

---

## FENESTRATION OF THE ANTERIOR CEREBRAL ARTERY (ACA) REGION, PARTICULARLY IN ITS A2 (VERTICAL SEGMENT) ACCIDENTALLY DISCOVERED

JULIA LAINE<sup>1</sup>, ABD-EL KADER MOUMOUN<sup>2</sup>, IVAN FRIDER<sup>1</sup>, ESSOHANAM KPELAO<sup>3</sup>, PASCAL COMPAORE<sup>2</sup>, DABOU ABIBA TAMOU TABE<sup>3</sup>, ABDERRAHMANE HAMLAT<sup>2</sup>, ALESSANDRO ARRIGO<sup>1</sup>

1- *Departement of Radiology, University Hospital of MARTINIQUE*

2 – *Departement of Neurosurgery, University Hospital of MARTINIQUE*

3- *University of Lomé, Faculty of Health Sciences*

---

**RÉSUMÉ :** La fenestration a précédemment été définie comme une division segmentaire d'un vaisseau pour former deux lumières distinctes, chacune avec sa propre couche endothéliale et musculaire, tandis que l'adventice peut ou non être partagée. De rares cas ont été rapportés sur l'artère cérébrale antérieure (ACA), en particulier dans son segment A2 (vertical). Nous rapportons un cas extrêmement rare de fenestration du segment A2 de l'artère cérébrale antérieure démontré à la fois sur la séquence vasculaire IRM et l'angiographie CT chez un homme de 70 ans, qui a d'abord admis aux urgences pour hémiparésie droite. Il avait été évoqué le diagnostic d'anévrisme de la cérébrale par le radiologue junior avant une rectification du diagnostic. Radiologue, le neurochirurgien doit être conscient du diagnostic du fenêtrage pour éviter un diagnostic faussement positif d'anévrisme cérébral utilisant une angiographie IRM.

**Mots clés :** *Malformation vasculaire cérébrale, Variation anatomique, Fenestration, Faux anévrisme.*

**ABSTRACT :** A fenestration has previously been defined as a segmental division of a vessel to form two separate lumens, each with its own endothelial and muscularis layer, while the adventitia may or may not be shared. It is a rare finding in the anterior cerebral artery (ACA) region, particularly in its A2 (vertical) segment. We report an extremely rare case of fenestrated A2 segment demonstrated on both MR vascular sequence and CT angiogram in a 70-year-old man, who initially presented to the emergency room (ER) for lack of strength in the right side of the body. Radiologist, neurosurgeon must be aware of the diagnosis of fenestration to avoid false-positive diagnosis of cerebral aneurysms using MR angiography.

**Key words :** *Brain vascular Malformation, Anatomic Variations, Fenestration A2, False aneurysm.*

---

### INTRODUCTION

A fenestration has previously been defined as a segmental division of a vessel to form two separate lumens, each with its own endothelial and muscularis layer, while the adventitia may or may not be shared [1]

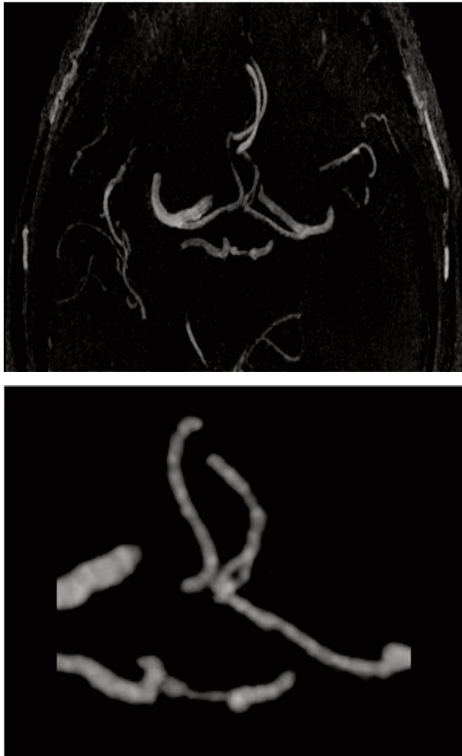
We report a case of fenestrated A2 segment demonstrated on both MR vascular sequence and CT angiogram in a 70-year-old man, who initially presented to the emergency room (ER) for lack of strength in the right side of the body.

