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Comprehensive Management of Intracranial Aneurysms in Rare and Variant Arterial Locations: A Detailed Case Report

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Abstract

Aneurysms on variant arteries, especially involving the persistent trigeminal artery (PTA), azygos artery, and lenticulostriate arteries (LSAs), are rare. This report presents a case and subsequent management of a patient with multiple unruptured aneurysms arising from variant anatomical structures. A 48-year-old patient with a history of worsening headaches presented with three unruptured aneurysms at the PTA, azygos artery, and left LSA, confirmed via catheter angiography with three-dimensional reconstruction. Given the potential effects on conventional cerebrovascular structures, managing multiple aneurysms in rare and variant locations requires a tailored strategy. This case was successfully treated with an endovascular approach and a period of observation, emphasizing the need for individualized treatment planning.

Keywords
- persistent trigeminal artery
- azygos
- lenticulostriate
- aneurysm

Introduction

Cerebral anatomic variants, such as persistent fetal arteries, arterial segment abnormalities, fenestration, and duplication, are frequent and some of them are linked to increased aneurysm and vascular malformation risks due to hemodynamic stress and vessel alterations.[1,2] The persistent trigeminal artery (PTA) appears in 0.1 to 1% of cerebral tomography (CT) angiographies.[1,3,4] The azygos variant in the anterior cerebral artery is observed in 1 to 2% of magnetic resonance angiographies[1]; however, a high incidence of aneurysms are reported in this variant.[1,5,6] Lenticulostriate arteries (LSAs) aneurysm are uncommon, fewer than 100 cases are reported.[7,8] This case highlights the rarity of aneurysms in these locations, especially PTA and LSA aneurysms.[5,7,8] Also, this report discusses multiple aneurysms within these uncommon arterial variations.

Case Report

A 48-year-old female patient, Latin-American background with a history of worsening headaches, nausea, and 5 days prior loss of consciousness while she was working, was admitted. Normal findings were observed in the neurological examination and CT. Lumbar puncture was not performed. CT angiography revealed three unruptured aneurysms: a $20 \times 18 \times 4.5$ mm aneurysm at the PTA (Saltzman type 1),[3] a $2.3 \times 1.8 \times 2.1$ mm aneurysm at the azygos artery (type C radiographic classification),[5] and a $5.2 \times 4.2 \times 4$ mm aneurysm at the left LSA (►**Fig. 1A**). The case was discussed in a multidisciplinary meeting with surgery and endovascular neurosurgeons. Given the patient's recent history and absence of other causal diagnoses, the decision was made to treat. Decision made was to approach via endovascular for PTA and LSA aneurysms. For PTA aneurysm due its complex surgical access and large size, and for LSA aneurysm given its medium

