The Egyptian Journal of Hospital Medicine (January 2025) Vol. 98, Page 385- 388

Recovery of Visual Field after Complete Occlusion of Wide Neck Anterior Communicating Artery Aneurysm with Balloon Assisted Coiling: Case Report

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ABSTRACT

Background: Intracranial aneurysms are characterised by focal dilatations of the cerebral vascular wall and can develop as a result of a complex interaction of several inherited and environmental variables. Symptoms such as headache, third cranial nerve palsy (posterior communicating artery aneurysm), hemianopia (anterior communicating artery aneurysm), and seizures can manifest in different ways depending on the aneurysm's location, size, and rupture risk.

Aim: This study aimed to assess the recovery of visual field after complete occlusion of wide neck anterior communicating artery aneurysm with balloon assisted coiling.

Case report: A 59-years-old female presented with bilateral temporal hemianopia, characterized by the loss of vision in the outer halves of both visual fields. This visual impairment prompted an extensive diagnostic workup, which revealed a wide-neck anterior communicating artery aneurysm. Given the complexity and morphology of the aneurysm, an endovascular approach utilizing balloon-assisted coiling was selected as the preferred intervention. The procedure was performed under general anesthesia with full systemic heparinization to mitigate thromboembolic risks. The balloon-assisted coiling technique provided optimal support for coil placement, ensuring complete occlusion of the aneurysm, classified as Raymond class I. Post-procedure imaging confirmed successful aneurysm exclusion without evidence of residual filling or complications.

Conclusion: This case illustrates the successful management of a wide-neck anterior communicating artery aneurysm using balloon-assisted coiling. The complete occlusion achieved, classified as Raymond class 1, emphasizes the efficacy of this technique in treating challenging aneurysms.

Keywords: Visual field, Anterior communicating artery aneurysm, Balloon-assisted coiling.

INTRODUCTION

Aneurysms in the anterior communicating artery (AComA) constitute 30–35% of all intracranial aneurysms, this structure is crucial to cerebral circulation [(1)].

Because the optic apparatus, which includes the optic nerve and chiasm, is compressed by AComA aneurysms, patients frequently experience vision impairments [(2)]. One of the main ways to manage these aneurysms is either endovascular coiling or surgical clipping. A new, safer option for complex or wide-neck aneurysms is balloon-assisted coiling (BAC) [(3)]. Clinically, there is still a lot of curiosity in the possibility of visual function recovery after BAC, even if the major goal of the treatment is to obliterate the aneurysm and avoid its rupture [(4)].

Damage to vision in AComA aneurysms typically occurs as a result of blood flow interruption or direct compression of the optic chiasm [(5)]. Irreversible damage can result from chronic compression, but if caught early enough, vision can be partially or fully restored. By limiting manipulation of adjacent structures, BAC allows for accurate aneurysm closure, which should presumably reduce the likelihood of additional optic nerve injury. The potential of BAC in visual recovery was highlighted in a study by **Kim *et al.*** [**(4)**]**,** which found that 60% of patients with preoperative visual abnormalities showed a considerable improvement in their visual fields after the procedure.

A number of variables influence how well the vision field recovers after surgery. These include the extent to which the aneurysm was compressed, the severity of the preoperative visual impairment, and the success of occlusion of the aneurysm. Visual outcomes are also greatly affected by intraoperative variables such as balloon inflation procedures and the prevention of ischaemic problems [(5)].

Large, wide-necked aneurysms have historically been the most common types of recurrence, and these patients often have two technical issues: First, it can be difficult to angiographically define and occlude the aneurysmal neck and second, it can be challenging to achieve appropriately thick coiling of the neck/fundus transition zone [(6)]**.**

Not all patients will undergo a full return of their vision following BAC, despite the encouraging outcomes [(6)]. Patients suffering from chronic compression or permanent ischaemia damage may show little to no recovery [(7)]. In addition, visual outcomes can be negatively impacted by complications like thrombosis, aneurysm rupture, or balloon-induced ischaemia [(8)].

Maximising visual recovery after BAC also requires rehabilitation and follow-up treatment [(9)]. To help compensate for any remaining deficiencies, visual rehabilitation techniques can be utilised, such as structured visual workouts, adaptive visual aids, prisms, and more. In order to detect any recurrence of aneurysms or delayed consequences that could affect visual function, it is essential to conduct clinical and imaging tests throughout long-term follow-up [(10)]. For

Received: 14/08/2024
Accepted: 14/10/2024

long-term results, it's also crucial to teach patients to keep their scheduled follow-up appointments and to recognize the symptoms of a recurrence [11].

Treatment options for AComA aneurysms have been broadened due to recent improvements in endovascular procedures, such as the use of intraoperative imaging technologies and flow-diverting stents. With these advancements, aneurysm treatment has become even more safe and effective, and the visual results may even improve. The development of standardized techniques for the prediction and management of visual recovery following BAC, however, requires additional large-scale, prospective investigations [12].

