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Subcallosal Artery: Identification prior to treatment. About a case and review of the literature.

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Abstract

The subcallosal artery is the longest perforating artery of the anterior communicating artery (AcoA).1 Despite its great importance and being present in 50-79% of patients, it is little described in the literature. It is essential to identify prior to endovascular or surgical procedures, because the lesion of this artery will produce a bilateral infarction of the subcallosal region and causing a severe cognitive impairment and alteration of anterograde memory, known as "Subcallosal amnesic syndrome".[1,2]

We present the case of a patient with a peri callosal arteriovenous malformation with identification of the Subcallosal artery prior to treatment as the only afferent.[3] It is often difficult to identify this artery on images and its prior visualization could prevent significant sequalae in patients. We concluded that the Subcallosal artery is the most important perforating artery in the communicating artery, therefore its identification prior to treatment is essential.[4]

Keywords: *Subcallosal artery, Anterior communicating artery, Corpus callosum, Cognitive impairment, Fornix.*

Introduction

The subcallosal artery (ScA) forms part of the perforating arteries of the anterior communicating artery, together with the chiasmatic and hypothalamic arteries[1]. Although it holds significant importance and is observed in 50-79% of patients, it is scarcely addressed in the literature, being the longest perforating artery of the anterior communicating artery (AcoA). It is called subcallosal if it does not extend beyond the genu or knee of the corpus callosum or medial artery of the corpus callosum (21%) if it extends distally to the splenium. It usually arises from the posterior or posterosuperior region of the AcoA, in its medial third in 53% of cases or the left lateral third in 29% of cases.[1,2]

The identification of this artery before endovascular or surgical procedures is essential since this artery is unique and when a lesion exists it will result in a bilateral infarction of the subcallosal/septal region producing a severe anterograde cognitive and memory impairment, known as "amnesic syndrome of the ScA".[3] Yasargil reports that up to 28.2% of patients may present lesion of this artery producing a bilateral infarction with a compromise of memory and character. In 5% of these patients, permanent disability may occur.[4]

The case of a patient with a pericallosal arteriovenous malformation with identification of the subcallosal artery as the only afferent artery before treatment is presented. Despite being a frequent clinical variant and having great clinical relevance in cognitive function, it is often difficult to identify this artery in pre-procedural imaging. In vivo investigation of the subcallosal artery is still the subject of ongoing research, and its prior visualization could avoid important sequelae in patients.

Case

A 10-year-old boy with no relevant history abruptly presented with a predominantly frontal headache, oppressive and of great intensity associated with nausea, vomiting, and a subjective sensation of rotatory vertigo, for which he was taken to the emergency room.

On clinical examination the patient was somnolent, disoriented in time and space, without motor or sensory deficit, with nuchal rigidity, and without cranial nerve involvement. Meningeal signs: Kernig and Brudzinski positive.

Brain tomography (CT) and brain magnetic resonance imaging (MRI) were performed, showing hyperintensity in the suprachiasmatic region suggestive of Fisher IV subarachnoid hemorrhage with irruption of lateral ventricles and left temporal horn (Figure 1). Digital subtraction angiography (DSA) is performed (Figures 2 and 3) where subcallosal arteriovenous shunt Spetzler-Martin grade 2 is observed: (size 1, eloquence 0, drainage 1), with a single afferent by Subcallosal artery and deep drainage to the septum pellucidum vein and the internal brain.

In DSA (Figures 2 and 3), the anatomical course of the ScA is observed. Embolization of 100% of the malformation was performed with Microcatheter Sonic 1.2F and Onyx 18 (Figures 3 and 4).

When the patient was discharged, he was not altered in the waking state, without orientation or cranial nerve involvement, and showed no visual, motor, or cognitive deficits.

5 months after AVM embolization, a comprehensive evaluation of the patient is performed by neuropsychology and neuroradiology showing total embolization of the malformation and cognitive and neurological integrity.

