Selective endovascular techniques in the treatment of cerebral mycotic aneurysms

Report of three cases

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The aim of this study was to evaluate the role of endovascular treatment for intracranial mycotic aneurysms. The clinical and angiographic features of three patients with endocarditic vegetation (two with Streptococcus viridans and one with Staphylococcus) were reviewed retrospectively. Patients were selected for this treatment according to the clinical setting and aneurysm location. In two cases, selective catheterization of a distal middle cerebral and posterior cerebral artery branch with a microcatheter followed by superselective amobarbital testing of the parent vessel was preliminary to the occlusion of that vessel with autologous clot or glue. The third patient was treated by selective occlusion of the aneurysm by intra-aneurysmal placement of platinum microcoils. Two patients presented with intracranial hemorrhage and in one the lesion was found on computed tomography. All three aneurysms had been excluded from the circulation at the 6-month follow-up review. The only complication from the procedure, despite the septic nature and distal localization, was balloon deflation in one patient, who was successfully retreated with coils. Endovascular embolization is indicated in patients who are at risk of hemorrhage and cannot undergo the standard procedure. The superselective amobarbital test allows selection of patients who will tolerate distal vessel occlusion. This endovascular procedure represents a safe and effective treatment for these lesions.

Key Words · mycotic aneurysm · embolization · endocarditis · subarachnoid hemorrhage · endovascular therapy

Which treatment for intracranial mycotic aneurysms is the most effective is controversial. Treatment has ranged from serial arteriography for all patients with endocarditis to selective investigation for symptomatic patients. Treatment with antibiotic medications alone has been advocated, as has a more aggressive urgent clipping of the aneurysm. Treatment must be tailored for each patient since antibiotic agents alone are efficacious in certain circumstances while the risk of hemorrhage has to be eliminated in a more urgent fashion in others.

Whether originating from extension of suppurative facial lesions or from septic emboli in the systemic circulation, mycotic aneurysms can enlarge, hemorrhage, and cause neurological sequelae. Because of the distal and sometimes deep location of these aneurysms, selective surgical treatment is not always possible, and treatment has usually consisted of cauterizing the aneurysm and occluding the parent vessel. Some surgeons recommend occluding the parent vessel after a vascular bypass. In the past, endovascular techniques have not been considered in the management of these lesions; however, with the advent of new microcatheters and new embolic material, these lesions can be treated effectively with minimal risk. This article describes the indications, techniques, and results of endovascular treatment in three patients with mycotic aneurysms.

Case Reports

In the past 2 years, three patients with four mycotic aneurysms were treated via the endovascular route. The decision to use embolization techniques was made by a multidisciplinary team. The risk involved with standard
surgery was considered high, and it was decided to attempt embolization first. One patient presented with subarachnoid hemorrhage, one had cerebral hematoma, and one aneurysm was discovered incidentally. The mean age at the time of diagnosis was 38 years (range 28 to 44 years). The aneurysms were treated as described below.

Case 1

This 28-year-old man in his 3rd week of antibiotic therapy for Staphylococcus aortic valve endocarditis presented with meningeal signs and symptoms. A computerized tomography (CT) scan showed interhemispheric hemorrhage in the subarachnoid and subdural spaces, but initial arteriography showed no abnormality. Two weeks later the patient complained of similar symptoms, and a second CT scan showed new subarachnoid hemorrhage. Repeat arteriography revealed a distal mycotic aneurysm on a branch of the posterior cerebral artery (Fig. 1).

Because of the location of the aneurysm and the reversible nature of the approach, endovascular therapy was tried first. Under light sedative anesthesia, the femoral artery was catheterized. A No. 5 French introducer was placed, and a No. 5 French catheter guide was positioned in the vertebral artery. A Magic No. 1.8 French catheter* was advanced under "road-map" control in the posterior cerebral artery. The flow-guided catheter would not enter the normal-caliber feeding pedicle of the aneurysm. An amobarbital (Amytal, 50 mg) test injected from the proximal position induced a dense left homonymous hemianopsia. The Magic catheter was therefore withdrawn, and a precurved steerable Tracker-18 catheter† was introduced and rapidly navigated to the pedicle concerned. A second amobarbital injection produced no deficits. Embolization was performed using N-butyl-cyanoacrylate glue. Follow-up arteriogram showing complete obliteration of the aneurysm. The patient’s neurological examination remained normal. Magnetic resonance image obtained 6 months after the procedure revealing minimal changes related to the earlier hemorrhage.

Case 2

This 44-year-old man with Streptococcus bovis endocarditis completed a course of antibiotic medication. Follow-up CT and MR imaging several weeks later showed a probable right middle cerebral artery (MCA) aneurysm, and arteriography revealed a distal aneurysm on a rolandic branch of the MCA (Fig. 2 left). After the internal carotid artery was catheterized through a femoral sheath, a Magic No. 1.8 French catheter was positioned in the feeding pedicle. Functional testing was accomplished by occluding the pedicle with the catheter itself (flow-control position) and following the patient’s clinical tolerance as well as by arteriographic evidence of collateral circulation (retrograde filling into the pedicle). The patient tolerated the procedure well, and no filling defects were observed on angiography (Fig. 2 right). Testing by amobarbital injection further confirmed the patient’s tolerance and the presence of adequate collateral flow. The aneurysm was then embolized with autologous clot, which occluded the aneurysm and the parent vessel. Follow-up arteriograms

* Magic catheter manufactured by Balt, Paris, France.
† Tracker-18 catheter manufactured by Target Therapeutics, Fremont, California.
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at 1 month and 8 months after the procedure showed exclusion of the aneurysm. Two months after the procedure, the patient resumed his full activities and had no sequelae.

