Case Lesson 49-2026

FD Treatment of De Novo MCA Blister Aneurysm in a patient with previous coiled saccular ICA

Eugen Enesi, Arben Rroji, Klodian Caci, Mirel Grada, Elvis Dervishi, Vojsava Leka, Aida Agastra, Stela Dodaj, Mentor Petrela

Abstract: Blood blister-like aneurysms (BBAs) are rare, fragile vascular lesions accounting for 1–2% of aneurysmal subarachnoid hemorrhages and are associated with a high risk of rupture (1,2). Most commonly is located on the supraclinoid internal carotid artery; involvement of the middle cerebral artery (MCA) is particularly rare (3). We report a ruptured MCA BBA treated with a flow diverter in a patient previously treated with coil embolization for a saccular MCA aneurysm. Treatment is performed following external ventricular drainage and initiation of dual antiplatelet therapy. The patient has a favorable outcome without neurological deficits. Flow Diverter represents an effective treatment in selected cases despite hemorrhagic risks (4–7).

Keywords: Blood blister-like aneurysm; middle cerebral artery; flow diverter; subarachnoid hemorrhage; endovascular treatment

Introduction: Blood blister-like aneurysms (BBAs) are rare pseudoaneurysms characterized by a fragile wall and broad-based morphology, most commonly arising from non-branching arterial sites of the supraclinoid internal carotid artery (1–3). Their structure predisposes them to rapid growth and rupture, resulting in high morbidity and mortality (2,4).

Diagnosis is often challenging, as BBAs may be angiographically occulted in the acute phase and may require repeated DSA or advanced modalities such as vessel wall MRI (1,4). Management remains controversial. Microsurgical approaches carry a high risk of intraoperative rupture, whereas endovascular techniques have emerged as less invasive alternatives (2,4).

Flow Diverters promote aneurysm occlusion and parent vessel reconstruction and have shown promising outcomes, although their use in ruptured BBAs is limited by the need for dual antiplatelet therapy (4,5). BBAs of the MCA are particularly rare and technically demanding, requiring individualized treatment strategies (3,6,7).

Case Presentation: A 42-year-old woman presented to the emergency department with the acute onset of a severe “thunderclap” headache. Her past medical history was notable for a previously treated ruptured Aneurysm of the Terminal Segment of the Right Internal Carotid Artery (ICA) in 2013, managed with endovascular embolization, with no residual neurological deficits.

On admission, neurological examination revealed meningeal irritation without focal neurological deficits. The patient was classified as Hunt–Hess grade II, with a National Institutes of Health Stroke Scale (NIHSS) score of 0 and a Glasgow Coma Scale (GCS) score of 15.

Non-contrast brain CT demonstrated subarachnoid hemorrhage consistent with Fisher grade 4. Digital subtraction angiography (DSA) identified a newly formed blister-like aneurysm located on the right M1 segment of the middle cerebral artery (Fig. 1).

