

AUTHOR(S): Frizzell, R. Tyler, M.D., Ph.D.;
Vitek, Jiri J., M.D.; Hill, Douglas L., M.D.;
Fisher, Wink S., III, M.D.

Division of Neurosurgery (RTF, WSF), Department of Radiology (JJV), Division of Cardiology (DLH), University of Alabama Birmingham Medical Center, Birmingham, Alabama

Neurosurgery 32; 852-854, 1993

ABSTRACT: THE CASE OF a patient with a bacterial intracranial aneurysm treated with antibiotics and endovascular obliteration is reported. The patient presented with dysphasia and right hemiparesis. A medical workup revealed endocarditis and associated heart valve dysfunction with no evidence of congestive heart failure. Computed tomography demonstrated subarachnoid hemorrhage, and a subsequent cerebral arteriogram showed a distal left middle cerebral artery aneurysm, which, as demonstrated by angiography, did not change in size in 2 weeks. An endovascular approach was used to obliterate the aneurysm and its parent vessel. Endovascular techniques may be used to obliterate certain bacterial intracranial aneurysms, particularly in patients who harbor distal aneurysms.

KEY WORDS: Aneurysm; Bacterial; Endovascular

Bacterial intracranial aneurysms that develop in patients with infective endocarditis are well described⁽⁸⁾; however, the optimal management of these lesions is still debated^(1,6,7). The patient's cardiac status (presence or absence of heart failure), the aneurysm's location (proximal or distal), and its response to antibiotic therapy (smaller, larger, or no change in size) are factors that must be considered in the treatment of these lesions. We present a patient in whom an intracranial bacterial aneurysm was treated by an endovascular approach.

CASE REPORT

A 44-year-old right-handed black man was transferred to our institution with a 3-day history of altered mental status. A neurological examination revealed a lethargic man with receptive dysphasia and mild right hemiparesis. His general physical examination was notable for a Grade IV/VI systolic ejection murmur without clinical evidence of congestive heart failure. Blood cultures grew *Streptococcus viridans*, and an echocardiogram demonstrated significant mitral and aortic regurgitation associated with vegetation of the aortic and mitral valves. Antibiotics were initiated after obtaining blood cultures.

Computed tomography revealed an accumulation of blood in the distal portion of the left sylvian

fissure with an extension of the blood into the subarachnoid space over the convexity of the left hemisphere (Fig. 1). A digital cerebral arteriogram demonstrated an aneurysm measuring 8 millimeters located distally on the parietal branch of the left middle cerebral artery (Fig. 2). Vasospasm of the middle cerebral artery was noted within the sylvian fissure. A subsequent arteriogram (obtained 2 weeks after the initial study) showed no change in the size of the aneurysm, but it did show that the spasm of the middle cerebral artery had diminished. A short stenotic area was noted in the sylvian segment of the left parietal artery proximal to the aneurysm.

Five days after the second arteriogram, the patient underwent obliteration of the bacterial aneurysm by endovascular techniques. A Tracker 18 catheter (Target Therapeutics, San Jose, CA) was placed in the involved vessel just proximal to the aneurysm, and an Amytal test performed before coil placement was negative. Two 0.5-mm straight coils with Dacron fibers (Cook, Inc., Bloomington, IN) were placed proximal to the aneurysm. The first coil slipped into the aneurysm. The second coil stayed in the parent vessel. Immediately after placement of the coils, the angiography was repeated. The aneurysm was not visualized in the arterial phase. Slow filling, however, was noted in the venous phase (Fig. 3).

Subsequent angiography 8 days later disclosed that the aneurysm as well as the most distal segment of the parietal artery were obliterated (Fig. 4). Computed tomography was performed 1 week after angiography and revealed no evidence of cerebral infarction. The patient was discharged from the hospital with near complete resolution of his receptive dysphasia and without hemiparesis. An examination in the clinic 2 months after discharge revealed no neurological deficit or heart failure.

DISCUSSION

Bacterial intracranial aneurysms are demonstrated in less than 5% of patients with bacterial endocarditis⁽³⁾, although the true incidence is unknown because antibiotic therapy may lead to resolution of such aneurysms^(2,4,6). Experimental work by Molinari et al.⁽⁵⁾ indicated that the genesis of a bacterial intracranial aneurysm results from the lodging of septic emboli at distal sites in the circulation and the movement of the bacteria through the vasa vasorum to the adventitia, followed by inflammatory necrosis extending from the adventitia to the medial layer and resulting in aneurysm formation.

Antibiotic therapy is indicated after the diagnosis of bacterial endocarditis has been secured and should be continued for 4 to 6 weeks. Early cardiac surgery is recommended for patients with cardiac failure secondary to aortic or mitral valve infection. The safety of cardiac surgery for patients who have an intracranial aneurysm has been investigated.

