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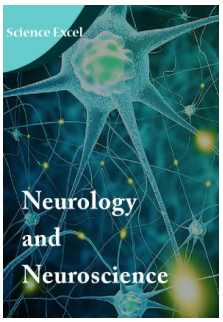
Case Report



Hybrid Management of Mirror Pericallosal Artery Aneurysms: Case Report and Literature Review

Pedro Nogarotto Cembraneli[1], Julia Brasileiro de Faria Cavalcante[1], Italo Nogarotto Cembraneli[2], Renata Brasileiro de Faria Cavalcante[1], José Edison da Silva Cavalcante[1], Leonardo Taveira Lopes[3], Rodrigo Correia de Alcântara[1], Marcos Daniel Xavier[1], Vitor Cesar Machado[1], Alessandro Fonseca Cardoso[1] and Chrystiano Fonseca Cardoso[1]

[1]*Department of Neurosurgery, Hospital of Neurology Santa Mônica, Goiânia, Goiás, Brazil*
[2]*Departament of Medicine, University Center of Mineiros, Mineiros, Goiás, Brazil*
[3]*Departament of Radiology, Hospital of Neurology Santa Mônica, Goiânia, GO, Brazil*

*Correspondence
Pedro Nogarotto Cembraneli
Department of Neurosurgery, Hospital of Neurology Santa Mônica, Goiânia, Goiás, Brazil

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Pericallosal aneurysm; mirror aneurysm; anterior cerebral artery; hybrid treatment; microsurgical clipping; endovascular coiling.

Abstract

Introduction: *Mirror aneurysms of the pericallosal artery are extremely rare and pose unique challenges for both neurosurgical and endovascular management. We report a case of hybrid treatment combining microsurgical clipping and endovascular coiling for bilateral distal anterior cerebral artery (DACA) aneurysms, with an anatomical, technical, and strategic discussion based on current literature.*

Case report: *A 72-year-old male patient with two unruptured pericallosal artery aneurysms underwent staged treatment: microsurgical clipping of the dominant lesion followed by endovascular embolization of the contralateral aneurysm. The left-sided aneurysm (6 mm) was successfully clipped. The right-sided lesion (3 mm), with a calcified neck, was treated endovascularly 30 days after the initial procedure. The patient remained neurologically intact.*

Discussion: *Even small distal ACA aneurysms carry a high risk of rupture and require individualized therapeutic planning. The combination of techniques—clipping for high-risk lesions and coiling for technically unfavorable configurations—offers an effective and safe strategy, especially when performed by a multidisciplinary team in hybrid-capable centers.*

Conclusion: *Hybrid strategies prove effective in selected cases of distal mirror aneurysms. Multidisciplinary, individualized assessment based on vascular anatomy and technical risk is essential for optimal outcomes.*

Introduction

Aneurysms of the pericallosal artery, corresponding to segments A2 through A5 of the anterior cerebral artery (ACA), represent approximately 2% to 9% of all intracranial aneurysms [1–3]. Bilateral or "mirror" aneurysms are even less common, with an estimated prevalence of less than 0.2%. Their rarity and deep interhemispheric midline location impose considerable challenges for both surgical and endovascular treatment [1–4].

These aneurysms are often associated with predisposing anatomical factors such as acute ACA bifurcations, congenital variations, and asymmetric hemodynamic flow [5]. Ruptures in this location typically result in deep interhemispheric hematomas, often without preceding clinical signs [6].

With advances in microsurgical and endovascular techniques, hybrid approaches have emerged as an effective alternative for complex cases. This report describes a rare case treated using a combined strategy, illustrating the nuances of decision-making and technical planning.

Case Report

A 72-year-old hypertensive, non-smoking male presented with persistent headache and no neurological deficits. Magnetic resonance angiography and computed tomography angiography revealed two unruptured saccular aneurysms in the A3 segment of the pericallosal artery: a 6 mm lesion on the left, adjacent to the rostrum of the corpus callosum, and a 3 mm lesion on the right, located deeper and more posteriorly (Figure 1).

After multidisciplinary discussion, initial microsurgical treatment was chosen due to internal carotid tortuosity, which would complicate endovascular navigation. Through a bicoronal craniotomy and interhemispheric dissection, both aneurysms were visualized. The left-sided aneurysm was safely clipped (Figure 2). The right-sided aneurysm had a calcified neck and anterior projection, which hindered clipping. After unsuccessful attempts, the surgical procedure was limited to the left lesion.

