Scientific Research Publishing

Forensic Medicine and Anatomy Research, 2022, 10, 44-49
https://www.scirp.org/journal/fmar
ISSN Online: 2327-4107
ISSN Print: 2327-4115

Incidental Finding of a Fenestrated Vertebrobasilar Junction Aneurysm

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How to cite this paper: Kassé, Y., Akpo, G.L., Niang, I., Ka, K.D., Diagne, R., Mar, N.B., Talhaoui, K., Mbaye, A., Diouf, P.M.D., Fall, M.C. and BaDiop, S. (2022) Incidental Finding of a Fenestrated Vertebrobasilar Junction Aneurysm. *Forensic Medicine and Anatomy Research*, **10**, 44-49.
https://doi.org/10.4236/fmar.2022.102005

Received: March 14, 2022
Accepted: April 23, 2022
Published: April 26, 2022

Abstract

Basilar artery fenestration is a rare anatomical variation resulting from the failed fusion of the two vertebral arteries during embryonic life. In order of frequency, it is the second most common location of vascular fenestrations after the anterior communicating artery. Vertebrobasilar junction aneurysms are uncommon but often associated with basilar artery fenestration. We report the case of a fenestrated vertebrobasilar junction saccular aneurysm in a 57-year-old woman. The diagnosis was incidentally made on CT angiography which found the anatomical variant and the aneurysm. The radiological features illustrating this association are detailed here and a brief discussion of its pathogenesis and management was made. Vertebrobasilar junction aneurysms are rare and their presence should suggest an associated basilar fenestration.

Keywords

Basilar Artery Fenestration, Vertebrobasilar Aneurysm, CT Brain Angiography

1. Introduction

Basilar artery fenestration is an anatomical variation consisting of a focal duplication located on any segment of the artery. It affects 1% of the population and is observed in 5% of autopsy series [1]. It results from an incomplete fusion of the two vertebral arteries during embryonic life. In order of frequency, it is the

second most common location of intracranial vascular fenestrations after the anterior communicating artery [2].

Aneurysms of the vertebrobasilar junction are rare, representing less than 0.5% of intracranial aneurysms, and are associated in 70% of cases with a basilar fenestration [3].

Altered hemodynamic flow associated with parietal abnormalities in the presence of fenestration explains the occurrence [4] [5] [6].

The typical presentation is a non-traumatic subarachnoid hemorrhage (95.2%) and, more rarely, a compressive mass syndrome, seen in 4.8% of cases [4].

We report the case of an incidental finding of this association on CT angiography.

This report aims to detail radiological features illustrating that rare condition.

2. Observation

The patient was a 57-year-old woman with a history of pulmonary embolism who was referred to our department for a cerebral CT angiography of a suspected cerebral venous thrombosis.

CT revealed a large unruptured saccular aneurysm of 13 × 16 mm on the proximal portion of the basilar artery (**Figure 1**). Oblique coronal MIP reconstructions (Maximum Intensity Projection) facilitate the visualization of the asymmetric basilar artery fenestration at its origin, with a right branch and a dominant left branch, surrounding a wide-necked (5 mm) aneurysmal sac (**Figure 2**). 3D VRT (Volume Rendering Technique) reconstructions views show more clearly the above-described abnormalities (**Figure 3**).

No signs of complications or other vascular abnormalities were noted, and the dural venous sinuses more specifically were permeable.

Neither surgical nor endovascular treatment has been undertaken for this unruptured aneurysm. The patient was discharged after the management of the pulmonary embolism.

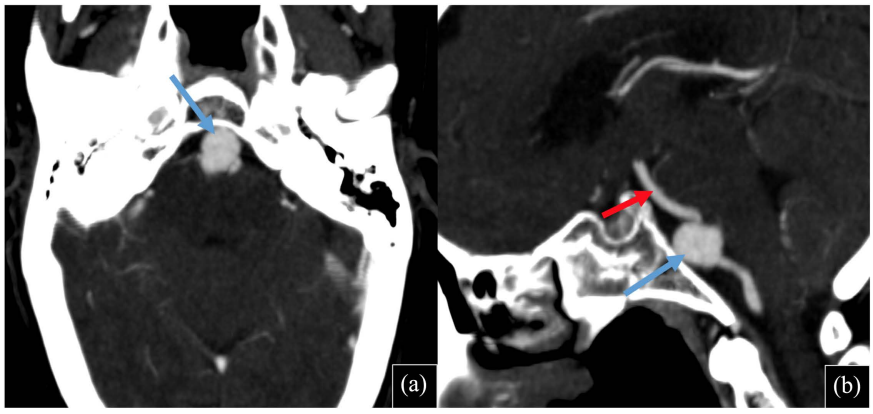

Figure 1. Cerebral CT angiography. Oblique axial section (a) and sagittal reconstruction (b) show a large unruptured saccular aneurysm (blue arrows) on the proximal portion of the basilar trunk (red arrow).

