Surg Radiol Anat (2018) 40:237–240
DOI 10.1007/s00276-017-1933-9

ANATOMIC VARIATIONS

Persistent trigeminal artery variant terminating in the posterior inferior cerebellar artery: a case report

Ga Young Lee[1] · Young Jin Heo[1] · Hyun Seok Jung[1] · Hye Jung Choo[1] · Young Jun Cho[1] · Hae Woong Jeong[1] · Jin Wook Baek[1]

Received: 13 June 2017 / Accepted: 30 September 2017 / Published online: 7 October 2017

Abstract Persistent trigeminal artery (PTA) is a rare cerebrovascular variation of remnant fetal carotid-vertebrobasilar anastomoses. The PTA variant terminates in the cerebellar artery with no direct connection to the basilar artery. We present a rare case of a PTA variant that terminated directly into the ipsilateral posterior inferior cerebellar artery.

Keywords Persistent trigeminal artery · Posterior inferior cerebellar artery · Internal carotid artery · Posterior communicating artery

Introduction

Persistent trigeminal artery (PTA) is the most common type of carotid-vertebrobasilar anastomosis, with an incidence of approximately 0.2% [1, 2]. PTA variants are rare, and occur when the PTA terminates in the cerebellar artery with no direct connection to the basilar artery [1, 3–5]. Herein, we report an extremely rare case of PTA variant that terminated directly into the ipsilateral posterior inferior cerebellar artery (PICA).

Case report

A 51-year-old woman with no underlying medical illness presented to a hospital with a headache following a car accident. Computed tomography imaging of the brain demonstrated no specific abnormal findings such as intracranial hemorrhage or skull fracture. Further evaluation was performed using magnetic resonance angiography (MRA), which revealed multiple saccular aneurysms at the origin of the right posterior communicating artery (PCOM), paraclinoid (ophthalmic) segment of the left internal carotid artery (ICA), and the left middle cerebral artery (MCA) trifurcation. An aberrant vessel, which originated from the proximal cavernous segment of the left ICA and ran posteriorly without joining the basilar artery, was also detected (Fig. 1).

The patient was subsequently transferred to our institution, whereby digital subtraction angiography (DSA) was performed. DSA demonstrated the same findings as those on MRA. The aberrant vessel supplied the left posterior inferior cerebellar hemisphere in the PICA. Therefore, we concluded that this vessel was a variation of the PTA that showed direct termination into the ipsilateral PICA, with no communication with the basilar artery (Saltzman type IIIc; Fig. 2). The rest of the PICA territory was supplied by the PICA arising from the V4 segment of the left vertebral artery (VA) (Fig. 2c). The patient was discharged following conservative treatment, with plans for surgical treatment of her aneurysms.

✉ Jin Wook Baek
baekjuk@hanmail.net

[1] Department of Diagnostic Radiology, Inje University Busan Paik Hospital, 75, Bokji-ro, Busanjin-gu, Busan 47392, South Korea

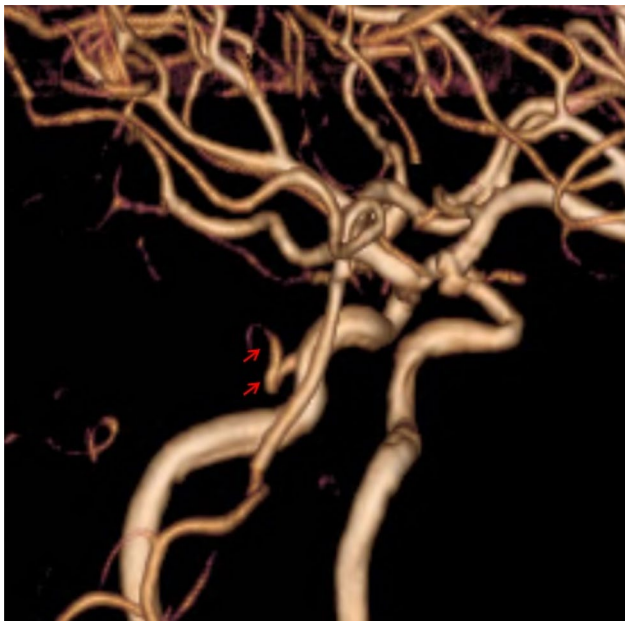

Fig. 1 MRA 3D reconstruction images show an aberrant vessel, which arises from the proximal cavernous segment of left ICA and runs posteriorly without joining the basilar artery

Discussion

According to Padget, there are five fetal carotid-basilar anastomoses at 5 weeks of gestational age: the trigeminal artery, otic artery, hypoglossal artery, and proatlantal arteries (type I and type II) from the craniocaudal direction [1, 6]. These anastomoses usually regress during the development of the PCOM and vertebrobasilar artery by fusion of two longitudinal neural arteries [1, 6]. Failure of this regression mechanism results in the persistence of carotid-vertebrobasilar anastomosis after birth. The PTA is the most common type of carotid-vertebrobasilar anastomosis, with an incidence of approximately 0.2% [1, 2].

