Dural Arteriovenous Malformation Associated with Meningioma : Spontaneous Disappearance after Tumor Removal

- Case Report -

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Dural arteriovenous malformations may be congenital, but most dural arteriovenous malformations are acquired lesions. The acquired dural arteriovenous malformations are rarely associated with brain tumors. We describe a case of dural arteriovenous malformation at the non-dominant transverse-sigmoid sinus associated with a convexity meningioma on the same side. The lesion was spontaneously disappeared after removal of the meningioma, even though the dural arteriovenous malformation was not manipulated. The authors describe a possible pathophysiology of dural arteriovenous malformations associated with tumors at the remote area and spontaneous closure after tumor resection.

KEY WORDS : Dural arteriovenous malformation · Sinus thrombosis · Meningioma · Pathophysiology.

Introduction

Dural arteriovenous malformations(AVMs) consist of arteriovenous shunts of blood confined within the dural leaflets. The cause and pathogenesis of dural AVMs remain unclear. Many reports have noted that dural AVMs were associated with some degree of flow compromise in the transverse/sigmoid sinus, such as thrombosis, trauma(cranial fracture, craniotomy), infection, previous tumor resection in the area, hypercoagulable state, pregnancy, hormonal disease, rupture of an aneurysm, and arterial dysplasia[2,4,5,7,9,10,12,14,17]. In rare cases, tumors that occluded the major sinuses were associated with dural AVMs, suggesting that the sinus occlusion by the tumors may induce the development of dural AVM[1,6,16,18,19]. However, dural AVMs have also been reported without sinus occlusion[3].

We recently encountered a case of transverse/sigmoid sinus dural AVM associated with meningioma that did not compromise of the dural venous sinus. That was disappeared spontaneously after removal of the tumor. We describe a plausible pathophysiological mechanism of dural AVM associated with a meningioma unrelated with sinus occlusion and its spontaneous closure.

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Case Report

A 45-year-old woman visited with a 4-month history of dull headache in the left side. She was neurologically normal at the time of admission. Preoperative magnetic resonance imaging(MRI) revealed an enhancing, extra-axial mass along the left parietal convexity(Fig. 1). Left external carotid angiography showed a tumor blush that was fed by the anterior branch of the left middle meningeal artery. In addition, a dural AVM was identified incidentally, which was fed by many branches of the left ascending pharyngeal, occipital, and middle meningeal arteries and drained into the left transverse sinus (Fig. 2A). Tumor feeding branches of the left middle meningeal artery were selectively catheterized and embolized with polyvinylalcohol(150 to 250 μm in size). After the embolization, there was no tumor staining, but the staining of

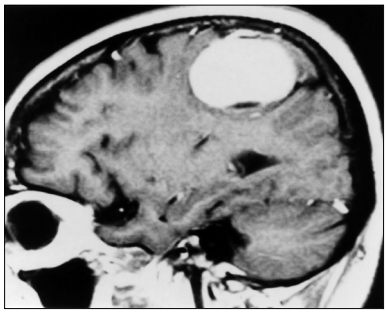

Fig. 1. T_1-weighted sagittal image of preoperative magnetic resonance imaging shows an enhancing, extra-axial mass along the left parietal convexity.

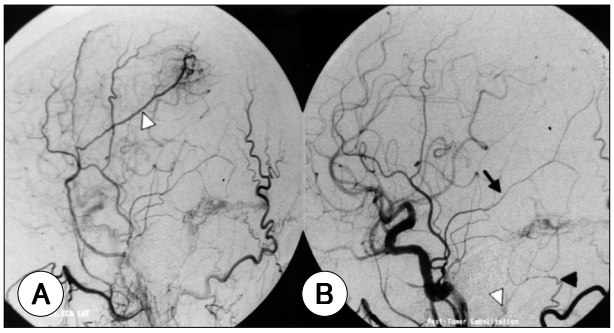

Fig. 2. Left external carotid angiography shows a tumor blush that is fed by the anterior branch of the left middle meningeal artery(white arrowhead). In addition, a dural arteriovenous malformation is identified incidentally, which is fed by many branches of the left ascending pharyngeal(white arrowhead), occipital(dark short arrow), and middle meningeal arteries (dark long arrow) and drained into the left transverse sinus (A). Tumor feeding branches of the left middle meningeal artery are selectively catheterized and embolized with polyvinylalcohol(150 to 250 μm in size). After the embolization, there is no tumor staining, but the staining of nidus of dural arteriovenous malformation was remained(B).

