Development of anterior cranial fossa dural arteriovenous malformation following head trauma

Case report

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Dural arteriovenous malformations (AVMs) are considered to be acquired lesions that develop secondary to venous obstruction, which sometimes happens in head trauma. However, there has been a report of an anterior cranial fossa dural AVM that occurred independently of a history of head trauma, and there has been speculation that these malformations are congenital.

The authors recount their experience with a patient who had an anterior cranial fossa dural AVM that was discovered incidentally. The lesion was fed by the bilateral anterior ethmoidal arteries and drained into the superior sagittal sinus via frontal cortical veins. The patient had a history of severe head trauma that had occurred 30 years earlier.

This is the first case report in which a previous head trauma is strongly believed to be the cause of an anterior cranial fossa dural AVM. The authors postulate that anterior cranial fossa dural AVMs can develop secondary to a head trauma.

KEY WORDS • dural arteriovenous malformation • anterior cranial fossa • intracranial aneurysm • head injury

Dural arteriovenous malformations (AVMs) of the anterior cranial fossa are rare vascular abnormalities that occur less frequently than those of the cavernous, transverse, or sigmoid sinus. It has been reported that dural AVMs of the anterior cranial fossa constitute a distinct subgroup that is characterized by an extremely high risk of intracranial hemorrhage, compared to dural AVMs at other locations. Dural AVMs are considered to be acquired lesions that develop secondary to venous obstruction. The causative venous obstruction is a result of congenital anomalies (hypoplasia, aplasia), trauma, infection, cerebral and craniofacial AVMs, and intracranial surgery. However, none of the reported cases of anterior cranial fossa dural AVM includes an evident history of head trauma. We treated a patient with a history of severe head trauma, which we strongly believe was the cause of an anterior cranial fossa dural AVM.

Case Report

This 70-year-old man had suffered a severe head trauma in a traffic accident when he was 40 years old. Following that event, he was unconscious for 2 weeks. Although medical records for that period are no longer available, we know that he was examined by cerebral angiography and underwent surgical removal of a chronic subdural hematoma through a small craniotomy on the right side. No vascular abnormalities were detected at that time. In addition, no skull fracture was found. The patient did well during the following 25 years, with no neurological deficits except for hyposmia, which was due to the head trauma.

First Examination and Treatment. When he was 65 years of age, the patient presented at our hospital with a chief complaint of motor weakness on the right side. Magnetic resonance (MR) imaging showed a small hematoma at the left thalamus. It also demonstrated old contusional changes on the right frontal lobe as well as on the medial and basal frontal lobe on the left side. In addition, abnormal signal voids on the surface of the left frontal lobe were demonstrated. Because the patient had suffered from hypertension for several years, the hemorrhage was thought to be caused by hypertension. The patient refused to undergo cerebral angiography. He fully recovered from hemiparesis with conservative treatment and was followed in our outpatient clinic.

Second Examination. Five years later, the man underwent follow-up MR imaging, the results of which indicated the presence of an aneurysm at the internal carotid.
artery on the right side (Fig. 1). He had no symptoms or neurological deficits except for persistent hyposmia. No bruit was audible. The patient consented to be examined by cerebral angiography. The angiogram showed a sacular aneurysm at the bifurcation between the internal carotid and posterior communicating arteries on the right side. An aneurysm dilation was observed at the identical location on the left side. In addition, a dural AVM of the anterior cranial fossa, fed by the bilateral anterior ethmoidal artery and draining into the superior sagittal sinus and deep sylvian vein via frontal cortical veins, was demonstrated (Fig. 2). The draining vessel had a small vascular sac.

Operations. The patient initially underwent clipping of the aneurysm neck on the right side. Two weeks later, in a separate operation, the abnormal vessels that provided communication between the dural AVM and the frontal cortical veins were obliterated. The aneurysm dilation on the left side was coated with Bemsheet and Biobond.

Postoperative Course. The patient’s postoperative course was uneventful, and an angiogram showed complete disappearance of the dural AVM of the left side and the aneurysm on the right side.

Discussion

By reviewing a report of two cases and detailed review of the literature by Kobayashi and colleagues, a series of eight patients reported by Martin, et al., and sporadic case reports, we found a total of 40 reported cases of dural AVMs located at the anterior cranial fossa. A dural AVM at this location is fed mainly by unilateral or bilateral anterior ethmoidal arteries and drains into the superior sagittal sinus via superficial cortical veins. In many reported cases, these dural AVMs were associated with a vascular sac (a venous aneurysm or varix) on the venous side. This vascular sac is the source of intracerebral or subarachnoid hemorrhage, which is the most common symptom of the anterior cranial fossa dural AVM.

In our case, the draining vessel was also associated with a small vascular sac. Including our present case, only three reported cases with dural AVM of the anterior cranial fossa were discovered incidentally. Two of these patients presented with intracerebral hematoma at locations unrelated to the dural AVM, and the other patient exhibited transient monocular blindness. According to Brown, et al., a person suffering from a dural arteriovenous fistula with a venous varix or an aneurysmal dilation of a draining vein has a significantly increased risk of hemorrhage. This finding is in accord with the results of a study conducted by Awad and colleagues. In two incidentally discovered dural AVMs, vascular sacs were found on the venous side. Those patients were surgically treated because they were thought to be at high risk of intracranial hemorrhage in the near future. We believe that surgical intervention is recommended for incidentally discovered dural AVMs of the anterior cranial fossa.

Dural AVMs of the anterior cranial fossa have been known to occur more frequently in males than in females, although dural AVMs at other locations are more prevalent in females. Because some dural AVMs are known to appear as an acquired lesion following trauma, one might speculate that a dural AVM at the anterior cranial fossa is closely related to trauma. However, as Dardenne and Martin, et al., have pointed out, neither their patients nor the reported patients they investigated were accompanied by an evident history of traumatic episode. Based on these findings, these authors have specu-
lated that those malformations are congenital and that symptoms occur only after long-standing hemodynamic stress which causes dilation and rupture of a draining venous channel. In other reports, none of the cases had an evident history of head trauma. In contrast, our patient had a distinct history of head trauma manifested as an old contusional change involving the medial and basal frontal lobe on both sides. The angiogram obtained 30 years earlier did not exhibit the presence of dural malformation. Given the low quality of angiograms at that time, we believe that our patient’s dural AVM is an acquired lesion that occurred following the head trauma. As Martin, et al., suggest, it may take a long time from the occurrence of the malformation to the presentation of symptoms such as intracranial bleeding. In our case, the time interval between the head trauma and the discovery of the dural AVM was 25 years. We do not think that all dural AVMs at this location develop secondary to head trauma. However, a minor head trauma, which is responsible for the formation of some dural AVMs, might not be recounted by a patient because it was not taken seriously and/or occurred too long ago to be remembered.

References


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