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Dural Arteriovenous Malformation in the Anterior Cranial Fossa: Report of a Case.

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Dural arteriovenous malformations (AVMs) are not rare, comprising 10 to 15% of all intracranial AVMs. However, most of dural AVMs have been seen in the region of the transverse-sigmoid sinus, or of the cavernous sinus, and the reports of dural AVMs involving the anterior cranial fossa are rare.

Case Report

This 56-year-old man was admitted with a history of double vision of 1 month's duration. He had been healthy until 1 month prior to admission when he suddenly experienced severe frontal headaches. Shortly afterwards he lost consciousness and remained unresponsive for a few hours. Although he apparently did not fall, nor hit his face or head at that time, his wife noticed that his right eyelids markedly swelled. When the swelling subsided a few days later, his right upper eyelid was drooping, and the double vision was apparent when he raised his ptotic lid with fingers.

On admission, physical and neurological examinations were normal except for a right third nerve palsy. Neither cervical nor cranial bruit was heard, and the results of routine laboratory examinations were all within normal limits.

Computed tomographic (CT) scan was performed 4 weeks after the clinical onset. It showed a low density area in the basal portion of the right frontal lobe. In the upper slices a thin extracerebral collection with mixed iso- and low densities was present over the right frontal convexity, and the frontal horns were minimally displaced toward the left. An intravenous administration of iodinated contrast media demonstrated a bi-lobed abnormal enhancement in the tip of the frontal base, from which a curvilinear enhancement continued toward the presellar region (Fig. 1).

Bilateral selective internal and external carotid angiography revealed a dural AVM in the tip of the frontal base. The feeding arteries were the anterior ethmoidal artery on each side as well as the internal maxillary, middle meningeal and superficial temporal arteries on the right side. The draining vein entered the superior sagittal sinus and the right cavernous sinus. On

Key words: Anterior cranial fossa, Dural AVM, Oculomotor nerve, Vascular malformation.
索引語：前頭蓋窩，硬膜動静脈奇形，動眼神経，血管障害，CT.
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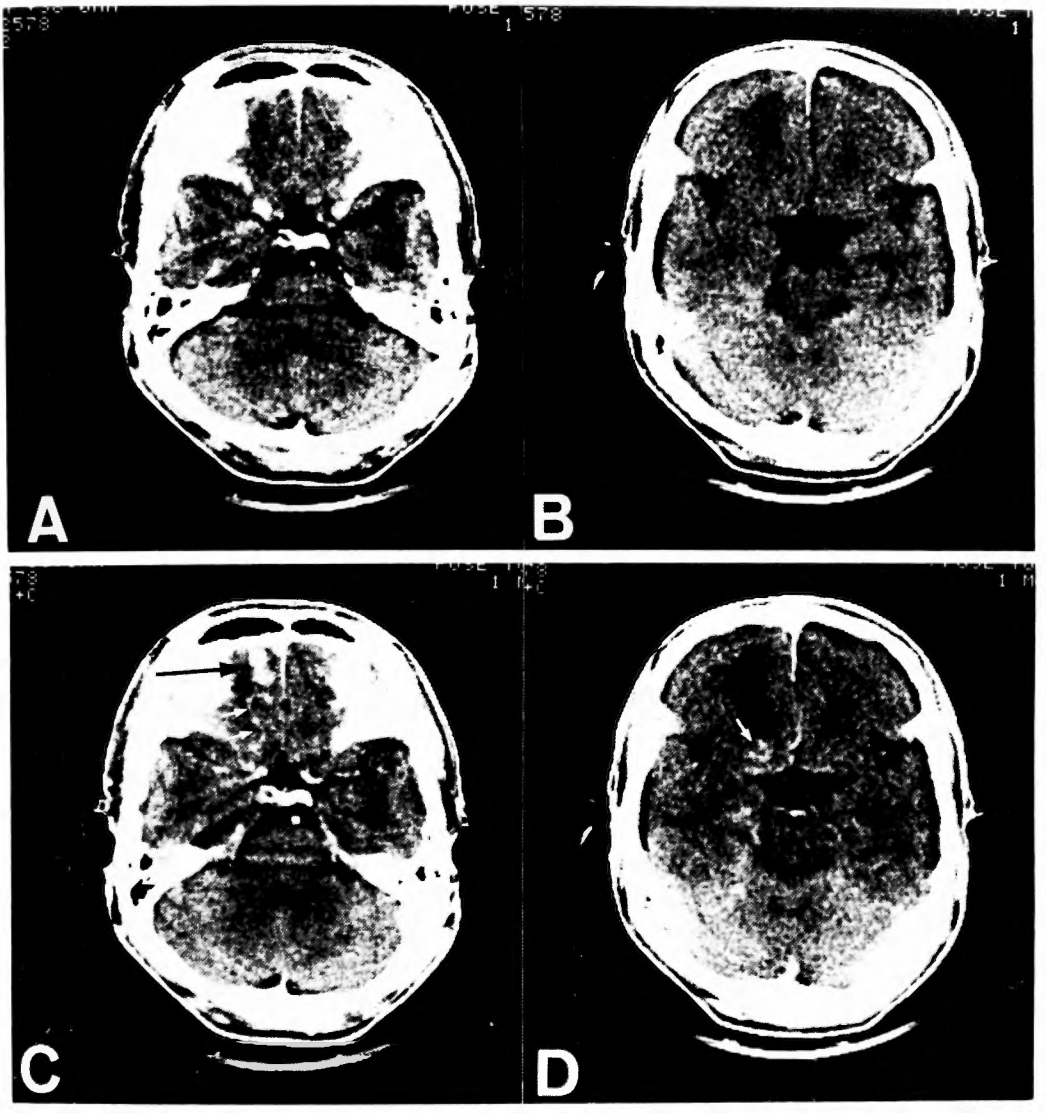

