



Ascending pharyngeal artery–posterior inferior cerebellar artery anastomosis via the jugular foramen: a case report and literature review

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Abstract

The posterior inferior cerebellar artery (PICA) rarely arises from the cavernous segment of the internal carotid artery (ICA) and is called persistent trigeminal artery variant. The PICA also can arise from the cervical segment of the ICA, and it enters the posterior fossa via the hypoglossal canal, where it is called persistent hypoglossal artery variant. Using magnetic resonance angiography (MRA), we diagnosed a 79-year-old man with a PICA arising from the ascending pharyngeal artery and passing through the medial side of the jugular foramen pars vascularis. Only six cases of this variation have been reported previously in the English language literature. To identify this variation on MRA, the careful observation of source images is useful. Recognizing this variation is important in order to avoid ischemic cerebellar complications during neck surgery and endovascular therapy.

Keywords Ascending pharyngeal artery · Cerebral arterial variation · Jugular foramen · Magnetic resonance angiography · Posterior inferior cerebellar artery

Introduction

The posterior inferior cerebellar artery (PICA) usually arises from the V4 segment of the vertebral artery (VA). Rarely, the PICA arises from the cavernous segment of the internal carotid artery (ICA) in one instance of persistent trigeminal artery (PTA) variants [6]. The PICA also extremely rarely arises from the cervical segment of the ICA and enters the posterior fossa via the hypoglossal canal (HC), where it is regarded as the persistent hypoglossal artery (PHA) variant [12]. Ascending pharyngeal artery (APA)-PICA anastomoses are extremely rarely seen via the HC [10] or the jugular foramen (JF) [1, 2, 4, 8, 11]. We herein report a case of APA–PICA anastomosis via the JF diagnosed by magnetic resonance angiography (MRA).

Case report

A 79-year-old man with chief complaints of vertigo underwent cranial magnetic resonance imaging (MRI) and MRA using a 3-T scanner (MAGNETOM Skyra, Siemens Medical System, Erlangen, Germany) for the evaluation of cerebrovascular diseases. MRA was obtained using a standard three-dimensional time-of flight technique. The MRI parameters were a flip angle of 18°, repetition time of 21.0 s, echo time of 3.69 s, and slice thickness of 0.8 mm. MRA of the neck region was simultaneously performed using a similar technique except for a slice thickness of 1.2 mm.

MRI revealed multiple ischemic white matter lesions in the bilateral cerebral hemispheres (not shown). MRA showed a hyperplastic right APA that continued to the right PICA (Figs. 1, 2, 3). The MRA source images revealed that the anastomotic artery passed through the medial side of the JF pars vascularis rather than the HC or foramen magnum (Fig. 2). The first author created partial volume-rendering (VR) images to demonstrate the anomalous artery more clearly (Figs. 1d, 3).

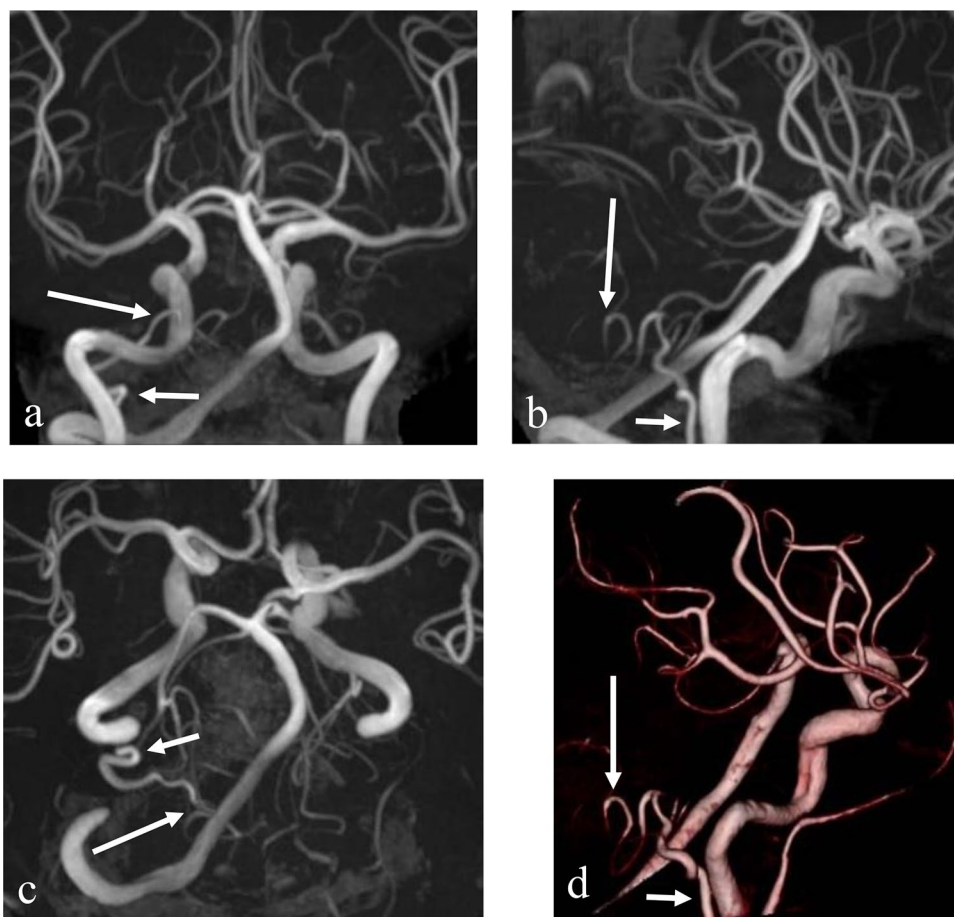
Further examinations, such as computed tomography angiography (CTA) or catheter angiography (CA), were not