Patients with anterior communicating artery aneurysms have hope for a return to visual function with balloon-assisted coiling, an effective method for controlling these conditions. Preoperative visual condition, aneurysm characteristics, and procedural approaches are some of the factors that impact outcomes, however it is possible to achieve significant visual improvement in many cases. Further optimization of patient outcomes should be pursued through the identification of visual recovery predictors and the refinement of endovascular procedures in future research [12].

We aimed at this study to assess the recovery of visual field after complete occlusion of anterior communicating artery aneurysm with balloon-assisted coiling.

PRESENTATION

A 59-years-old female presented with bilateral temporal hemianopia; a visual field defect characterized by the loss of vision in the outer (temporal) halves of both visual fields. This presentation necessitated a thorough diagnostic workup to identify the underlying cause. Diagnostic cerebral angiography revealed a wide-neck anterior communicating artery (ACom) aneurysm compressing the optic chiasma. The patient subsequently underwent balloon-assisted coiling of the aneurysm, resulting in complete occlusion classified as Raymond class 1.

METHODOLOGY

Upon presentation, the patient underwent a comprehensive neurological and ophthalmological examination to assess the visual impairment and to identify any other neurological deficits. Given the suspicion of an intracranial pathology, advanced imaging studies were requested. Diagnostic digital subtraction angiography (DSA) was performed to visualize the cerebral vasculature and assess possibility of ACom aneurysm.

The diagnostic DSA findings in this patient revealed a wide-neck ACom aneurysm measuring 5.8 mm at the dome and 4 mm at the neck, with a dome-to-neck ratio (DNR) of 1.45 **(Figure 1)**. The patient was then prepared for endovascular intervention. The procedure was done under general anesthesia with full systemic heparinization to minimize the risk of thromboembolic complications.

A balloon-assisted coiling technique was chosen due to the wide-neck nature of the aneurysm. These characteristics posed a challenge for traditional coiling techniques, thus necessitating the use of balloon-assisted coiling to achieve stable and complete occlusion. During the procedure, an Excelsior SL-10 microcatheter was navigated into the aneurysm, and a 4x15 Eclipse balloon was then inflated to assist in the placement of the detachable coils. The use of balloon assisted technique helps to prevent coil migration and ensures dense packing of the aneurysm sac. Target Detachable coils were deployed, resulting in complete occlusion of the aneurysm as confirmed by intra-procedural angiography. The final occlusion was classified as Raymond class 1 **(Figure 2)**.

The procedure was uneventful, with no immediate or delayed complications observed. The patient's visual symptoms and neurological status were closely monitored post-intervention. The complete occlusion of the aneurysm relieved the mass effect on the optic chiasma, likely contributing to the stabilization or improvement of her visual symptoms.

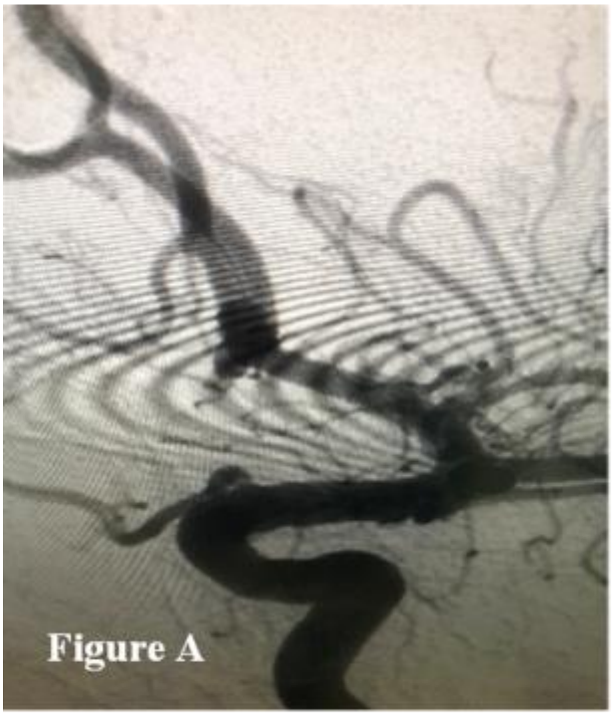

Figure (1): Cerebral angiography – intracranial aneurysm, this image showed a cerebral angiogram highlighting the vascular structure of intracranial arteries. A bulging area suggests the presence of a possible aneurysm, commonly evaluated for risk of rupture and intervention planning.

