

## An unusual variant of the common trunk of the fronto-orbital and frontopolar arteries associated with a ruptured aneurysm of the A1 segment of the anterior cerebral artery

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### Abstract

**Background:** The common trunk of the fronto-orbital artery (FOA) and frontopolar artery (FPA) arising from the A1 segment of the anterior cerebral artery (ACA) associated with a ruptured aneurysm (AN), is rare.

**Case Description:** The patient was a 52-year-old man who suffered from subarachnoid hemorrhage. Three-dimensional computed tomography angiography revealed an elongated and tortuous left A1 segment of the ACA and a saccular AN arising from the left A1 segment of the ACA at the origin of the cortical branch, defining its location just on the midline and behind the anterior communicating artery. This vessel had two branches. One branch ran along the inferior surface of the ipsilateral frontal lobe, and the other branch ran anteriorly and medially along the surface of the left hemisphere toward the frontal pole. The anomalous artery was interpreted as a common trunk of the FOA and FPA. Bifrontal craniotomy was performed. The anomalous artery arose from the A1 segment of the ACA at the origin of the AN, and the recurrent artery of Heubner branched off the anomalous artery. The AN was successfully obliterated, clipping with a bayonet-shaped Yasargil titanium clip. Complete AN occlusion and patency of both the A1 and the common trunk of the FOA and FPA, were confirmed intraoperatively by indocyanine green angiography.

**Conclusions:** Recognizing this variant preoperatively, could be helpful in preventing the complications of surgery.

**Key Words:** Aneurysm, anterior cerebral artery, common trunk, fronto-orbital artery, frontopolar artery

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### INTRODUCTION

Aneurysms (ANs) arising from the A1 segment of the anterior cerebral artery (ACA) are quite rare and are considered to be unique because they are usually connected with other vascular anomalies such as a fenestration of the A1 segment, an infra-optic course of the A1 segment, or an anomalous cortical branch arising from the A1 segment such as an accessory middle cerebral artery, a persistent primitive olfactory artery, or

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a callosomarginal artery.<sup>[1-4,6,7,10,12-14]</sup> We experienced a rare case of a ruptured AN at the origin of the common trunk of the fronto-orbital artery (FOA) and frontopolar artery (FPA), which arose from the A1 segment of the ACA. In this paper, we describe some unique characteristics and surgical approaches to these ANs.

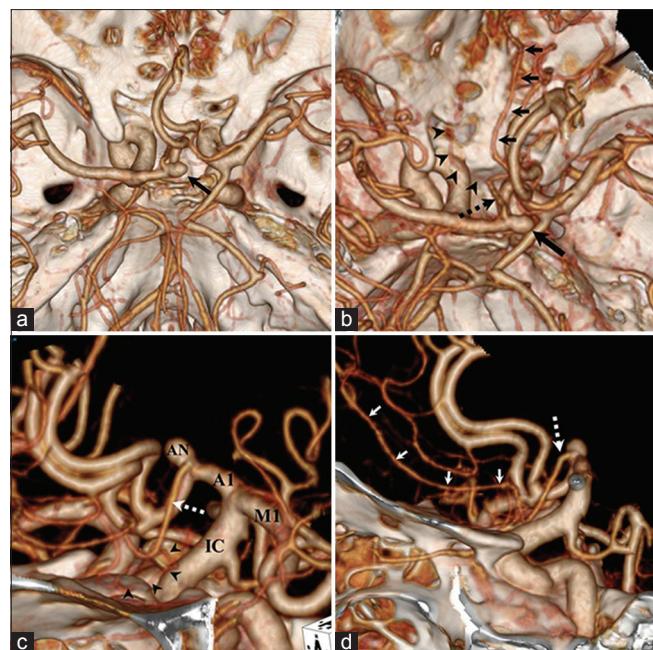
## CASE REPORT

A 52-year-old man presented with a severe headache and subsequent loss of consciousness was admitted to our hospital. No focal neurological abnormality was noted. Initial computed tomography (CT) showed the typical findings of subarachnoid hemorrhage in the basal cistern. Three-dimensional CT angiography revealed an elongated and tortuous left A1 segment of the ACA and a saccular AN arising from the left A1 segment of the ACA at the origin of the cortical branch, defining its location just on the midline and behind the anterior communicating artery (ACoA) [Figure 1]. This vessel had two branches. One branch ran along the inferior surface of the ipsilateral frontal lobe and the other branch ran anteriorly and medially along the surface of the left hemisphere toward the frontal pole. The left FOA and FPA arising from the A2 segment of the ACA were not identified. No other vascular anomalies were revealed on cerebral angiography. The anomalous artery was interpreted as a common trunk of the FOA and FPA.

Bifrontal craniotomy was performed, and the interhemispheric fissure was opened widely to expose the ACoA, the bilateral distal A2, and the A3 segment of the ACA [Figure 2]. Following exposure of the ACoA, the artery distal to the lesion was traced back to the AN, working between the left frontal lobe and the left A2 segment of the ACA. After partial resection of the ipsilateral gyrus rectus, the proximal and distal portions of the aneurysmal neck were seen. The anomalous artery arose from the A1 segment of the ACA at the origin of the AN, and the recurrent artery of Heubner branched off the anomalous artery. The AN was successfully obliterated, clipping with bayonet-shaped Yasargil titanium clip: No. FT727T. Complete AN occlusion and patency of both the A1 and the common trunk of the FOA and FPA, were confirmed intraoperatively by indocyanine green angiography. The postoperative course was uneventful, and the patient was discharged with no neurological deficits.

