

Case Report



Contralateral Transverse Sinus Occlusion After Treatment of Transverse-Sigmoid Sinus Dural Arteriovenous Fistula: A Case Report

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Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

A dural arteriovenous fistula (DAVF) is a pathologic arteriovenous shunt located within the dural wall of a venous sinus. In addition, DAVFs are associated with sinus thrombosis. Consequently, sinus occlusion may occur near DAVF lesions, making treatment challenging. However, there are few reports of sinus occlusion unrelated to lesions. In this study, we present a rare case of contralateral transverse sinus occlusion in a patient who underwent endovascular treatment and stereotactic radiosurgery for DAVF in the transverse-sigmoid sinus with ipsilateral sigmoid sinus occlusion.

Keywords: Dural arteriovenous fistula; Cerebrovascular occlusion; Transverse sinuses; Endovascular procedures

INTRODUCTION

A dural arteriovenous fistula (DAVF) is an arteriovenous shunt that causes headache, pulsating bruit or hemorrhage.^{6,9} DAVFs occur most frequently in the transverse-sigmoid sinus (TSS).⁹ Various treatment modalities, including microsurgery, endovascular treatment (EVT), and stereotactic radiosurgery (SRS), can be used to alleviate symptoms or prevent intracranial hemorrhage.^{1,9} The post-treatment prognosis is relatively good with low incidence of complications.^{1,6,9}

However, treatment of DAVFs in TSS with multiple sinus occlusions or multiple feeders is challenging.⁸ Moreover, life-threatening complications such as intracranial hemorrhage or cerebral venous congestion may occur.² However, there are few reports describing occlusion of the contralateral transverse sinus (TS) unrelated to the primary lesion.

Herein, we experienced the complicated case of contralateral TS occlusion in a patient who underwent EVT and SRS for DAVF in the TSS.

CASE REPORT

A 54-year-old man visited our ophthalmology clinic for a year owing to visual disturbance. His past medical history was unremarkable, and there was no past history of trauma. Papilledema was identified on neurologic examination; thus, brain magnetic resonance (MR) imaging was performed. DAVF in the left TSS was revealed on brain MR angiography, and the patient was referred for neurosurgical consultation. Conventional angiography revealed a DAVF in the left TSS fed by numerous branches of the left external carotid artery and right occipital artery. Total occlusion of the left sigmoid sinus (SS) and distal internal jugular vein, and focal stenosis of the right TS were identified (FIGURE 1A). Transvenous embolization (TVE) of the left TS with coils was performed to treat the lesion. The contralateral (right) TS was accessed to bypass the occluded left SS (FIGURE 1B). The left TS was successfully occluded, however, remnant fistulas in the torcular herophilli were identified on post-TVE angiography. Thus, transarterial embolization (TAE) with gelatin sponge particles was performed for remnant fistulas. No complications occurred pre- and post-procedure. Subcutaneous low molecular weight heparin was administered for 3 days; oral dual-antiplatelet agents (aspirin + clopidogrel) were administered.

Six months later, a follow-up angiography revealed a remnant fistula around the torcular herophilli (FIGURE 1C), and visual disturbance was sustained. We first recommended EVT and