Richardson et al.⁽⁹⁾, in their review of patients treated at the University of Alabama Birmingham from 1967 to 1977, reported no association between cardiopulmonary bypass and the appearance of new neurological deficits in patients with known bacterial intracranial aneurysms. Moreover, no patient

experienced rupture of an aneurysm during the perioperative period despite the use of heparin for a cardiopulmonary bypass procedure. It should be noted, however, that patients with bacterial endocarditis who require valve replacement and exhibit signs or symptoms consistent with cerebral embolization should undergo cerebral angiography preoperatively. Demonstration of an intracranial aneurysm preoperatively will ensure the placement of a bioprosthetic (tissue) valve to obviate anticoagulation postoperatively.

Open craniotomy is indicated for patients who demonstrate significant mass effect. Proximal and multiple lesions present particular problems⁽⁶⁾. The sacrifice of proximal vessels carries a significant threat of infarction to the perfused tissues. Bypass procedures are possible, although involvement of the vessel wall by the infectious process makes this procedure difficult. If it is logically possible, multiple lesions can be treated simultaneously with open craniotomy or with endovascular techniques.

The optimal intervention plan for patients who have previously ruptured aneurysms without significant mass effect remains unclear. Cantu et al.⁽²⁾, Morawetz and Karp⁽⁶⁾, as well as Meyer and Batjer⁽⁴⁾ have demonstrated that certain intracranial bacterial aneurysms resolve with antibiotic therapy. Unfortunately, certain aneurysms also rerupture during antibiotic therapy, as recently reported by Brust et al.⁽¹⁾. In the present case, we elected to intervene after 2 weeks of antibiotic therapy because, in our judgment, the risk of rerupture outweighed the risk of endovascular therapy.

Embolization, however, is by no means without potential complications. The intracranial vasculature in patients with bacterial aneurysms is probably more fragile⁽⁵⁾, and an endovascular procedure in these patients may be associated with greater risks than usual. If the Amytal test had been positive, we would have increased the patient's neurological deficit with an endovascular procedure. In that situation, we would have elected to abort the embolization and would have considered an open procedure. The optimal management strategy remains a clinical judgment by the neurosurgeon, and embolization therapy may represent the best option in certain clinical situations.

ACKNOWLEDGMENTS

We thank Vickie Beck for her excellent clerical assistance and Dr. Richard B. Morawetz for his critical comments in the preparation of this article.

Received, March 13, 1992.

Accepted, December 3, 1992.

Reprint requests: R. Tyler Frizzell, M.D., Ph.D., University of Alabama Birmingham Medical Center, Birmingham, AL 35294.

REFERENCES:

- Brust JCM, Dickinson PCT, Hughes JEO, Holtzman RNN: The diagnosis and treatment of cerebral mycotic aneurysms. **Ann Neurol** 27:238-246, 1990.
- Cantu RC, LeMay M, Wilkinson HA: The importance of repeated angiography in the treatment of mycotic-embolic intracranial aneurysms. **J Neurosurg** 25:189-193, 1966.
- Hart RG, Kagan-Hallet K, Joerns SE: Mechanisms of intracranial hemorrhage in infective endocarditis. **Stroke** 18:1048-1056, 1987.
- Meyer YJ, Batjer HH: Resolution of a recurrent/residual bacterial aneurysm during antibiotic therapy. **Neurosurgery** 26:537-539, 1990.
- Molinari GF, Smith L, Goldstein MN, Satran R: Pathogenesis of cerebral mycotic aneurysms. **Neurology** 23:325-332, 1972.
- Morawetz RB, Karp RB: Evolution and resolution of intracranial bacterial (mycotic) aneurysms. **Neurosurgery** 15:43-49, 1984.
- Ojemann RG, Heros RC, Crowell RM: *Surgical Management of Cerebrovascular Disease*. Baltimore, Williams and Wilkins, 1988, ed 2, pp 337-346.
- Osler W: Gulstonian lectures and malignant endocarditis. **Lancet** 1:415-418, 505-508, 1885.
- Richardson JV, Karp RB, Kirklin JW, Dismukes WE: Treatment of infective endocarditis: A ten year comparative analysis. **Circulation** 58:589-599, 1978.

COMMENT

Frizzell et al. have demonstrated the appropriate use of endovascular techniques for the final management of peripheral mycotic aneurysms of the brain. The combination of superselective catheterization of the involved cortical artery under road mapping and the use of a pre-embolization superselective injection of Amytal (30-60 mg) may decrease the morbidity involved in finding and blocking the parent artery as close as possible to the site of the aneurysm.

The nature of the aneurysm (infectious weakening of the arterial wall) makes it very difficult to perform an isolated surgical clipping of it, while preserving the parent artery. In most cases, it is necessary to perform a proximal clipping of the parent artery, with the concomitant obliteration of the mycotic aneurysm. The same anatomical results may be obtained by endovascular techniques, as described by the authors.

The endovascular obliteration of an intracranial aneurysm is usually performed with the patient awake. The pre-embolization injection of Amytal in the artery to be occluded, concomitant with an electroencephalogram and clinical evaluation, may reveal a potential neurological deficit related to the permanent occlusion of the diseased artery.

This excellent result may be reproduced in many patients who have single or multiple intracranial mycotic aneurysms.

