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Successful delayed coiling of a ruptured growing distal posterior cerebral artery mycotic aneurysm



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1. Introduction

Intracranial infectious aneurysm (IIA), also called mycotic aneurysm, are saccular or fusiform arterial dilatation that can occur anywhere in the arterial vasculature. However, they are mainly encountered in the major arteries. IIAs are typically multiple, distal, fusiform and, represent 0.7 to 5.4% of all cerebral aneurysms [1,2]. They are found in 3 to 10% of patients with an infective endocarditis and arise via acute inflammatory degradation of the arterial wall secondary to microbial infection.

IIAs develop when friable cardiac vegetation gives rise to septic emboli that lodge in intracranial vessels at branching points and distal branches. These emboli may occlude vessels, cause cerebral infarction, or promote infection [3].

The vasa vasorum theory is the most widely accepted mechanism of pathogenesis. It proposes that bacteria from septic emboli escape through the vasa vasorum and cause severe inflammation of the adventitia. The infection then spreads inwardly. The arterial pulsation against the weakened vessel wall eventually results in

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ABSTRACT

Intracranial infectious aneurysm (IIA) is a rare form of cerebrovascular malformation for which obliteration may be undertaken after rupture or non-response to targeted antibiotic therapy. We discuss the case of a 19-year-old man who presented with acute neurologic decline (Glasgow Coma Scale of 8) and endocarditis. CT images demonstrated subarachnoid haemorrhage, hydrocephalus and a mycotic aneurysm on the left posterior cerebral artery. Conservative management was initially decided due to the high risk of stroke and hemianopia. However, it was then escalated to endovascular treatment because of increased size of the aneurysm on surveillance scans.

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an aneurysm formation and enlargement. The resulting aneurysms are usually fusiform and eccentric, with no saccular characteristics [3].

Histologically, IIAs are characterized by acute neutrophil infiltration, along with marked intimal proliferation and internal elastic lamina destruction. Although a wide variety of bacteria, mycobacteria, viruses, and fungi may cause IIAs, Viridans Streptococci and *Staphylococcus aureus* are the most common etiologic etiological organisms [3].

The natural history and prognosis of mycotic aneurysms are unclear. Given the relative rarity of this disease, current recommendations regarding the management and treatment of IIAs have been extrapolated from a limited number of case reports. Over the past decade, the management of infective intracranial aneurysms has been divided into medical, endovascular, and surgical treatment. Mycotic aneurysms are known to resolve or decrease in size with antimicrobial therapy. Therefore, a conservative approach with medical management can only be chosen in the case of unruptured IIA with close angiography follow-up [3]. No reported prospective study, to our knowledge, has examined the rupture rates of IIA. However, an untreated mycotic aneurysm may be associated with a high risk of rupture and subsequent significant mortality ranging from 30% to 80% if rupture occurs [4].

The general consensus in the current literature is that ruptured IIAs carry a worse prognosis than unruptured IIAs. Therefore, most authors recommend treatment in cases of rupture [5,6]. In contrast to classical saccular intracranial aneurysms, the treatment of mycotic aneurysm is challenging due to the fragility of the

Abbreviations: CT, computed tomography; CTA, computed tomography angiography; DSA, digital subtraction angiography; GCS, Glasgow Coma Scale; IIA, Intracranial infectious aneurysm; MIA, mycotic intracranial aneurysms; MRI, magnetic resonance imaging; MRA, magnetic resonance angiography; PCA, posterior cerebellar artery; VSD, ventricular septal defect.

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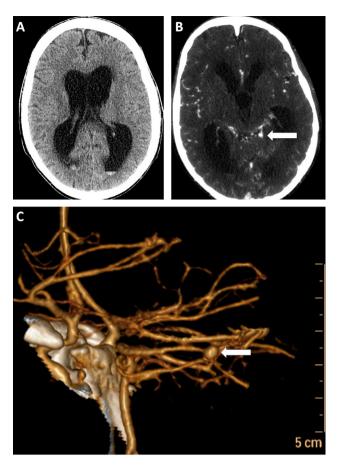


Fig. 1. A. Non-contrast CT scan depicting the SAH with the intra ventricular blood sediment and the hydrocephalus. B and C. Native slice and three-dimensional reconstruction CTA images showing the 5 mm distal left posterior cerebral artery IIA (white arrow).

affected parent artery and aneurysm wall. Therefore, clipping of the aneurysm neck or coil embolization are often replaced by sacrifice of the parent artery, by either microsurgical or endovascular techniques. Significant neurological morbidity may result from these radical solutions.

