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An unusual variant of the callosomarginal artery from the A1 segment of the anterior cerebral artery

Jun Yoshida, Hiroshi Kashimura, Masaru Takeda, Kenta Aso

Department of Neurosurgery, Iwate Prefectural Chubu Hospital, Kitakami, Iwate, Japan

E-mail: Jun Yoshida - junyoshida_0331@yahoo.co.jp; *Hiroshi Kashimura - h-kashimura@pref.iwate.jp; Masaru Takeda - mtd2295@gmail.com; Kenta Aso - kenta.asoh.doc@hotmail.co.jp
*Corresponding author

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Abstract

Background: Although the anatomy of the A1 segment of the anterior cerebral artery (ACA) is highly variable, a callosomarginal artery (CMA) arising from the A1 segment of the ACA is rare.

Case Description: A 27-year-old man presented with severe headache and was admitted to our hospital. Initial computed tomography (CT) showed subarachnoid hemorrhage in the basal cistern. Three-dimensional CT angiography revealed a saccular aneurysm arising from the left internal carotid bifurcation and showed an anomalous cortical branch originating from the left A1 segment of the ACA. The anomalous artery was interpreted as a CMA.

Conclusions: Recognizing this variant preoperatively could be helpful in preventing complications of surgery. Careful follow-up studies are necessary in the present case to monitor the development of another aneurysm at the junction between the left CMA and the left A1 segment of the ACA.

Key Words: Aneurysm, anterior cerebral artery, callosomarginal artery, variant

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INTRODUCTION

The anatomy of the A1 segment of the anterior cerebral artery (ACA) is highly variable.[4] Variant anatomies of the artery consist of hypoplasia, fenestration, infraoptic course of the A1 segment of the ACA, and an anomalous cortical branch arising from the A1 segment, such as an accessory middle cerebral artery, a fronto-orbital artery (FOA), a common trunk of the FOA and frontopolar artery (FPA), or a persistent primitive olfactory artery (PPOA).[1-3,6,9] In this study, we describe a case of unusual variant of the callosomarginal artery (CMA) from the A1 segment of the ACA.

CASE REPORT

A 27-year-old man presented with severe headache and subsequent loss of consciousness and was admitted to our hospital. No focal neurological abnormality was noted. Initial computed tomography (CT) showed typical findings of subarachnoid hemorrhage in the basal cistern. Three-dimensional CT angiography revealed a saccular aneurysm arising from the left internal carotid bifurcation, fenestration of the right P1 segment of the posterior cerebral artery, and an anomalous cortical branch originating from the left A1 segment of the ACA [Figure 1]. The artery ran anteromedially and then ascended superiorly, parallel to the right A2 segment of

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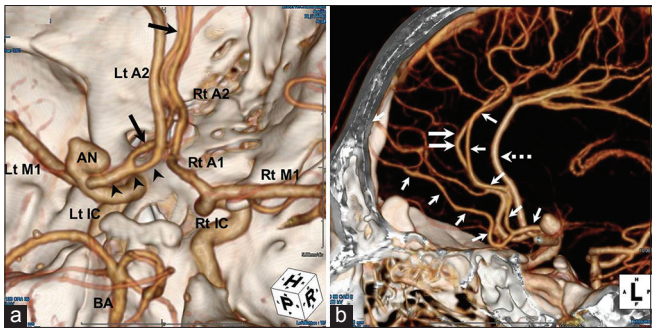

Figure 1: (a) Superoinferior view of the three-dimensional computed tomography angiogram, showing a saccular aneurysm arising from the left internal carotid artery bifurcation and an anomalous cortical branch originating from the left A1 segment of the anterior cerebral artery (black arrowheads). The anomalous artery runs anteromedially and then ascends superiorly and parallel to the right A2 segment of the anterior cerebral artery (black arrows). (b) Left lateral view of the three-dimensional computed tomography angiogram, showing the arterial course of an anomalous cortical branch originating from the left A1 segment of the anterior cerebral artery (white arrows) and its relationship to the bilateral A2 segment of the anterior cerebral artery. The artery runs parallel to the right A2 segment of the anterior cerebral artery (white double arrows). The left A2 segment of the anterior cerebral artery supplies the bihemispheric branches (white dotted arrow). A1: A1 segment of the anterior cerebral artery, A2: A2 segment of the anterior cerebral artery, BA: Basilar artery, IC: Internal carotid artery, Lt: Left, M1: M1 segment of the middle cerebral artery, Rt: Right, AN: Aneurysm

the ACA. The artery has two main branches: The inferior branch running anteriorly and extending toward the frontal pole, and the superior branch ascending superiorly and parallel to the right A2 segment of the ACA. The left A2 segment of the ACA supplied the bihemispheric branches, which ran rather parallel to the anomalous cortical branch and the right A2 segment of the ACA. The usual CMA was absent from the left A2 segment of the ACA. The anomalous artery was interpreted as a left CMA.

