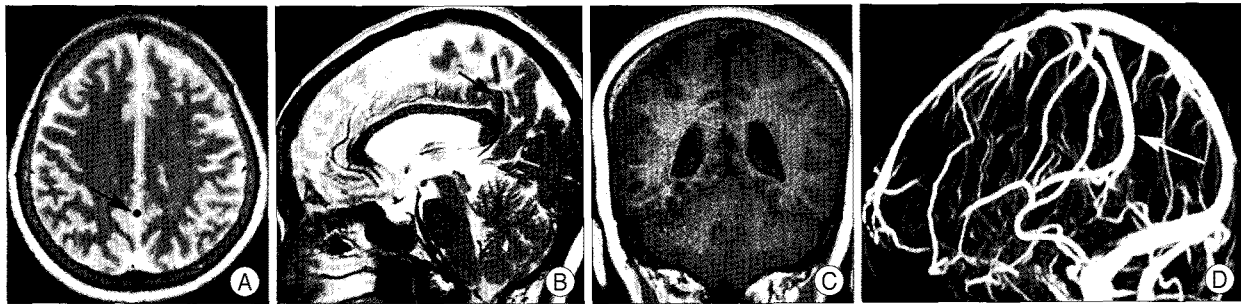
• Address for reprints : Myoung Soo Kim, M.D.

Department of Neurosurgery, Seoul Paik Hospital, Inje University College

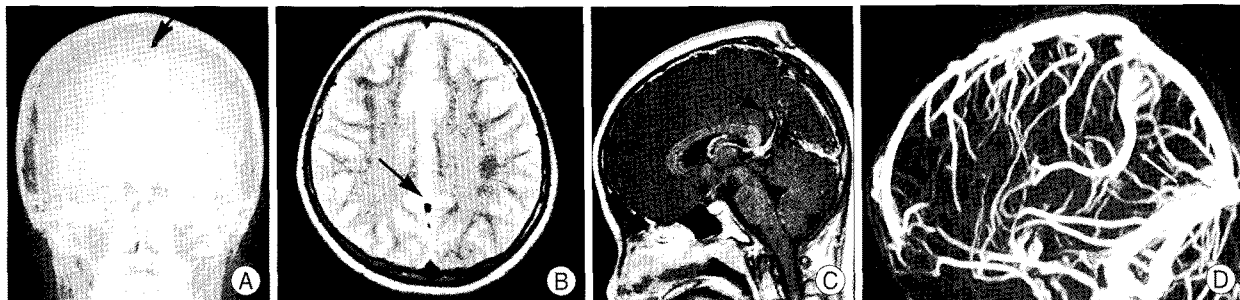
of Medicine, 85 Joo-dong 2-ga, Jung-gu, Seoul 100-032, Korea

Tel : +82-2-2270-0032, Fax : +82-2-2270-0573

E-mail : hanibalkms@hanmail.net



**Fig. 1.** Magnetic resonance images of persistent falcine sinus in Case 1. A : Axial T2-weighted image showing abnormal flow void in interhemispheric space (arrow : abnormal flow void). B : Sagittal T2-weighted image demonstrating an abnormal flow void continuous with the internal cerebral vein (arrow : abnormal flow void). C : Coronal T1-weighted image suggesting a low position and suspicious partial agenesis of tentorium cerebelli. D : Magnetic resonance venography revealing an absent straight sinus and persistent falcine sinus (arrow : persistent falcine sinus).



**Fig. 2.** An 11-year-old girl who has atretic encephalocele and persistent falcine sinus. A : Plain radiograph of the skull showing a well-defined bony defect at the interparietal region (arrow : bony defect). B : Axial T2-weighted image demonstrating an abnormal flow void in the interhemispheric space (arrow : abnormal flow void). C : Sagittal enhanced T1-weighted image revealing an abnormal blood vessel continuous with the internal cerebral vein and a hypointense subscalp mass lesion (arrow : abnormal blood vessel). D : Magnetic resonance venography showing an absent straight sinus and persistent falcine sinus continuous with the internal cerebral vein (arrow : persistent falcine sinus).

No change in shape or size of mass was noted when she performed a strong expiration with a Valsalva maneuver. On neurological examination, she showed no abnormal response. Laboratory examination showed normal blood ranges.