Postoperative angiography confirmed complete exclusion of the left aneurysm. The

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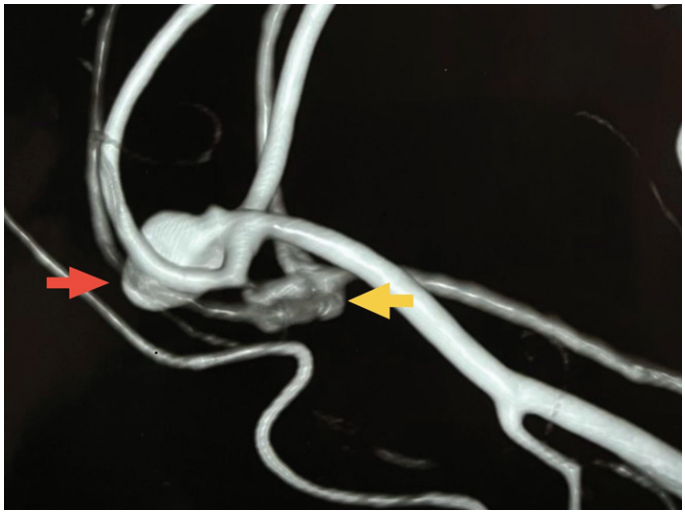

Figure 1. *Three-dimensional reconstruction of cerebral CT angiography showing a saccular aneurysm of the left pericallosal artery measuring approximately 6 mm (red arrow), with a wide neck, located in the A3 segment of the ACA, projecting superiorly and medially, adjacent to the rostrum of the corpus callosum. Note the tortuous trajectory of the intracranial vessels and the emergence of the contralateral pericallosal branch, partially obscured by vascular overlap. The image supports the diagnosis of a Type 1 mirror aneurysm, with both aneurysms originating from the same vessel, the right one measuring approximately 3 mm (yellow arrow).*

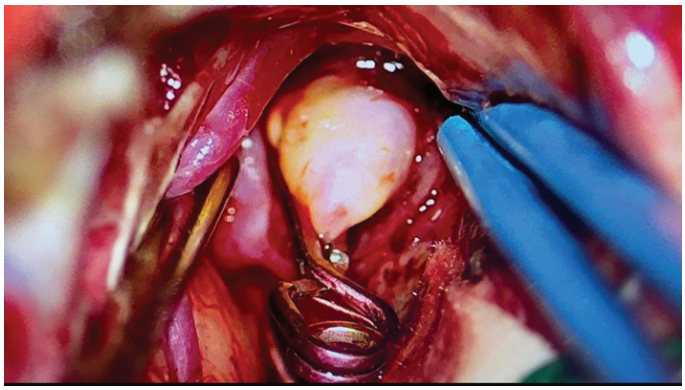

Figure 2. *Intraoperative image during interhemispheric approach for clipping of the left pericallosal artery aneurysm. A saccular aneurysm of approximately 6 mm is observed, with a yellowish, glistening dome compatible with an unruptured lesion. A titanium clip is already positioned at its base, achieving complete neck exclusion.*

right-sided lesion was successfully treated with endovascular coiling 30 days later, without complications (Figure 3). The patient was discharged neurologically intact.

Discussion

Distal anterior cerebral artery (DACA) aneurysms are clinically relevant even at small sizes due to their high risk of early rupture, particularly in the pericallosal region—an anatomically deep and surgically constrained area. This justifies early therapeutic intervention, as demonstrated in recent studies [6,7].

