



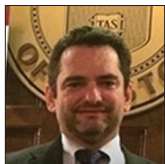
Case Report

# Anterior communicating artery duplication associated with a triplication of anterior cerebral artery – A rare anatomical variation

Francisco Matos Ureña<sup>1</sup>, Jose Gregorio Matos Ureña<sup>1</sup>, Saul Almeida<sup>1</sup>, Nicollas Nunes Rabelo<sup>1</sup>, Julian Reis da Silva<sup>2</sup>, Mauricio Mandel<sup>1</sup>, Manoel Jacobsen Teixeira<sup>1</sup>, Eberval Gadelha Figueiredo<sup>1</sup>

<sup>1</sup>Department of Neurosurgery, University of Sao Paulo, São Paulo, <sup>2</sup>Department of Neurosurgery, Atenas University Center, Paracatu, Minas Gerais, Brazil.

E-mail: Francisco Matos Ureña - fmatosu@gmail.com; Jose Gregorio Matos Ureña - jose\_gregorio15@hotmail.com; Saul Almeida - alm.saul@gmail.com; Nicollas Nunes Rabelo - nicollasrabelo@hotmail.com; Julian Reis da Silva - julian\_reis@hotmail.com; Mauricio Mandel - mmandel87@yahoo.com.br; Manoel Jacobsen Teixeira - nicollas.rabelo@hc.fm.usp.br; \*Eberval Gadelha Figueiredo - ebgedelha@yahoo.com



\*Corresponding author:

Eberval Gadelha Figueiredo,  
Department of Neurosurgery,  
University of São Paulo,  
Brazil - Rua Eneas Aguiar, 255,  
São Paulo, Brazil.

ebgedelha@yahoo.com

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## ABSTRACT

**Background:** The anterior communicating artery complex may present several anatomical variations, and many abnormalities have been reported in radiological and cadaveric studies.

**Case Description:** The authors present a case of a 44-year-old Caucasian female, with a prior history of smoking and arterial systemic hypertension, admitted in the emergency department complaining of a sudden headache, nausea, and vomiting followed by tonic-clonic seizures. Computerized tomography (CT) and angiography (angio-CT) were carried out and showed Fisher Grade IV subarachnoid hemorrhage. Angio-CT revealed an anterior communicating artery (ACoM) aneurysm. Minimally invasive craniotomy and microsurgical clipping were performed uneventfully. An unusual anatomical variation of the ACoM complex characterized by duplication of the ACoM associated with a triplication of anterior cerebral artery (ACA) was observed. The patient was discharged with no neurological deficits.

**Conclusion:** This unique anatomical variation of the ACoM-ACA complex constitute risk factors for development and rupture of aneurysms.

**Keywords:** Anatomy, Anterior cerebral artery, Anterior communicating artery

## INTRODUCTION

The circle of Willis was originally described in 1664.<sup>[8]</sup> It usually shows a large number of morphologic and angiographic anomalies.<sup>[4]</sup> Since the development of new technologies and sophisticated software imaging, surgeons have been able to study and identify new anatomical variations that have not been described in cadaveric studies. The anterior communicating artery complex consists of two anterior cerebral arteries (ACAs), the anterior communicating artery (ACoM), and the recurrent arteries of Heubner.<sup>[9]</sup> ACoM aneurysms are common and constitute 30.3% of all cerebral aneurysms.<sup>[5]</sup> The anterior communicating artery complex may present several anatomical variations, and many abnormalities have been reported in radiological and cadaveric studies.

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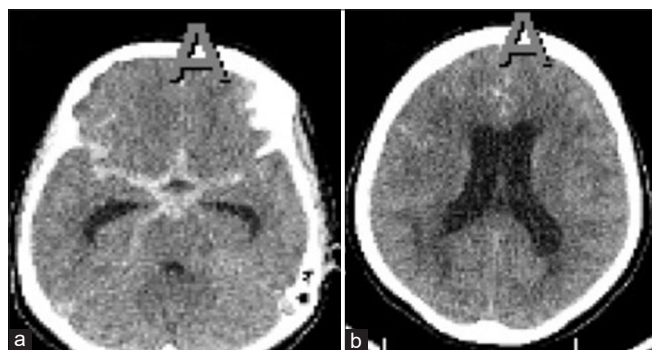
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Several authors have studied these anatomical variations and proposed many common anatomical variations. Understanding the anatomy of the anterior communicating artery complex and its possible variations is fundamental for the treatment of aneurysm in this topography, considering therapeutic planning decision-making process (endovascular or microsurgical clipping) and to prevent complications related to the procedure.

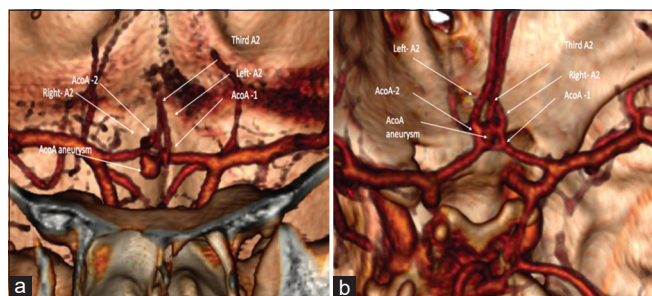
In this paper, we present a case with an unusual association of duplication of the AComA associated with a triplication of ACA. To the best of our knowledge, this is the second description of this kind of variation in the literature, the first that was depicted in the radiological study.