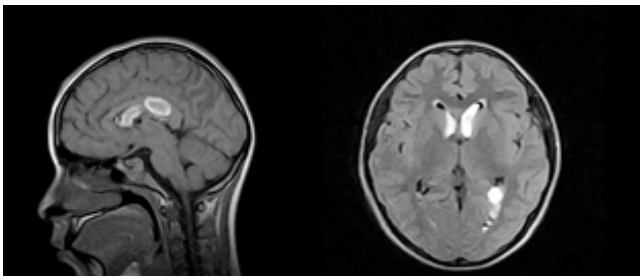

Figure 1. Brain MRI - FLAIR. A. Sagittal view and B. Axial view, showing hyperintensity corresponding to hemorrhage with lateral ventricular and temporal horn disruption.

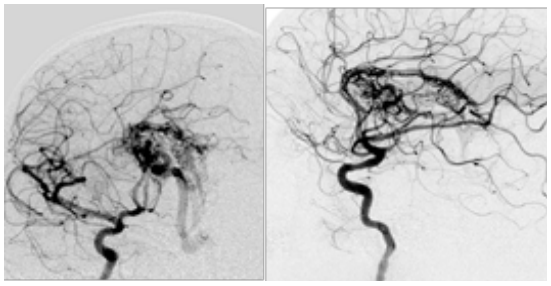

Figure 2 A y B: Digital Subtraction Angiography (DSA) anteroposterior and lateral views, showing an arteriovenous shunt with afferent supply from the subcallosal artery.

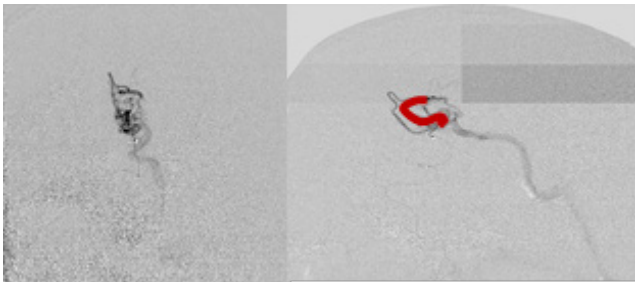

Figure 3. Supraselective DSA in AP and lateral projections of the subcallosal artery, showing an S-shaped course and afferent supply to a pericallosal arteriovenous shunt.

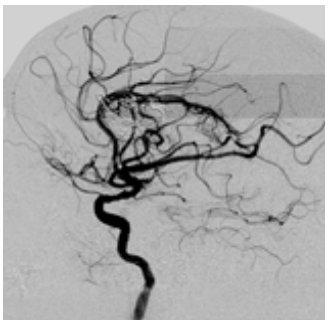

Figure 4. Lateral DSA showing complete embolization of arteriovenous shunt.

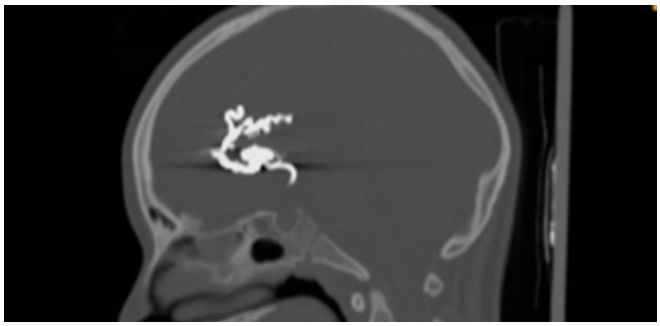

Figure 5. Angio-CT showing an embolized subcallosal artery.

Discussion

This case presents an arteriovenous malformation with a single afferent through the ScA where the characteristic vascular trajectory is identified, which despite its great importance due to its eloquence and being the main perforator of the AcomA is little described and identified in the literature.

There is a variant of the ScA, present in 21% of cases, known as the medial artery of the corpus callosum. This variant has an identical course as the ScA but extends more distally to the body and splenium of the corpus callosum. The lesion of this artery will produce a bilateral fornix infarction with anterograde amnesia.