### CASE REPORT

A 70-year-old man presented to the ER at night with a stroke symptomatology, supposedly less than 4.5 hours after the

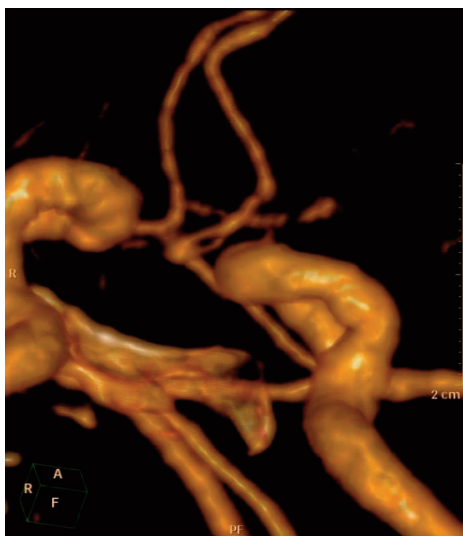
brutal onset of his symptoms that include a proportional hemiparesis in the right side of the body. A 1.5T brain MRI was performed (protocole ). The images revealed an increased DWI signal in the left middle cerebral artery (MCA) territory associated with marked hyperintensity on the FLAIR sequence. This left MCA acute infarction was thus non-thrombolysable.

The resident radiologist reading of the MR vascular sequence (Fig. 1) concluded to a thrombus of the M2 segment of left MCA. He also described an image of left A2 "aneurysm". That false diagnosis was corrected later by a senior radiologist who concluded to an ovoid shaped fenestration of A2.



**Fig. 1 : Time Of Flight (TOF)  
 MR vascular sequence**

Complementary multi-detector CT angiogram of the circle of Willis and supra aortic arteries was performed as part of the etiologic work-up, visualizing this isolated left A2 fenestrated segment (Fig. 2).



**Fig. 2 : Three-dimensional volume-rendered image shows anterior cerebral artery A2 segment fenestration (arrow).**

## DISCUSSION

Therefore, there are two morphological types of fenestrations : 1) small, slit-like fenestration or 2) large, lenticular fenestration. It is a developmental variant ensuing from disruption of fusion of a multi-

channel network of vessels that develop into vessels during fetal life. Fenestration may occur in all cerebral arteries. However, it most commonly involves the Circle of Willis. Prevalence reported in the literature differs depending on imaging methods and location. In large post-mortem and surgical studies fenestrations in the area of anterior communicating artery are reported in about 40% of subjects [2]. Their prevalence in the ACA region as diagnosed in 3-dimensional rotational angiography is about 28% [3]. In Angio-CT imaging of entire cephalic circulation it is diagnosed in 11% of cases [4]. In large studies performed with classical angiography prevalence of fenestrations is 0.07–0.7% [3]. In a large study based on the analysis of Angio-CT studies in Polish population reported prevalence of fenestrations was 3.5%. They were most often visualized in the basilar artery (45%), anterior cerebral artery (40%) and anterior communicating artery (10%) [5]. These differences ensue from different ability to visualize small vessels. Many fenestrations are built by very thin vessels, about 0.1–0.3 mm in diameter.

Fenestrations may occur in all cerebral arteries, however, these are typically encountered in the vertebral artery or the ICAs in the neck [6,7]. It is a rare finding in the ACA region, predominantly observed within the distal A1 segment with a prevalence estimated between 0-4% on anatomical studies [8] and 0.058% on angiographic studies [2].

