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Left anterior inferior cerebellar artery supplied by an anomalous branch arising from the right vertebral artery: a case diagnosed by magnetic resonance angiography

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Research Article

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Abstract

Purpose

To describe a case of a left anterior inferior cerebellar artery (AICA) supplied by an anomalous branch arising from the contralateral right vertebral artery (VA).

Methods

An 88-year-old woman presenting with vomiting underwent cranial magnetic resonance imaging (MRI), MR angiography (MRA), and MR cisternography using a 3-T scanner. MRA was performed using a standard three-dimensional (3D) time-of-flight technique. MR cisternography was performed using 3D heavily T2-weighted imaging.

Results

MRI showed acute and chronic cerebellar infarctions in the territory of the left posterior inferior cerebellar artery (PICA). MRA showed nonvisualization of the left VA, including the left PICA. The left AICA was supplied by an anomalous branch arising from the V4 segment of the right VA. No normally arising left AICA was identified. MR cisternography showed fusion of the anomalous artery with the occluded left VA.

Conclusion

The AICA usually arises from the proximal basilar artery. Several variations in the origin of the AICA have been reported. We report the first case of a left AICA supplied by the contralateral right VA. The proximal segment of the anomalous left AICA appears to represent a connecting artery between the right VA and the occluded left VA. The anastomotic artery between the bilateral VAs may have developed as a variation of the anterior spinal artery system. MR cisternography is useful for identifying an occluded artery within the cistern. Careful observation of MRA, together with the generation of partial volume-rendered images, may facilitate the identification of this rare arterial variation.

Introduction

The anterior inferior cerebellar artery (AICA) usually arises from the proximal basilar artery (BA) and supplies the anterolateral surface of the pons and cerebellum. According to a meta-analysis by Tempski et al. [9], the prevalence of a BA-origin AICA in the general population is approximately 90%. The AICA may also arise from the terminal segment of the vertebral artery (VA) or from a hyperplastic posterior inferior cerebellar artery (PICA), forming a common trunk of the PICA and AICA. An AICA arising from the

cavernous or precavernous segment of the internal carotid artery (ICA) is regarded as a persistent trigeminal artery (PTA) variant [6]. Other variations in the origin of the AICA are extremely rare [7].

Herein, we report a case of a left AICA arising from the contralateral right VA. To our knowledge, no similar case has been reported in the relevant English-language literature.

Case report

An 88-year-old woman presenting with vomiting underwent cranial magnetic resonance imaging (MRI), MR angiography (MRA), and MR cisternography using a 3-T scanner (MAGNETOM Skyra; Siemens Healthineers, Erlangen, Germany). MRA was performed using a standard three-dimensional (3D) time-of-flight (TOF) technique. The imaging parameters were as follows: flip angle, 15°; repetition time, 38.0 ms; echo time, 3.7 ms; slice thickness, 0.5 mm; number of slices, 190; slab thickness, 95 mm; and field of view, 25.2 × 18.0 cm. MR cisternography was performed using 3D heavily T2-weighted imaging. The imaging parameters were as follows: repetition time, 3000 ms; echo time, 499 ms; and slice thickness, 0.7 mm.

MRI showed acute and chronic left cerebellar infarctions in the territory of the left PICA. MRA showed occlusion of the left VA, including the left PICA (Figs. 1 and 2). Partial volume-rendering (VR) images of the vertebrobasilar system clearly demonstrated the left AICA arising from the contralateral right VA (Fig. 2). MR cisternography demonstrated the occluded left VA, which was continuous with the anomalous left AICA (Fig. 3). Therefore, the proximal segment of the anomalous artery could be regarded as an anastomotic artery connecting the bilateral VAs. A schematic illustration of the arterial variations in this patient is presented in Fig. 4.

The patient was treated conservatively and had a good clinical course. Neither cranial computed tomography angiography (CTA) nor catheter angiography was performed.

Discussion

The cerebellar artery that arises from the proximal BA and supplies the anterolateral surface of the pons and cerebellum is called the AICA. It courses through the central portion of the cerebellopontine angle. The AICA consists of four segments: (1) the anterior pontine segment, (2) the lateral pontine segment, (3) the flocculonodular segment, and (4) the cortical segment [3]. The cerebellar artery that arises from the VA and supplies the posteroinferior surface of the cerebellum is called the PICA. However, there are numerous variations in the origins and configurations of both the AICA and PICA. The AICA may arise from the terminal segment of the VA. The AICA may also arise from a hyperplastic PICA, forming a common trunk of the PICA and AICA. Conversely, a hyperplastic AICA may supply the PICA territory, forming a common AICA–PICA trunk.