The diameter of this artery is described in the literature as 0.4-0.6 (average 0.5mm). In our case, the diameter is higher being 0.9mm, probably due to a hypertrophy of this artery for being afferent to the arteriovenous shunt.[2,3]

During the superselective angiography of our patient, the "S"-shaped course of the subcallosal artery was observed as the least frequent form (27%). The most frequent form is the "C" shape in up to 55.9% followed by the straight form that runs towards the knee(16.9%).[2,5] The subcallosal artery is the longest perforating artery of the anterior communicating artery. It crosses the pericallosal cistern along the corpus callosum, irrigates the anterior part of the hypothalamus, paraterminal gyrus, subcallosal area, fornix, and the medial portion of the anterior commissure, the medial portion of the rostrum and knee of the corpus callosum.[4,6]

Generally, the involvement of the ScA causes infarction of the anterior columns of the fornix, producing disruption of the Papez circuit that connects the hippocampus with the limbic system producing anterograde amnesia associated with other alterations such as visual and behavioral involvement, psychomotor retardation or Korsakoff psychosis.[8] In our case, a post-treatment MRI was performed with no evidence of infarction. Characteristically, in axial brain magnetic resonance imaging, the image is described as a "Y" image due to the involvement of the corpus callosum, genu, and both anterior columns.[9]

Because of the eloquence of ScA and the high frequency of pathologies involving these areas such as AcomA aneurysms, anterior skull base meningiomas, pituitary adenomas, and craniopharyngiomas, it is essential to locate the artery before endovascular, surgical or endoscopic treatment. Generally, the identification of this artery by MRI and digital subtraction angiography (DSA) is extremely difficult.

It is concluded that the subcallosal artery is the most important perforating artery of the anterior communicating artery, so its identification through imaging techniques such as angiography before treatment is essential.

References

1. Serizawa T, Saeki N YA. Microsurgical anatomy and clinical significance of the anterior communicating artery and its perforating branches. itle. Neurosurgery. 1997;40:1211–1216.
2. Chenin L, Kaoudi A, Foulon P, Havet E, Peltier J. Microsurgical anatomy of the subcallosal artery. Surg Radiol Anat. 2019;(0123456789):1-8. doi:10.1007/s00276-019-02279-8
3. Najera E, Gardner PA, Fernandez-miranda JC. Surgical Anatomy of the Subcallosal Artery : Implications for Transcranial and Endoscopic Endonasal Surgery in the Suprachiasmatic Region. 2019;17(1):79-87. doi:10.1093/ons/opy276
4. Yasargil MG, Smith RD, Young PH TP. Anterior Cerebral and Anterior Communicating Artery Aneurysms. Vol 2.; 1984.
5. Matsushige T, Chen B, Dammann P, Johst S, Wrede KH. Microanatomy of the subcallosal artery : an in-vivo 7 T magnetic resonance angiography study. 2015. doi:10.1007/s00330-015-4117-1
6. Krayenbühl HA YM. Radiological anatomy and topography of the cerebral vessels. In: Cerebral angiography. Lippincott,. second:20-84.
7. Ture UYGKA. The Arteries of the Corpus Callosum: A Microsurgical Anatomic Study. Neurosurgery. 1996;39:1075-1085.
8. Mugikura S, Kikuchi H, Fujimura M, Mori E, Takahashi S, Takase K. Subcallosal and Heubner artery infarcts following surgical repair of an anterior communicating artery aneurysm : a causal relationship with postoperative amnesia and long - term outcome. Jpn J Radiol. 2017;(0123456789). doi:10.1007/s11604-017-0703-2
9. Pardina-vilella L, Pinedo-brochado A, Vicente I, Bocos-portillo J, Martínez-arroyo A, García-moncó JC. The goblet sign in the amnestic syndrome of the subcallosal artery infarct. 2018:2-4.

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