Primitive Trigeminal Artery Variant Aneurysm Treated With Guglielmi Detachable Coils

—Case Report—

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Abstract

A 69-year-old woman had suffered from diplopia on right lateral gaze for the last 4 months due to right abducens nerve paresis. Right carotid angiography showed a cavernous internal carotid artery (ICA) aneurysm of $17 \times 16 \times 14$ mm size and a primitive trigeminal artery (PTA) variant supplying the territory of the posterior inferior cerebellar artery. Intraluminal occlusion of the aneurysm was performed with 15 Guglielmi detachable coils. The flow of the PTA variant and the ICA was preserved. Right abducens nerve paresis improved partially. PTA variant is a primitive artery originating from the cavernous ICA supplying the cerebellum without opacification of the basilar artery. Only four of the 67 cases of PTA variant were associated with an aneurysm of the PTA variant. The possibility of this rare association should be considered when treating cavernous portion aneurysm because of the risk of cerebellar ischemia.

Key words: primitive trigeminal artery variant, cerebral aneurysm, endovascular treatment, Guglielmi detachable coil

Introduction

Primitive trigeminal artery (PTA) is the most common primitive carotid-basilar artery anastomosis with an incidence of approximately 0.2%.²⁾ Association with cerebrovascular anomalies, such as aneurysm^{7,8,21,32,34)} or arteriovenous malformation,¹⁵⁾ is also common. Approximately 14% of cases of PTA are associated with an intracranial aneurysm.⁸⁾

Carotid-superior cerebellar artery (SCA) anastomosis without opacification of the basilar artery was first reported as a variant of PTA in 1972.³⁶⁾ Since then, 67 cases have been described.^{1,4-6,9-14,16-20,22,24-28,30,31,33,35-40)}

We report a case of this PTA variant associated with aneurysm that was successfully treated with the Guglielmi detachable coils (GDCs).

Case Presentation

A 69-year-old woman was admitted to our hospital with the chief complaint of diplopia. She had

suffered from diplopia on right lateral gaze for the last 4 months. Neurological examination on admission showed only right abducens nerve paresis without other deficits. T₁- and T₂-weighted magnetic resonance (MR) imaging showed a signal void in the right cavernous sinus (Fig. 1). Right carotid angiography showed an aneurysm of $17 \times 16 \times 14$ mm size at the cavernous portion of the internal carotid artery (ICA) and an anomalous anastomotic vessel from the cavernous ICA (Fig. 2). The aneurysm originated from the junction of the PTA variant and the ICA. The neck of the aneurysm was 3 mm in diameter and the dome of the aneurysm projected superiorly. The neck was smaller than the dome of the aneurysm. Therefore, we planned intra-aneurysmal coil embolization with preservation of the ICA and PTA variant.

A Fas Tracker microcatheter (Target Therapeutics, Fremont, Calif., U.S.A.) with two tip markers was introduced into the aneurysm by a femoral approach via a guiding catheter (Fas Guide; Target Therapeutics). Almost total obliteration of the aneurysm was achieved after inserting 15 GDCs with a total length of 292 cm. Angiography showed

Fig. 1 Magnetic resonance images (left: T₁-weighted coronal view, right: T₂-weighted axial view) showing a signal void (arrow) in the right cavernous sinus.

Fig. 2 Preoperative internal carotid arteriograms (left: anteroposterior view, right: lateral view) showing the cavernous internal carotid artery aneurysm of 17 mm size and the anomalous anastomotic vessel from the cavernous portion of the internal carotid artery (arrow).

the flow in the PTA variant and the ICA was preserved. The anomalous anastomotic vessel supplied the posterior inferior cerebellar artery (PICA) territory (Fig. 3).

Right abducens nerve paresis improved partially one day after embolization. Although the patient did not improve neurologically at the follow-up examination, follow-up MR angiography 2 years after the embolization showed almost complete occlusion of the aneurysm and follow-up skull roentgenography showed no coil compaction.