## DISCUSSION

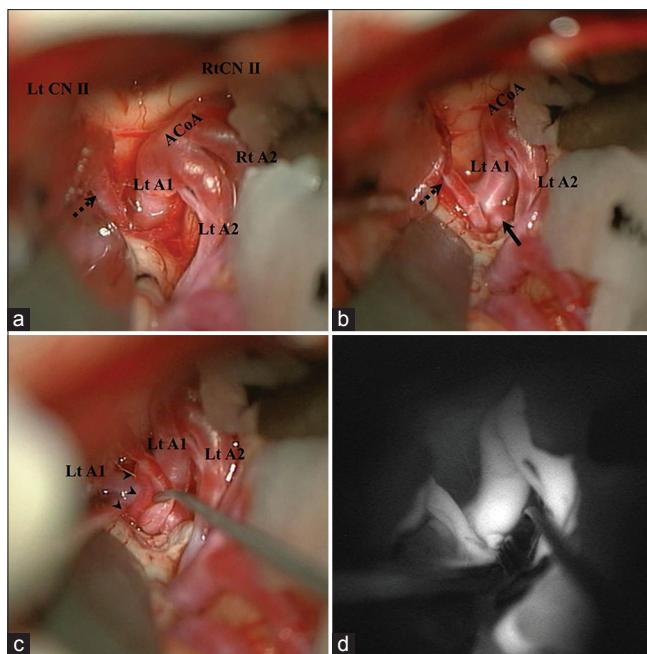
The FOA is the first cortical branch of the ACA and normally arises from the ipsilateral pericallosal artery.<sup>[5]</sup> It may uncommonly arise from the A1 segment just proximal to the ACoA.<sup>[3,8]</sup> According to Marinković



**Figure 1:** Three-dimensional computed tomography angiogram, superoinferior view (a and b) showing a saccular aneurysm (black arrow) arising from the left A1 segment of the anterior cerebral artery at the origin of the common trunk (black dotted arrow) of the fronto-orbital artery (black arrowheads) and frontopolar artery (black arrows). An aneurysm is located just on the midline and behind the anterior communicating artery. Three-dimensional computed tomography angiogram, oblique view (c), showing an elongated and tortuous left A1 segment of the anterior cerebral artery. The common trunk (white dotted arrow) shares a fronto-orbital artery and runs along the inferior surface of the ipsilateral frontal lobe (black arrowheads). Three-dimensional computed tomography angiogram, lateral view (d), showing an aneurysm located in the highest place on the vessel. The common trunk (white dotted arrow) shares a frontopolar artery, which runs anteriorly and medially along the surface of the left hemisphere toward the frontal pole (white arrows). **ACA:** Anterior cerebral artery, **AN:** Aneurysm, **A1:** A1 segment of the anterior cerebral artery, **CT:** Computed tomography, **IC:** Internal cerebral artery, **MI:** MI segment of the middle cerebral artery, **FOA:** Fronto-orbital artery, **FPA:** Frontopolar artery

results, the incidence of the FOA originating from the ipsilateral A1 segment of the ACA is 4%.<sup>[9]</sup> The FPA is the next cortical branch of the ACA and arises from the A2 segment of the pericallosal artery or the callosomarginal artery, but can share a common trunk with the FPA and Heubner's artery.<sup>[11]</sup> The FPA, or the common trunk of the FOA and FPA, arising from the A1 segment of the ACA, is a rare finding. Yasargil previously reported the variation of the FPA and Heubner's artery on the basis of operative and autopsy findings. The FPA originating from the A1 segment of the ACA gave rise to the proximal medial striate artery and Heubner's artery in 0.5% of operative and 1.0% of autopsy findings, respectively.<sup>[15]</sup>

The featured case has some interesting characteristics. First, a common trunk of the FOA and FPA arose from the A1 segment of the ACA associated with ruptured



**Figure 2:** Intraoperative photographs showing the aneurysm (black arrow) and its relationship to the left distal A1 segment, left A2 segment of the anterior cerebral artery, anterior communicating artery, and the common trunk of the frontopolar artery and fronto-orbital artery (black dotted arrow) (a and b). A small cortical incision is made in the gyrus rectus allowing visualization of the proximal aneurysmal neck (b). The common trunk of the fronto-orbital artery and the frontopolar artery from the A1 segment of the anterior cerebral artery shares Heubner's artery (black arrowheads) (c). Intraoperative indocyanine green angiogram showing the patency of both the A1 (proximal A1 segment) (white arrow) and the common trunk of the frontopolar artery and frontopolar artery (white arrowheads) (d). ACA: Anterior cerebral artery, ACoA: Anterior communicating artery, CN: Cranial nerve, FOA: Fronto-orbital artery, FPA: Frontopolar artery, Lt: Left, Rt: Right

AN. Anomalous arteries originating from the A1 segment of the ACA are often associated with cerebral AN. The pathogenesis of associated ANs has not been fully clarified, and both genetic and hemodynamic factors are considered. Therefore, a careful follow-up study is necessary to monitor AN formation in cases with an arterial abnormality of the A1 segment of the ACA.

Second, the ruptured AN was located just on the midline and behind the ACA due to an elongated and tortuous left A1 segment of the ACA. In treating A1 ANs, most of the ANs are easily visualized by using a standard pterional approach. In the present case, the patient underwent microsurgical clipping via the interhemispheric approach because of its deep and high location. It is critical to preserve the patency of the A1 segment of the ACA

as well as the common trunk of the FOA, FPA, and Heubner's artery. Recognizing and reporting this variant could be helpful in preventing the complications of surgery. Although injury to the common trunk itself is unlikely to result in clinical deficits, precise knowledge of the vascular anatomy, including such variants, is essential to help minimize complications. When an A1 AN is found, one should carefully scrutinize the angiograms to identify anomalies.

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### Conflicts of interest

There are no conflicts of interest.

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