Case 3

This 39-year-old man had *Staphylococcus epidermidis* endocarditis and aortic insufficiency. Two months into the course of his treatment with adequate antibiotic coverage, he suddenly became confused and developed left-sided weakness. A CT scan showed a right intraparenchymal hemorrhage. Four-vessel angiography revealed two aneurysms: a small MCA aneurysm with a narrow neck and associated stenosis of the M1 segment, and a small posterior cerebral artery aneurysm (rolandic branch) located very distally on the inner surface of the occipital lobe (Fig. 3). Hemorrhage was from the MCA aneurysm, which was treated via the endovascular route.

Through a femoral approach, a Schneider No. 8 French catheter guide† was placed in the internal carotid artery. A Magic BD2L catheter with a balloon was introduced into the MCA. The balloon was inflated with 0.05 ml of contrast medium, which was exchanged with a polymerizing solution (Polymeran) and detached, thereby selectively excluding the aneurysm.

Follow-up arteriography 1 month later confirmed exclusion of the MCA aneurysm and the spontaneous disappearance of the posterior cerebral artery aneurysm (with the patient receiving antibiotic therapy alone). At a 3-month follow-up review, the MCA aneurysm had refilled because the balloon had partially deflated. The patient was therefore treated with Hilal minicoils.§ A Tracker-18 catheter was introduced into the aneurysm with a guidewire. Two Hilal minicoils introduced with a 0.014-mm guidewire excluded the aneurysm. At 1 month and 6 months after this second procedure, arteriography confirmed exclusion of the aneurysm.

Discussion

Mycotic Aneurysms

The natural history of mycotic aneurysms is not well defined. They are known to cause intracranial hemorrhage, but the reported frequency of this event has varied in different series.2,3,10,12 Similarly, recommendations concerning the indications for treatment of symptomatic and asymptomatic lesions have ranged from surgical therapy to prolonged medical therapy. Even the true incidence of mycotic aneurysms has varied among the different series according to the frequency of angiographic studies.11,13

The etiology of mycotic aneurysms is the septic emboli that originate in the heart and lodge at distal sites of the cerebral circulation — mainly in the territory of the MCA or posterior cerebral artery.6 These emboli produce a lesion in the vessel wall. The intima is subsequently destroyed, and an aneurysmal outpouching appears.

Symptomatic mycotic aneurysms that persist despite a full course of antibiotic treatment or that are present in patients who need anticoagulant therapy (cardiac surgery) clearly require treatment. Traditional surgical methods have included a craniotomy to expose these

†Catheter guide manufactured by Schneider, Lausanne, Switzerland.

§Hilal minicoil manufactured by Cook Europe, Amsterdam, The Netherlands.
typically distal lesions. After dissection to the aneurysm is completed, the aneurysm is excluded by parent vessel occlusion using electrocautery and surgical clips. Because of the small caliber of the vessels and the fragile wall of the aneurysms, the parent vessel usually cannot be saved.

**Endovascular Approach**

The endovascular technique involves placing a microcatheter in the distal circulation, which is now possible with torque-control catheters. The mycotic aneurysm is then excluded selectively or by occluding the parent vessel. When possible, selective occlusion of the aneurysm is the method of choice (as evidenced in Case 3) and will be significantly enhanced with the newly developed Guglielmi detachable coils. Parent-vessel occlusion is an effective alternative, as performed in our Cases 1 and 2 and as demonstrated previously. The endovascular approach allows functional investigation of the artery and its distal territory before occlusion.

This functional investigation is performed in awake cooperative patients with close neurological monitoring during the procedure; avoiding general anesthesia in these critically ill patients is a major advantage. The exact location of the aneurysm and its feeding pedicle is well demonstrated using superselective catheterization. Amobarbital (50 mg) injected through the microcatheter helps to identify "eloquent" areas before parent vessel occlusion. For example, in Case 2, blood flow from adjacent collateral circulation could be seen on fluoroscopy when the catheter was in the occlusive position. Embolization of the artery was judged to be safe despite its anatomical position in the rolandic area. An occlusion test of the parent vessel with close neurological monitoring is a good assessment of the arterial pedicle; this is possible using a microballoon, autologous clot, or positioning the catheter in a flow-control position. To refine this technique further, radioisotope scanning (particularly single-photon emission CT) may be helpful to assess physiologically the flow to a certain region.

There were no recurrences or abscesses in our patients with cerebral mycotic aneurysms; this is similar to the experience with systemic mycotic aneurysms. A longer follow-up period and a larger series are necessary and will be obtained to confirm the stability of these occlusions. The reversible nature of the endovascular procedure (to the point just before embolization) is a distinct advantage. The absence of complications or deaths indicates that these methods are now safe and effective for the treatment of mycotic aneurysms. These vessels, which are sometimes difficult to reach surgically, are catheterized readily without retraction or dissection of the vessel. The appropriateness of endovascular treatment for mycotic aneurysms should be evaluated individually in each patient. With functional investigation, these are safe and effective methods that can potentially benefit these patients.

**References**


Fig. 3. Case 3. Angiography showed two aneurysms: a right middle cerebral artery (MCA) aneurysm that hemorrhaged and an asymptomatic small posterior cerebral artery aneurysm. Left: Lateral internal carotid arteriogram showing the MCA aneurysm, which was treated endovascularly with a balloon. Center: The balloon deflated and the aneurysm refilled. Right: The aneurysm was then successfully obliterated with minicoils.
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