Fig. 1. Noncontrast (A, B) and contrast (C, D) CT.
Large arrow indicates an aneurysmal dilatation of the draining vein, and white arrows the draining vein.

the right side, the initial portion of the draining vein showed an aneurysmal dilatation (Fig. 2). Orbital phlebography via the frontal vein showed a non-visualization of the S-III portion of the right superior ophthalmic vein. The right cavernous sinus was poorly contrast-filled.

At operation, a right frontal bone flap was turned laterally. On elevating the right frontal lobe and incising the falx cerebri, an AVM was found to involve the tip of the frontobasal dura mater on both sides. The dura mater covering the crista galli looked intact. On the left side, a draining vein entered the cortical vein that coursed posteriorly. On the right side, a large red vein was found to arise from the center of the AVM. After traversing the subdural space, this

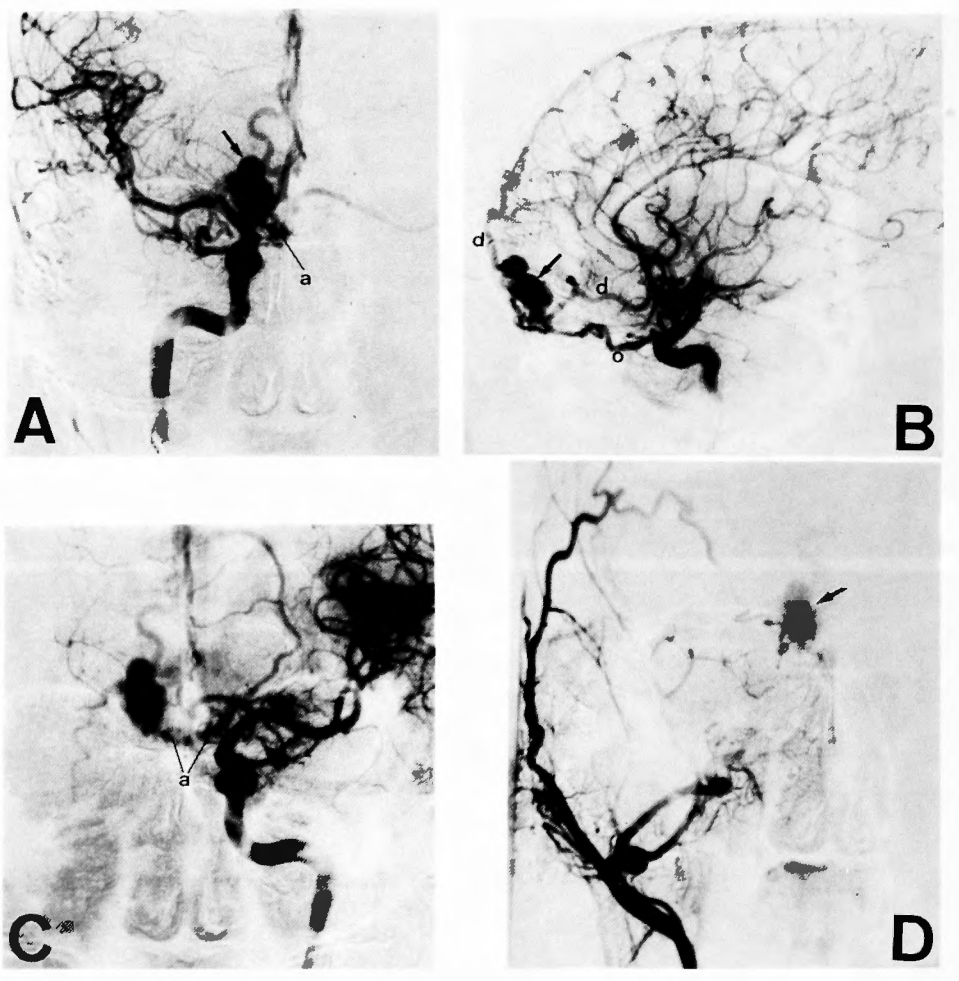

Fig. 2. Right internal carotid (A, B), left internal carotid (C), and right external carotid (D) angiograms.
a: dural AVM, o: enlarged ophthalmic artery, d: draining vein, arrow: aneurysmal dilatation of the draining vein.

vein entered the aneurysmal sac that was mostly embedded in the parenchyma of the frontal tip. From this aneurysmal sac arose two veins; the one coursed superiorly over the convexity surface to enter the superior sagittal sinus and the other coursed posteriorly on the basal surface of the right frontal lobe. This aneurysmal dilatation of the draining vein was surrounded by a small amount of aged, amorphous intracerebral clot, which had ruptured into the subdural space to form a thin organizing clot. The hematoma was evacuated, and the dural AVM was totally removed by peeling it off from the bone of the skull base, together with the narrow fringe of the surrounding, seemingly normal basal dura mater. Arterial bleeding from the foramen caecum and the ethmoid plate on each side was readily controlled using the bone wax and a monopolar coagulation.

Postoperatively the added neurologic deficit was confined to anosmia on the right side.

Follow-up bilateral angiography confirmed a total removal of the lesion. The oculomotor palsy disappeared completely within three months.

Discussion