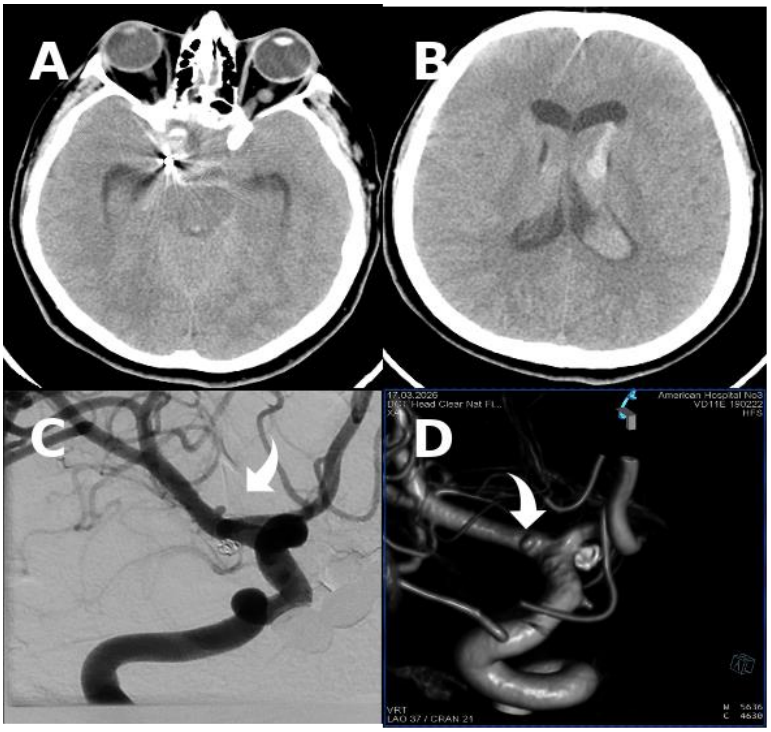

Fig. 1. (A and B) Initial CT showed SAH and hydrocephalus. (C) Subtracted DSA image showing the BBA on the anterior wall of the right MCA (arrow) and coils in the previously treatment Aneurysm of the Terminal Segment of the Right Internal Carotid Artery (ICA). (D) 3D angiogram confirmed the BBA (arrow)

Given the small size and fragile morphology of the aneurysm, coil embolization was deemed unfeasible. Endovascular treatment with a flow diverter was therefore recommended.

As the non-contrast brain CT demonstrated signs of hydrocephalus and flow diverter placement requires dual antiplatelet therapy, an external ventricular drain (EVD) was placed prior to the endovascular procedure.

The patient was pretreated with loading doses of aspirin and clopidogrel. Endovascular treatment was then performed using a Silk Flow Diverter. Based on vessel measurements, a 4 × 20 mm device was selected and successfully deployed, extending adequately into the middle cerebral artery proximal to the bifurcation (Fig. 2).

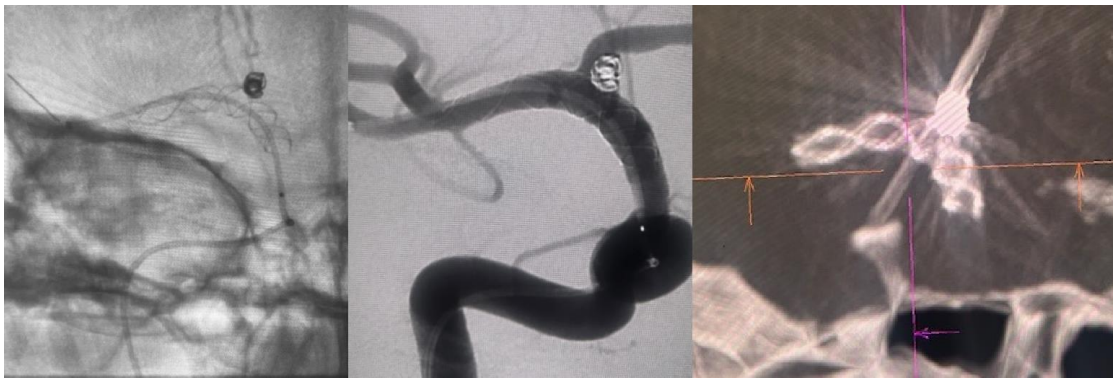

Fig.2. (A) Non-subtracted DSA image and (B) subtracted DSA image showing placement of the intracranial stent and the coils in the previously treated Aneurysm of the Terminal Segment of the Right Internal Carotid Artery (ICA) (C) Reconstruction of the 3D acquisition showing the flow-diverter stent deployed in a multilayer configuration at level of the ICA-MCA

Post-procedurally, the patient remained neurologically intact, with no focal deficits. The external ventricular drain (EVD) was initially kept closed.

One week after treatment, the patient developed polyuria and hyponatremia without any associated neurological deterioration. These findings were suggestive of cerebral salt-wasting syndrome. Follow-up brain CT demonstrated enlargement of the ventricular system. The EVD was reopened, after which the polyuria resolved and electrolyte levels normalized over the subsequent hours.

Discussion: Blood blister-like aneurysms (BBAs) are rare vascular lesions, accounting for approximately 1–2% of all aneurysmal subarachnoid hemorrhages (1,2). They are characterized by fragile walls, broad-based morphology, and a predilection for non-branching arterial sites, most commonly the supraclinoid internal carotid artery (2,3). Histopathologically, BBAs are considered pseudoaneurysms due to the absence of normal vessel wall layers, which contributes to their high propensity for rupture and regrowth (3,4).

Diagnosis of BBAs remains challenging. Several studies have highlighted that these lesions may be angiographically occult during initial evaluation, particularly in the acute phase of subarachnoid hemorrhage (1,5). Repeat angiography is often necessary, as BBAs can evolve rapidly and become more apparent over time (1). Advanced imaging techniques, such as high-resolution vessel wall MRI, have also been proposed to aid diagnosis (4).