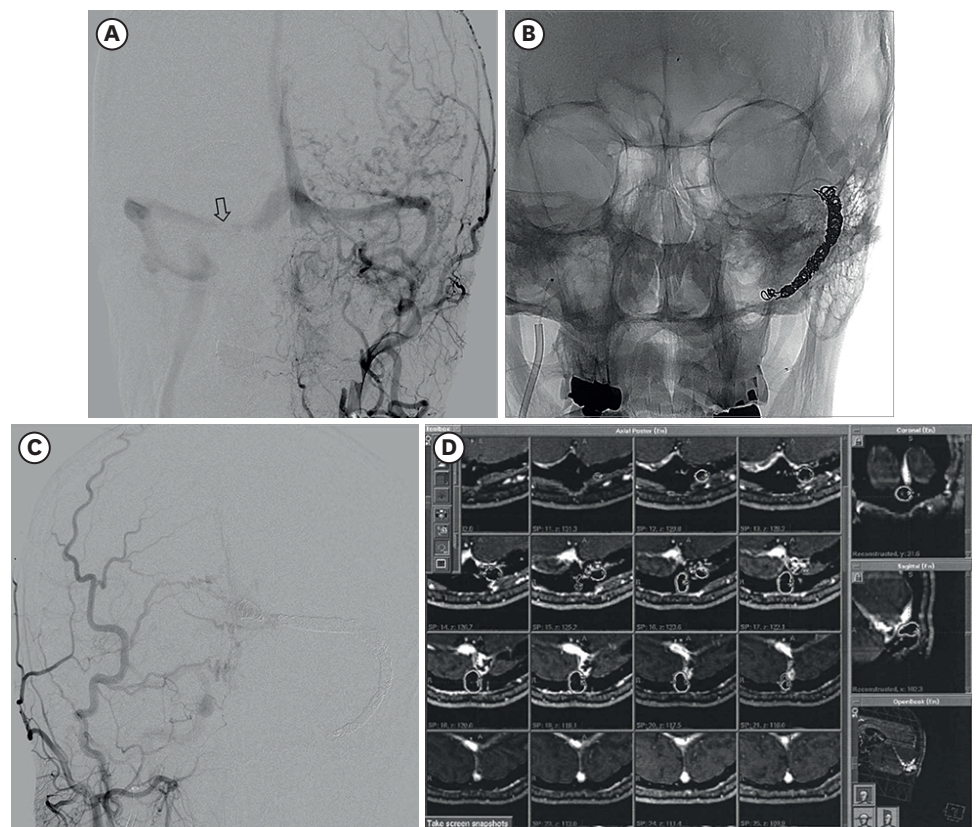


FIGURE 1. (A) Left external carotid artery angiography shows a dural AVF at the left TSS (Borden type IIb, Cognard type IIa+b) with left sigmoid sinus occlusion and focal stenosis of right transverse sinus (arrow). (B) Transvenous embolization with coils was performed through the right TSS. (C) Follow-up angiography revealed remnant AVF. (D) Gamma knife radiosurgery was performed for the remnant AVF. AVF: arteriovenous fistula, TSS: transverse-sigmoid sinus.

offered SRS as an alternative. The patient chose to undergo SRS. Gamma-knife radiosurgery (GKRS) was performed. There were 6 target points with a 20-Gy prescription dose (**FIGURE 1D**).

Two years post-GKRS, follow-up angiography revealed remnant fistulas that drained into the internal cerebral and cortical veins (**FIGURE 2A**). The left TSS was completely excluded from the circulation, and the right TS was also occluded (**FIGURE 2B & C**). Venous drainage on the right side was performed through the SS and cavernous sinus via collateral veins, like the right occipital cortical veins (**FIGURE 2C & D**). There were no DAVF-attributable symptoms. Therefore, we performed TAE using the Onyx[®]. No TAE-related complications were observed. However, even after repeated TAE, symptoms such as headache and visual field disturbance recurred. DAVF lesions were identified by follow-up conventional angiography; additional TAE with particles and an additional session of GKRS were performed.

Nine years after identification of the first lesion, the patient's symptoms worsened, and brain MR imaging and catheter angiography revealed aggravation of DAVF (**FIGURE 2E**). TAE using particles and ventriculostomy were performed symptom palliation. However, the symptoms were relieved and then worsened. We attempted a transvenous approach for angioplasty of the