According to a meta-analysis by Tempski et al. [9], the AICA was absent in 2.9% of cases, had a single branch in 85.5%, and had double or triple branches in 10.4%. The reported origins of the AICA were the

BA (90.1%), VA (10.1%), PICA (6.9%), and an AICA–PICA common trunk (9.5%). They also reported an ICA origin of the AICA in 32.6%, an extremely high prevalence that was probably attributable to misinterpretation. An AICA arising from the ICA without a connection to the BA is regarded as a PTA variant. Using a 1.5-T scanner, the first author previously reported a prevalence of the AICA-type PTA variant of 0.14% [10]. However, this prevalence may have been underestimated because of the relatively low spatial resolution of the 1.5-T scanner. Sato et al. [7] recently reported a case of an AICA supplied by the hypoglossal branch of the ascending pharyngeal artery. To our knowledge, no other rare variations in the origin of the AICA have been reported.

The anterior spinal artery (ASA) is present between the bilateral VAs and arises from the terminal segments of both VAs [2]. Therefore, the bilateral VAs are normally connected via the ASA. In our patient, a connecting artery between the bilateral VAs was present in the premedullary cistern. However, it was located at a lower level than the usual site of origin of the ASA. Several radiculomedullary arteries, including the artery of Adamkiewicz, also contribute to the blood supply of the ASA. In general, arterial variations are thought to result from abnormal regression, fusion, or persistence of the primitive arterial network during early embryonic development. Siclari et al. [8] reported that a PICA originating at the C1/2 level may be formed by variations in the size and connections of the lateral spinal artery (LSA) or posterior spinal artery (PSA) systems. In our patient, the anomalous artery was located in the premedullary cistern. Therefore, the anastomotic artery between the bilateral VAs may have developed as a variation of the ASA system. PTA variants may be formed by partial persistence of the primitive lateral basilovertebral anastomosis (PLBA) [5]. Therefore, the left AICA in our patient may have been partly formed by persistence of the PLBA.

In our patient, the left VA was not visualized on MRA. In contrast, MR cisternography demonstrated the occluded left VA. MR cisternography is useful for identifying structures within the cisterns, including the arterial system [1]. Nagahata et al. [4] initially reported the usefulness of basiparallel anatomic scanning (BPAS) for evaluating the surface appearance of the vertebrobasilar arteries. Originally, they used a thick-slice two-dimensional technique. We used a three-dimensional technique, which clearly demonstrated the detailed configuration of the occluded left VA and the anomalous connecting artery between the bilateral VAs (Fig. 3).

Conclusions

The authors report a case of a left AICA arising from the contralateral right VA. The proximal segment of the anomalous left AICA appears to represent a connecting artery between the right VA and the occluded left VA. MR cisternography is useful for identifying an occluded artery within the cistern. Careful observation of MRA, together with the generation of partial VR images, may facilitate the identification of this rare arterial variation.

Declarations

Conflict of interest

The authors declare no competing interests.

Ethical approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent for publication

The patient gave her written informed consent for the publication of publishing of his data and figures.

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Author Contribution

AU designed the study and drafted the manuscript. AU and YM critically reviewed the manuscript and read and approved the final manuscript.

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Data availability

Not applicable.

