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# Endovascular Therapy as the Preferred Method of Treatment for "Surgical" Aneurysms: What Must Happen for This to Become Reality?

Since the introduction of the Gugliemli detachable coils (GDCs) in clinical research trials in 1991, over 40,000 patients worldwide with cerebral aneurysms have been treated with the device. The safety and efficacy of GDCs in preventing rehemorrhage of previously ruptured cerebral aneurysms was proved in the initial multicenter GDC trial, and subsequently has been substantiated in multiple published reports from major medical centers internationally. The multicenter GDC trial, which resulted in eventual Food and Drug Administration approval of the device in 1995, evaluated the GDCs for the treatment of aneurysms considered to be at increased risk for conventional surgical clipping. GDCs are being used with increasing frequency to treat aneurysms that are not considered to be at increased risk for surgical clipping. This is particularly true in Europe, but less so in North America. There are now 210 medical centers in the United States with the capability to use GDCs. Approximately 3500 aneurysms annually are being treated with GDCs in the United States; however, this represents only approximately 15% of all treated aneurysms. What is preventing endovascular coil occlusion from becoming the preferred method of treatment for aneurysms that are currently considered "surgical?"

There are two issues repeatedly mentioned by prominent neurosurgeons who speak and write against the practice of endovascular coil occlusion for surgically straightforward aneurysms. Their contention is that endovascular coiling of aneurysms is not "definitive" therapy, and that it is a "high-maintenance" procedure. These issues need to be addressed satisfactorily by interventionalists before endovascular treatment will be considered the preferred method of treatment for the majority of cerebral aneurysms.

The persistence of a small-neck remnant is not uncommon after endovascular coil occlusion of aneurysms. The long-term natural history of these neck remnants is unknown. Furthermore, the few reported cases of autopsy examination of coiled aneurysms are contradictory and inconclusive regarding whether there is endothelialization across the neck of coiled aneurysms. Successful surgical clipping of an aneurysm reapproximates the intima across the neck of the aneurysm, thereby constituting "definitive" treatment. Endovascular techniques such as balloon-assisted remodeling for the treatment of wide-neck aneurysms and three-dimensional coils improve the mechanical blockage of the coils at the neck of the aneurysm and reduce the size and number of neck remnants. Nevertheless, these mechanical techniques have not been shown, as of yet, to promote endothelialization across the neck of coiled aneurysms. Work is in progress to develop neck-bridging devices and coils that are biologically active that will promote endothelialization and scarring across the necks of coiled aneurysms. In addition, new liquid embolic agents are showing promise in early animal studies. Researchers, in collaboration with industry, need to continue and expand these efforts by initiating human clinical trials. When embolic agents are available that consistently result in a biological blockage across the neck of aneurysms, the argument that endovascular treatment of aneurysms is not "definitive" therapy will no longer be valid.

Because we are using a new technology that lacks long-term follow-up results and, because of the high incidence of persistent neck remnants, we are forced to perform frequent follow-up angiographic examinations. Thus, the claim that endovascular coil occlusion of aneurysms is a "high-maintenance" procedure that commits patients and their physicians to years of follow-up gains credence. Repeated conventional angiographic procedures for following up stable neck remnants are onerous for the patient and detract from the appeal of recommending this less invasive procedure upon initial patient presentation. In this issue of the *AJNR*, Kähärä and colleagues (page 1470) present the results of their study by comparing findings of MR angiography (MRA) with conventional angiography in the follow-up evaluation of aneurysms endovascularly treated with the GDCs. Although the numbers are small, their results are encouraging. Using commonly available 3D time-of-flight pulse sequences and targeted maximum-intensity-projection reconstructions, they found the overall sensitivity of MRA and the positive predictive value were both 90% for revealing neck remnants, and the specificity of MRA was 91% for ruling out neck remnants. With verification of Kähärä and colleagues' results from other centers, and additional refinement of pulse sequences specifically developed and tailored to evaluate coiled aneurysms, it is very realistic to believe that MRA will become the primary imaging method for following up endovascularly treated aneurysms. When that is accomplished, the assertion that endovascular coil occlusion of aneurysms is a "high-maintenance" procedure necessitating frequent invasive angiographic follow-up examinations will no longer be true.

We must remain cognizant of the relatively early infancy of endovascular coil occlusion as a method

of treatment of cerebral aneurysms. Improvements in technology and noninvasive imaging follow-up will occur. When this happens, it will not be possible to ignore the tremendous clinical results that already have been reported. The overlying issues of turf, egos, and economics will need to give way to the scientific data. Endovascular treatment will become the preferred method of treatment for the majority of cerebral aneurysms in the near future.

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