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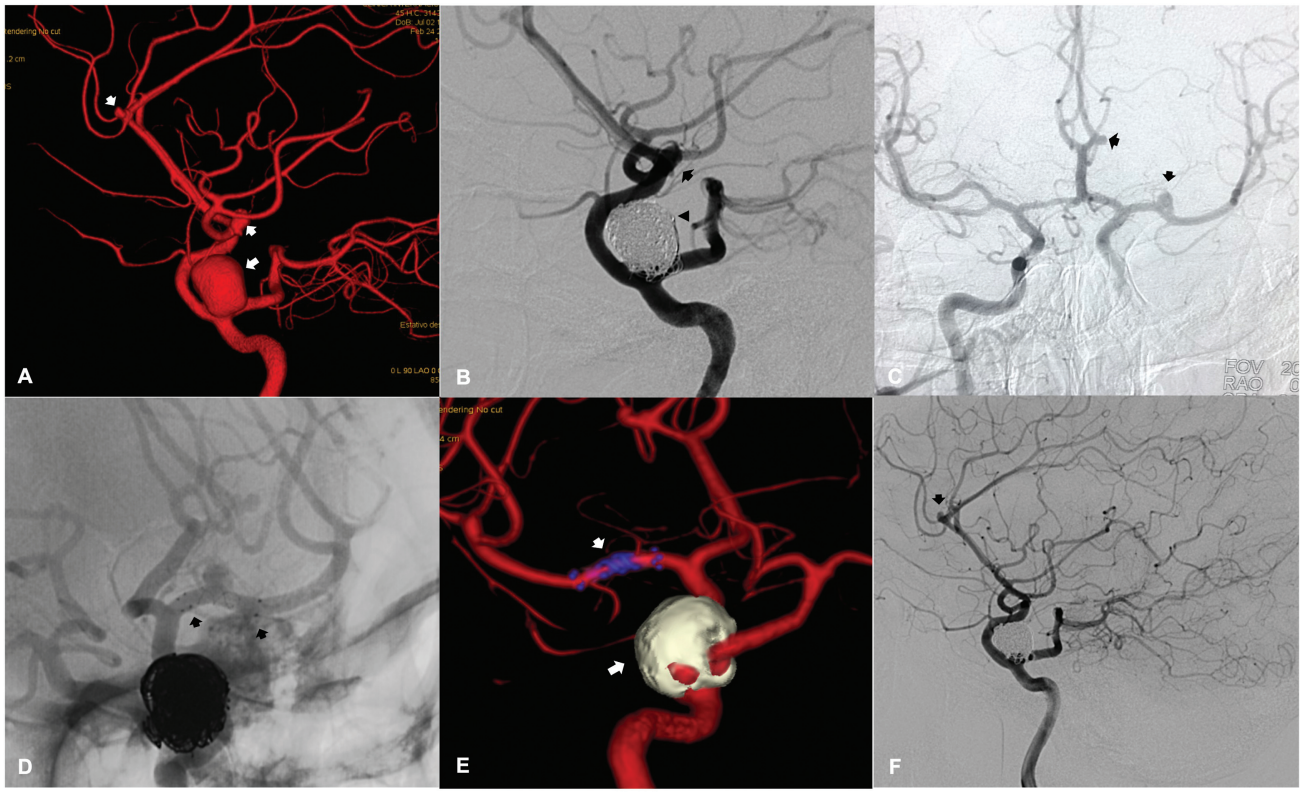

Fig. 1 (**A**) Pretreatment three-dimensional (3D) angiography showing persistent trigeminal artery (PTA), azygos, and left lenticulostriate artery (LSA) aneurysms (arrows). (**B**, **C**) Angiography showing coiled PTA and azygos aneurysms (arrows). (**D**) Deployment of 2508 FRED Jr flow diverter in left middle cerebral artery (MCA) for treatment of LSA aneurysms (arrow). (**E**) One-year follow-up 3D angiography showing microcoils cast at PTA-treated aneurysm and FRED Jr deployed at left MCA. (**F**) One-year follow-up angiography showing complete occlusion of the PTA and LSA aneurysms; unchanged azygos aneurysm (arrow).

size and neck to the limit. Also, observation decision was made for azygos aneurysm given its small size. After discussion with the patient, the decision was made to proceed with endovascular treatment in two stages. Endovascular management for the PTA aneurysm involved femoral arterial access via the Seldinger technique, using a 6-Fr femoral introducer sheath. Selective angiography was performed. A 6-Fr Chaperon guide catheter (MicroVention, Tustin, California, United States), a 17 Headway microcatheter (MicroVention), and a 0.14 Traxcess microguidewire (MicroVention) were used as the interventional apparatus. Sequential embolization using 16 Cosmos microcoils (MicroVention) (►**Fig. 1B**) was delivered to obliterate the PTA aneurysm, achieving a Class 1 Raymond-Roy occlusion (►**Fig. 1C**). For the second stage, the decision was to place a flow diverter because of the dome-to-neck ratio of 1.05 (< 2). So, a dual antiplatelet therapy with daily aspirin 100 mg and clopidogrel 75 mg was initiated a week prior to the intervention, a VerifyNow test[9] was not performed given limited availability and costs.[10] Via the Seldinger technique, a 6-Fr femoral introducer was used to secure femoral access. Through a 6-Fr Chaperon guide catheter (MicroVention), selective angiography was performed. A 17 Headway microcatheter (MicroVention) and 0.14 Traxcess microguidewire (MicroVention) were navigated and placed in the M2 division of the middle cerebral artery. A single 2508 FRED Jr (MicroVention) flow diverter was deployed without complication to treat the LSA aneurysm (►**Fig. 1D**). The azygos aneurysm was managed conservatively due to its small size. One-year follow-up showed complete occlusion of the PTA and LSA aneurysms, with the azygos aneurysm remaining unchanged (►**Fig. 1E, F**).