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Figures

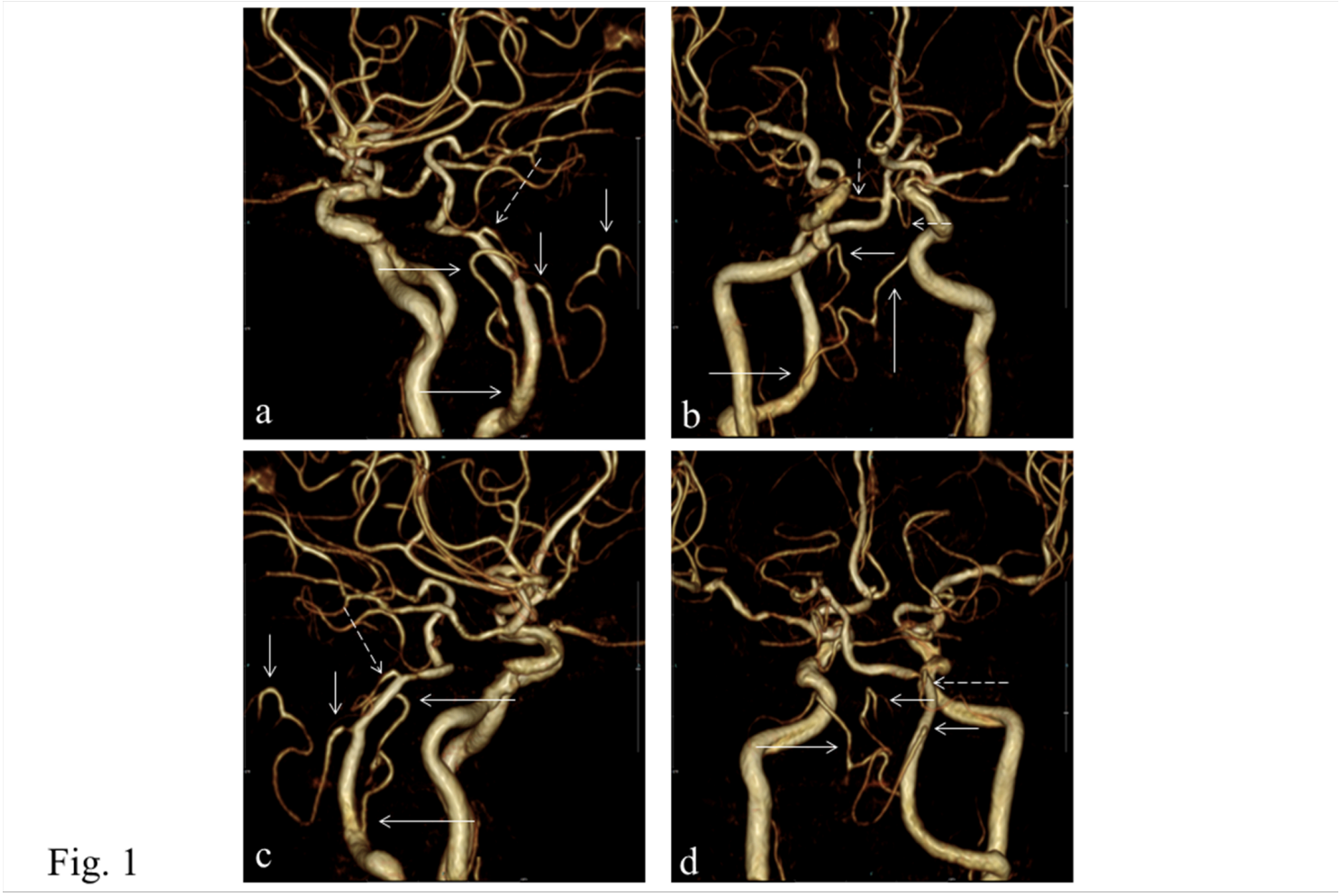


Fig. 1

Figure 1

Left lateral (**a**), anteroposterior (**b**), right lateral (**c**), and posteroanterior (**d**) projections of volume-rendered (VR) images of cranial magnetic resonance angiography (MRA).

The left vertebral artery (VA), including the left posterior inferior cerebellar artery (PICA), is not visualized. The left anterior inferior cerebellar artery (AICA) arises from the right VA (*long arrows*). The right PICA arises normally (*short arrows*). The right AICA is also visualized (*long dotted arrows*). *Short dotted arrows* indicate the bilateral superior cerebellar arteries (SCAs).

