Clipping of an aneurysm 20 years after encasement with methyl methacrylate

Case report

CHRISTOPHER S. OGLVY, M.D., AND CHARLES E. POLETTI, M.D.

Cerebrovascular Surgery Neurosurgical Service. Massachusetts General Hospital, Boston, Massachusetts

A variety of agents have been used to coat aneurysms as an alternative to clipping. These agents were employed more frequently prior to the routine use of the operating microscope and the presently available variety of aneurysm clips. One such coating agent is methyl methacrylate. This report describes a patient with an anterior communicating aneurysm that rebled 20 years after being encased in methyl methacrylate. At operation, the pulsating aneurysm had eroded the adjacent layer of methyl methacrylate, creating a small intervening space. This space allowed removal under the microscope (with a high-speed air drill and a diamond bit) of the methyl methacrylate from the anterior cerebral arteries and aneurysm, exposing it for definitive clip placement. The feasibility of clipping encased aneurysms is discussed.

Key Words • aneurysm • methyl methacrylate • clipping

As microsurgical visualization and aneurysm clip designs have improved, the need to treat aneurysms with techniques other than direct clipping has become less frequent. However, with some aneurysm configurations, coating may present the optimum treatment. Once an aneurysm is encased, recurrent hemorrhage presents a dilemma in management. Depending on the type of agent used to encase the lesion it may be possible to remove the coating material and definitively clip the aneurysm. We report a patient in whom an anterior communicating aneurysm previously encased in methyl methacrylate was clipped after it rebled.

Case Report

This 62-year-old woman had suffered a subarachnoid hemorrhage (SAH) in 1969, at the age of 42 years. She did well after an anterior communicating artery aneurysm had been fully encased with methyl methacrylate. Her medical history also included a myocardial infarction in 1984 and a mastectomy for cancer in 1986.

On July 10, 1989, the patient developed the abrupt onset of severe headache with nausea. A cerebral computerized tomography scan confirmed the suspicion of a repeat SAH (Fig. 1).

Fig. 1. Computerized tomography scan obtained at the time of the second subarachnoid hemorrhage, 20 years after the aneurysm had been encased with methyl methacrylate.
Examination. On arrival at our hospital on the day of her SAH, the patient was sleepy but arousable, had no stiff neck or cranial nerve abnormalities, and had normal sensation and strength in all extremities. An angiogram showed an anterior communicating artery aneurysm directed anteriorly (Fig. 2). The patient was stabilized from a cardiac standpoint and taken to the operating room.

Operation. On July 20, surgery was performed via a right-sided temporal approach. Methyl methacrylate was found at the proximal A1 segment of the right anterior cerebral artery. As the methacrylate was exposed it became clear that the pulsating right anterior cerebral artery was not firmly adherent to the acrylic. The methyl methacrylate reached approximately \( 270^\circ \) around the artery, and a free space was present between the methyl methacrylate and the vessel. As the frontal lobe was elevated, the methacrylate was easily separated from the inferior frontal lobe permitting exposure of three A2 segments of the anterior communicating arteries (Fig. 3). Again, a 0.5-mm space was identified between the acrylic and the pulsating arterial walls.

A high-speed air drill with a diamond bit* was then used to gradually remove the encasing acrylic. This was accomplished by using gentle brush-like strokes of the drill bit on the exposed surface of the methacrylate with gradual thinning of the plastic. As the remaining block of acrylic became more mobile, it was necessary to stabilize the solid piece by placing a microdissector diametrically opposed to the pressure point of the drill. The aneurysm dome and neck were then gradually identified. At this point, a small amount of acrylic remained. The aneurysm was clipped and the remaining methacrylate was excised (Fig. 4). The patient has done well postoperatively with no new neurological deficits.

Discussion

Dutton was the first author to describe the use of methyl methacrylate to coat aneurysms; the longest follow-up period in his four patients was 6 months with no repeat hemorrhages reported. In a larger series reported by Hammon of 102 aneurysms encased with methyl methacrylate, there were two rebleeds in an unspecified follow-up period. This group of patients included a subseries of 40 patients followed for up to 6 years. The recurrent bleeding in two aneurysms was attributed to incomplete investment of the aneurysm with the methyl methacrylate. In a review of 106 aneurysms coated with methyl methacrylate and followed for 1 to 10 years, Dutton reported no rebleeds.

One theoretical criticism of the methyl-methacrylate compound is that in its polymerized state it is hydro-

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* Air drill with diamond bit manufactured by Midas Rex, Fort Worth, Texas.

Fig. 2. Angiogram showing an anterior communicating artery aneurysm directed anteriorly.

Fig. 3. Retouched operative photograph (left) and artist's drawing (right) at right pterional craniotomy with the frontal lobe retracted. The following features are visible: internal carotid artery (ICA), right A1 segment of the anterior cerebral artery (RA1), the two ipsilateral A2 segments (RA2), and the contralateral A2 segment (LA2).

Fig. 4. Retouched operative photograph (left) and artist's drawing (right) showing the clipped aneurysm after complete removal of the methyl methacrylate encasement. In addition to the structures labeled in Fig. 3, the A1 segment of the contralateral anterior cerebral artery is now visualized (LA2).
Methyl methacrylate aneurysmal coating

phobic, producing poor tissue adherence. Indeed, in the present case the methacrylate was only mildly adherent to the optic chiasm and brain tissue; in contrast, adjacent to the arteries and aneurysm, it had been eroded by the vascular pulsations, leaving a small intervening space that permitted rebleeding.

A variety of agents have been developed specifically to adhere to the aneurysm wall.10,11,15,16,20-22 These adherent compounds include methyl-2-cyanoacrylate (Eastman 910 monomer),1,14-15,21 ethyl-2-cyanoacrylate (Aron Alpha A), vinyl chloride-vinylidene dichloride copolymer (applied with a second coat of epoxy resin),18 and Biobond.15,24

As different adhesive compounds were used, new problems developed. For instance, methyl-2-cyanoacrylate was found to produce a massive inflammatory response of contiguous brain tissue.17 Neuronal death, erosion of the media and adventitia of larger vessels,22 fusiform dilatation of large arteries,21 and vascular thrombosis14,17 were also observed. Ethyl-2-cyanoacrylate was found to be extra adhesive, yet this also produced meningeal necrosis, neuronal death, vascular wall degeneration, thrombosis, and gliosis.3,4,14 This agent also cracks with time.6 In a large review of various agents available for encasing aneurysms, Handa, et al.,10 concluded that an ideal agent should have high tissue adhesiveness with good film formation, short hardening times, structural stability, and lack of toxicity.

While methyl methacrylate has the advantage of producing less inflammatory response than some other agents, this material is less adherent to aneurysms. In the case reported here, there was a definite space between the arterial structures and the methacrylate, allowing gentle removal of the casing. In contrast, for adherent compounds, the associated scarring and gliosis may make their removal from encased aneurysms unduly hazardous.

Acknowledgments

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Manuscript received November 9, 1990. Address reprint requests to: Christopher S. Ogilvy, M.D., Cerebrovascular Surgery, Neurosurgical Service, Massachusetts General Hospital, Fruit Street, Boston, Massachusetts 02114.