Left frontotemporal craniotomy was performed, and the aneurysm was successfully obliterated with clipping with a bayonet-shaped Yasargil titanium clip (No. FT727T). Postoperative digital subtraction angiography confirmed complete aneurysm occlusion, showed the right A2 segment, and showed that the anomalous cortical branch originating from the left A1 segment of the ACA terminated at the medial internal frontal artery [Figure 2]. 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. It may uncommonly arise from the A1 segment just proximal to the anterior communicating artery.[4] According to Marinković results, the incidence of the FOA originating from the ipsilateral A1 segment of the

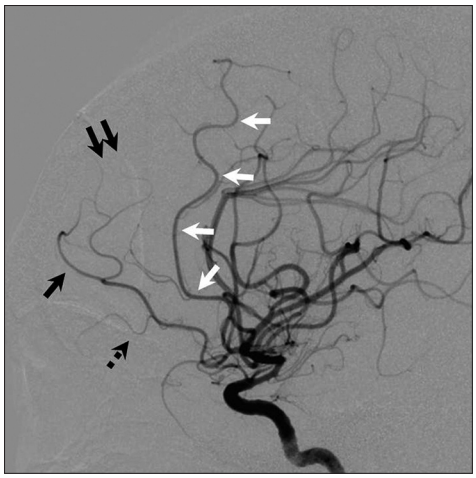

Figure 2: Lateral view of the right carotid arterial digital subtraction angiogram showing the arterial course of an anomalous cortical branch originating from the left A1 segment of the anterior cerebral artery. The artery has two main branches: The inferior branch forming the common trunk of the fronto-orbital (black dotted arrow), frontopolor (black arrow) and the anterior internal frontal arteries (black double arrows), and superior branch forming the callosomarginal branch of the anterior cerebral artery. The artery terminates in in medial internal frontal artery (white arrows)

ACA is 4%.[7] The FPA is the next cortical branch of the ACA and arises from the A2 segment of the pericallosal artery or the CMA but can share a common trunk with the FPA and Heubner's artery. An FPA, or the common trunk of the FOA and FPA, arising from the A1 segment of the ACA is a rare finding.[1] Yasargil previously reported a 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 findings and in 1.0% of autopsy findings.[10] The PPOA (Type 3) arises from the A1 segment of the ACA, runs along the olfactory tract, and makes a hairpin bend to supply the territory of the distal ACA. There have been only two reports of Type 3 PPOA associated with a ruptured aneurysm.[3,9]

The CMA is defined as the artery that courses in or near the cingulated sulcus and gives origin to two or more cortical branches. This artery runs parallel to the pericallosal artery and gives origin to the three internal frontal arteries, even though the most consistent branch to originate from it is the middle internal frontal artery.[8] Although the CMA shows considerable variation in its origin and may arise anywhere from the A2 to the A4 segment of the ACA, origination from the A1 segment of the ACA is extremely rare. There has been only one report of an anomalous origin of CMA from the A1 segment of the ACA.[5] Krishnamoorthy *et al.* reported that the anomalous artery was interpreted as a CMA based on various criteria, including satisfying the definition of Rhoton for the CMA, an arterial course of the vessel, absence of the ipsilateral CMA, and either the middle

internal frontal artery or posterior internal artery arising from the vessel.[5] The featured case also satisfied these conditions. Furthermore, the anomalous artery does not form a hairpin bend. Thus, we consider the anomalous artery originating from the left A1 segment of the ACA as the CMA.

Anomalous origin of a cortical branch from the A1 segment of the ACA predisposes to the formation of aneurysm. The pathogenesis of associated aneurysms has not been fully clarified. Mechanisms contributing to aneurysm formation may involve either increased local hemodynamic forces or structural weakness of the arterial wall. Structural anomalies, such as persistent trigeminal artery, azygous ACA, and fenestration of the intracranial arteries, show higher rates of aneurysm formation than other vessels. Therefore, careful follow-up studies are necessary in the present case to monitor for the development of another aneurysm at the junction between the left CMA and the left A1 segment of the ACA.

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Conflicts of interest
There are no conflicts of interest.

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