

## Case Report

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# Exclusive contra lateral irrigation of the anterior cerebral artery territory through the anterior communicating artery: an angiographic verification — case report

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## ABSTRACT

Anatomical variations in the circle of Willis are every day findings in neurosurgical and neurointerventional procedures. A clear understanding of these variants is important since they could have serious clinical consequences if not considered properly. In a carotid angioplasty and stenting (CAS) we found a bilateral angiographic variation of the feeding of the anterior cerebral artery (ACA) territory by an unusual anterior communicating artery (ACoA). Our first impression was that a fragment of the atherosclerotic plaque occluded the ACA, but the patient did not show any neurological deficit. After evaluation of the contra lateral common carotid artery (CCA) we realized that we were facing an uncommon angiographic variation of the ACoA. These kind of anomalies must be recognized during a functional cerebral angiography in order to evaluate hemispheric collateral flow properly and to understand paradoxical clinical manifestations of occlusive diseases. © *Neuroanatomy*. 2008; 7: 76–78.

**Key words** [endovascular neurosurgery] [cerebral angiography] [anterior cerebral artery] [anterior communicating artery]

## Introduction

A large number of morphologic and angiographic anomalies in the circle of Willis have been described [1–4]. It is always important to keep these anomalies in mind since they are not rare, and could have serious clinical implications [3,4]. Variations of the anterior communicating artery (ACoA) are every-day angiographic findings; many descriptions of these variations are given in the literature such as absence, fenestration, duplication, triplication and abnormal vessels arising from the ACoA [3,5]. Previous studies reported the frequency of anomalous ACoA ranging from 8 to 20% and a higher incidence in the presence of aneurysms [3].

In this report we describe a unique angiographic variation of the ACoA complex that was found during an endovascular procedure of carotid angioplasty and stenting (CAS).