### CASE REPORT

A 44-year-old Caucasian female, with a previous history of smoking and arterial systemic hypertension, was admitted to our emergency department complaining of a sudden headache, nausea, and vomiting. At her initial presentation, she was awake and aware, without any neurological deficits. Six hours after, she presented generalized tonic-clonic seizures. The patient received an attack dose of phenytoin and improved her level of consciousness after the postictal period.



**Figure 1:** (a and b) Admission axial head computerized tomography scan shows circle of Willis with subarachnoid hemorrhage Fisher IV.

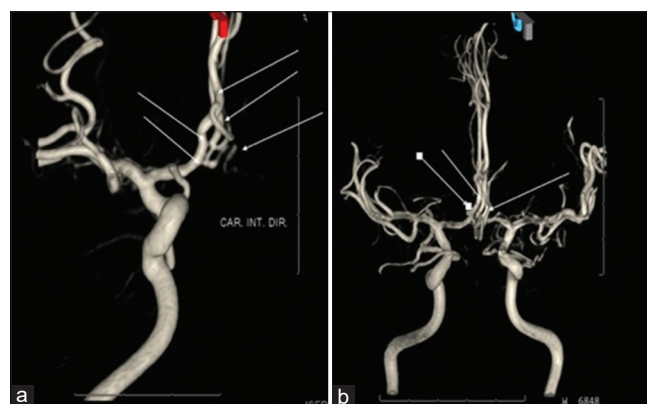


**Figure 2:** (a) Frontal view showing the inferior anterior orientation of an aneurysm and the trifurcation of A2 and duplication of the ACoA. (b) Posterior view angiography – computerized tomography 3D reconstruction shown in arrows: left, right, and third A2, ACoA 1 and 2, and ACoA aneurysm.

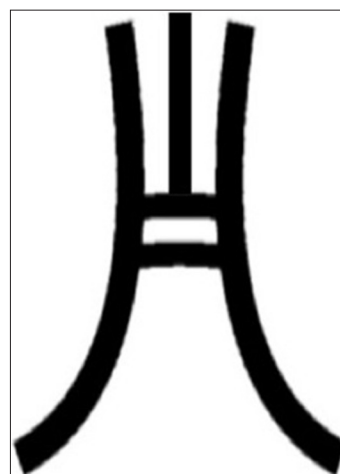
Head computerized tomography (CT) and angiography (angio-CT) were performed. Subarachnoid hemorrhage Fisher Grade IV was diagnosed [Figure 1]. Angio-CT with 3D reconstruction reveals an AComA aneurysm inferiorly and anteriorly projection with a duplication AComA and a trifurcation of the ACA [Figure 2]. It was surgically treated and microsurgical clipping [Figures 3 and 4]. Surgery was uneventful. The patient was discharged with no complications 14 days after the surgery.

### DISCUSSION

It is well known that some anatomical variations of the A1 artery (diameter asymmetry) are associated with more risk of intracranial aneurysm development and rupture.<sup>[3,4,6,7]</sup> We sought in the literature for any association between



**Figure 3:** (a) Frontal and (b) coronal view. Postoperative 3D digital subtraction angiography illustrating the described malformation with no residual neck of the ACoA aneurysm, after surgery, shown in arrows: left, right, and third A2, ACoA 1 and 2, and ACoA aneurysm. Narrows show the anatomy variation.



**Figure 4:** Schematic design illustrating artery anatomy variation of duplication of the AComA and a triplication of the anterior cerebral artery.

triple A2 artery and duplication AComA associated or not with aneurysm. Dimmick and Faulder<sup>[2]</sup> in a retrospective analysis of 300 CT angiograms described a prevalence of 18% of duplication of the AComA, whereas trifurcation ACA varied from 2% to 13%. Cui *et al.*<sup>[1]</sup> studied 45 formalin, preserved human brains, and performed microsurgical dissection with especial attention to the anatomical variations of anterior communicating artery complex. They found six brain specimens with trifurcation of the ACA, while double AComA was observed in 25 specimens (55.6%). In addition, they found only one case with triplication of the ACA associated with duplications of the AComA. To the best of our knowledge, he was the first author who described this type of dual anatomical variations in a cadaveric study. The current case is the first radiological description of this very rare anatomical variation.

## CONCLUSION

We reported the first radiological description of a very rare duplication of the AComA associated with triplication of the ACA and a ruptured intracranial aneurysm. Anatomical variations in the ACA-AComA complex constitute risk factors for the development and rupture of aneurysms. The perfect understanding of the regional anatomy and its variants is fundamental for successful endovascular or surgical treatment of aneurysms located at this site.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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