CASE REPORT

Caudate haemorrhage caused by pseudoaneurysm of accessory middle cerebral artery

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SUMMARY

A 68-year-old man experienced a right caudate haemorrhage with intraventricular haemorrhage. Although a subarachnoid haemorrhage was not shown clearly, our investigation demonstrated an aneurysm-like vascular pouch located in the anomalous vessel arising from the A2 segment of the right anterior cerebral artery. Rupture of the vascular pouch was considered to be the cause of the caudate haemorrhage. Neck clipping was performed. In intraoperative observation, the anomalous vessel was diagnosed as a right accessory middle cerebral artery. Histopathology of the saccular wall showed only an adventitia and a fibrin layer, indicating a pseudoaneurysm. We routinely perform detailed vascular evaluation for any cerebrovascular disease. A meticulous vascular survey makes it possible to obtain valuable clues in cases such as caudate haemorrhage due to pseudoaneurysm of the accessory middle cerebral artery, leading to prevention of rebleeding.

BACKGROUND

The incidence of caudate haemorrhage is markedly less than that of haemorrhage of the putamen, thalamus, corticomedullary junction or posterior fossa, and accounts for 0.1–7.0% of all cases of spontaneous intracerebral haemorrhage.¹ Although hypertension is a major risk factor for caudate haemorrhage, aneurysm, arteriovenous malformation or moyamoya disease are also potential causes.¹ The caudate nucleus receives blood supply from the recurrent artery of Heubner, the anterior lenticulostriate arteries and the lateral lenticulostriate arteries.² The accessory middle cerebral artery (MCA) is a variation of the MCA and, according to Teal's classification, which is widely accepted for variations of the MCA, originates from the A1 or proximal A2 segment of the anterior cerebral artery (ACA).^{3–4} The frequency of accessory MCA is reported to be 0.3–2.7% of autopsy series and 0.26–4% of angiographical studies.³ Accessory MCA coexists with the recurrent artery of Heubner, and it reaches the anterior perforated substance.³ Therefore, a vascular event in the proximal portion of the accessory MCA may result in a stroke in the caudate. We present a case of caudate haemorrhage caused by a ruptured pseudoaneurysm of the accessory MCA, which was treated by surgical intervention. Although there are a few reports of aneurysm of the accessory MCA, to the best of our knowledge, this is the first case describing the relationship between rupture of the accessory MCA and caudate haemorrhage.

CASE PRESENTATION

A 68-year-old man was initially admitted to a local hospital because of a disturbance in consciousness and vomiting. Neurological examination on admission was Hunt and Kosnik grade 3 without motor weakness. He had no health problems and no family medical history. The patient was diagnosed as having caudate haemorrhage, and referred to our hospital for further treatment after receiving conservative care. On examination, he was fully conscious without any focal neurological deficits.

INVESTIGATIONS

CT on the first admission demonstrated a haematoma in the right caudate nucleus with intraventricular haemorrhage. A subarachnoid haemorrhage was not clearly visualised ([figure 1](#)). In our hospital, CT angiography (CTA) showed an aneurysm-like vascular pouch located in the anomalous vessel arising from the right ACA. Digital subtraction angiography (DSA) revealed a stenosis of the M1 segment of the right MCA, and an anomalous vessel originating from the proximal portion of the A2 segment of the right ACA, which coursed parallel to the MCA and continued to the cortical area ([figure 2](#)). Furthermore, a vascular pouch 7 mm in diameter was demonstrated in the anomalous vessel ([figure 2](#)).

TREATMENT

The location of the haematoma and the vascular pouch were so close that the cause of the haemorrhage was considered to be rupture of the vascular pouch. We decided that the vascular pouch should be treated because of a high risk of rebleeding. A trans-sylvian approach with frontotemporal craniotomy was performed. The MCA was identified, and several branches of the MCA exhibited

Figure 1 CT scans on the first admission showing a right caudate haemorrhage with intraventricular haemorrhage and subarachnoid haemorrhage, which was not clearly demonstrated (R, right).