nidus of dural AVM was persistent(Fig. 2B). The convexity tumor unrelated with the major draining sinus was then resected. There was no severe dural bleeding at the dural opening. The histological diagnosis of the tumor was meningioma of transitional type. After the surgery, and till the last follow-up (12 months), the patient was free from headache. The follow-up angiography performed at 12 months after removal of the tumor, revealed a spontaneous disappearance of the dural AVM(Fig. 3).

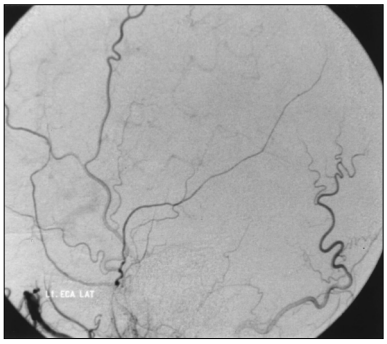

Fig. 3. The dural arteriovenous malformation disappeared spontaneously on the follow-up angiography at 12 months after removal of the tumor.

Discussion

Although some of the dural AVMs in infancy may be congenital lesions[13], the majority has been considered to be acquired[5,10,17]. Trauma, surgery, sinus thrombosis, or other factors often initiate the formation of dural AVMs[2]. The association between dural AVMs and intracranial tumors is rare[1,6,16,18,19]. The most common tumor associated with dural AVMs is reported as a meningioma[1,6,16,18,19]. A potential causative relationship between the dural sinus obstruction and/or thrombosis induced by the tumor and the development of abnormal dural arteriovenous shunts has been suggested in the previous reports[1,6,16,18,19]. Arnautović et al.[1] suggested that involvement of the dominant sinus was an important contributive factor to transverse/sigmoid sinuses dural AVMs. Yokota et al.[19] reported a dural AVM associated with a meningioma and postulated that the infiltration of the meningioma into the sinus wall may accelerate the subsequent occurrence of sigmoid sinus thrombosis, in addition to the direct compression by the meningioma. Vilela et al.[18] presumed that the downstream sinus obstruction may act as a trigger, changing the local hemodynamics and producing flow turbulence and/or venous hypertension. These hemodynamic changes may contribute to the development of dual AVMs. Most cases of dural sinus obstruction or invasion by the tumor are not associated with the dural AVM, however, dural sinus obstruction or thrombosis cannot alone explain the presence of acquired dural AVMs. Dural sinus was also intact and there was no definite proof of sinus infiltration of the tumor in our case. However, meningioma without sinus obstruction might be relevant to the development of dural AVMs because the associated dural AVM in our case was disappeared after tumor resection. We assume that meningioma might be related with role of aberrant angiogenesis in the pathogenesis of dural AVMs. Sawamura et al.[16] presumed that a meningioma-induced vascular malformation might be explained as an exceptional consequence of tumor-related angiogenesis, which is a complex process including diverse angiogenic factors.

In addition to the controversy about the pathogenesis of dural AVMs, there are still numerous questions related to the lesion maturation and progression. A progressive recruitment of additional arterial feeders does not always occur in a predictable fashion or at any predictable rates. Many dural AVMs maintain a stable size and profile of arterial feeders during years of prospective follow-up[2]. Factors predisposing to spontaneous resolution of dural AVMs are not known[4,8]. It is possible that spontaneous thrombosis may play a role in some cases, and thrombosis may occasionally extend into the adjacent dural sinus secondarily. The recanalization of the sinus coincided with the spontaneous closure of the malformation[11]. Certain dural AVMs involving the cavernous sinus region are more likely to undergo spontaneous resolution, but spontaneous closure has been less frequently reported in dural AVMs of other locations[15]. It is not known whether local hemodynamic or pathophysiologic phenomena peculiar to that location predispose such dural AVMs to spontaneous involution[8].