Dural AVMs occur most often in the region of the transverse-sigmoid sinus. There is no sex differences in such cases, and the age of presentation is predominantly between 40 and 60 years. Besides annoying tinnitus and cranial bruit, the symptoms and signs secondary to an increased intracranial venous pressure and cerebral hypoxia, such as headaches, papilledema and various neurologic deficits, are often seen in patients harboring a large arteriovenous fistula in this region. The incidence of association of intracranial hemorrhage, however, is relatively low[1,7,8].

Dural AVMs in the region of the cavernous sinus probably account for most of the so-called spontaneous carotid-cavernous sinus fistulae. This vascular anomaly is most often seen in the middle-aged woman. The signs and symptoms are usually mild and include dilatation of conjunctival veins, bruit, and proptosis. Transient abducent paresis and unilateral headaches may be seen, but the intracranial hemorrhage has not been reported and the spontaneous resolution is not uncommon[1,6].

In comparison, dural AVMs involving the anterior cranial fossa are very rare. Pertinent clinical data of 8 such cases including the one herein reported are summarized in the Table 1[2,3,4,5,9,10]. The age of the patients ranged from 34 to 61 years, and 7 patients were male and one was female. Cranial bruit was heard in only 2 cases.

Dural AVMs in the anterior cranial fossa are further divided into three groups: those involving primarily the basal dura mater of the anterior cranial fossa, the anterior portion of the falx cerebri, and the dura mater of the frontal convexity[10]. Their principal blood supply is the ophthalmic artery, via the anterior or posterior ethmoidal branch and/or anterior falx artery. The middle meningeal artery and the superficial temporal artery, and rarely a small branch of the pial artery also may feed the malformation. Most AVMs in this location drain into the cortical vein, but the inferior sagittal sinus or the cavernous sinus may be involved. Present case is unique in that the lesions occurred symmetrically on both sides.

The most striking point with this type of dural AVMs is that the complicating intracranial hemorrhage occurred in five out of 8 patients. Two patients experienced subarachnoid hemorrhage, and three other patients had intracerebral hemorrhage. Putaminal hemorrhage was found in the other one patient[2], but it was not related to his dural AVM located in the tip of the left frontal base.