In comparison, fenestration of the A2 segment was described anatomically and found in 2% of fetal post-mortem examinations [9]. S.J. Dimmick et Al. presents the radiological findings of two cases of a rare fenestration of the A2 segment of the anterior cerebral artery [2,10].

Krings et Al [6] recently proposed a revised nomenclature which defines fenestrations, segmentally unfused arteries and duplications. A fenestration is defined as a single artery with two luminal channels and may be due to a nerve or other anatomical structures «piercing» the artery ; Segmentally unfused arteries constitute a lack of fusion of embryologically paired vessels. Duplications can occur where the «double lumen» is due to two embryologically different vessels that fuse during development and an additional vessel persists. This is distinct from a fenestration where the two lumina correspond to a single artery. The nomenclature proposed by

Krings et Al therefore may not be as easily applied to a «fenestration» of the A2 segment, due to the uncertainty of the embryological aetiology of this anomaly within the anterior cerebral arteries.

Coexistence of fenestrations with other vascular malformations, particularly with aneurysms, had been profusely described in literature especially in the vertebrobasilar artery region. It has been postulated that turbulent flow created by defects in the tunica media at the proximal and distal ends of a fenestrated segment leads to aneurysm formation [2].

This knowledge was recently questioned by S.J. Dimmick et Al. review of literature, highlighting that there is no consensus whether fenestrations of intracranial arteries predispose individuals to aneurysm formation [10].

### CONCLUSION

In this case, there was no such association of fenestration with aneurysms.

The main mistake consisted of a false-positive diagnosis of intracerebral aneurysm, that contraindicates intravascular thrombolysis and could have led to a dramatic abstain from therapeutic. Radiologist, neurosurgeon must be aware of the diagnosis of fenestration to avoid false-positive diagnosis of cerebral aneurysms using MR angiography.

### DISCLOSURE OF INTEREST

The authors declare that they have no competing interest.

### REFERENCES

- 1] PARMAR H, SITOY YY, HUI F: Normal variants of the intracranial circulation demonstrated by MR angiography at 3T. *Eur J Radiol* 2005;56:220–228.
- 2] SANDERS WP, SOREK PA, MEHTA BA: Fenestration of intracranial arteries with special attention to associated aneurysms and associated anomalies. *Am J Neuroradiol* 14: 675-680, 1993;14:675–680
- 3] MINAKAWA T, KAWAMATA M ET AL: Aneurysms associated with fenestrated anterior cerebral arteries. Report of four cases and review of the literature. *Surg Neurol* 24: 284-288, 1985.

- 4] ZHAO H, FU J, LU Z ET AL: Fenestration of the anterior cerebral artery detected by magnetic. *Chin Med J*, 2009; 122: 1139–42
- 5] KOWADA M, YAMAGUCHI K, TAKAHASHI H: Fenestration of the vertebral artery with a review of 23 cases in Japan. *Radiology*, 1972; 103: 343–46
- 6] KRINGS T, BACCINCE, ET AL: Segmental unfused basilar artery with kissing aneurysms: report of three cases and literature review. *Acta Neurochir (Wien)* 149: 567-574, 2007
- 7] UCHINO A, SAITO N, OKADA Y, KOZAWA E, NISHI N, MIZUKOSHI W, INOUE K, NAKAJIMA R, TAKAHASHI M (2012) Fenestrations of the intracranial vertebrobasilar system diagnosed by MR angiography. *Neuroradiology* 54:445–450
- 8] WASHIYAMA JK ET AL: Fenestration of the anterior cerebral artery. *Neuroradiol* 21: 277-280, 1981.
- 9] VUCETIC RR. : Segmental duplication of the fetal anterior cerebral artery. *J Anat* 1998 ; 192 : 431–434.
- 10] DIMMICK SJ : Fenestrated Anterior Cerebral Artery with Associated Arterial Anomalies Case Reports and Literature Review. *Interv Neuroradiol*. 2008 ; 14: 441–445