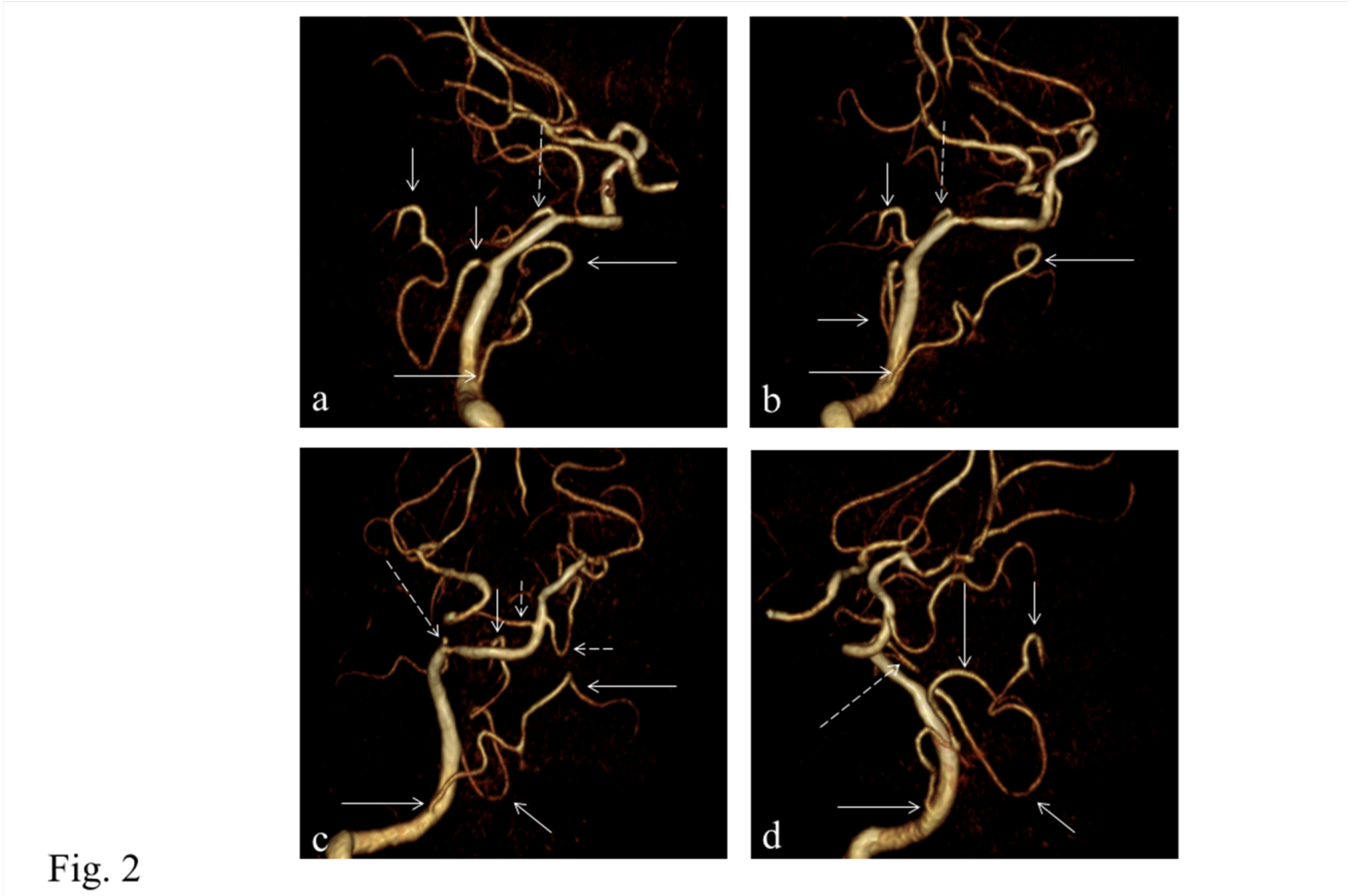


Fig. 2

Figure 2

Right lateral (**a**), right anterior oblique (**b**), anteroposterior (**c**), and left anterior oblique (**d**) projections of partial VR images of the vertebrobasilar system.

An anomalous artery arises from the proximal V4 segment of the right VA and continues to the contralateral left AICA (*long arrows*). The right PICA (*short arrows*), right AICA (*long dotted arrows*), and bilateral SCAs (*short dotted arrows*) arise normally.

