

Infraoptic Course of the Anterior Cerebral Artery: Case Report¹

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An infraoptic anterior cerebral artery (ACA) arising at a low bifurcation of the internal carotid artery is a rare anomaly, of which about 33 cases have been reported to date, often in association with cerebral aneurysms. We describe a case involving an infraoptic ACA in which a ruptured middle cerebral artery aneurysm was also present. Angiography revealed the presence of an abnormal solitary ACA, arising from the intracranial proximal internal carotid artery near the origin of the ophthalmic artery, and a contralateral middle cerebral artery aneurysm. Magnetic resonance imaging showed that the ACA passed below the ipsilateral optic nerve, anterior to the optic chiasm, to join the normally positioned anterior communicating artery above the optic chiasm.

Index words : Aneurysm, cerebral
Arteries, MR
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Although anomalies of the anterior cerebral artery (ACA)-anterior communicating artery (AComA) complex are commonly identified at imaging studies, an infraoptic ACA is extremely rare (1 - 4). In such cases, an anomalous vessel originates from the internal carotid artery (ICA) at the level of the ophthalmic artery, and then pursues an infraoptic and prechiasmatic path to supply the ACA. We describe a case of in which this anomaly coexisted with a ruptured middle cerebral artery aneurysm, and include the angiographic and magnetic resonance imaging findings.

Case Report

A 55-year-old woman in previous good health experienced the sudden onset of severe headache without focal neurological deficits. CT scanning demonstrated hemorrhage in the left side of the basal cistern and left sylvian fissure (Fig. 1), suggesting rupture of a left middle cerebral artery aneurysm. Angiography revealed a broad-based saccular aneurysm at the main division of the left middle cerebral artery (Fig. 2), and an anomalous arterial branch, originating from the right ICA at the level of the ophthalmic artery, was also visible. A portion of its proximal segment contained an almost horizontal portion, suggesting that an anomalous ACA coursed below the ipsilateral optic nerve (Fig. 3). Its initial course was medial, and it then turned superiorly to join the normally positioned AComA. The left A1 segment was not hypoplastic. T2-weighted magnetic resonance imaging confirmed the infraoptic course of the proximal precommunicating tract (A1) under the ipsilat-

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eral optic nerve, with the distal A1 tract anterior to the chiasm and positioned between the optic nerves, and the joining of bilateral ACAs above the optic chiasm was also visualized (Fig. 4). Next day, the left middle cerebral artery aneurysm was surgically clipped during pterional craniotomy.

Discussion

Anomalies of the anterior circle of Willis are quite commonly discovered at imaging studies but are usually

of little clinical significance. Aplasia or hypoplasia of the A1 segment, fenestration or duplication of the AComA, and the presence of three distal ACAs are frequently reported anomalies (4). An infraoptic ACA is an exceedingly rare anomaly, however, and one which-because of the high prevalence of associated aneurysms and surgical planning-has important implications. It was first described, after discovery during an anatomic dissection, by Robinson in 1959 (5) and first demonstrated angiographically by Isherwood and Dutton (6). To date, about 33 cases, which came to light during autopsy or surgery,

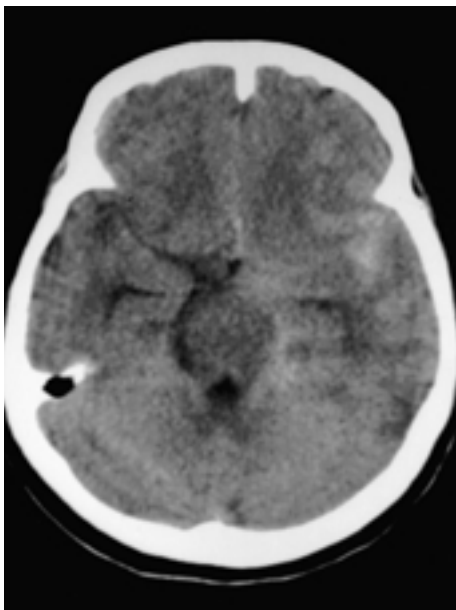


Fig. 1. Unenhanced CT scan shows hemorrhage in the left side basal cistern and the left sylvian fissure, suggesting the rupture of left middle cerebral artery aneurysm.