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Figure 2 Preoperative right internal carotid angiograms revealing a stenosis of the M1 segment of the right MCA; the anomalous vessel originated from the A2 segment of the right ACA with an aneurysm-like vascular pouch (ICA, right internal carotid artery; ACA, right anterior cerebral artery; MCA, right middle cerebral artery).

atherosclerotic changes. After removal of the old haematoma in the base of the right frontal lobe, the vascular pouch harbouring the anomalous vessel was located. In intraoperative observation, the recurrent artery of Heubner was also confirmed, so that this anomalous vessel was identified as an accessory MCA from its origin and its course. Part of the saccular wall was dark red, indicating partial thrombosis (figure 3). After clipping the origin of the vascular pouch, the wall of the pouch was partially resected. Histopathological examination revealed that the wall of the vascular pouch was partly thrombosed and consisted of an adventitia and a fibrin layer without intima, internal elastic membrane and media (figure 4). These histopathological features indicated that this vascular pouch was a pseudoaneurysm.

OUTCOME AND FOLLOW-UP

Postoperative angiography showed disappearance of the vascular pouch with preserved patency of the right accessory MCA (figure 5). The postoperative course was uneventful and the patient was discharged on foot.

DISCUSSION

In 1973, Teal *et al*⁴ suggested that the term, 'accessory middle cerebral artery', given by Crompton *et al*, referred to an

anomalous vessel arising from the ACA and running parallel to the MCA. The accessory MCA can coexist with the recurrent artery of Heubner, and also runs laterally into the sylvian fissure, unlike the recurrent artery of Heubner, which enters into the anterior perforated substance.⁵ In Teal's classification, the accessory MCA usually originating from the A1 or proximal A2 segment of the ACA provides the territory of the orbitofrontal, prefrontal, precentral and/or central arteries.^{3 4} Although it is generally smaller than the MCA, there are abundant anastomoses between the accessory MCA and the major trunk of the MCA.⁶ Therefore, the accessory MCA may serve as a collateral blood supply to the rest of the MCA territory.⁷ In the present case, stenosis of the M1 segment might have caused the accessory MCA to provide additional collateral blood flow to the MCA territory. The accessory MCA aneurysm is so rare that only 12 cases, including ours, have been reported in the literature.⁸ Haemodynamic stress has been suggested to lead to formation of an aneurysm, including a pseudoaneurysm.⁹ The recurrent blood flow from the A1 segment of the ACA to the accessory MCA may have produced haemodynamic stress.⁸ The present case may have exhibited haemodynamic stress induced by the severe stenosis in the M1 segment, resulting in increased blood flow to the accessory MCA. The pseudoaneurysm may have resulted from the haemodynamic stress that affected the accessory MCA. All the reported cases of ruptured accessory MCA aneurysm presented with subarachnoid haemorrhage.⁸ However, in the present case, the subarachnoid haemorrhage

Figure 3 Intraoperative photograph showing a dark red wall on part of the vascular pouch, indicating partial thrombosis (Accessory MCA, right accessory middle cerebral artery).

Figure 4 Histopathological photomicrograph of the saccular wall demonstrating that the arterial layer was only an adventitia and a fibrin layer without intima, internal elastic membrane and media. H&E stain, magnification $\times 400$.

Figure 5 Postoperative right internal carotid angiogram showing patency of the right accessory MCA and exclusion of the vascular pouch (ICA, right internal carotid artery; ACA, right anterior cerebral artery; MCA, right middle cerebral artery; Accessory MCA, right accessory middle cerebral artery).

Learning points

- ▶ Although caudate haemorrhage and accessory middle cerebral artery are both rare, they can coexist, and caudate haemorrhage is caused by rupture of the accessory middle cerebral artery.
- ▶ The pseudoaneurysm develops in the accessory middle cerebral artery associated with a stenosis of the middle cerebral artery.
- ▶ In a typical cerebral haemorrhage, a meticulous vascular survey is important to prevent rebleeding.

was not shown clearly and the caudate haemorrhage was strongly visualised. Most caudate haemorrhage occurs in the penetrating arteries of the ACA or MCA,¹⁰ with no reports of accessory MCA rupture as a cause of caudate haemorrhage. Although caudate haemorrhage and accessory MCA are rare, our data suggest that they can coexist. In our hospital, because vascular evaluation such as CTA and DSA is routinely performed for any cerebrovascular disease including intracerebral haemorrhage, it was possible to obtain this valuable case. In a typical haematoma in the basal ganglia, meticulous vascular survey should be performed, and any vascular anomaly should be treated.

Contributors ST was responsible for the conception, design and interpretation of this report. JT, YN and TY participated in drafting and critical revision of the manuscript for important intellectual content.

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