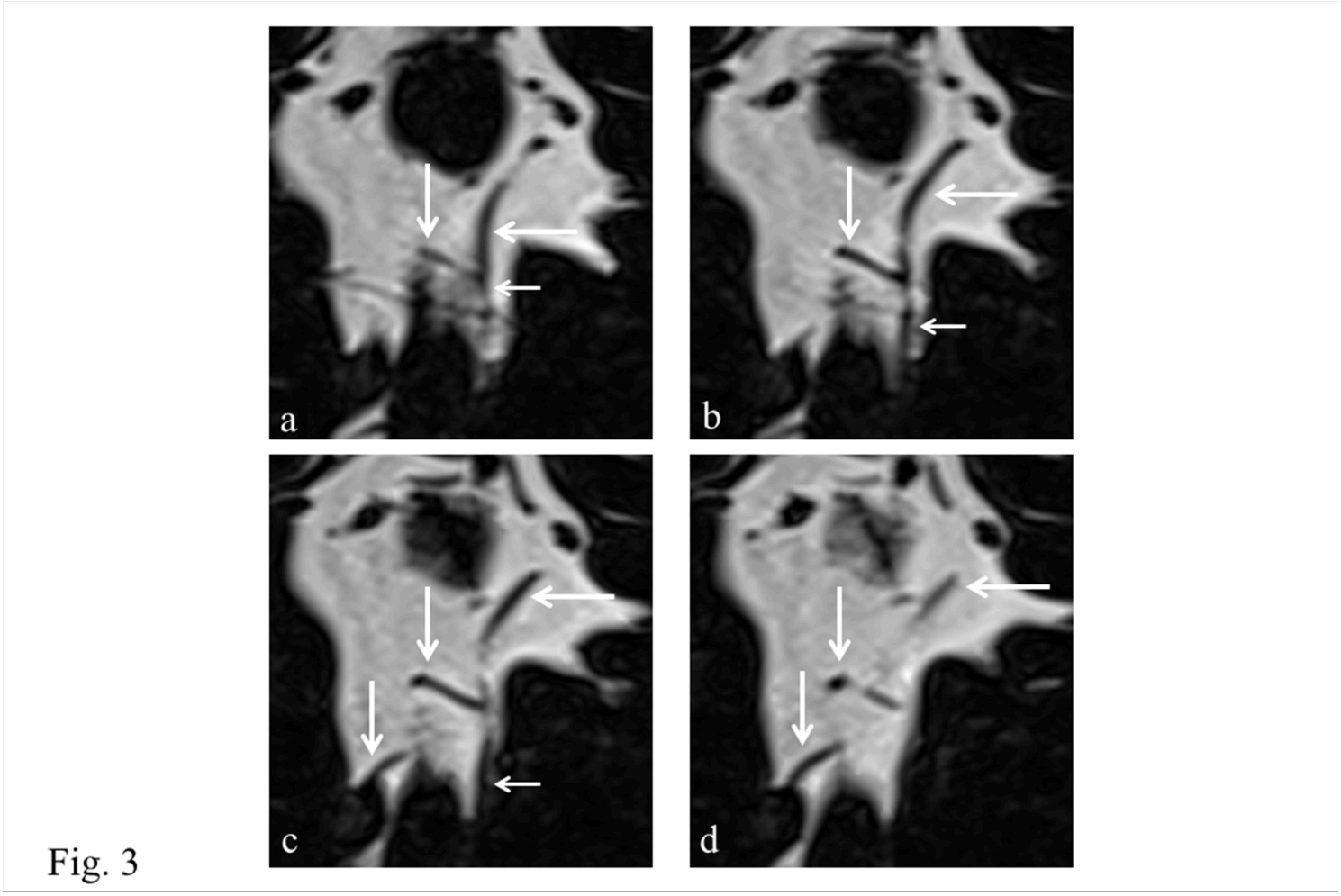


Fig. 3

Figure 3

(**a–d**) Continuous coronal images of MR cisternography (slice thickness, 0.7 mm; repetition time, 3,000 ms; echo time, 499 ms).

Long arrows indicate the anomalous artery, and *short arrows* indicate the occluded left VA. These two arteries appear to be continuous with each other. Therefore, the proximal segment of the anomalous artery can be regarded as an anastomotic artery between the bilateral VAs.

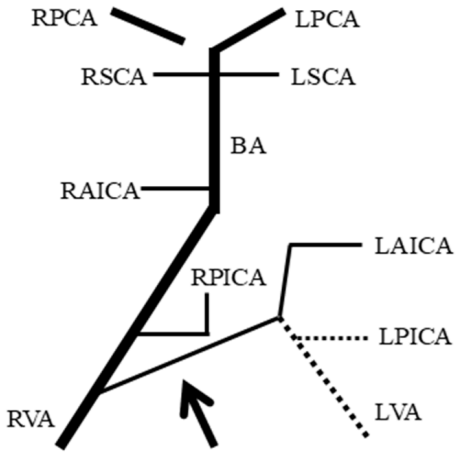


Fig. 4

Figure 4

Schematic illustration of the arterial variations in this patient (anteroposterior projection).

AICA, anterior inferior cerebellar artery; BA, basilar artery; PCA, posterior cerebral artery; PICA, posterior inferior cerebellar artery; SCA, superior cerebellar artery; VA, vertebral artery; L, left; R, right.

The *arrow* indicates the anastomotic artery between the bilateral VAs. *Dotted lines* indicate occluded arteries.