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Case Report

Infraoptic Course of Both Anterior Cerebral Arteries

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A 28-year-old woman was referred to our hospital with a sudden, very severe headache. Brain computed tomographic angiography showed a saccular cerebral aneurysm at the bifurcation of the left middle cerebral artery and infraoptic courses of both anterior cerebral arteries. The anterior cerebral arteries were seen to arise from the ipsilateral internal cerebral arteries at the level of the origin of the ophthalmic artery, passed underneath the ipsilateral optic nerve, and turned upward at ventral portion of the optic chiasm.

Infraoptic course of the proximal anterior cerebral artery is an extremely rare anomaly and is often associated with cerebral aneurysms. We report the clinical features, radiological findings, and possible genesis of this anomaly with a literature review.

KEY WORDS : Anterior cerebral artery · Infraoptic course · Optic chiasm.

INTRODUCTION

Although variations in the anterior cerebral artery/anterior communicating artery complex are common, an infraoptic course of the A1 segment of the anterior cerebral artery, which originates from the internal cerebral artery at the level of the ophthalmic artery, passes below the ipsilateral optic nerve, and ascends anterior to the optic chiasm, is an extremely rare anomaly[1,2,4-11,13-19].

Although rare, the condition should be considered as an entity. The incidence of associated berry aneurysm[1,4-7,10,11,14,15,18] and other intracranial vascular anomalies[7,8,19] is high. The clinical features, radiological findings, and possible genesis of this anomaly are presented here.

CASE REPORT

A 28-year-old woman was admitted to our hospital after developing a sudden severe headache. The physical examination revealed moderate neck stiffness.

Brain computed tomography (CT) on admission showed a diffuse subarachnoid hemorrhage in the suprasellar, ambient and both Sylvian cisterns (Fig. 1). Brain CT angiography showed that both anterior cerebral arteries originated from the ipsilateral internal carotid arteries at level of the ophthalmic artery. Then, both anterior cerebral arteries coursed under and medial to the respective optic foramens and ran cephalad (Fig. 2). Brain CT angiography also revealed a saccular aneurysmal dilatation at the bifurcation of the left middle cerebral artery.

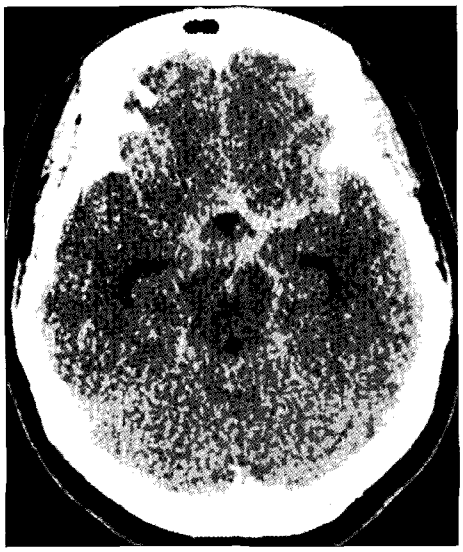

Fig. 1. Preoperative computed tomography images show diffuse subarachnoid hemorrhage in suprasellar, ambient, and both Sylvian cisterns.

Transfemoral four-vessel angiography demonstrated low bifurcation of both internal carotid arteries. Both anterior

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cerebral arteries arose from the internal carotid arteries bilaterally at the level of the ophthalmic artery, coursing medially and superiorly and rising at the midline (Fig. 3).

A left frontopterional craniotomy was performed via transsylvian approach. The aneurysm was approached first, dissected free from adherent clots, and clipped adequately. After the carotid and chiasmatic cisterns were opened, a low bifurcation of the left internal cerebral artery was observed, the left proximal A1 segment coursed under the left optic nerve and the both distal A1 segments ran anterior to the optic chiasm (Fig. 4).

DISCUSSION

Although variations of the anterior cerebral artery/anterior communicating artery complex are common, the presence of an infraoptic course of the proximal precommunicating segment of the anterior cerebral artery is an extremely rare anomaly[1,2,4-11,13-19]. Robison[13] first described this anomaly from an anatomic dissection in 1959. The first angiographic demonstration was done by Isherwood and Dutton[5]. Until now, approximately 30 cases of this anomaly have been identified[18].

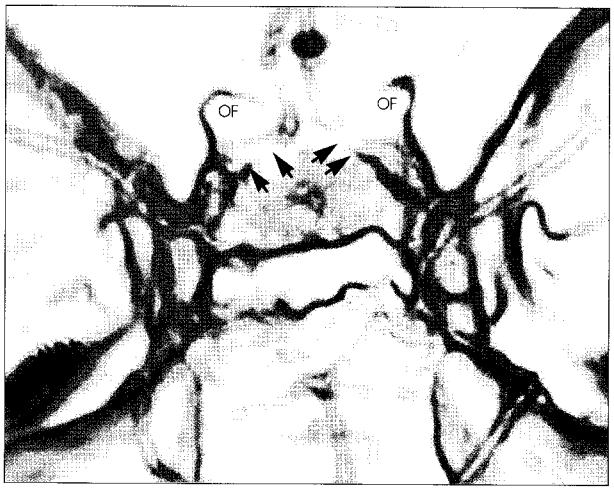

Fig. 2. Preoperative Brain computed tomography angiography demonstrates that both anterior cerebral arteries (black arrow) originate from the internal carotid artery at level of the ophthalmic artery and then course under and medial to each optic foramen. OF: optic foramen.