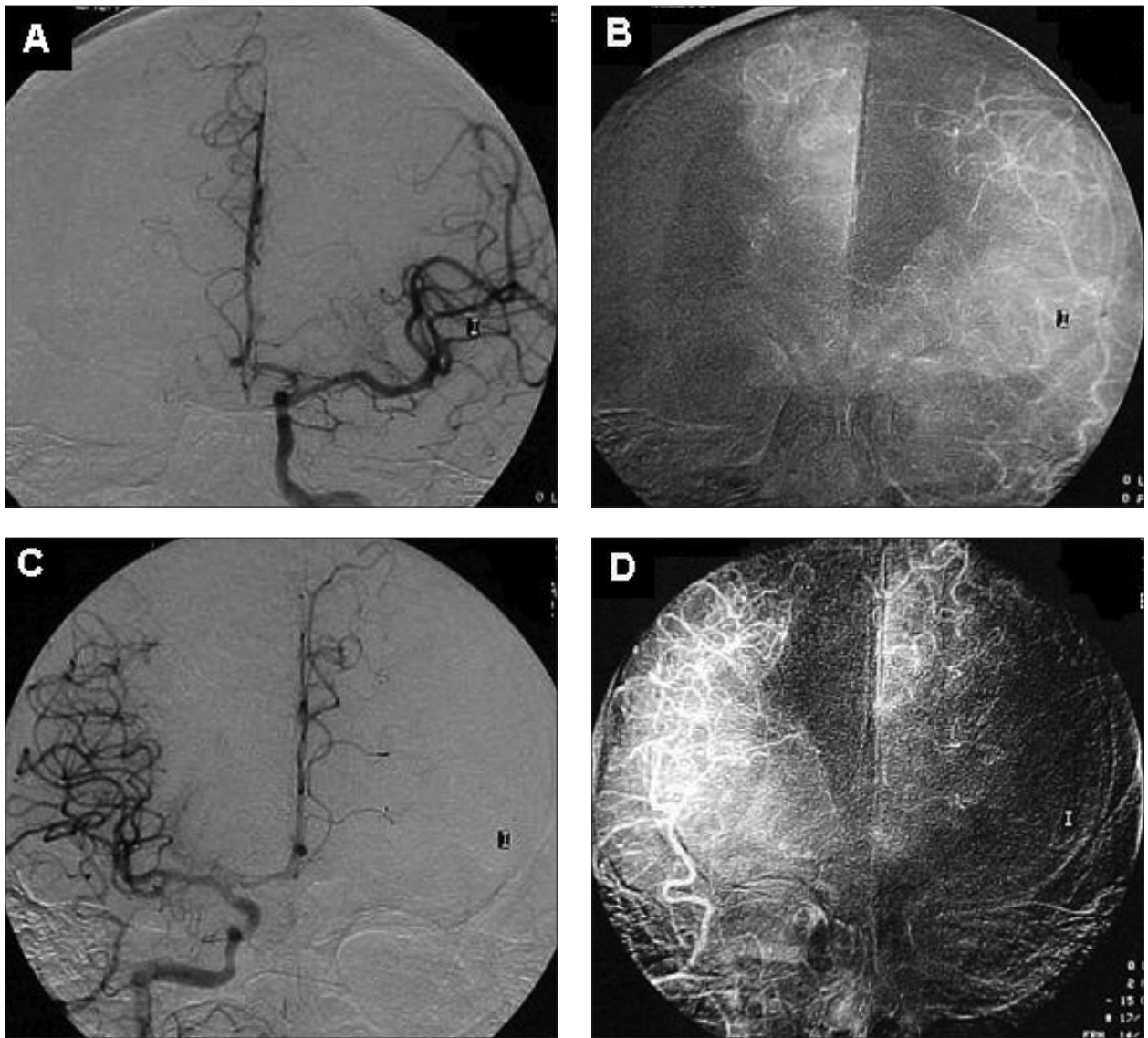
## Case Report

A 64-years-old, right-handed Hispanic man was evaluated. Three weeks before, the patient referred two episodes of right-sided weakness and aphasia. Each episode lasted less than 10 minutes. Twenty-four hours before the admission the patient suffered a temporal monocular blindness in his left eye, which made him seek for medical attention. At the evaluation in the emergency room his neurological examination was unremarkable and no cervical bruit was found. Ultrasonographic evaluation of the cervical carotid artery showed 85% stenosis in the

proximal segment of the cervical left internal carotid artery. A diffusion/perfusion MRI of the brain did not show any recent ischemic insult, and the patient was programmed for endovascular treatment of CAS after being impregnated with oral clopidogrel.

Under local anesthesia the patient went into the neurovascular suite. In the diagnostic phase of the procedure a severe stenosis in the left carotid bifurcation was confirmed. We made injections of contrast material into the left common carotid artery (CCA) in order to have a cerebral angiogram for intracranial dynamics evaluation. In a Towne projection we found normal filling of the middle cerebral artery (MCA) and contra lateral anterior cerebral artery (ACA), but the ipsilateral ACA territory was absent. This finding was confirmed with a new injection in capillary phase (Figure 1). The endovascular neurosurgeon thought that the atherosclerotic plaque had been broken and an embolism had occluded the left ACA. Neurological examination of the patient did not reveal any abnormal sign. The right CCA was canalized and a lateral and Towne view were obtained. We found that the ACA territory of the left cerebral hemisphere was fed by the right carotid system. As previously mentioned, the right ACA territory was filled by the left carotid artery.

Then, we recognized that we were dealing with an uncommon angiographic variation, and proceeded with the CAS without complications. The patient was discharged after 3 days.



**Figure 1.** Cerebral angiogram. (A: Normal filling of the MCA and right ACA but not of the left ACA; B: Capillary phase shows the empty left ACA territory; C: After the right CCA was canalized, the left ACA territory was exclusively filled by right carotid artery; D: Capillary phase shows that the right ACA territory is not filled)

### Discussion

Anatomic variations of the anterior circulation of the brain may or may not have pathological significance [4]. For some authors, a complete Circle of Willis with its nonagonal shape and 10 components is the exception [2,5]. Marinkovic et al, reported that 'classical ACoA' was observed in only a 41% of the cases, which indicates that a 'no classical' ACoA is observed in the majority of the cases [6]. Knowledge of these normal variants becomes particularly important in neurosurgical and endovascular procedures.

A complete evaluation of the collateral circulation is a very important parameter investigated during the performance of a functional angiography, and these patterns of circulation must be kept in mind, since they could have hazardous or even fatal consequences if not considered. During the angioplasty and stenting of this

patient, we made a cerebral angiogram for comparison purposes; a thromboembolism was suspected after the angioplasty had been completed. This procedure is routinely made to patients fully awake, which allow us to constantly interact with the patient and evaluate his neurological status during the diagnostic and therapeutic phases.

The vascular anatomy of the region of ACoA is generally complex due to its embryological development. In the 24 mm embryo the ACoA is still a plexiform structure connecting both ACA. Incomplete fusion of this anastomosis may lead to fenestration, doubling or tripling of the ACoA [7]. Anomalies in the anterior part of the Circle of Willis are demonstrated in about 60% of the cases with aneurysms of the ACoA, and 90% of those have unilateral hypoplasia of the A1 portion [5]. According to Rhoton Laws' these anomalies induce hemodynamic

abnormalities that impose stress on a weak point of the artery [8]. Kwak et al. reported from 296 patients with ACoA aneurysms, 17 cases with fenestration and 13 cases with abnormal vessels originated from ACoA [5]. They illustrated the morphological characteristics of the ACoA region wonderfully but did not give details of the angiographic and hemodynamic behavior.

This type of exclusive contralateral irrigation of the ACA territory could be the cause of paradoxical neurological signs in occlusive diseases, eg: facial and superior monoparesis with contra lateral inferior weakness in case of acute occlusion of the internal carotid artery or contra lateral inferior monoparesis in case of occlusion of the ACA. To our knowledge, this dynamic anatomical variation has not been reported previously.

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