

# Digital subtraction angiography of a persistent trigeminal artery variant

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## ABSTRACT

Persistent trigeminal artery variants are described as cerebellar arteries that directly originate from the precavernous segment of the internal carotid artery. This has been observed in 0.18% of cerebral catheter angiograms. On the other hand, a persistent trigeminal artery variant feeding both the anterior inferior cerebellar artery and the posterior inferior cerebellar artery territory is very rare. We present this uncommon anomalous artery along with digital subtraction angiography findings and discuss its clinical significance in light of the literature.

*Key words:* • digital subtraction angiography • internal carotid artery • subarachnoid hemorrhage

**P**ersistent trigeminal artery (PTA) is the most common persistent carotid-basilar arterial anastomosis with an incidence of 0.1–0.2% in large angiographic series (1–3). Moreover, direct anastomosis between precavernous portion of the internal carotid artery (ICA) and the cerebellar arteries without interposition of the basilar artery are described as PTA variants (4–7). Although the anterior inferior cerebellar artery (AICA) is the most common variant type of PTA, its course to the AICA-posterior inferior cerebellar artery (PICA) territories of the cerebellum at once is very rare, to the best of our knowledge. In this case report, we describe a case where the PTA variant supplied the ipsilateral AICA territory and most of the PICA territory. The significant catheter digital subtraction angiographic (DSA) features of this anomalous artery are also shown.

## Case report

A 61-year-old male was admitted to the hospital for the evaluation of acute subarachnoid hemorrhage. He had no significant past or family medical history except headache for one year. Cranial computed tomography (CT) showed perimesencephalic subarachnoid hemorrhage (Fig. 1). Because of the suspicion of an aneurysm, a four-vessel cerebral catheter DSA was performed. Carotid artery injections were performed via the internal carotid arteries. DSA demonstrated the PTA variant as a vessel originating from the precavernous portion of the right internal carotid artery and running to the posterior fossa without joining the basilar artery. The anomalous artery was paired in two groups. While the anterior group vessels were blushing the AICA territory completely, the posterior group vessels, supplied most of the PICA territory (Figs. 2, 3). On the left vertebral artery angiogram, there was no right AICA filling (Fig. 4). The right vertebral angiography demonstrated a rudimentary right PICA and absence of the right AICA (Fig. 5). No vascular lesions, such as an aneurysm at the junction of the ICA and PTA variant, were encountered. This case was interpreted as idiopathic perimesencephalic hemorrhage by CT and follow-up catheter angiography was not performed.

## Discussion

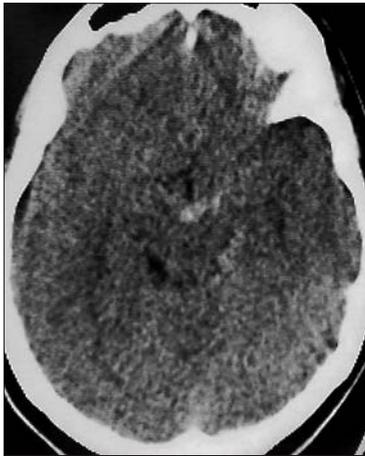
Teal et al. were the first to report a case of the cerebellar arteries originating from the ICAs but these anomalous arteries did not have interposition with the basilar artery (8). The PTA variant may irrigate the corresponding territories of the AICA or PICA, or the superior cerebellar artery (SCA). The most commonly encountered PTA variant type is the AICA (3, 4). On the other hand, PTA variant feeding both AICA and PICA territories is very rare (7).

There was no additional vascular anomaly in our case. In the study of Siqueira et al. (4), 10 patients with 11 anomalous origins of the cerebel-

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**Figure 1.** Axial cranial CT image shows slight subarachnoid hemorrhage in the basal cisterns.



**Figure 2.** On lateral projection DSA image of the right internal carotid artery injection, an anomalous arterial structure (arrows) that originates from the precavernous segment, and courses through the posterior fossa is seen.