Normally, the anterior cerebral artery arises as the medial component of the carotid bifurcation and courses over the superior surface of the optic chiasm (70%) or nerves (30%)[12]. In ours and the other reported cases[1,2,4,9-11,14-18], the infraoptic course of the A1 segment has a characteristic appearance on angiography; an apparent low bifurcation of the internal cerebral artery at the level of the ophthalmic artery or just above, and a horizontal-medial course of the proximal anterior cerebral artery as it passes under the ipsilateral optic nerve before turning superiorly to the anterior communicating artery.

A unilateral anomalous infraoptic course of the anterior cerebral artery is more common than anomalies of both anterior cerebral arteries[4]. With a unilateral infraoptic course of the anterior cerebral artery, the absence or hypoplasia of the contralateral anterior cerebral artery is common[4,11,14,15,18]. To our knowledge, only four cases of the infraoptic courses of both anterior cerebral arteries, including our case, have been reported[18].

This anomalous vessel is frequently accompanied by other intracranial vascular anomalies secondary to embryogenic disorders, such as a variant of the carotid-basilar artery anastomosis[7,19], a fused pericallosal artery[8], or a plexiform anterior communicating artery[8]. In our case, however, we found no other intracranial vascular anomalies.

Similar to the other variations in the circle of Willis, the prevalence of cerebral aneurysm is much higher with an infraoptic course of the anterior cerebral artery[1,4-7,10,11,14,15,18]. The most common site of aneurysm is at the anterior cerebral artery/anterior communicating artery complex[1,4,6,10,11,14,15,18]. This might be because the anomalous anterior cerebral arteries supply the majority of the anterior circulation bilaterally and are frequently associated with an azygous A2 segment of anterior cerebral artery[4,11,14,15,18]. In our case, however, both anterior cerebral arteries passed under the

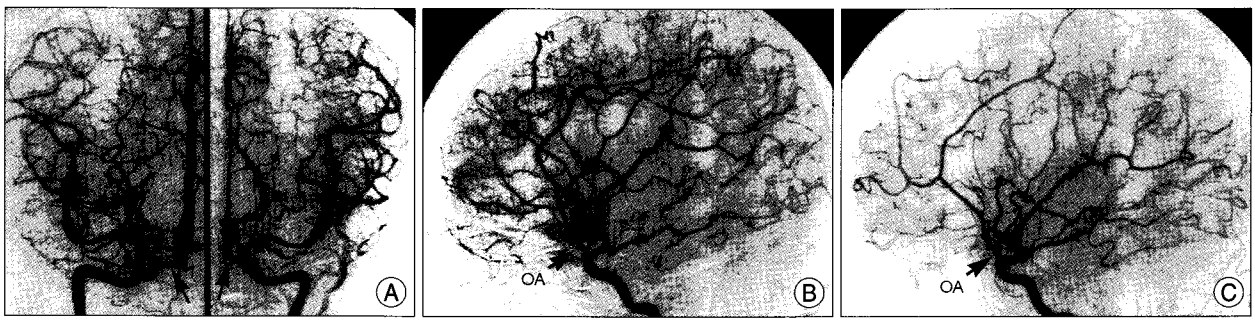

Fig. 3. Transfemoral four-vessel angiography (B : right ICA image, C : left ICA image) shows a saccular aneurysm at the bifurcation of left middle cerebral artery (A, white arrow) and both anterior cerebral arteries arise from the ICA on each side at the level of the ophthalmic artery, coursing medially and superiorly (black arrow). OA : ophthalmic artery.

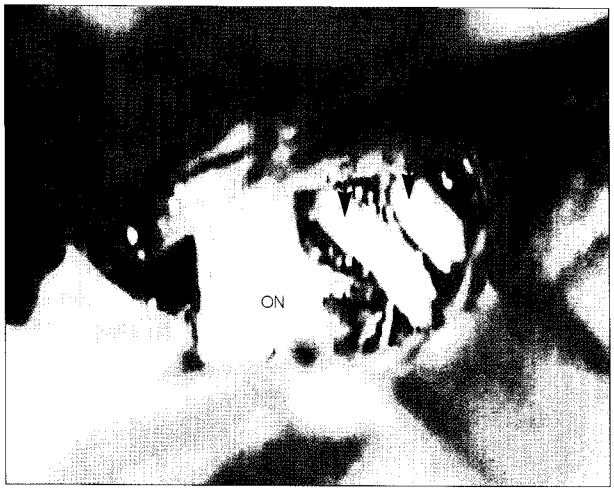

Fig. 4. Intraoperative view (left pteryonal approach). At the medial side of the left optic nerve, both anterior cerebral arteries (black arrow) are demonstrated. ON : optic nerve.

ipsilateral optic nerve and were well developed.

It is resonable to speculate that the common origin of the ophthalmic artery and the anomalous A1 segment is proof of a close relationship to the development of the adult ophthalmic artery.

Odake[11] thought that the artery could not be considered an abnormal anterior cerebral artery because a normally positioned ipsilateral anterior cerebral artery was present in several cases. Therefore, he described the anomaly as a carotid-anterior cerebral artery anastomosis, as Nutik and Dilenge[10] advocated.

Several theories regarding the origin of this anomalous vessel have been proposed. Early bifurcation of the internal cerebral artery[13], enlargement of the prechiasmal anastomosis[10,14], a persistent in utero communication between primitive dorsal and ventral ophthalmic arteries[10,11], and anastomosis between branches of the primitive olfactory and primitive maxillary arteries have been postulated as embryologic explanations[10,14].

CONCLUSION

Infraoptic course of the anterior cerebral artery is an extremely rare anomaly and is frequently associated with other intracranial vascular anomalies secondary to embryogenic disorders. If an infraoptic course of the anterior cerebral artery is noted, we recommend to search other possible vascular anomalies.

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