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Fig. 1 Antero-posterior **a**, right lateral **b** and inferosuperior **c** projections of cranial magnetic resonance angiography (MRA) show a relatively large artery running parallel to the cervical segment of the right internal carotid artery (ICA), indicative of a hyperplastic ascending pharyngeal artery (APA) (*short arrows*). The artery enters the posterior fossa and continues to the posterior inferior cerebellar artery (PICA) (*long arrows*). The right vertebral artery (VA) is hyperplastic, while the left VA is hypoplastic. A right lateral projection of the partial volume-rendering (VR) image **d** shows the anomalous artery more clearly



performed. The patient was treated conservatively with a clinical diagnosis of benign paroxysmal positional vertigo.

Discussion

There are many types of anastomosis between the carotid and vertebro-basilar arteries (VBA) [9]. Among them, there are four types of carotid–PICA anastomosis: (1) PICA arising from the cavernous segment of the ICA (rare type of the PTA variants) [6], (2) PICA arising from the cervical segment of the ICA (PHA variant) [12], (3) anastomosis between APA and PICA via the HC (type 2 PHA variant) [10], and (4) anastomosis between APA and PICA via the JF [1, 2, 4, 8, 11] (Fig. 4). Including our patient, to our knowledge, only seven cases have been reported in the English language literature (Table 1). Many years ago, Lasjaunias et al. [5] initially reported a case of APA–PICA anastomosis using CA. However, on reviewing the CA figures presented in their paper, we were unfortunately unable to decide which anomalous artery passing through, the HC or the JF. The source images of MRA or CTA will be necessary to determine passing canal/foramen (Fig. 2).

According to the review article by Hacein-Bey et al. [3], the neuro-meningeal trunk of the APA has a hypoglossal branch, jugular branch, internal auditory canal branch, and clival branches. These branches supply the lower cranial nerves and posterior fossa dura. The posterior fossa meningeal arteries occasionally anastomose with pial arteries, such as the PICA [7]. Although the reason is unclear, the jugular branch of the APA may anastomose with the PICA exceptionally rarely. Ipsilateral VAs may not be related to the formation of APA–PICA anastomosis via the JF, because both aplastic VAs [11] and hyperplastic VAs (as in our patient) exist. Effendi et al. [1] reported a case of APA–PICA anastomosis via the JF connecting to normally originating PICA from the VA. Fujihara et al. [2] reported a case of bilateral APA–PICA anastomoses via the JF associated with bilateral carotid–anterior cerebral artery anastomoses. Excluding this bilateral patient, the right side was reported in four cases and the left side was two (four men and two women; Table 1).

Although such anastomosis is usually asymptomatic, Thomas et al. [8] reported a case of hemifacial spasm caused by APA–PICA anastomosis via the JF. Recognition of this anastomosis is important in order to avoid ischemic cerebellar complication during neck surgery and endovascular therapy. To avoid missing this rare arterial variation