We present the case of a patient whose aneurysm initially monitored was finally occluded respecting the parent artery.

2. Case report

A 19-year-old man with a moderate perimembranous ventricular septal defect (VSD) presented with sudden loss of consciousness; in retrospect, he had been unwell for one month but had not presented in hospital for assessment. He was transferred to the cardiac intensive care unit. An echocardiogram identified mobile mass lesions on all four heart valves and the VSD and, blood cultures grew *Streptococcus mitis*. Despite resuscitation including broad spectrum antibiotics, the patient remained GCS 8 and a CT brain demonstrated hydrocephalus secondary to subarachnoid haemorrhage, Fisher IV (Fig. 1A). A subsequent CT angiogram (CTA) showed a 5 mm vascular malformation on the left distal posterior cerebral artery (junction P2–P3). It was diagnosed as a ruptured IAA, which bled causing his neurological collapse (Fig. 1B and C).

An external ventricular drain was inserted in emergency, improving his clinical state. A digital subtraction angiography (DSA) confirmed the aneurysm with a wide neck (Fig. 2A). A magnetic resonance imaging (MRI) and angiography (MRA) failed to demonstrate other intracranial aneurysms but showed acute infarcts within the left posterior occipital lobe and right thalamus (Fig. 2D). The patient's case was discussed and occlusion of the distal left posterior cerebral artery aneurysm was not first retained as the optimal therapeutic option, as it would lead to infarction of the parietal-occipital region. A period of watchful waiting was therefore adopted.

However, a repeat MRA 7 days later, revealed an increase in size of the mycotic aneurysm along with changes in its shape, with involvement in the adjacent branches (Fig. 2C). A further DSA confirmed the aneurysm had nearly doubled in size (Fig. 2E). After discussion with the neurosurgical team, the patient and his family, it was decided to proceed to the embolization of the aneurysm.

Thirteen days after the collapse, the aneurysm was occluded, using a combination of AxiumTM copolymer and nylon fibred micro coils (eV3/Covidien, Irvine CA.) through an EchelonTM 10 micro-catheter (eV3/Covidien, Irvine CA.), navigated coaxially into the sac.

Post embolization angiography confirmed resolution of the aneurysm with preservation of the downstream blood flow in the posterior cerebral artery (Fig. 2F). Clinical state was unchanged after the procedure. Five days later, he was transferred to cardiac surgery and underwent bioprosthetic aortic valve replacement, mitral valve repair, closure of ventricular septal defect and excision of vegetation from pulmonary and tricuspid valves. Investigation revealed an endocarditis most likely of dental origin.

After extensive rehabilitation, the patient is independent and capable of looking after himself at home, managing all activities of daily life. His visual field was tested clear at 14 months. The last post-operative MRI and MRA showed no significant brain infarction (Fig. 3A and B), the preservation of the calcarine branch and no sign of aneurysm regrowth (Fig. 3C).

3. Discussion

IIAs are most frequently located on distal branching points of arteries, mainly on the middle cerebral artery, and in 17.6% on the posterior cerebral arteries.

Ruptured, symptomatic or enlarging IIAs usually require treatment. Indications for a surgical versus endovascular treatment remain controversial as the success of such intervention is dependent of the aneurysm morphology [1]. Endovascular treatment of IIA provide high occlusion and low procedure-related complication rates [7,8]. However, Gross et al. reported that frequently the aneurysm was excluded by parent artery occlusion and only in 24% by aneurysm embolization with vessel preservation [7]. Parent artery occlusion is attempted when the aneurysm is distally located, dysplastic and, involving the whole circumference of the parent vessel provided that the area of the brain supplied by that artery is non-eloquent.