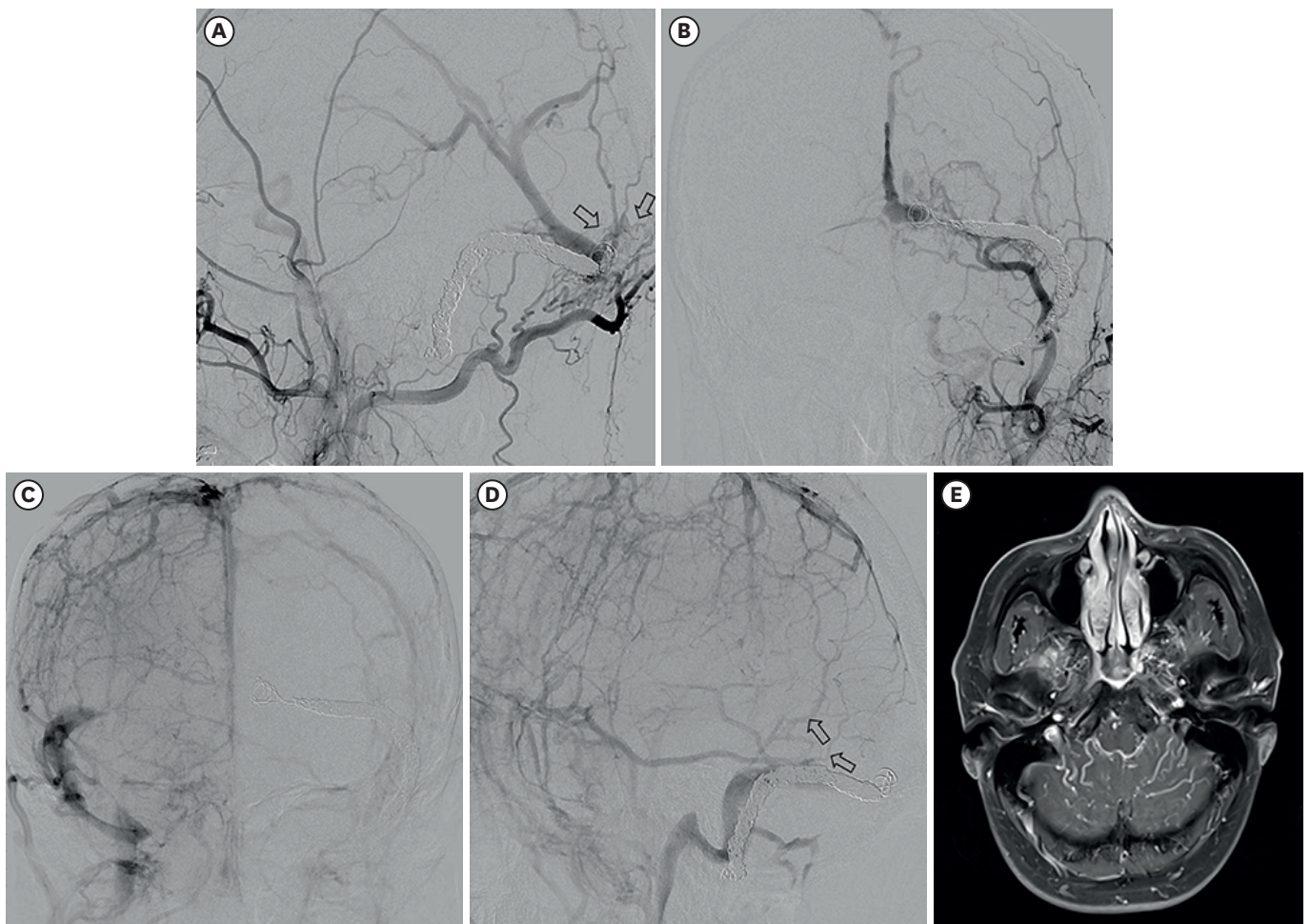


FIGURE 2. (A) Follow-up angiography 2 years post-radiosurgery revealed that fistula was not obliterated (arrows). (B) The left transverse-sigmoid sinus was completely occluded, but the remnant fistula was identified, and the right transverse sinus was occluded. (C) The right transverse sinus was occluded; however, venous drainage through the right sigmoid sinus via the collateral veins was intact. (D) Venous drainage was performed through the right occipital cortical veins (arrows). (E) Brain magnetic resonance imaging with enhancement revealed vein dilatation of both the cerebellum and the narrowed fourth ventricle.

right TS, but this was futile because the lesion was inaccessible. Additional TAE with particles was performed as described previously. Eventually, all symptoms improved after repeated TAE. There were no TAE-related complications; symptoms have been stable for a year since.

DISCUSSION

DAVF can occur secondary to several known causes including trauma, inflammation, or sinus thrombosis, but most DAVF cases are idiopathic.⁴⁾ On the other hand, the hypothesis about the obstruction of invading sinus and aggravation of DAVF is well known.⁴⁾ DAVF induces sinus occlusion through intrasinus thrombosis and sinus wall hypertrophy.³⁾ In this case, the cause of DAVF was unclear as there was no underlying medical or trauma history. The mechanism underlying delayed occlusion of the contralateral sinus which is not involved in DAVF, is also elusive. It is probable the right TS occlusion occurred owing to a change in venous blood flow after the left TS occlusion. Since the right TS was directly connected to the left TSS, it may have received considerable blood flow through the DAVF; however, as the DAVF was obliterated, blood flow to the right TS would be reduced and that to other collateral veins would be relatively increased. Thrombosis may have been induced in the right TS by the decreased blood flow. Next, there is a possibility that right TS occlusion occurred due to combined procedures. We performed TAE on torcular herophilli, followed by GKRS around the lesion. Sinus occlusion may have occurred as a complication during the course of these various treatments.

TVE with coils is a curative treatment modality for DAVF with sinus occlusion.^{5,7)} However, sinus packing can cause inadequate collateral venous pathways to compensate for the sacrificed sinus, resulting in unexpected venous infarction or intracranial hemorrhage.⁸⁾ In particular, in some DAVF cases with multiple sinus occlusion and/or a restricted collateral venous outlet, it may be an inappropriate treatment modality.⁸⁾ We chose to occlude the left TS with coils as a curative treatment because the left TS was not dominant, the left SS was already occluded, and the right TS flow was relatively good. After the left TS occlusion, venous drainage through the fistula was significantly reduced. However, remnant fistulas were identified. Thus, we tried TAE using gelatin sponge particles. Because we were concerned about the possibility of complete occlusion of the contralateral TS and torcular herophilli, we used the gelatin sponge, which was a temporary embolic agent.