Conclusions

We experienced a dural AVM associated with a menin-

gioma without sinus encroachment at the remote site. The lesion was spontaneously disappeared after removal of the meningioma, even though the dural AVM was not manipulated. Our experience supports the hypothesis that dural AVMs are acquired and induced. However, this case might be fortuitous in association because there was no sinus thrombosis or occlusion induced by the tumor. We propose the possibility of a meningioma related aberrant angiogenesis, which is a complex process including diverse angiogenic factors.

References

1. Arnautović KI, Al-Mefty O, Angtuaco E, Phares LJ:Dural arteriovenous malformations of the transverse/sigmoid sinus acquired from dominant sinus occlusion by a tumor:report of two cases. **Neurosurgery 42**:383-388, 1998
2. Awad IA, Little JR, Akrawi WP, Ahl J:Intracranial dural arteriovenous malformations:factors predisposing to an aggressive neurological course. **J Neurosurg 72**:839-850, 1990
3. Barnwell SL, Halbach VV, Dowd CF, Higashida RT, Hieshima GB, Wilson CB:A variant of areriovenous fistulas within the wall of dural sinuses. **J Neurosurg 74**:199-204, 1991
4. Bitoh S, Sasaki S:Spontaneous cure of dural arteriovenous malformation in the posterior fossa. **Surg Neurol 12**:111-114, 1979
5. Chaudhary MY, Sachdev VP, Cho SH, Weitzner I Jr, Puljic S, Huang YP:Dural arteriovenous malformation of the major venous sinuses: an aquired lesion. **AJNR 3**:13-19, 1982
6. Chung YG, Lee KC, Lee HK, Lee NJ:Tentorial meningioma encroaching the transverse sigmoid sinus junction area associated with dural arteriovenous fistulous malformation: a case report. **J Korean Med Sci 14**:465-468, 1999
7. Friedman AH:Etiologic factors in intracranial dural arteriovenous malformations in Award I, Barrow D(eds):**Dural Arteriovenous Malformations**. Park Ridge:AANS, 1993, pp35-47
8. Halbach VV, Higashida RT, Hieshima GB, Mehringer CM, Hardin CW:Transvenous embolization of dural fistulas involving the cavernous sinus. **AJNR 10**:377-383, 1989
9. Handa J, Yoneda S, Handa H:Venous sinus occlusion with a dural arteriovenous malformation of the posterior fossa. **Surg Neurol 4**:433-437, 1975
10. Houser OW, Campbell JK, Campbell RJ, Sundt TM Jr:Arteriovenous malformation affecting the transverse dural venous sinus: an acquired lesion. **Mayo Clin Proc 54**:651-661, 1979
11. Kutluk K, Schumacher M, Mironov A:The role of sinus thrombosis in occipital dural arteriovenous malformations-development and spontaneous closure. **Neurochirurgia(Stuttg) 34**:144-147, 1991
12. Mayberg MR, Zimmerman C:Vein of Galen aneurysm associated with dural AVM and straight sinus thrombosis:Case report. **J Neurosurg 68**:288-291, 1988
13. Morita A, Meyer FB, Nichols DA, Patterson MC:Childhood dural arteriovenous fistulae of the posterior dural sinuses:three case reports and literature review. **Neurosurgery 37**:1193-1200, 1995
14. Nabors MW, Azzam CJ, Albanna FJ, Gulya AJ, Davis DO, Kobrine AI:Delayed postoperative dural arteriovenous malformations:Report of two cases. **J Neurosurg 66**:768-772, 1987
15. Pritz MB, Pribram HF:Spontaneous closure of a high-risk dural arteriovenous malformation of the transverse sinus. **Surg Neurol 36**:226-228, 1991
16. Sawamura Y, Janzer RC, Fankhauser H, Tribolet N:Arteriovenous malformation in meningothelial meningioma:case report. **Neurosurgery 29**:109-112, 1991
17. Sundt TM Jr, Piepgras DG:The surgical approach to arteriovenous malformations of the lateral and sigmoid sinuses. **J Neurosurg 59**:32-39, 1983
18. Vilela P, Willinsky R, terBrugge K:Dural arteriovenous fistula associated with neoplastic dural sinus thrombosis: two cases. **Neuroradiology 43**:816-820, 2001
19. Yokota M, Tani E, Maeda Y, Yamaura I:Meningioma in sigmoid sinus groove associated with dural arteriovenous malformation:case report. **Neurosurgery 33**:316-319, 1993