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Letter to Editor

The role of the orbitofrontal artery in the clipping of superiorly projecting anterior communicating artery aneurysms

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BACKGROUND

Anterior communicating artery (ACoA) aneurysms are the most common type of cerebral aneurysms 23–40%.[2] They are categorized by dome projection with respect to the ACoA artery as superior (34%), anterior (23%), posterior (14%), and inferior (13%).[1] ACoA aneurysms pose a challenge due to their deep midline location and anatomical complexity, therefore, a thorough radiographic analysis of the aneurysm and the surrounding vasculature is crucial to surgical planning. ACoA aneurysm clipping requires the identification of several important arteries; the ipsilateral and contralateral precommunicating segments of the anterior cerebral artery (ACA) (A1) and postcommunicating segment of the ACA (A2) as well as, the ipsilateral and contralateral recurrent artery of Heubner (RAH). In certain situations, especially for superiorly projecting ACoA aneurysm, the orbitofrontal (OF) artery can complicate aneurysm exposure as it lies within the surgical corridor. Here, we will discuss the significance of the OF artery during the exposure of superiorly projecting ACoA aneurysms.

MICROSURGICAL ANATOMY

The A2 (a.k.a. postcommunicating) segment of the ACA begins at the ACoA junction and continues along the rostrum of the corpus callosum – hence the term subcallosal segment – until it reaches the rostrum-genu juncture of the corpus callosum. The A2 segment of the ACA gives three main branches, two of which (RAH and OF artery) are closely related to ACoA aneurysm clipping.[4]

The RAH is the first branch of the A2 and is the largest and longest branch, frequently originating within 4 mm of the ACoA junction, with an average length of 23.4 mm (range, 12–38 mm).[4] The importance of the RAH in ACoA clipping is well-established inasmuch as its identification and preservation are a routine step during the microsurgical clipping of ACoA aneurysms. Infarction

in the poorly collateralized territory of the RAH results in caudal stroke with a well-defined triad of contralateral facial and brachial hemiparesis, as well as expressive aphasia in the dominant hemisphere.[4]

The OF artery is a term commonly applied for the medial OF artery of the A2 (a.k.a. frontobasal). The lateral OF artery is a branch of the superior trunk of the middle cerebral artery (M2 segment) and is outside the scope of this discussion. The OF artery is the first cortical branch from the A2; it may originate as a common trunk with the frontopolar (FP) branch (18%) or, rarely, from the A1 segment of the ACA. The OF artery originates within 5 mm (range, 4–9 mm) from the ACoA junction and runs anteriorly and inferiorly, passing perpendicularly over the gyrus rectus and across the olfactory tract en route to the OF cortex. The course of the OF artery may resemble that of a RAH, but it diverges distally from the A1 segment. It supplies the gyrus rectus, the olfactory bulb, and the medial orbital surface of the frontal lobe, producing numerous perforators (Brodmann's areas 25,11).[3,4]

THE OF ARTERY IN ACOA CLIPPING SURGERY

The OF artery is a component of the core vascular complex that must be identified and preserved during the surgical clipping of ACoA aneurysms, especially the superiorly projecting type.

It is imperative to underline an existing discrepancy between our 2D understanding of the OF and its intraoperative orientation in the setting of ACoA clipping surgery [Figure 1]. The OF artery is perpendicular to the ipsilateral A2 and runs horizontally toward the surface of the OF cortex [Figure 1]. In addition, the ACoA rarely rests horizontally as represented in anatomy textbooks, but most of the time is obliquely angled which results in one A2 being located anteriorly relative to the other A2.

In superiorly projecting ACoA aneurysms, the aneurysm dome is located between the bilateral A2 segments, effectively blocking the view of the contralateral A2. As a result, access to the contralateral proximal A2 requires deep dissection around and above the dome and up through the interhemispheric fissure. In certain scenarios, the presence of the OF artery can add more technical challenges to the exposure as it would be located at the level of the aneurysm. In such a case, the OF artery represents a real obstacle, complicating the dissection and raising the question of what are the potential immediate and long-term consequences of intentional vessel sacrifice or inadvertent injury [Figures 2 and 3].