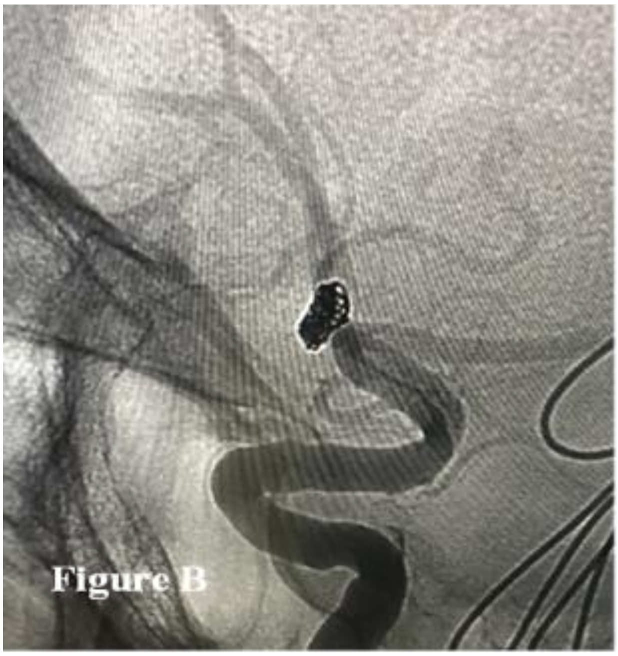

Figure (2): Cerebral angiography – coiled intracranial aneurysm, this image displayed a cerebral angiogram showing an aneurysm that was treated with endovascular coiling. The metallic coils are visible within the aneurysm sac, preventing blood flow into the weakened area and reducing the risk of rupture.

Ethical approval:
This study has been approved by the Suez Canal Faculty of Medicine's Ethics Committee. Following receipt of all information, signed consent was provided by each participant. The study adhered to the Helsinki Declaration throughout its execution.

DISCUSSION

In keeping with the most recent recommendations, our research used digital subtraction angiography (DSA) to diagnose the ACom aneurysm. The great resolution and capacity to analyse vascular anatomy in detail make DSA the gold standard for visualising cerebral aneurysms. **Brinjikji *et al.*** [(7)] and **Molyneux *et al.*** [(12)] have also shown that DSA is useful for intracranial aneurysm diagnosis and treatment planning.

As a well-established method for treating wide-neck ACom aneurysms, balloon-assisted coiling (BAC) was utilised in our investigation. The wide-neck morphology, with a dome-to-neck ratio of 1.45, made traditional coiling difficult, therefore BAC was a good option. **Pierot *et al.*** [(13)] in similar investigations corroborate this where they found that BAC successfully occludes wide-neck aneurysms with a high percentage of technical success and low rates of complications. Our results are in agreement with those of **Shapiro *et al.*** [(14)] who noted that BAC aids in preventing coil migration and guarantees dense packing.

Nevertheless, there are studies that point to stent-assisted coiling (SAC) or flow diversion as potential alternatives for some wide-neck aneurysms, especially those with intricate morphology or bigger dimensions. **Brinjikji and colleagues** [(7)] reported that despite a greater risk of thromboembolic complications, SAC has the potential to offer superior long-term occlusion rates than BAC.

The aneurysm was 5.8 mm in diameter and had no complicated characteristics, therefore we followed the literature and chose BAC. Raymond class 1 occlusion was obtained in our study, which is the therapeutic gold standard for aneurysms. These results are in line with those of **Pierot *et al.*** [(13)] who found that BAC causes a significant percentage of total occlusion. Aneurysms treated with BAC had a reported occlusion rate of 70-80% according to Raymond's class 1. According to **Sluzewski *et al.*** [(15)]**,** BAC is great for lowering recanalisation rates and getting dense packing.

As previously mentioned in the literature, the lack of immediate or delayed problems in our study provided further evidence supporting the safety profile of BAC.

It is noteworthy that the patient's visual issues improved after the intervention. Research has shown that blocking off aneurysms can reduce the pressure on nearby tissues like the optic chiasma. **Kang *et al.*** [(16)] reported that once aneurysms, which compress the optic apparatus are successfully treated, patients often notice an improvement in their vision. According to research by **Zhang *et al.*** [(17)]**,** improved visual results can be achieved with early intervention in these instances.

Although BAC worked for us, it's important to know that other methods, such as stent-assisted coiling (SAC) or flow diversion, are becoming more popular for wide-neck aneurysms. There are situations in which these methods might be useful. While, SAC improves coil installation support and potentially lowers recanalisation rates, it increases the risk of bleeding problems due to the requirement of dual antiplatelet medication. Although flow diversion is highly helpful for massive aneurysms, it might not be the best option for minor aneurysms such as the one we were studying. The size and shape of the aneurysm informed our decision to employ BAC, and there is evidence to suggest that this approach is effective in these cases.