The angiographic appearance of PTA was classified into three types by Saltzman [7]. Saltzman type I PTA terminates at the basilar artery between the level of the superior cerebellar artery (SCA) and anterior inferior cerebellar artery (AICA). This PTA supplies PCAs and SCAs, and conversely, the proximal basilar artery and PCOM become hypoplastic. Saltzman type II PTA joins the basilar artery above the origin of the SCAs. In this type, the PCOM is patent and supplies the ipsilateral PCA. Type I combined with type II is known as Saltzman type III PTA. Variations of the PTA with no direct connection to the basilar artery have also been included into Saltzman type III [8]. Ali et al. [3] divided Saltzman type III PTAs into three subtypes: those terminating directly into the SCA (type IIIa), AICA (type IIIb), or PICA (type IIIc). The incidence of PTA variants (type III) has been reported to be approximately 0.18% [5, 9]. Type IIIb is the most common, while types IIIa and IIIc are extremely rare. The PTA variant we report in this case is consistent with type IIIc. Interestingly, this case showed another ipsilateral PICA originating from the V4 segment of the left VA that supply vermis of the cerebellum. The cerebellar hemisphere is very often supplied by one or two ipsilateral PICAs on the same side. The PTA only supplies the cerebellar hemisphere, while the vermis of the cerebellum can be supplied by another ipsilateral PICA emerging from the vertebral artery (V4) as in our case or by a contralateral PICA. The perforators for the brainstem originate from the second PICA arising from V4, not from the VA or from the PTA [10].

PTAs and its variants are usually found incidentally and rarely cause neurological symptoms, including oculomotor nerve palsy and trigeminal neuralgia [9, 11, 12]. Various vascular anomalies are also associated with PTA, including aneurysms of the circle of Willis, arteriovenous malformation, carotid-cavernous fistula, agenesis of the carotid and vertebral arteries, and Moyamoya disease [3, 4]. In this case, we identified multiple aneurysms located at the origins of the right PCOM and left paraclinoid (ophthalmic) segment of left ICA, as well as the left MCA trifurcation.

In conclusion, we report a case of PTA variant that terminated directly into the PICA, combined with multiple cerebrovascular aneurysms. Although PTAs and its variants are rare, neuroradiologists and neurosurgeons should be aware of this variation during endovascular intervention and surgery to avoid ischemia of the brainstem and cerebellum via vascular injury and emboli passing through a PTA or its variants.