The origin of complicating intracranial hemorrhage is believed to be the draining vein rather than the nidus of the AVM, and this was the case in the present patient. It seems interesting to note here that the aneurysmal dilatation of the draining vein was seen in 4 out of 5 patients with adequate description in the reports. Such an aneurysmal sac interposed between the nidus of the AVM and the cortical vein or it was embedded in the brain. In our patient, the aneurysmal sac was embedded in the brain and it was surrounded by a localized clot. HOUSER et al. also re-

Table 1. Summary of patients with dural AVM in the anterior fossa.
(♯ Incidental putaminal hemorrhage)

Authors	Year	Age	Sex	Bruit	Intracranial hemorrhage	Treatment	Results
Houser et al	1972	40～49	M	+	+	?	?
		40～49	M	−	−	?	?
Handa et al	1973	56	M	−	+	Removal	Excellent
Kosnik et al	1974	34	F	−	+	Removal	Excellent
Waga et al	1977	46	M	−	+	Removal	Excellent
Takaku et al	1978	34	M	+	−	Removal	Excellent
Bitoh et al	1981	61	M	−	+♯	Removal	Excellent
Kidooka et al (present case)	1982	56	M	−	+	Removal	Excellent

ported that in dural AVMs the draining cortical vein may be occasionally accompanied by a markedly dilated vascular sac, which may be embedded in the brain substance and associated with hemorrhage[4].

Treatment of dural AVMs is often very difficult. Although some patients not treated or submitted only to obliteration of several feeding arteries may improve, occlusion of some of the afferent arteries either by operation or by means of endovascular procedures is usually insufficient to isolate these vascular anomalies from circulation. Direct surgical approach with removal of the malformation has been considered the best form of treatment. This is, however, impractical in dural AVMs involving the cavernous sinus, and technically often very difficult, if not impossible, in patients with lesions in the transverse-sigmoid sinus region.

Fortunately, a radical operative removal is usually possible in patients with dural AVMs located in the anterior cranial fossa. This was done in 6 out of 8 patients in the literature with uniformly excellent results (Table 1). In the remaining two patients, the detail of treatment is unknown. When the high incidence of complicating intracranial hemorrhage and the excellent operative results are taken into account, a radical operative procedure evidently is the treatment of choice in dural AVMs in this location.

Oculomotor palsy seen in the present patient is not fully explained. A rupture of dural AVM with formation of intracerebral hematoma and oculomotor palsy may have been coincidental. The patient was not diabetic or hypertensive, however, and other possible causes of oculomotor palsy such as an internal carotid aneurysm were not found.

Contrast-filling of the S-III segment of the superior ophthalmic vein and the cavernous sinus on the right side was poor in this patient. This fact may represent a high intravenous pressure secondary to a shunting of the arterial blood flow, or it may be due to an occurrence of phlebothrombosis in the cavernous sinus as often seen in the sigmoid sinus in patients with dural AVMs in the posterior fossa. Abrupt occurrence of palpebral edema in the present case in the absence of local inflammatory signs is not incompatible with phlebothrombosis of, or an acute increase in pressure in, the cavernous sinus.

If an outflow of the shunted blood into the cavernous sinus is acutely hindered by a process

of thrombosis within it, a diversion of flow may increase the pressure and flow within the alternative draining vein, causing its rupture. Conversely, an incidental rupture of a cortical draining vein with formation of hematoma around it may divert more blood into the cavernous sinus and cause a sharp rise of the pressure within the sinus. In such events, the oculomotor palsy may be caused either by thrombosis or acute expansion of the cavernous sinus. Based on the presently available data, however, a definite conclusion cannot be drawn as to the pathogenesis of oculomotor palsy in this particular patient.

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和文抄録

前頭蓋窩の硬膜動静脈奇形

滋賀医科大学脳神経外科
木戸岡 実，中洲 敏，中洲 庸子，半田 譲二

56才男で，頭痛，意識障害，左眼瞼浮腫で発症し，眼瞼浮腫消褪後右動眼神経麻痺を呈した前頭蓋窩底面先端部の硬膜動静脈奇形（AVM）の1例を報告した．CTおよび血管撮影上 crista galli の両側に存在したAVMは両側前篩骨動脈および右外頸動脈分岐より支配され，導出静脈は軟膜静脈で海綿洞および上矢状洞に注ぎ，この静脈の一部に動脈瘤様拡張が存在し，その周囲に脳内および硬膜下血腫をみとめた．

前頭蓋窩AVMは稀であるが，本例を含め8例の報告例中7例は男，5例は頭蓋内血腫を併発し，記載の明らかな5例中4例で導出静脈に動脈瘤様拡張をみとめた．頭蓋内出血の出血源は導出静脈側といわれる．この部のAVMは手術が比較的容易で好成績が得られる．頭蓋内出血の危険性を考慮して，根治手術を行なうべきである．