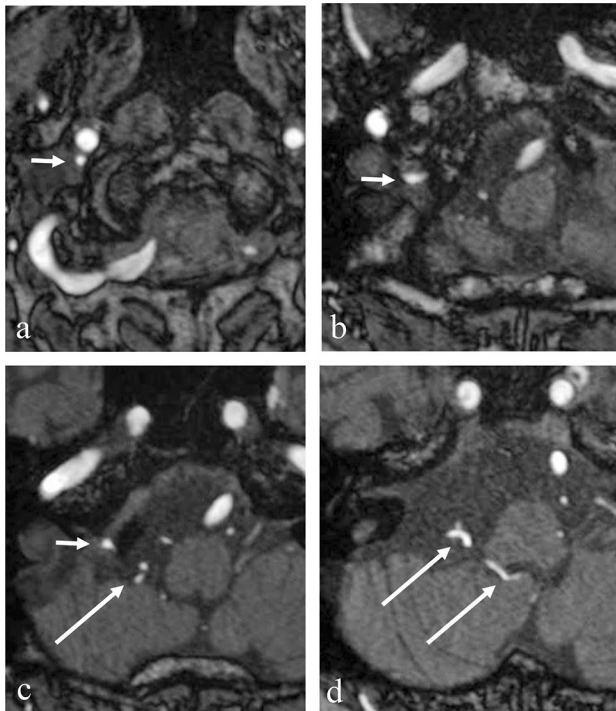


Fig. 2 Source images of MRA show that the hyperplastic APA (*short arrows*) enters the medial side of the jugular foramen pars vascularis and continues to the right PICA (*long arrows*)



Fig. 3 A right lateral projection of a partial VR image of the cervical right carotid system clearly shows the hyperplastic APA (*short arrows*). The dotted arrows indicate the occipital artery

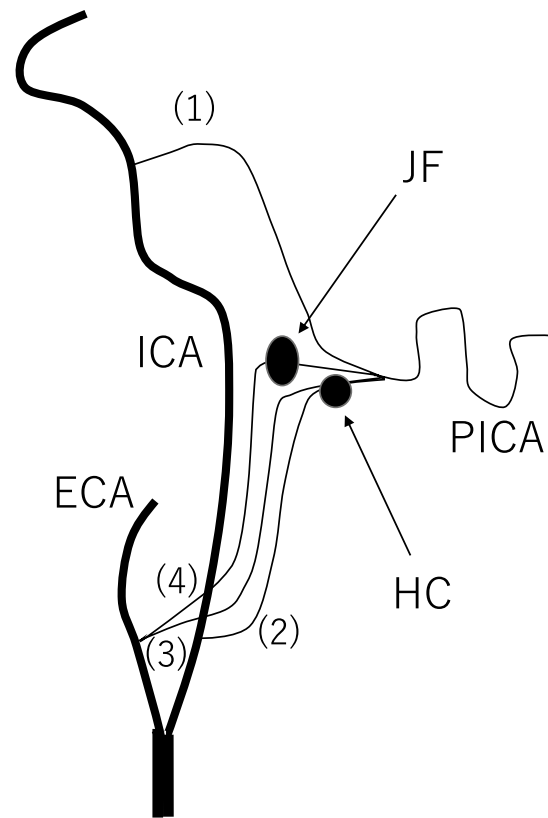


Fig. 4 A schematic illustration of the four types of carotid–PICA anastomosis in left lateral projection. Persistent trigeminal artery variant (PICA type). Persistent hypoglossal artery (PHA) variant. Type 2 PHA variant. APA–PICA anastomosis via the JF (present case). *ECA* external carotid artery, *HC* hypoglossal canal, *ICA* internal carotid artery, *JF* jugular foramen, *PICA* posterior inferior cerebellar artery

during interpretation of MRA and making a correct diagnosis, the careful observation of source images is required (Fig. 2). If possible, the creation of partial VR images should be performed to ensure the clear identification of arterial variation with a three-dimensional appearance (Figs. 1d, 3).

Conclusions

We encountered a case of APA–PICA anastomosis via the JF, an extremely rare type of carotid–VBA anastomosis, diagnosed by MRA. To identify this variation, the careful observation of MRA source images is required.

Table 1 Reported cases of ascending pharyngeal artery-posterior inferior cerebellar artery anastomosis via the jugular foramen

	Year (Reference no)	Age/sex	Side	Ipsilateral VA	Associated arterial variations	Clinical symptoms	Diagnostic modality
1	2011 [11]	58/Female	Right	Aplastic	None	None	MRA
2	2011 [11]	69/Male	Right	Hypoplastic	None	None	MRA
3	2015 [8]	33/Male	Right	Hyperplastic	NA	Right hemifacial spasm	CTA
4	2016 [1]	NA	Left	Normal VA-PICA	NA	NA	Cadaver dissection
5	2019 [2]	50/Male	Bilateral	Dominant left VA	Bilateral carotid-ACA anastomoses	Nuchal pain	MRA, CTA, CA
6	2020 [4]	63/Female	Left	Normal	None	Right hemifacial spasm	MRA, CTA, CA
7	Present case	79/Male	Right	Hyperplastic	None	Vertigo	MRA

ACA anterior cerebral artery, CA catheter angiography, CTA computed tomography angiography, MRA magnetic resonance angiography, NA not applicable, PICA posterior inferior cerebellar artery, VA vertebral artery

Author contributions AU carried out the study design and drafted the manuscript. All authors reviewed the manuscript critically, and have read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest We declare that we have no conflict of interest.

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