The clinical significance of OF artery sacrifice is not well understood with a noticeable gap between microanatomical and surgical-clinical studies. A search of the Medline at PubMed database from its inception to the present using the following search algorithm; ((OF) OR (Fronto-orbital) OR (Frontobasal) AND (ACoA)) AND (aneurysm), revealed no papers discussing the functional significance of the OF artery. The existing research was either cadaver based or primarily focused on the origin, course, territories, and anastomoses of the OF artery, with no studies connecting the functional, neurological, or cognitive outcomes of patients undergoing ACoA clipping surgery to the preservation or sacrifice of the OF artery. At our institution,

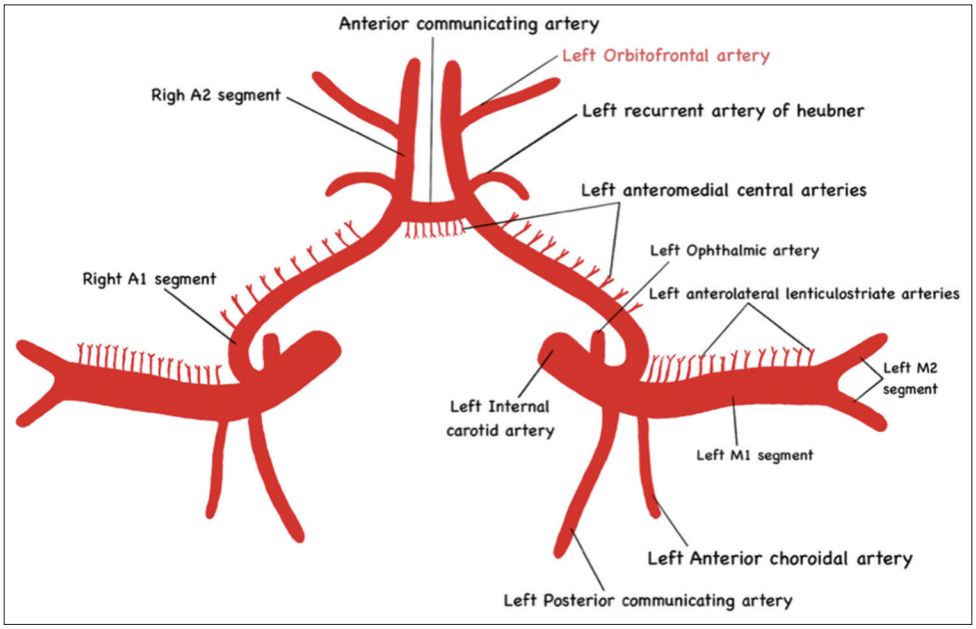

Figure 1: An anatomical depiction of the orbitofrontal artery, running laterally from the A2.

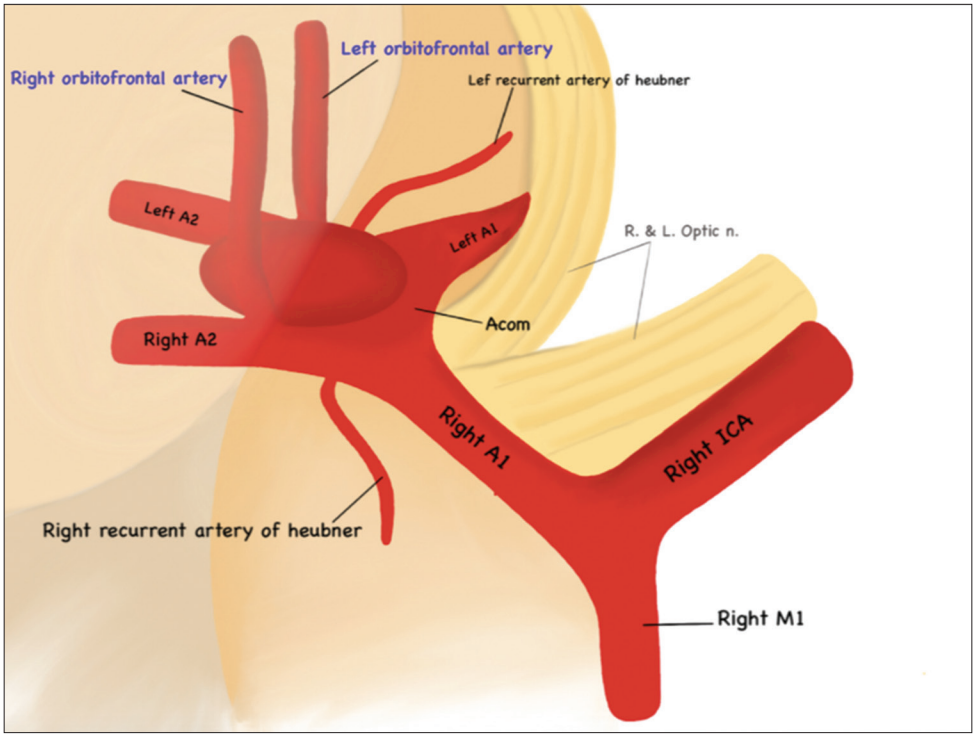

Figure 2: An anatomical depiction of the vessels closely related to the anterior communicating artery (ACoA) shows the potential for the orbitofrontal artery to be an obstacle in the surgical corridor in superiorly projecting ACoA aneurysms.

