

## Dural Arteriovenous Fistula of the Cavernous Sinus

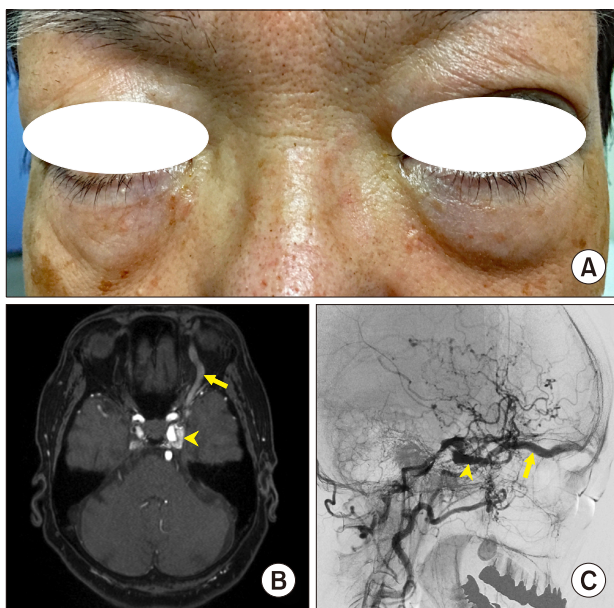
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A 71-year-old woman with diplopia, left-dominant bilateral exophthalmos, and left-sided pulsatile tinnitus was referred by a general practitioner to the department of neurosurgery of our hospital. These symptoms had been getting worse over the past three months. She underwent a left radical mastectomy for breast cancer 19 years ago and had no recurrence after surgery. She had received medication for hypertension and diabetes mellitus for 10 years. Visual inspection revealed left-dominant bilateral periorbital bluish edema and chemosis of the left conjunctiva (Fig. 1A). Auscultation of the left orbit revealed a pulsatile bruit. Laboratory tests revealed no abnormalities except

for a slightly elevated C-reactive protein (0.36 mg/dL; reference value < 0.14 mg/dL). The source image of cerebral magnetic resonance (MR) angiography showed signal hyperintensity in the left cavernous sinus (CS) and enlargement of the left superior ophthalmic vein (SOV) (Fig. 1B). Two weeks later she underwent cerebral angiography. A selective left external carotid artery arteriogram showed early filling of the left CS, ectatic cortical veins, and enlarged left SOV (Fig. 1C). She was diagnosed as having CS dural arteriovenous fistula (CS-DAVF) classified as Borden type II. Transvenous coil embolization of the DAVF via the left inferior petrosal sinus (IPS) was successfully performed. Her symptoms immediately improved and eyelid edema gradually disappeared.

CS-DAVF results from an abnormal vascular shunt between the CS and the meningeal branches of internal and/or external carotid arteries, and the SOV and IPS are frequent venous drainers. CS-DAVF occurs most commonly in postmenopausal females and sinus thrombosis associated with estrogen imbalance and venous hypertension is recognized as the major cause of DAVF.<sup>1</sup> Typical symptoms of CS-DAVF include diplopia, exophthalmos, conjunctival injection, chemosis, and tinnitus. Untreated patients have a risk of permanent vision loss or intracranial hemorrhage.<sup>2</sup> MR imaging is the first imaging modality when suspecting CS-DAVF. The important findings of conventional MR imaging are flow voids in the affected CS and dilation of the SOV, which are visualized as high signal intensity on the source images of MR angiography.<sup>3</sup> Selective cerebral angiography should be performed for treatment planning of CS-DAVF. Angiograms of the bilateral external carotid arteries, internal carotid arteries, and their branches are required for assessment of the feeding arteries, fistula site, and venous drainage. Endovascular transvenous and/or transarterial embolization is the standard treatment for DAVFs, and transvenous embolization via the inferior petrosal sinus is considered safe and the most effective treatment for CS-DAVF.<sup>4</sup> Adjuvant stereotactic gamma-knife radiosurgery may be considered after unsatisfactory endovascular treatment.<sup>5</sup> Medical professionals should keep in mind that early diagnosis and ap-



**FIG. 1.** (A) Visual inspection showed left-dominant bilateral exophthalmos, periorbital bluish edema, and left conjunctival injection. (B) A source image of cerebral MR angiography showed a hyperintense signal of the left cavernous sinus (arrowhead) and enlarged left superior ophthalmic vein (arrow). (C) Selective arteriogram of the left external carotid artery showed a dural arteriovenous fistula involving the left cavernous sinus (arrowhead) with enlarged left superior ophthalmic vein (arrow).

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appropriate treatment are crucial for patients with CS-DAVF.

#### CONFLICT OF INTEREST STATEMENT

None declared.

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