CONCLUSION

This case illustrated the successful management of a wide-neck anterior communicating artery aneurysm using balloon-assisted coiling. The complete occlusion achieved was classified as Raymond class 1 and emphasized the efficacy of this technique in treating challenging aneurysms. The patient's favorable outcome, without any complications, highlighted the importance of good procedural planning and execution in the management of intracranial aneurysms. Balloon-assisted coiling represents a valuable tool in the endovascular treatment for wide-neck aneurysms where standard coiling techniques may be insufficient.

No funding.
No conflict of interest.

REFERENCES

1. **Lu G, Chung J, Park J *et al.* (2022):** Comparison of Visual Outcomes of Ophthalmic Artery Aneurysms Treated with Microsurgical Clipping and Endovascular Coiling. Neurointervention, 17 (1): 18–27.
2. **Baskaya M, Menendez J, Yuceer N *et al.* (2003):** Results of surgical treatment of intrasylvian hematomas due to ruptured middle cerebral artery aneurysms. Journal of Neurosurgery, 99 (3): 518-523.
3. **Peng F, Feng X, Tong X *et al.* (2020):** Endovascular Treatment of Small Ruptured Intracranial Aneurysms (<5 mm): Long-term Clinical and Angiographic Outcomes and Related Predictors. Clinical Neuroradiology, 30: 817–826
4. **Kim J, Phi J, Lee J *et al.* (2018):** Surgical Outcomes of Thalamic Tumors in Children: The Importance of Diffusion Tensor Imaging, Neuro-Navigation and Intraoperative Neurophysiological Monitoring. Brain Tumor Research and Treatment, 6 (2): 78-85.
5. **Benalia V, Cortez G, Mounayer C *et al.* (2023):** Safety and Efficacy of Flow Diverters for Treatment of Unruptured Anterior Communicating Artery Aneurysms: Retrospective Multicenter Study. Journal of NeuroInterventional Surgery, 15 (12): 1181-1186.
6. **Jang C, Chung J, Lee J *et al.* (2020):** Recurrence and retreatment of anterior communicating artery aneurysms after endovascular treatment: a retrospective study. BMC Neurology, 20: 287-92.
7. **Brinjikji W, Lanzino G, Cloft H *et al.* (2016):** Endovascular Treatment of Very Small (≤3 mm) Intracranial Aneurysms: Report of a Consecutive Series and a Meta-Analysis. Stroke, 47 (1): 191-194
8. **Spiotta A, Chaudry M, Turner R *et al.* (2018):** Balloon-Assisted Coiling of Intracranial Aneurysms: Evaluation of Local Thrombus Formation and Symptomatic Thromboembolic Complications. AJNR American Journal of Neuroradiology, 39 (7): 1236-1241.
9. **Cho W, Lee J, Ha E *et al.* (2018):** Low-Dose Prasugrel vs Clopidogrel-Based Tailored Premedication for Endovascular Treatment of Cerebral Aneurysms. Neurosurgery, 83 (5): 981-988.
10. **Nishi H, Pereira V, Benndorf G (2022):** A novel endovascular treatment for true ophthalmic artery aneurysms: a case report. Frontiers in Ophthalmology, 2: 940479. https://doi.org/10.3389/fopht.2022.940479
11. **Nanda A, Sonig A, Banerjee A *et al.* (2014):** Surgical Management of Anterior Communicating Artery Aneurysms: Do Outcome Depend on the Complexity of the Aneurysm or the Experience of the Surgeon? World Neurosurgery, 82 (6): 1187-1193.
12. **Molyneux A, Kerr R, Yu L *et al.* (2005):** International Subarachnoid Aneurysm Trial (ISAT) of neurosurgical clipping versus endovascular coiling in 2143 patients with ruptured intracranial aneurysms: a randomised comparison of effects on survival, dependency, seizures, rebleeding, subgroups, and aneurysm occlusion. The Lancet, 366 (9488): 809-817.
13. **Pierot L, Cognard C, Spelle L *et al.* (2013):** Safety and efficacy of balloon remodeling technique during endovascular treatment of intracranial aneurysms: Critical review of the literature. American Journal of Neuroradiology, 34 (9): 1766-1771.
14. **Shapiro M, Becske T, Nelson P (2012):** Learning from failure: Persistence of aneurysms following pipeline embolization. Journal of Neurosurgery, 116 (2): 289-295.
15. **Sluzewski M, van Rooij W, Beute G *et al.* (2003):** Balloon-assisted coil embolization of intracranial aneurysms: Incidence, complications, and angiography results. Journal of Neurosurgery, 99 (2): 284-289
16. **Kang H, Han M, Kwon B *et al.* (2015):** Postoperative 3D angiography in intracranial aneurysms. American Journal of Neuroradiology, 26 (1): 86-91.
17. **Zhang X, Li L, Hong B *et al.* (2018):** Endovascular treatment of intracranial aneurysms with the pipeline embolization device: A systematic review and meta-analysis. Neurosurgical Review, 41 (4): 1029-1038.