Sacrifice of the P2 segment (distal to the thalamic perforators and inferior to temporal branches) is an option in the management of complex peripheral PCA aneurysms. Although important midbrain and thalamic perforators arise from the P1 and proximal P2 segments, the primary visual and visual-associated cortices are supplied by the more distal calcarine and parieto-occipital branches of the PCA. In rare circumstances, the need may arise to sacrifice the PCA peripherally in treating complex PCA aneurysms. Acquired visual field deficit may occur in approximately 17.3% of such cases as there is a rich collateral supply to the visual cortex [9].

In the case of our patient the distal location of the aneurysm, at the P2–P3 junction (which corresponds to the collicular point), the small size and wide "neck", made endovascular treatment successful and challenging with an increased risk of periprocedural complication including occlusion of the feeding artery. Moreover, as the first MRI revealed two ischaemic areas. Therefore, an initial

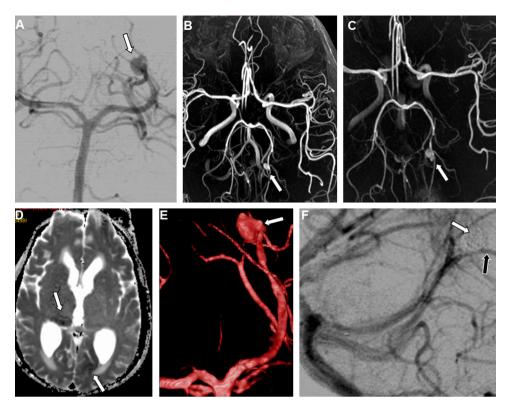


Fig. 2. A. Antero-posterior DSA confirming the mycotic aneurysm at the collicular point, P2–P3 junction. B. First ARM depicting the aneurysm. C. Second ARM with aneurysm's size increased. D. MRI apparent diffusion coefficient (ADC) demonstrating restricted diffusion corresponding to ischemic areas in within the left posterior occipital lobe and right thalamus (white arrows). E. Second DSA with 3 dimensional reconstruction. F. Aneurysm coiled (white arrow) with efferent blood flow preserved (black arrow) in the left posterior crebral artery (P3).

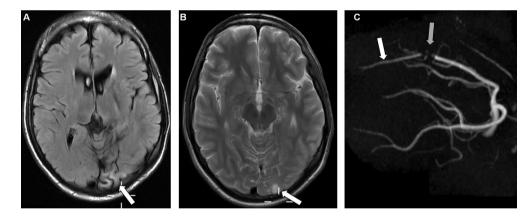


Fig. 3. A and B. Post-operative MRI showing an asymptomatic tiny signal attenuation on Flair and T2 images on the left occipital lobe. C. Three-dimensional reconstruction MRA images showing the preservation of the calcarine branch (white arrow) and a signal void created by the coils with no images of aneurysm regrowth (grey arrow).

conservative approach was chosen due to the high risk of definitive right homonymous haemianopia.

Reported revascularization strategies for the PCA territory have included only the more proximal (P2) segment as the recipient segment. Bypass grafts for this segment have been used to manage complex posterior circulation (including proximal PCA) aneurysms but are technically demanding and require long periods of temporary occlusion. These proximal PCA bypasses, however, are not a consideration when treating more peripherally located PCA aneurysms [9]. Revascularization of this domain after distal PCA sacrifice has not been recommended and we did not consider this as a management option.

MRI is a useful and accurate tool to monitor the aneurysm characteristics and associated strokes as detection of intra cranial abnormalities are found in about one quarter of infective endocarditis cases. In the present case, as the aneurysm exhibited volume rise and shape change, features that predict further rupture, it was decided to alter the prime treatment strategy [5]. Endovascular treatment is often more suitable than surgical aneurysmal clipping in the context of infective endocarditis, as these patients are often at high risk for major surgery because of co-morbidities. In our case the risk of catheter-related perforation of the aneurysm was recognised but justified to allow exclusion of the aneurysm, which was successfully achieved with preservation of the arterial supply to the occipital cortex.

4. Conclusion

Our report suggests that a close surveillance of ruptured IIA may be accurately assessed by repeated MRIs. When an intervention is mandated, aneurysmal coiling can be achieved safely, preserving the functionality of the vessel even in aneurysms with distal configuration and/or complex morphology.

Disclosure of interest

The authors declare that they have no competing interest.

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