Plain radiography of the skull revealed a coin-sized, well-defined bony defect at the interparietal region (Fig. 2A). MR imaging revealed an abnormal flow void in the interhemispheric space (Fig. 2B). Contrast enhanced T1-weighted imaging showed a nonenhancing hypointense subscalp lesion and anomalous falcine sinus (Fig. 2C). Three-dimensional MR venography clearly demonstrated a fetal-form falcine sinus and an absent straight sinus (Fig. 2D). Excision of the scalp mass was performed. Pathological diagnosis was atretic encephalocele.

## DISCUSSION

### Falcine sinus as congenital variation

The falcine sinus is a normal intrauterine venous structure located between the dural leaves of the falx cerebri<sup>12</sup>. The falcine sinus is considered to develop from the sagittal plexus of veins<sup>7</sup>. In the 20-mm embryo stage, the primitive falx cerebri between the cerebral hemispheres is thought to contain a mesh of anastomotic venous loops called the sagittal

plexus. A dominant venous channel from the sagittal plexus is thought to give rise to the dorsally located superior sagittal sinus. Similarly, the inferior sagittal sinus and straight sinus are thought to develop from the ventral aspect of the sagittal plexus with disappearance of the smaller channels of the sagittal plexus<sup>7</sup>.

Most authors suggest that a falcine sinus exists through recanalization because of obstruction of the straight sinus and potential increased venous pressure, or had always been present as a congenital variation<sup>1,4,5,11</sup>. However, which one of the reasonable mechanisms actually causes the venous flow patency in the falcine sinus remains obscure<sup>2</sup>.

A defect in the development of the straight sinus can lead to an atretic or hypoplastic straight sinus and formation of an alternate venous pathway from the sagittal plexus to shunt the blood from the deep venous system to the superficial system<sup>11</sup>. This alternate pathway is served by the falcine sinus<sup>1,12</sup>.

It is extremely rare to find a persistent falcine sinus without associated anomalies<sup>7,11,12</sup>. Associated anomalies with persistent falcine sinus include bifid cranium, vein of Galen malformation, agenesis of the corpus callosum, Apert syndrome, osteogenesis imperfecta, Chiari malformation Type II, occipital encephalocele, absent or dysplastic tentorium cerebelli, and bilateral giant parietal foramina<sup>1,5,9</sup>. In our reports, the

first patient showed low position and suspicious partial agenesis of the tentorium cerebelli and an absent straight sinus. The second patient demonstrated an absent straight sinus and atretic encephalocele. Congenital variation seems a more plausible pathogenesis of the persistent falcine sinus in our patients.

In Korea, three cases of persistent falcine sinus have been reported<sup>2,6,15</sup>. One patient had atretic encephalocele, an absent straight sinus, and atrophy of the anterior cerebellar vermis<sup>2</sup>. The second patient had atretic encephalocele and an absent straight sinus<sup>6</sup>. The third patient demonstrated an absent straight sinus and a temporal arteriovenous malformation<sup>15</sup>. In these three cases, persistent falcine sinus may be developed as a congenital variation.

### Falcine sinus as collateral channel in sinus obstruction or thrombosis

There are few reported acquired lesions in association with a persistent falcine sinus including venous sinus thrombosis or obstruction of the straight sinus by a mass lesion<sup>1,4,5,8</sup>. In some, where a reported acquired disorder such as venous sinus thrombosis and obstruction of the straight sinus by a mass lesion occurs, the falcine sinus can be reopened using a mechanical effect<sup>5</sup>.

Varma et al.<sup>14</sup> reported that the absence of the falcine sinus in the first MR study and its recanalization on a second MR study demonstrated the potential for its recruitment as an alternative venous channel. These authors suggested that obliteration of falcine sinus on the follow-up MR study and normal caliber of the straight sinus confirm a causal relationship between superior sagittal sinus thrombosis and recanalization of the falcine sinus<sup>14</sup>.

Tubbs et al.<sup>13</sup> reported that in a study of 25 adult cadavers an extensive network of small tributaries within the falx cerebri could always be found, especially within its posterior one third. All of these vessels communicated with the inferior sagittal sinus. Seventeen of 27 (63%) specimens had communication with the superior sagittal sinus. Kaplan et al.<sup>3</sup> reported that freely anastomosing small plexiform channels are present throughout the falx cerebri. These pockets or venous lakes are located between the layers of the falx, joining the inferior sagittal sinus at their rostral aspect and the straight sinus at their caudal end. Under appropriate conditions, these

channels could potentially function as collateral pathways.

## CONCLUSION

In our two cases, persistent falcine sinuses were associated with an absent straight sinus, atretic encephalocele, and suspicious dysplastic tentorium cerebelli. These combinations can be explained embryologically.

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