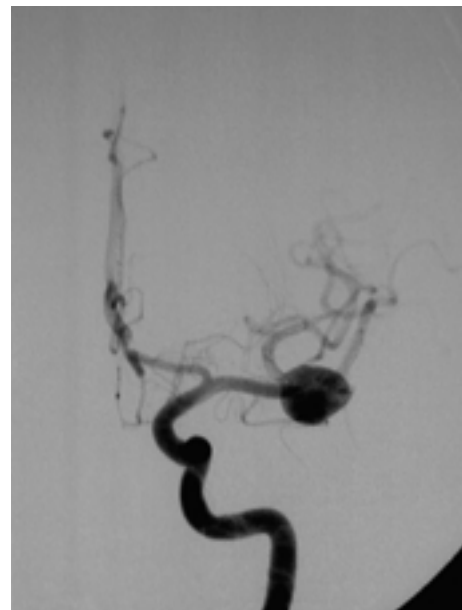


Fig. 2. Left internal carotid arteriogram reveals a broad-based saccular aneurysm at the main division of the middle cerebral artery.

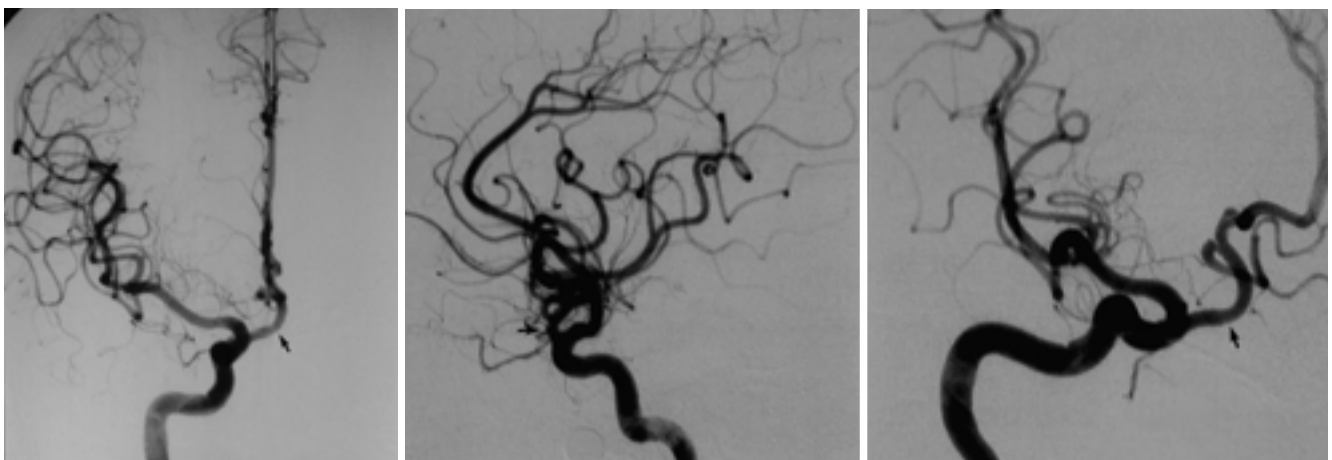


Fig. 3. Right internal carotid arteriogram AP (A), lateral (B), and oblique (C) views reveal an anomalous vessel (arrows) arising from the internal carotid artery at the level of the ophthalmic artery, which courses medially and then superoposteriorly to join the anterior communicating artery.