When severe cortical vein dilatation, cerebral edema and hydrocephalus were detected on MR images, TAE was performed first because the venous approach became impossible owing to occlusion of both TSs. However, despite successful first TAE, symptoms remained. Thus, we expected a poor outcome. However, fortunately, the collateral venous channels were gradually well established (**FIGURE 3**). Eventually, symptomatic improvement can be achieved by reducing arterial feeders through repeated TAE and maintaining venous drainage through the collateral venous channels.

CONCLUSION

In this study, a complicated case of contralateral TS occlusion in a patient who underwent EVT and SRS for DAVF in the TSS was described. We treated this case with repeated TAE. And, in such complex case, short-term regular follow-up will be necessary after treatment.

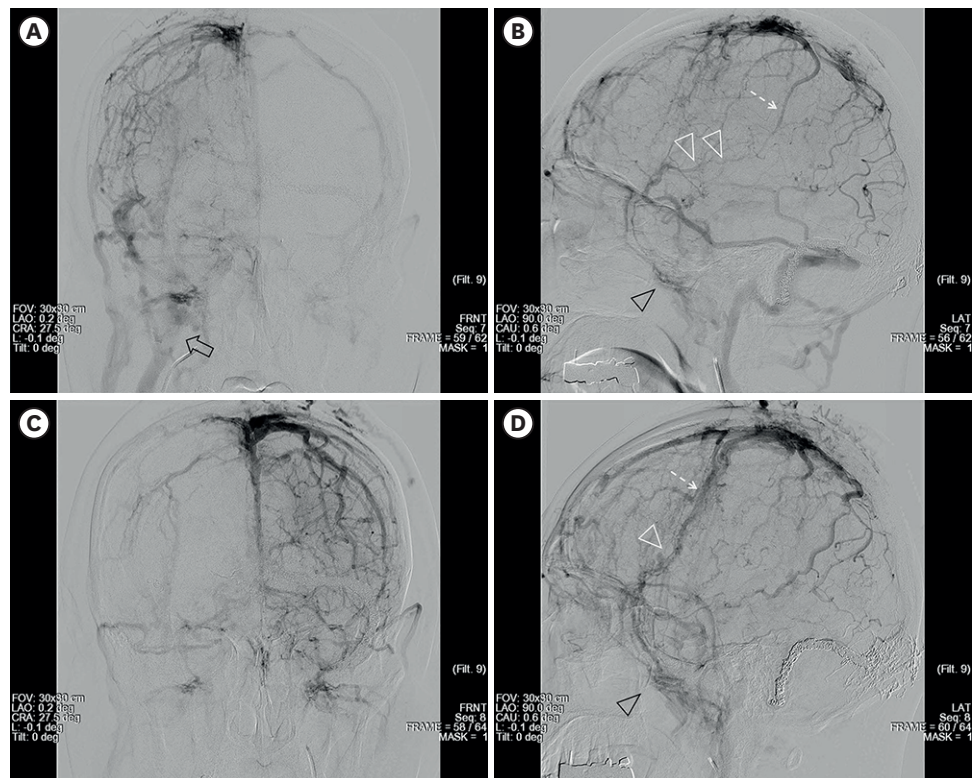


FIGURE 3. (A) AP view of angiography for the right ICA revealed that venous blood drained into the right SS (arrow) (B) Lateral view of right ICA angiography revealed that venous blood drained from the cortical veins to the SSS. And then, the venous blood drained into the CS via the SAV (white dotted arrow) and SMCV (white arrowheads). Afterward, the venous blood entering in the CS was then drained into the right SS through the superior petrosal vein, and some drained into the right pterygoid plexus (black arrowhead). (C) AP view of left ICA angiography revealed bilateral transverse sinus occlusion. (D) Lateral view of left ICA angiography revealed the venous blood drained from the cortical veins to the SSS. And then, the venous blood drained into the CS via the SAV (white dotted arrow) and SMCV (white arrowhead). Afterward, the venous blood entering in the CS was mainly drained into the left pterygoid plexus (black arrowhead), because the left SS was occluded. AP: anterior-posterior, ICA: internal carotid artery, SS: sigmoid sinus, SSS: superior sagittal sinus, CS: cavernous sinus, SAV: superior anastomotic vein, SMCV: superficial middle cerebral vein.

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