Discussion

The trigeminal arteries appear in the 3-mm embryo

Fig. 3 Postoperative internal carotid arteriograms (left: anteroposterior view, right: lateral view) showing almost total occlusion of the aneurysm and preservation of the flow in the internal carotid artery and the primitive trigeminal artery variant (arrow) supplying the posterior inferior cerebellar artery territory.

as the second of two branches of the first aortic arch.²⁹⁾ The trigeminal arteries communicate with fragments of the paired longitudinal neural arteries, which are formed in the region of the future basilar artery, during the 4-mm stage. The SCA develops for the first time as a definite vessel, which leaves the cranial end of the basilar artery and supplies the region of the trochlear nerve and the developing metencephalon, in the 7- to 10-mm embryo.²⁹⁾ The basilar artery is usually fully formed from the paired longitudinal arteries by the 11.5-mm stage (35 days gestation). Involution of the trigeminal artery occurs during the formation of the basilar artery and is usually complete by the 14-mm stage.^{11,36)} The stem of the anterior inferior cerebellar artery (AICA) can be identified by the 18-mm stage (48 days).

Persistence of the PTA with normal fusion of the paired longitudinal arteries into the basilar artery may result in a carotid-basilar artery anastomosis and persistence of the PTA with incomplete fusion of the paired longitudinal arteries may result in the SCA or inferior cerebellar vessel arising anomalously from the cavernous ICA.¹¹⁾ PTA variant could develop with the anastomosis between the ICA and the cerebellar artery, when the primitive lateral basilovertbral anastomosis is present and the anastomosis between primitive lateral basilovertbral anastomosis and longitudinal neural artery is obliterated.¹²⁾ This hypothesis suggests that the PTA variant must run along the same course as does the PTA after branching from the ICA and connect directly with the cerebellar artery without an interposed segment of basilar artery. This means that the PTA variant arises from the junction of the presellar

and juxtasegmental segments of the ICA and passes upward and posteriorly or almost posteriorly through the cavernous sinus medially to the trigeminal nerve. Some PTAs penetrate the dorsum sellae and others penetrate the dura mater at the petrous apex. An anomalous AICA arose from the cavernous ICA and coursed dorsally between the fifth and eighth cranial nerves in close proximity to the root entry zone of the fifth cranial nerve.¹⁴⁾

The 67 cases of PTA variant occurred in 15 males, 31 females, and not mentioned in 21 patients, aged from 8 months to 77 years (mean 44.6 years). Approximately 71.6% of PTA variants connected with the AICA, 28.4% with the SCA, and 18.0% with the PICA.

Almost 14% of cases of PTA are associated with an intracranial aneurysm,⁸⁾ but the associated aneurysm arose from the PTA in only 2% of cases.²³⁾

Twenty-two aneurysms occurred in 15 of the 67 cases of PTA variant.^{1,6,9,12,14,19,20,26,28)} Most of the associated aneurysms were found at the circle of Willis. Only four cases^{9,20,39)} including our case were associated with an aneurysm arising from the junction of the ICA and PTA variant. A 32-year-old woman presented with subarachnoid hemorrhage in whom cerebral angiography demonstrated the SCA originating from the cavernous segment of the ICA and the aneurysm at the junction of the right ICA and PTA variant.²⁰⁾ A 67-year-old woman presented with subarachnoid hemorrhage in whom the AICA originated from the cavernous segment of the right ICA and the fusiform aneurysm at the junction of the right ICA and PTA variant.³⁹⁾ In another case, a 71-year-old woman presented with subarachnoid hemorrhage in whom cerebral angiography demonstrated a saccular aneurysm located on the distal portion of the PTA variant trunk.⁹⁾ This patient underwent endovascular surgery. The proximal end of the PTA variant segment including the aneurysm was occluded with a coil after the provocation test with amobarbital sodium proved negative. The patient's clinical course was unremarkable and she was discharged without neurological deficit. In our patient, the aneurysm was occluded by intra-aneurysmal coiling with preservation of the PTA variant and the ICA.

The clinical significance of the PTA variants is not yet completely defined, but the territory of these vessels is important. The territory supplied by the cerebellar arteries is variable and the hemodynamic balance between the arteries makes individual territories difficult to delimit precisely. However, therapeutic occlusion of the ICA carries potential risks of brain stem and/or cerebellar ischemia.^{3,14,30,36)}

We think that the possibility of the presence of

PTA variant should always be considered when cavernous portion aneurysm is treated.

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