**Figure 3.** Oblique projection DSA image of the right internal carotid artery injection shows blushing of the territories of anterior inferior cerebellar artery (open arrow) and posterior inferior cerebellar artery (solid arrow) by the persistent trigeminal artery variant.



**Figure 4.** On anteroposterior projection DSA image of the left vertebral artery, there is no right anterior inferior cerebellar artery filling.



**Figure 5.** On anteroposterior projection DSA image of the right vertebral artery, the anterior inferior cerebellar artery was not seen and a hypoplastic branch that originates from the posterior inferior cerebellar artery site (arrowhead) is identified.

lar arteries from the ICA were shown among 5,500 angiographic examinations with an incidence of 0.18%. While the PTAs terminate as they join the basilar artery, the PTA variants usually do not usually encompass the basilar artery, and they are diagnosed because of the similarity of their course and distribution to the normal cerebellar arteries (4).

In imaging studies of PTA and PTA variants usually unilateral persistence was shown (2–4). In our case, unilateral PTA variants irrigated the corresponding territories of the AICA and PICA. Some arteries such as the meningo-hypophyseal trunk, the artery of the inferior cavernous sinus, and AICA are described as arising from the proximal or distal part of the PTA in the literature (6). Persistent anastomoses have also been associated with a variety of

anomalies in the normal cerebral vasculature. Some hypoplastic or agenetic vessels (such as the common carotid artery, basilar artery, and vertebral arteries), cerebral aneurysms and arteriovenous malformations or Moyamoya disease have also been reported associated with a PTA (2, 4, 6, 7, 9, 10). Although a high prevalence of saccular cerebral aneurysms was reported to be associated with the PTA or variants in some studies, a study including 34 patients with PTA demonstrated that the aneurysm prevalence is no greater than in the general population (2). While subarachnoid hemorrhage was seen in our case on CT, the four-vessel cerebral catheter DSA did not show any aneurysm.

In subjects with normal anatomy, the territory volume that the cerebellar arteries supply is variable and different distributions due to hemodynamic changes can be seen (4). The AICA and PICA territories are usually complementary. If one of the AICA or PICA is hypoplastic, the well-developed cerebellar artery supplies the territory of the hypoplastic one (11). This compensatory mechanism also coexists in cases with direct origination from the internal carotid artery. In cases with a PTA variant, a corresponding artery of a vertebrobasilar origin may be absent or hypoplastic depending on the caliber of the artery or the width of the irrigation area (4). In our case, the PTA variant supplied the ipsilateral AICA territory and most of the PICA territory. The AICA was completely absent and the PICA was notably hypoplastic on the vertebrobasilar system similar to the case of Rossitti and Raininko (7). It is known that the PTA has protective effects on the brain-stem and posterior circulation. At the same time, PTA var-

iants are not able to feed directly the basilar artery, with which they are not related with. In occlusions of the vertebrobasilar system, they play protective roles only for supplying the cerebellar artery territories. In addition, they can supply the other branches of the basilar artery retrogradely and collaterally (1, 4, 12).

There are some imaging studies about the existence of PTA and its variants by magnetic resonance imaging (MRI) and MR angiography. Conventional MRI or MR angiography can show large PTAs but fails to detect especially the small-caliber PTAs or PTA variants. Besides, MRI and MR angiography can not detect the distal segments of these anomalous vasculature (3, 6, 13).

In conclusion, we presented a PTA variant supplying the vascular territory of the AICA and most of territory of the PICA, and discussed its clinical significance. Awareness of existence and course of this anomalous vessel is helpful for various treatment strategies. Endovascular procedures should be modified accordingly to avoid ischemia of the cerebellum. On the other hand, failure to recognize such anomalous vessels may lead to the infarctions of posterior circulation after therapeutic balloon occlusion or ICA clamping for carotid endarterectomy. In these cases, embolism originating from the carotid arteries can also cause a high incidence of ischemic attacks in the posterior fossa.

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