Discussion

This case highlights the rarity of multiple aneurysms in variant locations like the PTA, azygos, and LSA. The complexity of these aneurysms necessitated a detailed neuroimaging analysis and individualized treatment planning; assessing collateral circulation is critical before surgical or endovascular interventions.[1] The successful endovascular treatment of the PTA and LSA aneurysms, along with the conservative management of the azygos aneurysm, demonstrates the importance of a tailored approach in managing such cases. The case of the PTA aneurysm presented here aligns with findings from a systematic review[3] encompassing a patient age range of 20 to 77 years, with a predominant incidence in females. Among the reported cases, half were unruptured aneurysms, yet symptomatic in 80% of instances.[3,4] Notably, 75% of PTA aneurysms were categorized as cavernous, with a substantial portion (31%) presenting a large diameter ranging between 15 and 24 mm, and an equal proportion (31%) being smaller than 7 mm in size.[3] Furthermore, the majority of PTA aneurysms (97%) were classified as Saltzman type II, mirroring

the classification of our case.[3] Treatment modalities varied, with 55% of the cases undergoing endovascular intervention, while 40% did not receive any treatment.[3] This specific type of aneurysm is occasionally associated with other aneurysms or vascular malformations, as observed in our case—a rarity in medical literature with only seven similar instances reported.[4] Previous reports have identified other localizations, such as the middle and anterior cerebral arteries and the posterior communicating artery. However, our case is distinctive as the only reported instance featuring multiple aneurysms located in the PTA, LSA, and azygos variant.[3,4] LSA aneurysms are uncommon, with limited cases documented in literature. The primary contention regarding these aneurysms lies in the diversity of opinions surrounding their treatment.[7,8] Reported treatment strategies for LSA aneurysms, include observation, excision, clipping, and also the application of embolizing agents such as onyx or n-butyl cyanoacrylate, or Gamma Knife surgery.[7] To our knowledge, this report documents the first case treated with a flow diverter device, achieving favorable clinical outcomes, without any complication and complete occlusion at the follow-up stage. The azygos variant, with its relatively low prevalence of 1 to 2%,[1] interestingly demonstrates a higher incidence of aneurysms, ranging from 41 to 71% among individuals with this condition.[5,11] The risk of azygos aneurysm rupture is not clear, some reports state they tend to be higher due the lack of resistant arachnoid membranes; mostly if the size is greater than 3 mm, and when it is associated with multiple aneurysm the risk of rupture increases to 30 to 50% of cases.[12] In this scenario, surgical treatment should be considered.[12,13] In our case, a conservative management approach was adopted for the azygos aneurysm due to its small size. The 1-year angiographic follow-up showed no changes in the aneurysm —a contrast to the majority of cases in literature that were treated with surgical clipping.[5,6]

Conclusion

The presence of multiple aneurysms in rare and variant arterial locations poses significant challenges in management. This case report emphasizes the importance of staged, individualized treatment strategies in the successful management of such complex aneurysms.

Authors' Contribution

The manuscript has been read and approved by all the authors, and the requirements for authorship as stated have been met; each author believes that the manuscript represents honest work.

Conflict of Interest

None declared.

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