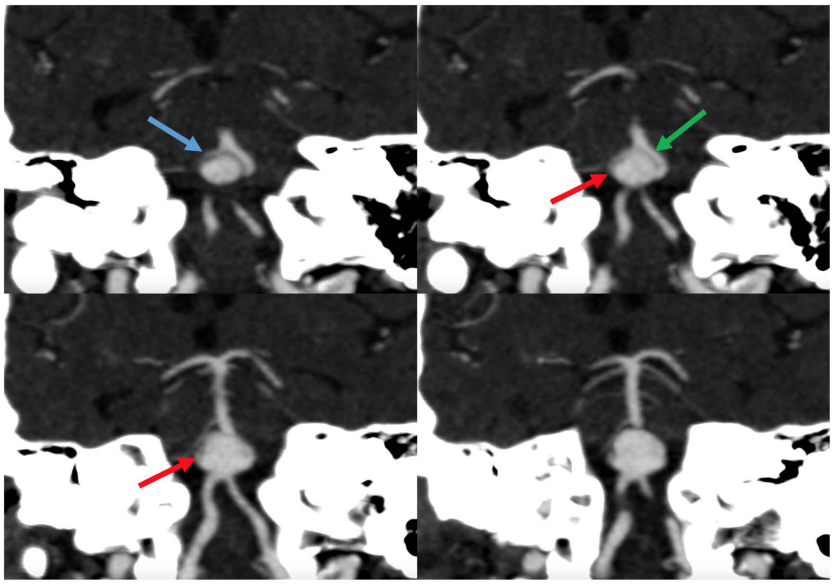

Figure 2. Cerebral CT angiography. Oblique coronal MIP reconstructions (Maximum Intensity Projection) allow visualization of the asymmetric fenestration of the basilar artery at its origin, with a right branch (blue arrow) and a dominant left branch (green arrow), surrounding the aneurysmal sac (red arrows).

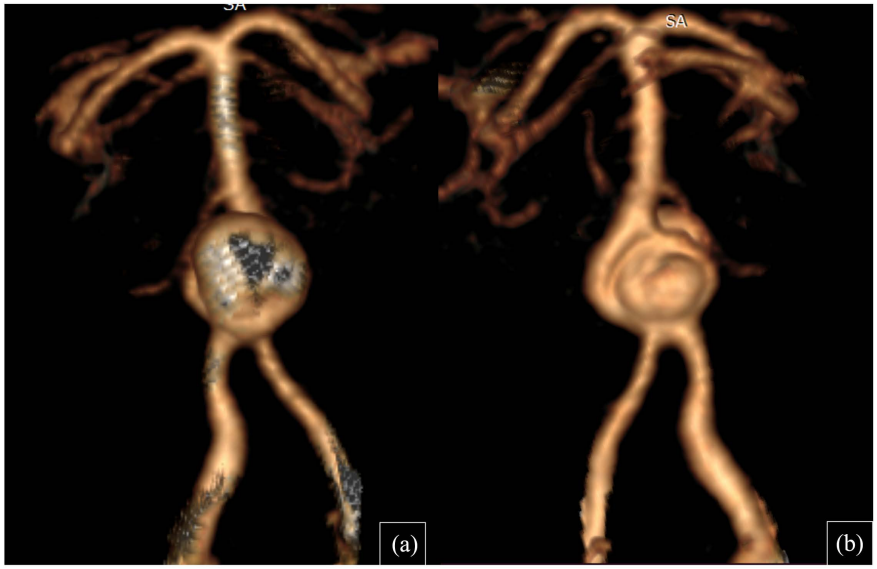

Figure 3. 3D VRT (Volume Rendering Technique) reconstructions: anterior (a) and posterior (b) views showing the aneurysm developed on the fenestration of the vertebrobasilar junction.

3. Discussion

A fenestration is an anatomical variation that refers to a single artery with a double-lumen over a short segment of its course due to a lack of fusion of embryologically paired vessels. It is often confused with duplication. In that situation, the presence of two lumens is due to the fusion of two embryologically different vessels [7] [8].

The basilar artery is formed by the union of the two vertebral arteries around the 7th week of amenorrhea. Any fusion anomaly may result in a focal "duplication" of the basilar artery [9]. This can occur over the entire height of the artery but predominates in over 92% of cases in the proximal segment [10].

A classification based on the relationship between the fenestration and the origin of the anterior inferior cerebellar arteries (AICA) distinguishes 4 types [6] [7] (**Figure 4**):

- Type I: the fenestration is located upstream of the origin of the AICA (this is the case of our patient);
- Type II: the two AICAs are born symmetrically on the fenestration;
- Type III: the emergence of a single AICA on the fenestration;
- Type IV: the fenestration is located downstream from the origin of the AICA.