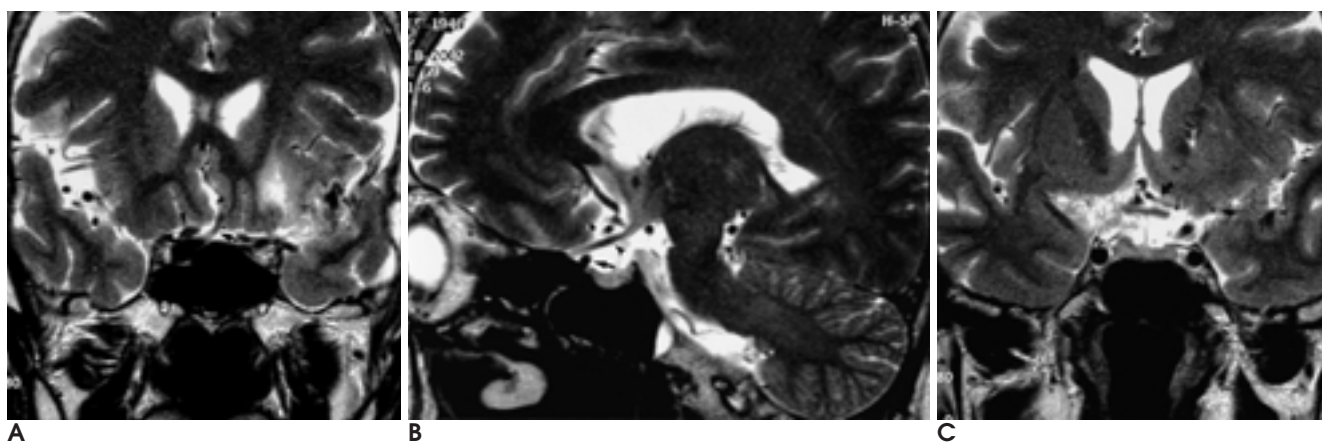


Fig. 4. T2-weighted coronal (A) and oblique sagittal (B) magnetic resonance images show an anomalous anterior cerebral artery (arrows) passes below ipsilateral optic nerve (arrowheads) and ascends superiorly between bilateral optic nerves to join the normally positioned anterior communicating artery above the optic chiasm. Normal course of left anterior cerebral artery (curved arrow) is well demonstrated on T2-weighted coronal image at the level of the optic chiasm (C).

or at radiological imaging studies, have been reported. In cases of unilateral infraoptic ACA, there is a slight right-sided predilection; bilateral anomalous ACAs (7) and an infraoptic ACA associated with a pituitary tumor (8) have also been reported.

From the bifurcation of the ICA, the ACA normally courses medially and often somewhat anteriorly towards the interhemispheric fissure, passing over the optic nerves and chiasm. In all reported cases, the infraoptic course of the ACA began at a low bifurcation of the ICA, at the level of the ophthalmic artery or above. This anomalous ACA is of large caliber and is often associated with contralateral A1 agenesis or hypoplasia (3). In our case, the caliber of the contralateral A1 was near normal. In a few cases, a hypoplastic ipsilateral supraoptic A1 tract has been reported in association with an anomalous infraoptic A1 tract (9), and although this anomalous vessel is functionally equivalent to the A1 segment of the ACA, some authors thus prefer the term "carotid-anterior cerebral artery anastomosis" to "anomalous ACA".

The embryogenesis of this anomalous ACA is controversial. Because a hypoplastic ipsilateral supraoptic A1 has been identified, and the anomalous vessel and the ophthalmic artery appear to share a common origin, some authors maintain that this anomaly is not a misplaced A1 segment, but the persistence of an embryological vessel such as a variant of a primitive prechiasmal arterial anastomosis (5, 6) or primitive ventral ophthalmic artery (10).

As with other variations in the circle of Willis, the prevalence of associated cerebral aneurysms is higher

(1, 11), and the cause is thought to be the hemodynamic stress borne by an asymmetric vessel in an incomplete or unbalanced circle of Willis (12, 13). The most common site of an aneurysm is the ACA-ACoM complex (3, 11) but they may arise anywhere within the circle of Willis, including the middle cerebral artery, as in our case.

In summary, an infraoptic ACA arising at a low bifurcation of the ICA is a rare congenital anomaly originating from the ICA at the level of the ophthalmic artery and passing below the ipsilateral optic nerve before ascending between bilateral optic nerves to meet the contralateral ACA above the optic chiasm. Where surgery is being considered for either an aneurysm in the ACA-ACoM complex or a pituitary tumor, preoperative recognition of this aberrant artery is important.

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