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AN OVERVIEW OF NEUROVASCULAR DISEASE MANAGEMENT

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Neurovascular disorders, including brain aneurysms, arteriovenous malformations (AVMs), carotid artery disease, and intracranial atherosclerotic disease, take a huge health and economic toll on U.S. citizens and can lead to a host of neurological problems ranging from stroke and subarachnoid hemorrhage to disability and death. According to the Brain Aneurysm Foundation, cerebral aneurysms affect an estimated 6 million Americans and are responsible for close to half a million deaths worldwide each year, with half the victims age 50 and younger.[1] A 2004 study showed that survivors of brain aneurysm rupture and their caretakers lost roughly $138 million in combined wages in a single year.[1] Of the roughly 30,000 cases of aneurysmal subarachnoid hemorrhage that occur annually, about 60% result in disability or death. Close to 1 million strokes occur in the United States each year, with 10% to 15% attributed to intracranial atherosclerotic disease.

Despite these devastating effects, progress has been made in the management of neurovascular diseases, and the field has undergone significant advances in the last decade due to the explosion of innovation in endovascular and microsurgical devices and treatments. This is particularly true for the treatment of cerebral aneurysms, especially after the landmark 2005 ISAT trial validating endovascular therapy as a mode of treatment for these types of lesions.[2] Since then, endovascular therapy has evolved from simple coiling to balloon- and stent-assisted coiling and now flow diversion. These have all given surgeons and patients a broader range of options for treating aneurysms with new minimally invasive techniques.

With flow diversion, the need for treating aneurysms with complex bypasses has dropped significantly although it remains important in a limited number of patients. Flow diversion uses a low-porosity stent placed in a parent artery across the aneurysm neck to slow blood flow and promote thrombosis, thereby excluding the aneurysm from circulation while preserving flow through the parent vessel. Early results have been promising for large proximal internal carotid aneurysms although early results for posterior circulation aneurysms have not been as favorable.[3]

Open microsurgical clipping is also improving with the use of adenosine-induced flow arrest, which has resulted in improved outcomes for complex cerebral aneurysms. To obtain successful clipping of an aneurysm, circumferential visualization of the aneurysm, branches, and perforators are vital to prevent residual aneurysms or strokes. This is particularly important in large aneurysms, where temporary occlusion has been the traditional approach. However, recent use of adenosine to induce asystole and relative hypotension has been reported by Powers and colleagues.[4] A period of 30 seconds of asystole has provided the surgeons using this method with enough time to better visualize and place a clip safely on the aneurysm neck.

Other advances in neurovascular disease treatment include the use of embolization for cerebral AVMs, a treatment that is often used adjunctively with microsurgical resection and stereotactic radiosurgery and one that has sparked controversy in the medical community. It is also important to understand the role of the recent ARUBA trial, which questions the safety of and need for treating all unruptured AVMs.[5]

Another interesting advance is internal carotid artery stenting for intracranial atherosclerotic disease, an important topic considering that many active surgeons believe it to be helpful in selected patients. However, the SAMMPRIS trial has shown worse outcomes with regard to medical treatment, causing many surgeons to abandon the procedure.[6]

In this issue of the *Methodist DeBakey Cardiovascular Journal*, leading authorities in neurovascular disease from the University of Washington, Columbia University Medical Center, Houston Methodist DeBakey Heart & Vascular Center, Centro Médico Nacional de Occidente, State University of New York, Buffalo, and the University of Cincinnati College of Medicine discuss innovations in the neurovascular armamentarium, including coil placement, stent-assistant coiling, flow diversion, and microsurgical clipping.

This issue opens with my review of the benefits and risks of endovascular versus surgical treatment of aneurysms, with a specific focus on microsurgical clipping using adenosine-induced flow arrest as a viable option for patients who are not candidates for endovascular therapy. Addressing the topic of bypasses and reconstruction for complex brain aneurysms, Drs. Sekhar and da Silva explore the types and properties of complex intracranial aneurysms and discuss the viability of microsurgical techniques for managing these lesions—emphasizing, through an expert case series, the technical challenges of and indications for bypass surgery.

Dr. Siddiqui and colleagues reveal how improved technology and promising results from clinical trials have ushered in the burgeoning era of endovascular techniques such as embolization and flow diverters, which have revolutionized the treatment of wide-necked, giant, and fusiform aneurysms. A key topic of interest is intracranial atherosclerotic disease, for which Drs. Kim & Osbun discuss the range of treatments including the preferred role of aggressive medical management with antithrombotic therapy compared to intracranial stenting, balloon angioplasty, and cerebrovascular bypass.

Microsurgical resection and radiosurgery are now two valid tools to treat cerebral AVMs, and Drs. Zuccarello and Serrone address these and other multimodality treatment options in their review of AVM management strategies. On a similar note, Drs. Lavine and Ellis focus on the nature of cerebral AVMs and the benefits and risks of endovascular embolization and its various embolizing agents.

With this issue, we hope to offer our readers a broad overview of the advances in neurovascular-related tools and techniques and demonstrate how endovascular and microsurgical options are both viable and often complementary in treating the range of neurovascular diseases.

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