Although rare, aneurysms of the vertebrobasilar junction are associated in 70% with a fenestration of the basilar trunk [3].

The first case of this rare entity was described in 1979 by Hoffman *et al.* [12]. It affects 1% of the population and is observed in 5% of autopsy series [1]. Two-thirds of the patients are female, showing a clear predisposition to this variety of aneurysms [4].

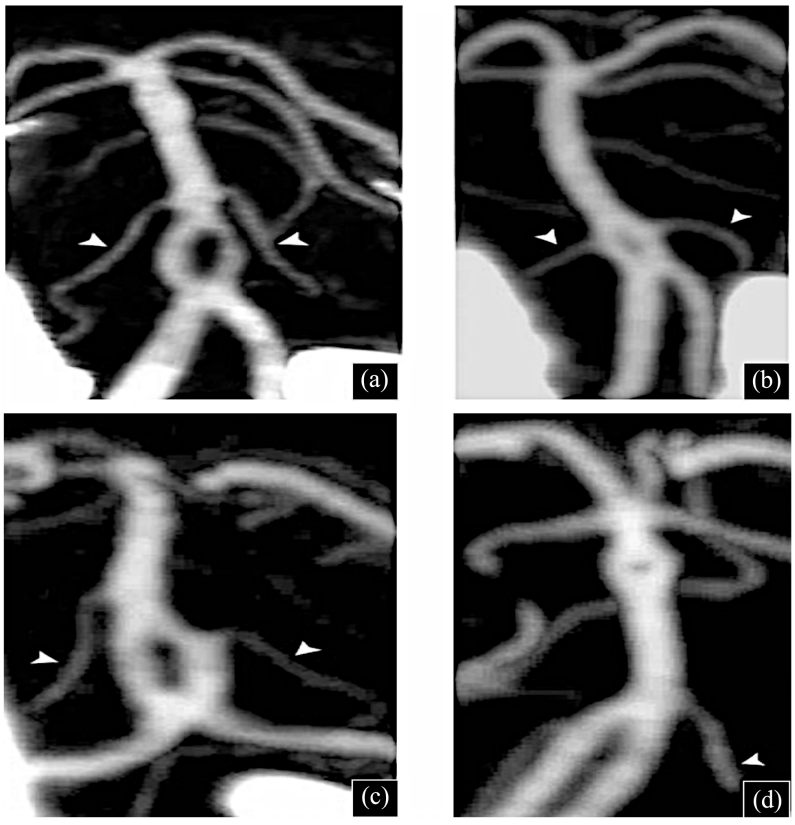

Figure 4. Classification of basilar artery fenestrations. According to Gao *et al.* [11]. Type I (a): fenestration before the emergence of the AICAs, Type II (b): emergence of the two AICAs on fenestration, Type III (c): emergence of a single AICA on fenestration, Type IV (d): fenestration downstream from the origin of the AICAs.

While in our patient this type of aneurysm was incidentally discovered, it is very rarely the case in most studies where it's revealed by a subarachnoid hemorrhage [4].

As with other intracranial arterial fenestrations, the occurrence of this association is explained by the presence of parietal abnormalities related to these anatomical variations: locally absent media, discontinuity of the elastin, and locally thinned subendothelium. This parietal fragility, added to the turbulence of the arterial flow, predisposes the formation of aneurysms [4] [5] [6].

CT angiography is currently the best technique for the diagnosis and preoperative evaluation of these aneurysms. The 3D VRT reconstructions are valuable for understanding their often complex anatomy [13].

Their localization makes surgical treatment delicate, because of the presence of narrow vascular-nervous relationships and the difficulty of finding an adequate approach. The current treatment is based on endovascular coil embolization [6] [9] [13], the morbimortality of embolization of aneurysms in the posterior fossa is three times lower (2.6%) than open surgery for these same locations (7.7%) [14].

Trivelato *et al*. [2] proposed a classification to choose the best technique for endovascular treatment. This classification is essentially based on two parameters: the width of the neck of the aneurysm and the position of its base of implantation. Four types have been described: type 1A: narrow neck, symmetric at the bifurcation. Type 1B: narrow neck, spares one loop. Type 2A: wide neck, involves both loops. Type 2B: wide neck, spares one loop.

In our patient's case, the aneurysm was unruptured and was incidentally discovered, so no treatment has been suggested by neurosurgeons. This is also related to the weakness of our technical platforms, offering us limited therapeutic choices.

4. Conclusion

Aneurysms of the vertebrobasilar region are rare and their presence should be investigated for associated fenestration, which is a predisposing factor. Radiologists and neurosurgeons should be aware of this high probability of lesion association.

Patient Consent

Written informed consent for the case to be published (incl. Images, case history, and data) was obtained from the patient for the publication of this case report.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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