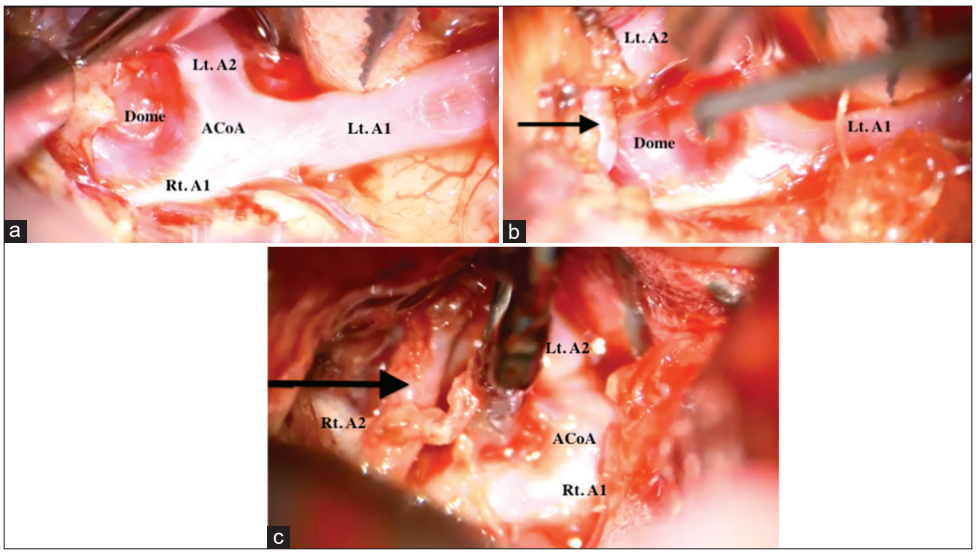

Figure 3: Intraoperative images of a ruptured, superiorly projecting anterior communicating artery (ACoA) clipping through the right pterional approach. (a) Initial dissection: the right A1, the ipsilateral A2, as well as the ACoA aneurysm are visible. (b) The orbitofrontal (OF) artery runs in proximity relation to the aneurysm dome (black arrow). (c) The preserved OF artery appears superior to the clip at the end of surgery.

the OF had to be sacrificed in 6 out of 50 patients with clip secured ruptured ACoA aneurysms. All six patients had gyrus rectus resection necessitated by the ruptured status of the aneurysm, resulting in the aneurysm dome being adherent to the surrounding parenchyma. All six patients had no noticeable neurological deficits with a mean follow-up of two years; this phenomenon may be explained in part by probable collateralization between medial and lateral OF arteries, which acts to mitigate neurological damage in the event of OF artery sacrifice.

CONCLUSION

The OF artery is a critical component in the surgical clipping of superiorly projecting ACoA aneurysms. It can obscure the surgeon's view of the aneurysm and the contralateral A2, which can increase the risk of surgical dissection and aneurysm rupture. Future snalysis of the clinical repercussions resulting from OF artery scarifice are required to guide intraoperative decisions of vessel preservation or sacrifice.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Bhattarai R, Liang CF, Chen C, Wang H, Huang TC, Guo Y. Factors determining the side of approach for clipping ruptured anterior communicating artery aneurysm via supraorbital eyebrow keyhole approach. Chin J Traumatol 2020;23:20-4.
2. Chen J, Li M, Zhu X, Chen Y, Zhang C, Shi W, *et al*. Anterior communicating artery aneurysms: Anatomical considerations and microsurgical strategies. Front Neurol 2020;11:1020.
3. Hernesniemi J, Dashti R, Lehecka M, Niemelä M, Rinne J, Lehto H, *et al*. Microneurosurgical management of anterior communicating artery aneurysms. Surg Neurol 2008;70:8-28; discussion 29.
4. Perlmutter D, Rhoton AL Jr. Microsurgical anatomy of the distal anterior cerebral artery. J Neurosurg 1978;49:204-28.

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