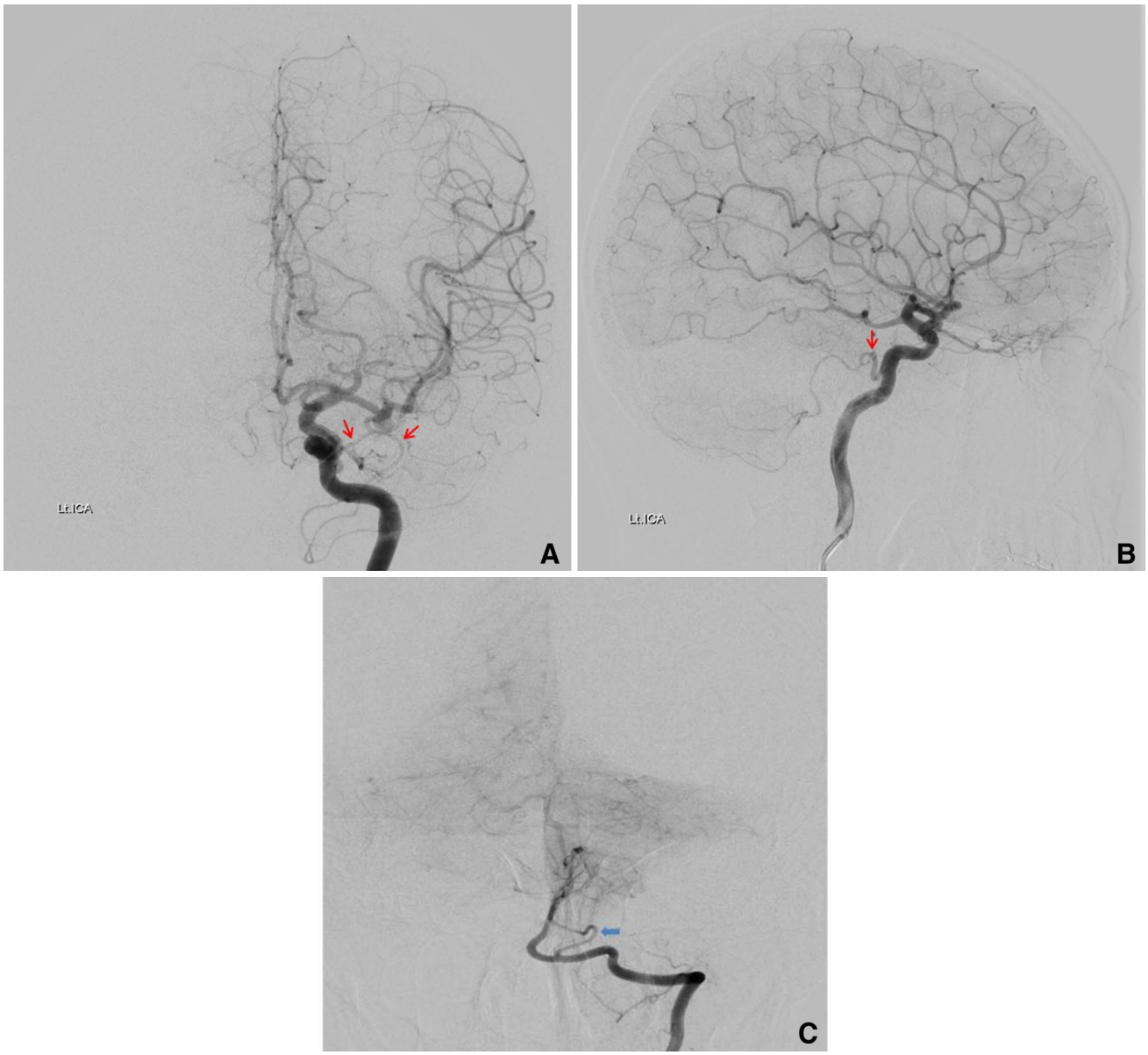

Fig. 2 Anteroposterior (AP) view (**a**) and lateral (**b**) views of the left ICA angiography, showing variation of the persistent trigeminal artery (arrows), which supplies the left posteroinferior cerebellar hemisphere and PICA territory. On AP view of the left VA angiography (**c**), there is another PICA, arising from V4 segment of left VA (thick arrow) that supplies the rest of the PICA territory

Compliance with ethical standards

Conflict of interest The author(s) declare that they have no conflict of interest.

References

1. Bosch D (2002) Surgical neuroangiography, vol 1. Lasjaunias P, Berenstein A, ter Brugge KG (eds) Clinical Vascular Anatomy and Variations. Springer, Berlin (**2001**)
2. Luh GY, Dean BL, Tomsick TA, Wallace RC (1999) The persistent fetal carotid-vertebrobasilar anastomoses. AJR Am J Roentgenol 172:1427–1432
3. Ali S, Radaideh MM, Shaibani A, Russell EJ, Walker MT (2008) Persistent trigeminal artery terminating in the posterior inferior cerebellar artery: case report. Neurosurgery 62:E746-8
4. Samaniego EA, Dabus G, Andreone V, Linfante I (2011) Rare anatomical variations of persistent trigeminal artery in two patients with non-aneurysmal subarachnoid hemorrhage. J Neurointerv Surg 3:282–284
5. Siqueira M, Piske R, Ono M, Marino Junior R (1993) Cerebellar arteries originating from the internal carotid artery. AJNR Am J Neuroradiol 14:1229–1235

6. Padget DH (1948) The development of the cranial arteries in the human embryo. Contr Embryol 32:205–261
7. Saltzman G (1959) Patent primitive trigeminal artery studied by cerebral angiography. Acta Radiol 51:329–336
8. McKenzie JD, Dean BL, Flom RA (1996) Trigeminal-cavernous fistula: Saltzman anatomy revisited. AJNR Am J Neuroradiol 17:280–282
9. Uchino A, Saito N, Okada Y, Kozawa E, Mizukoshi W, Inoue K, Takahashi M (2012) Persistent trigeminal artery and its variants on MR angiography. Surg Radiol Anat 34:271–276
10. Mercier P, Brassier G, Fournier H, Picquet J, Papon X, Lasjaunias P (2008) Vascular microanatomy of the pontomedullary junction, posterior inferior cerebellar arteries, and the lateral spinal arteries. Interv Neuroradiol 14:49–58
11. Lee SH, Koh JS, Lee CY (2011) Trigeminal neuralgia caused by an anomalous posterior inferior cerebellar artery from the primitive trigeminal artery: case report. The Cerebellum 10:199–203
12. Wakuta N, Abe H, Nonaka M, Higashi T, Ueba T, Inoue T (2015) Management of trigeminal neuralgia caused by an intraneural spiral trigeminocerebellar artery: a case report. J Neurol Surg Rep 76:e59–e61