The "current" status of aneurysm treatment?

V Halbach

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Commentary

The "Current" Status of Aneurysm Treatment?

Van Halbach[1]

Two papers contained in this month's journal that deal with platinum coils (1, 2) are timely and welcome additions to our understanding of the recent advances in the endovascular treatment of aneurysms. These papers highlight how rapidly changes have occurred in this field. Not long ago, the development of soft and steerable microcatheters permitted intracranial navigation to nearly all cerebral vascular territories. Unfortunately, the choice of embolic agents to deliver through these marvelous catheters initially proved to be quite limited. Ground-up bed pillows (PVA), rapidly setting glue (IBCA), and alcohol were all available and could pass through the narrow caliber minicatheters, but none was without its drawbacks.

Our initial attempts to produce coil embolic agents consisted of cutting the distal tips of discarded microguidewires (3), an expensive and time-consuming operation. The addition of thrombogenic fibers to coils with a multitude of shapes and sizes permitted more accurate occlusion of high flow fistulas and arteriovenous connections. Earlier, clinical experience showed that platinum coils without fibers were largely incapable of producing a complete or permanent occlusion, but served as radioopaque markers and vehicles for the delivery of more thrombogenic substances. Properly sized coils could serve as a net to capture other embolic agents, such as silk suture, and their shape and configuration would prevent distal migration. The addition of thrombogenic fibers (dacron and silk) along with complex shapes produced increased friction, thereby limiting the length of coils that could be delivered. The development of an electrolytically detachable coil has proved to be a tremendous advance in the treatment of intracranial aneurysms.

As Graves and colleagues have concluded (1), the electrolytically detachable coils have many advantages over the fibered platinum coils. The electrolytically detachable coils are softer than fibered coils and, unencumbered by silk or Dacron fibers, can achieve much greater lengths. Most importantly, the ability to remove, reposition, and detach the coil gives it an unprecedented advantage over fibered coils. In their series, Graves et al (1) delivered electrolytically detachable coils into the aneurysm more than 10 times the length of fibered coils. The electrolytically detachable coil proved superior to the fibered coil in nearly every aspect including percent reduction in volume and absence of parent artery occlusions. Considerable clinical experience with the electrolytically detachable coil has been achieved, and I am sure that the results of this study come as no surprise to those familiar with these devices.

My only concerns regarding an otherwise outstanding contribution involve the design of the study. I would assume that to compare the differences between two different coil designs the authors would have placed the devices in similar aneurysms. Yet this study compared two different populations of experimental aneurysms. The fibered coils were placed into lateral aneurysms in 87% of cases, whereas the electrolytically detachable coils used the lateral aneurysm in only 38% of cases. The remainder of cases used the bifurcation or terminal aneurysm model. The flow dynamics and response to endovascular therapy should be quite different among these three different aneurysm locations. The lateral aneurysm model used by the authors was a modification of that of German and Black (4); it has been described by the authors as producing a wide-necked aneurysm with 100% patency (5) and has been noted to have stagnation of contrast within the lumen during angiography lasting up to several minutes (6). The same authors evaluated the hemodynamics in lateral, bifurcation, and terminal aneurysms with angiography and color Doppler techniques (6) and concluded that not all

[1] Department of Radiology, University of California Medical Center, 505 Parnassus Avenue, Room L352, San Francisco, CA 94143.

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aneurysms share the same stresses. They also stated that decisions regarding the size and type of device that can best be used for treatment (of aneurysms) can be logically based on an understanding of these hemodynamic features. Although I am unaware of any studies comparing the responses of endovascular therapy of different aneurysm models (specifically lateral, terminal, and bifurcation types) to the same embolic device, I would assume from the hemodynamic data published (5–8) that significant differences should occur.

Arvin et al evaluated the response abilities of various polyurethane coatings on platinum coils to produce thrombus in a rabbit carotid (2). The authors accurately point out that a number of electrolytically detachable coils are often required to achieve complete thrombosis of an intracranial aneurysm in clinical practice. I would disagree with their statement that the entire volume of the aneurysm must be filled with strands of platinum coils. Preliminary studies have shown that a densely packed and completely treated aneurysm contains approximately 40% of coil by volume (Gugliemi G, personal communication, 1992). I would agree with the authors that a coating that would promote thrombosis may be advantageous in achieving complete aneurysmal thrombosis with fewer embolic devices. The authors have shown some exciting preliminary work suggesting that a thin coat of one type of polyurethane coating does increase thrombogenicity. As with all great research, many new questions remain to be answered. Is the thrombus formed by this coating as stable and permanent as the thrombus formed by electrothrombosis? How much, if any, thrombus is formed from the electrolysis process? Does the polyurethane coating inhibit the electrolysis or electrothrombosis process? Little research has been performed to date regarding the thrombus formed during electrolysis of platinum coils. The stability, ultrastructure, strength, and amount of thrombus formed by various new therapies will need to be studied. The authors should be congratulated on their outstanding contributions to the field of interventional neuroradiology.

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