Mirror aneurysms, also referred to as "kissing aneurysms" when in close proximity, are classified based on the origin of their necks. According to the classification proposed by Harada

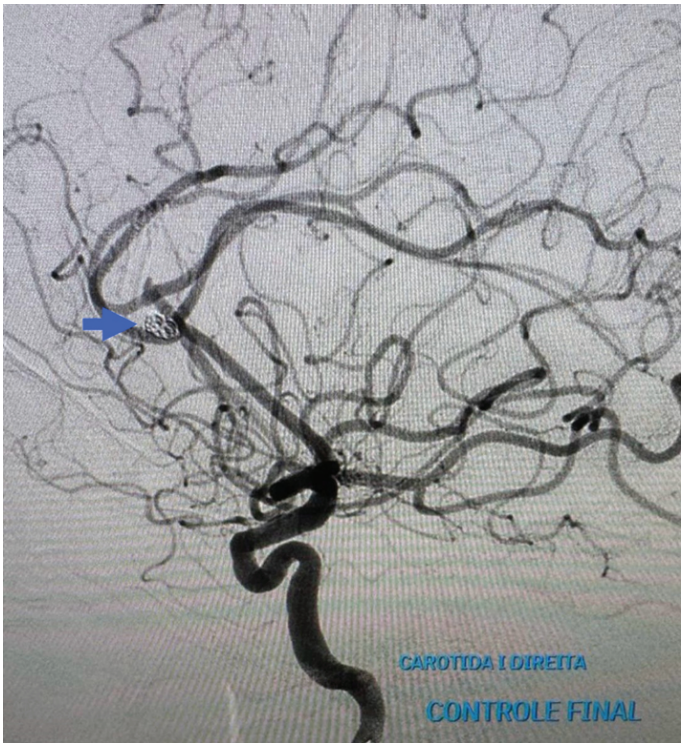

Figure 3. *Digital subtraction angiography (DSA) – selective injection of the right internal carotid artery, anteroposterior projection. Final angiographic control after endovascular treatment of a 3 mm saccular aneurysm of the right pericallosal artery (blue arrow). The lesion was completely excluded from the circulation using coil embolization, with no compromise of the parent vessel flow. Anterograde perfusion of the distal branches of the anterior cerebral artery is preserved, as is collateral circulation. Findings confirm complete occlusion of the aneurysm with a satisfactory angiographic result (Raymond-Roy Occlusion Classification I).*

et al., Type 1 aneurysms originate from the same parent vessel—typically a single pericallosal artery branch—while Type 2 aneurysms have separate necks, each arising from different vessels, such as the right and left pericallosal arteries [8].

This classification has significant implications for surgical and endovascular planning: Type 1 aneurysms are usually closer together and may share vascular structures, increasing the risk of parent vessel injury during clipping or coiling. In contrast, Type 2 aneurysms offer greater anatomical separation, allowing for more targeted approaches. In our case, both necks arose from the left pericallosal artery, classifying the lesion as a Type 1 mirror aneurysm.

Surgical treatment, although durable and effective, is technically demanding due to deep location, limited exposure through the narrow interhemispheric fissure, and risk of intraoperative rupture. Suh et al. reported intraoperative rupture rates as high as 50% in DACA aneurysm surgeries [9].

Endovascular treatment, while less invasive, may be hindered by vessel tortuosity and small aneurysm size, which increase the risk of catheter instability and coil migration. However, recent advances in balloon-assisted, stent-assisted, and flexible microcatheter techniques have improved endovascular success rates. Huang et al. (2022) reported an initial occlusion rate of 91.5% with only 10% requiring retreatment [10]; Asano et al. (2023), in a multicenter review, achieved a 96.3% technical

success rate with permanent complications in less than 3% of treated DACA aneurysms [11].

A 2024 retrospective study by Yamada et al. emphasized that hybrid strategies are associated with lower morbidity in complex aneurysm cases compared to single-modality approaches [12].

In the present case, favorable anatomy allowed safe interhemispheric exposure and clipping of the larger aneurysm. However, technical limitations of the smaller, calcified right-sided lesion justified its endovascular management.

The hybrid treatment concept has evolved in recent years, particularly in tertiary centers integrating neurosurgical and endovascular expertise. It allows the most appropriate technique to be selected for each lesion, based on aneurysm morphology, anatomical constraints, intraoperative risks, and team experience.

Conclusion

Distal anterior cerebral artery aneurysms, particularly in mirror configurations, present significant therapeutic challenges. Optimal management requires individualized, multidisciplinary strategies. Hybrid treatment—combining the long-term durability of microsurgical clipping with the minimally invasive benefits of endovascular coiling—has proven to be safe and effective in selected cases. Continuous technical advances and long-term follow-up will determine the consolidation of these approaches as standard for complex aneurysm cases.

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