Management of BBAs is complex and remains controversial due to the absence of randomized controlled trials (2,6). Microsurgical approaches, including clipping, wrapping, and trapping with or without bypass, offer high rates of aneurysm occlusion but are associated with significant intraoperative rupture risk and morbidity (2,6).

In the authors' experience with four blood blister-like aneurysms (BBAs) involving the internal carotid artery (ICA) and basilar artery (BA), treated prior to the flow diverter (FD) era, outcomes were unfavorable. One patient with a BA BBA died two weeks postoperatively

due to slippage of a Yasargil angled miniclip. Two ICA BBAs experienced intraoperative rupture and were managed with wrapping using Sundt clips; in one case, this required sacrifice of the posterior communicating artery and meningohypophyseal trunk, while in the other, the anterior choroidal and posterior communicating arteries were sacrificed, resulting in motor deficits. The temptation to use low power bipolar coagulation as recommended by Yasargil in daughter aneurysm provoked the rupture of our two ICA BBA.

Endovascular techniques, such as stent-assisted coiling, primary stenting, and flow diversion, have emerged as less invasive alternatives with lower immediate complication rates (2,7). Flow diverters have demonstrated promising long-term outcomes, achieving high rates of complete occlusion and parent artery reconstruction (2,7). However, their use in ruptured BBAs is limited by the requirement for dual antiplatelet therapy, which increases the risk of hemorrhagic complications (6). Recent advances, including the use of short-acting intravenous antiplatelet agents such as cangrelor, have been introduced to mitigate these risks (5).

Special anatomical variants, such as BBAs occurring at the middle cerebral artery bifurcation, present additional technical challenges (3). In such cases, innovative endovascular techniques—including braided stent-assisted coiling with shelfing techniques—have demonstrated favorable outcomes while preserving branch vessel patency (3).

Management of BBAs must therefore be individualized, taking into account patient factors, aneurysm morphology, and institutional expertise (1–7). Multidisciplinary decision-making involving neurosurgeons and neurointerventionists is essential to optimize outcomes.

Conclusion: Blood blister-like aneurysms remain among the most challenging entities in cerebrovascular neurosurgery and neurointervention. Their rarity, fragile nature, and diagnostic ambiguity contribute to significant morbidity and mortality. While microsurgical techniques provide high occlusion rates, endovascular approaches—particularly flow diversion—are increasingly favored due to improved safety profiles and promising long-term outcomes.

Despite these advances, no single treatment modality has emerged as the gold standard. Future research is needed to establish optimal management strategies for BBAs.

References

1. Kranawetter M, et al. Missing a blood blister-like aneurysm in the setting of aneurysmal subarachnoid hemorrhage. *Neurosurg Rev*. 2023;46(1):1–8.
2. Singh P, Patel A, Mack WJ. Blister aneurysms: Decision-making when there's no perfect answer. *Endovascular Today*. 2018;17(2):80–82.
3. Londhe S, Gupta V, Parthasarathy R, et al. Blister aneurysm of middle cerebral artery division: stent-assisted coiling using shelfing technique. *J Clin Interv Radiol ISVIR*. 2019;3(2):126–129.
4. Rouchaud A, Brinjikji W, Cloft HJ, Kallmes DF. Endovascular treatment of ruptured blister-like aneurysms: a systematic review and meta-analysis. *AJNR Am J Neuroradiol*. 2015;36(12):2331–2339.
5. Cagnazzo F, Limbucci N, Nappini S, Renieri L, Rosi A, Laiso A, et al. Cangrelor in neurointerventional procedures: a systematic review. *AJNR Am J Neuroradiol*. 2020;41(12):2198–2203.
6. Aydin K, Arat A, Sencer S, Barburoglu M, Men S. Treatment of blister-like aneurysms with reconstructive endovascular techniques: single-center experience. *AJNR Am J Neuroradiol*. 2015;36(3):537–542.
7. Gonzalez AM, Narata AP, Yilmaz H, Bijlenga P, Radovanovic I, Schaller K, et al. Blood blister-like aneurysms of the anterior circulation: clinical characteristics and treatment outcomes. *AJNR Am J Neuroradiol*. 2014;35(2):345–350.