Ruptured aneurysm of the middle meningeal artery associated with occlusion of the posterior cerebral artery

Case report

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The authors describe the case of a 69-year-old man with an intracerebral hemorrhage due to rupture of a nontraumatic aneurysm of the middle meningeal artery (MMA). The ipsilateral posterior cerebral artery (PCA) was occluded, and dural anastomoses developed as the main collateral pathway between the MMA and the cortical branch of the PCA, on which the aneurysm was located. It is considered that increased hemodynamic stress to the collateral pathway contributed to the formation of the aneurysm.

KEY WORDS • aneurysm • middle meningeal artery • dural anastomoses

PSEUDOANEURYSM of the middle meningeal artery (MMA) due to head trauma is a well-known cause of intracranial hemorrhage, especially in epidural hematoma of delayed onset. However, a nontraumatic aneurysm of the MMA is a rare lesion; only nine cases have been reported previously. Most of these cases were associated with increased hemodynamic stress on the MMA. We report an extremely rare case of an intracerebral hemorrhage due to rupture of a nontraumatic aneurysm of the MMA associated with the occlusion of the posterior cerebral artery (PCA).

Case Report

This 69-year-old man with a history of hypertension was admitted to another hospital for examination of renal dysfunction. He suddenly lost consciousness on December 13, 1994, and he was transferred to our hospital immediately.

Examination. The patient was semicomatose on admission and showed decerebrate posturing. Both pupils were miotic without light reflex. Computerized tomography scanning revealed a subcortical hematoma in the right temporal lobe and an intraventricular casting hematoma (Fig. 1). After the patient underwent emergency placement of external ventricular drains in both lateral ventricles for acute obstructive hydrocephalus, angiography was performed (Fig. 2). Intracranial arteries, especially the right internal carotid artery (ICA), showed marked atherosclerotic changes, and occlusion of the right PCA at its origin was noted (Fig. 2A and D). Its territory was supplied mainly via dural anastomoses with the MMA, on which a saccular aneurysm was identified (Fig. 2B and C), and partially supplied via the anterior choroidal artery (Fig. 2A). The posterior communicating artery (PCoA) could not be identified. A ruptured MMA aneurysm was diagnosed.

Fig. 1. Preoperative computerized tomography scan showing a subcortical hematoma in the right temporal lobe.
Operation. The patient underwent a right frontotemporal craniotomy. The aneurysm originated from the anastomotic vessel between the dural and cortical arteries of the temporal lobe, and the aneurysmal dome was surrounded by an intracerebral hematoma. After the aneurysm was coagulated and resected, the intracerebral and intraventricular hematomas were evacuated to the extent possible.

Postoperative Course. Following surgery the patient remained semicomatose, and on January 5, 1995, he died of acute renal failure. An autopsy was not permitted.

Pathological Examination. Histological examination of the surgical specimen showed that most of the aneurysmal wall consisted of thrombus, and the internal elastic membrane was identified in part of it by elastic tissue van Gieson's staining. Whether it was a pseudo or a true aneurysm could not be determined by those findings (Fig. 3).

Discussion

Nine cases of nontraumatic aneurysm of the MMA have been reported previously. The aneurysm in one case was not associated with other pathological findings, and in another case involving occlusion of the ICA there was no detailed information about its etiology. However, among the other seven cases, three were associated with Paget's disease, in which sarcomatous change occurs in the cranium and blood flow in the external carotid artery is known to increase; there was one case of dural arteriovenous malformation; one case of angiomat; one case of moyamoya disease; and one case of cavernous hemangioma of the skull. In these cases, increasing hemodynamic stress on the MMA was suggested to be an important factor contributing to the formation of the aneurysms.

In our case, occlusion of the right PCA was noted, and its territory was supplied mainly via dural anastomoses with the MMA on which a saccular aneurysm was identified. The dural branch of the PCA was not investigated because it was known to supply the tentrium and falx cerebri. When the PCA is occluded, the distal portion is usually supplied by the anterior and middle cerebral arteries through leptomeningeal anastomoses and by the PCoA. Parenchymal anastomoses may occur with the anterior choroidal, the superior cerebellar, and lenticulostrate arteries. In our case, it is not known why dural anastomoses between the MMA and the cortical branch of the PCA became so prominent. However, leptomeningeal and parenchymal anastomoses were unavailable, probably due to marked atherosclerotic changes of intracranial arteries, and the dural anastomoses became well developed as the main collateral pathway.

There are many reports of cases involving cerebral aneurysms associated with arterial occlusive lesions, and it has been suggested that hemodynamic factors play a role in the pathogenesis of these aneurysms. However, to our knowledge, there is only one report of an aneurysm on the MMA contributing to collateral circulation via dural anastomoses, as in our case. Collateral circulation is supposed to be a low-pressure system, covering low-perfusion areas in place of the main arterial system. Therefore, it is quite conceivable that bleeding from collateral circulation rarely occurs. The only disease in which bleeding from the collateral circulation occurs frequently is moyamoya disease. In this disease, it is well known that the origin of bleeding is moyamoya vessels, which are abnormally developed perforating arteries in the basal ganglia that compensate for the occlusion of the circle of Willis. In some cases, well-developed collateral circulation is seen in the transdural anastomosis from the MMA to the pial artery. Indeed, Takahashi reported a case of moyamoya disease in which a small aneurysm arose from the junction of the MMA and a branch of the anterior cerebral artery. In our case, we speculated that increased hemodynamic stress on the anastomotic vessel contributed to the formation of the aneurysm, as occurred in most other reported cases of MMA aneurysm.

Whether the aneurysm was a pseudo or true aneurysm could not be determined by histological examination in our case. Hence there is another possibility regarding its pathogenesis. The rupture of the anastomotic vessel may have resulted in the formation of a pseudoaneurysm. Some cases of acute subdural hematoma caused by the
rupture of transdural anastomotic vessels in moyamoya disease have been reported.\textsuperscript{13,20} McDermott, \textit{et al}.\textsuperscript{11} reviewed cases of spontaneous arterial subdural hematoma and noted that a small artery anastomosing a cortical artery to a dural vessel might be one source of bleeding. However, in our case, hematoma could not be identified in the subdural or subarachnoid space, so it was presumed that rupture of a preexisting aneurysm resulted in the intracerebral hematoma.

In nine reported cases of MMA aneurysm, only one aneurysm ruptured, resulting in an epidural hematoma.\textsuperscript{18} This is the first reported case of an MMA aneurysm presenting as intracerebral hematoma. Without question, radical surgery is required for ruptured aneurysms. For unruptured aneurysms, surgery should be considered because of the risk of a fatal rupture as in our case.

References

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