Fernando Viñuela
Los Angeles, California

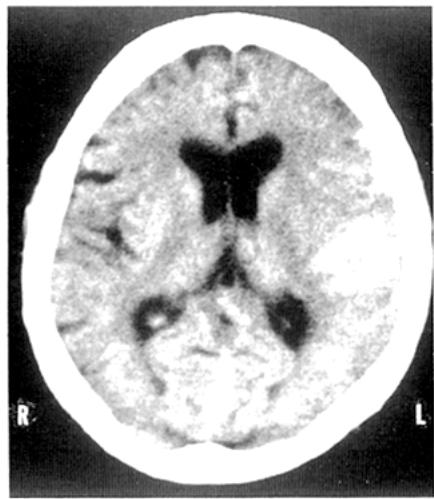


Figure 1. Computed tomographic scan without contrast shows the accumulation of blood in the top of the left sylvian fissure and in the subarachnoid space.

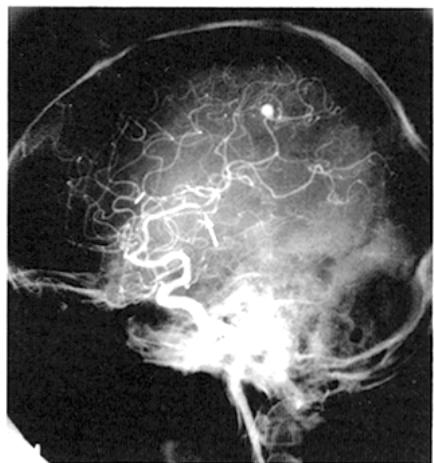


Figure 2. Left internal carotid artery angiogram shows a bacterial aneurysm of the anterior parietal branch of the left middle cerebral artery and stenosis of the parietal artery in the mid sylvian fissure (arrow).

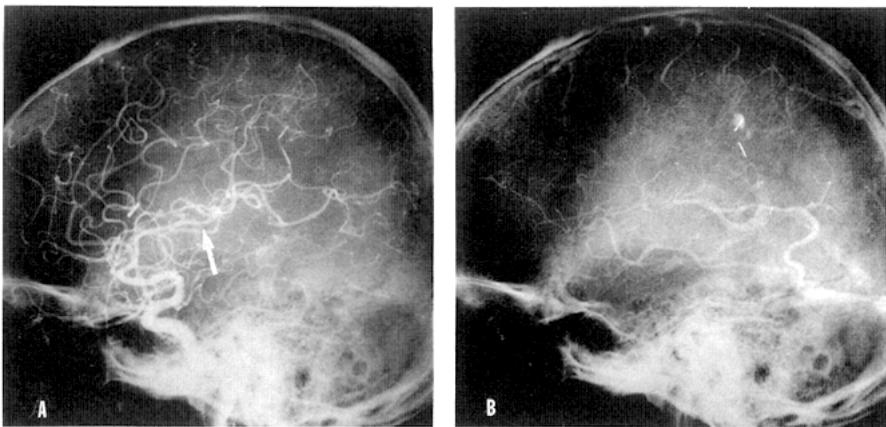


Figure 3. Immediate postembolization arteriogram shows two coils in the anterior parietal branch of the left middle cerebral artery. *A*, arterial phase: stenosis of the parietal branch of the middle cerebral artery (arrow) is slightly wider than on the preembolization arteriogram (Fig. 2). *B*, late venous phase: delayed, incomplete filling of the bacterial aneurysm.

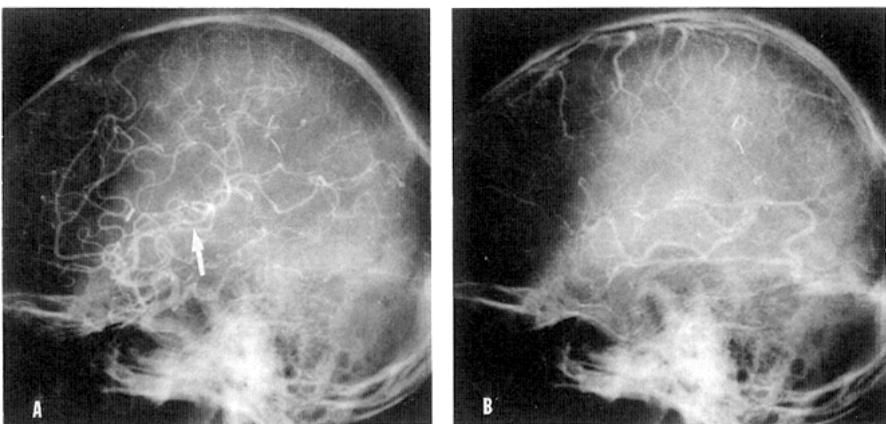


Figure 4. Delayed postembolization (10 days) arteriogram shows thrombosis of the terminal segment of the anterior parietal artery and the aneurysm. Slight stenosis remains in the sylvian segment of the left parietal artery (arrow). *A*, arterial phase. *B*, late venous phase.