A Case of Isolated Third Nerve Palsy with Pupillary Involvement Diagnosed with Cavernous Dural Arteriovenous Fistula

Yeo Jung Kim, MD, Suk Yoon Lee, MD, Jin-ho Jung, MD, Jung Hwa Seo, MD, Eung-Gyu Kim, MD, PhD, Ki-Hwan Ji, MD, Jong Seok Bae, MD, and Sang-Jin Kim, MD

Department of Neurology, Inje University College of Medicine, Busan Paik Hospital, Busan, Korea

Background: Third nerve palsy can result from lesions located anywhere along its path from the oculomotor nucleus to the nerve termination within the extraocular muscles of the orbit. Common etiologies of isolated third nerve palsy with pupillary involvement are intracranial aneurysm, uncal herniation, neoplasia, and traumatic and inflammatory conditions. Case Report: We present a case of a 71-year-old female with complete left third nerve palsy with pupillary involvement. She was diagnosed with cavernous dural arteriovenous fistula (dAVF) using source images of time-of-flight (TOF) magnetic resonance (MR). Cerebral angiography revealed a cavernous dAVF via a branch of the distal intracranial artery. Conclusion: Isolated third nerve palsy may be caused by cavernous dAVF, and TOF MR angiography may be a useful non-invasive pre-diagnostic tool for detecting the shunts.

KEYWORDS: Dural arteriovenous fistula · Third nerve palsy · Magnetic resonance angiography.

Introduction

Isolated third nerve palsy is associated with variable etiologies. However, cavernous dural arteriovenous fistula (CdAVF) involvement in isolated third nerve palsy is rare and not commonly considered as the cause of the condition. Source images of time-of-flight (TOF) magnetic resonance (MR) angiography may be more useful for the detection of arteriovenous shunts than conventional MR imaging.1-3 We present a case of left isolated third nerve palsy associated with CdAVF.

Case

A 71-year-old female was referred to the emergency department as a result of left ptosis and ocular nerve palsy with dilated pupil. Three days earlier, she felt a strange sensation of something moving upward on her left neck. The next morning she had complete left ptosis. Her initial vitals were: blood pressure 160/100 mm Hg, pulse rate 78 bpm, and temperature 36.5°C. The ophthalmological evaluation revealed complete left ptosis and left third nerve palsy with mydriasis without pupillary light reflex. The left eye was deviated downward and outward. The left pupil was dilated 7 mm and did not react to direct light stimulus. The right pupil was 3 mm and reacted to direct light stimulus.

Physical examination did not reveal conjunctival injection, chemosis, proptosis, or eyelid swelling. The patient denied headache, ocular pain, tinnitus, and a trauma history. She had hypertension and a history of renal tuberculosis. She had complete left third nerve palsy with pupillary involvement. Other cranial nerve functions were normal. The brain MR image was normal, and the MR angiography showed no evidence of intracranial aneurysm or vascular malformation. However, source images of TOF MR angiography revealed a prominent flow signal in the left cavernous and petrosal sinuses (Fig. 1). Given the putative diagnosis of dAVF in the left cavernous sinus, we performed a cerebral angiography, which revealed a left CdAVF in a branch of the meningohypophyseal trunk in a distal intracranial artery. Drainage occurred primarily via the inferior petrosal sinus and was not observed in the cortical or ophthalmic veins (Fig. 2). Our patient was treated conservatively because the amount of flow through the dAVF shunt was small. One week following treatment, the left pupil was dilated; however, it reacted to direct light stimulus. One month later, ptosis and eyeball movement
Isolated Third Nerve Palsy and Cavernous Dural Arteriovenous Fistula

YJ Kim, et al.

Discussion

The most common cause of isolated third nerve palsy with pupillary involvement, as described here, is an aneurysm in the posterior communicating artery. The differential diagnosis includes intracranial hemorrhage, subarachnoid hemorrhage, bacterial meningitis, cavernous sinus thrombosis, and midbrain infarction. CdAVF generally accompanies congestive ocular symptoms and signs, such as conjunctival injection, chemosis, proptosis, eyelid swelling, and ocular pain.

CdAVF is a pathological condition associated with abnormal connectivity between the meningeal branch of the internal or external carotid artery and the cavernous sinus. CdAVF is not uncommon in isolated cranial nerve palsy, including third nerve palsy. Several cases studies have shown that the third nerve is frequently compromised and isolated third nerve palsy is often associated with CdAVF. A previous case series found that CdAVF was the etiology of isolated third nerve palsy in eight of 11 patients.

Congestive ocular symptoms have been shown to be caused by retrogade venous flow and/or pressure from cavernous sinus to ophthalmic vein. However, when fistula shunt flow is directed toward the superior or inferior petrosal sinus rather than the ophthalmic vein, as in our case, isolated ocular motor function was partially improved; however, movement of the extraocular muscle by the left third nerve remained limited.

FIGURE 1. In magnetic resonance angiography (MR) (A), there was no evidence of aneurysm and vascular malformation. However, time of flight MR (B) revealed prominent flow signal in left cavernous and petrous sinus (B) (arrows).

FIGURE 2. Left intracranial angiography. Cerebral angiography revealed left cavernous dural arteriovenous fistula through dural branch of meningohipophyseal trunk. Shunt flow was drained through the intercavernous sinus, right inferior petrosal sinus and clival venous plexus (arrows). Engorged ophthalmic vein was not visualized.
nerve palsy may occur without congestive ocular symptoms.\textsuperscript{7,8} Moreover, superoposterior drainage may compress the third nerve against the roof of cavernous sinus.\textsuperscript{9}

The primary treatment strategies for CdAVF are endovascular management, radiotherapy, and conservative care. Conservative treatment is appropriate for patients, such as ours with benign symptoms and a low-flow shunt.\textsuperscript{4,6}

Nevertheless, the diagnosis of CdAVF requires cerebral angiography, which is a relatively invasive procedure, and less intrusive pre-diagnostic decision tools are needed. Contrast-enhanced computed tomography (CT) and spin-echo MR imaging can be used to assess CdAVF.\textsuperscript{1,10} However, in some cases CT, MR, and MR angiography may not be sufficient to visualize a dAVF, and source image of TOF MR angiography is a superior tool for detecting arteriovenous shunts.\textsuperscript{2,11}

In our case, source image of TOF MR angiography played an important role in our pre-angiographic diagnostic decisions.

In conclusion, brain MR and MR angiography are useful methods for the evaluation of isolated third nerve palsy. However, CdAVF is a rare etiology of isolated third nerve palsy, and source image of TOF MR angiography may be a useful non-invasive pre-diagnostic tool for detecting the shunts.

REFERENCES