FEATURE

Advances in Endovascular Interventions Will Continue to Improve Patients' Lives

Written by Lynne Lederman, PhD

Barry T. Katzen, MD, Baptist Cardiac and Vascular Institute, Miami, Florida, USA, reviewed the achievements, challenges, and future directions in endovascular interventions. Endovascular interventions are procedures in which a catheter is inserted percutaneously into a blood vessel. This allows for treatment of vascular diseases by delivering pharmacologic agents or implantation of small devices (eg, stents, coils) on a catheter. Diagnostic and interventional endovascular procedures include the treatment of peripheral artery disease (PAD), coronary artery disease, neurovascular disease, structural heart disease, and aortic, abdominal, thoracic, or peripheral aneurysms. Such treatments may involve the opening, closing, or repairing of blood vessels, replacing a valve, or implanting hemodynamic support devices.

In the 1960s, early endovascular procedures included catheter-directed angiography to diagnose gastrointestinal bleeding and perform vascular embolization. Technology has advanced to the point that in the current era endovascular procedures can now be used to repair abdominal and thoracic aneurysms. Dr. Katzen suggested that endovascular techniques of the future may be able to combine ascending aortic aneurysm repair with transcatheter aortic valve replacement. Peripheral vascular disease and critical limb ischemia is increasingly being treated with percutaneous interventions due to advances in technology. Drug-eluting stents to treat PAD were approved in the United States this year and drug-coated balloons should be available within the next few years for the treatment of PAD. Novel approaches to re-establish circulation in patients with PAD, such as approaching a blocked popliteal vessel via the foot, rather than via the femoral artery, are being shown to be effective in re-establishing circulation. Advances have also been made in controlling hypertension via renal denervation using an endovascular approach.

Peer-Reviewed Highlights From the

Transcatheter Cardiovascular Therapeutics 2013 Interventional Conference

Determining which patients will benefit from endovascular therapies and which procedures provide value has been difficult and will require comparative effectiveness research. As a result, endovascular therapy must become more cost-effective while also becoming safer for both patients and practitioners. Another challenge within the endovascular arena is providing appropriate and adequate training to physicians interested in the field.

One goal for the future of endovascular therapy is being able to treat more complicated anatomy while advancing toward the ability to provide these procedures on an outpatient basis. This includes endovascular repair of abdominal and thoracic aortic aneurysms, which have become a significant medical advancement. Future areas for improvement include the development of lower profile devices to reduce vascular access complications, vascular closure for larger arteries, advances in antiplatelet and anticoagulant therapy, and better training to improve the skills of the practitioners.

Advances in vascular stents to open blood vessels will include the use of bioresorbable vascular scaffolds, some of which may be drug-eluting. These stents are being studied for use in coronary arteries, superficial femoral arteries and potentially in the popliteal arteries. The advantage of bioresorbable stents is that they provide support of the vessel for a short period of time while the vessel heals and then dissolve, leaving behind a fully functional endothelium without a permanent metal implant.

The future of endovascular interventions will rely not only on new technology, such as image-guided therapies, but also on an interdisciplinary approach where interventional radiologists, interventional cardiologists, vascular surgeons, and other practitioners share their environment and continue to develop new skills.

NEUROVASCULAR INTERVENTIONS

Leo Nelson Hopkins, MD, University at Buffalo Neurosurgery, Buffalo, New York, USA, discussed some of the challenges involved in neurovascular interventions. One issue concerns the use of carotid artery stenting (CAS) versus coronary endarterectomy (CEA) surgery for carotid stenosis. According to Dr. Hopkins, more minor perioperative strokes occur with CAS; however, the procedures are otherwise fairly equivalent, and CAS is less invasive and complementary to CEA. Dr. Hopkins feels that CAS will one day become the primary treatment although currently there is disagreement between the specialties. Futher complicating a more widespread use of CAS are the current indications and reimbursement adopted by the Centers for Medicare and Medicaid Services (CMS), which are based on some older trials.

Endovascular treatment for acute stroke is an entirely different type of neurointervention. It is extremely difficult to run randomized, controlled trials in patients with acute strokes, partly because accrual of even small numbers of patients can take years. Long recruitment times and rapid technology changes can result in a trial testing outdated technology and not reflecting current clinical practice. Trials might not take into account the learning curve required for advanced technologies.

Dr. Hopkins proposes that CAS does have a role in treatment, and that many patients are undergoing inappropriate CEA. He encourages practitioners to continue to challenge CMS and apply political pressure. Meanwhile, outcomes research on the effectiveness of CAS should continue so that an evidence base can be developed and used for coverage of the procedure. Because of the problems in conducting randomized clinical trials in acute stroke, registries can provide an alternative source of reliable data. This could lead to the ability to study a fully developed interventional technique in a well-designed trial.

It is clear that the development of methods that reduce perioperative strokes are needed. This is essential due to the devastating effect that a stroke can have on patients, their families, and society in general. Proper selection of patients for whom CAS is appropriate may help reduce the incidence of strokes. Mesh-covered stents and clot retrieval tools are potential therapies which may be able to reduce the incidence of perioperative stroke. The level of awareness of acute stroke and how to evaluate and treat it in some settings (eg, rural and underserved areas) continues to be poor. In addition, there is a shortage of neurointerventionists who treat stroke, which results in decreased access to these specialists among the populations most likely to have a stroke. Dr. Hopkins suggests that cardiologists could help fill this gap, because they have catheter skills, are familiar with pharmacotherapeutics, devices, and emergency situations, and are available almost anywhere and anytime. Patients with stroke tend to have cardiac problems and may already have their own cardiologist.

Only 5% of patients with acute stroke receive intravenous (IV) tissue plasminogen activator (tPA) [Reeves MJ et al. *Stroke* 2005], but of those who do receive IV tPA, 60% will be either disabled or dead by 3 months posttreatment. Therefore, alternative methods that can restore cerebral blood flow are needed. Other needs include devices to repair the aortic arch, which are in development, and the ability to treat dissecting aneurysms. Stem cell therapies might prove useful one day, but these are farther off in the future. Other possible future applications of endovascular interventions include treatment of benign prostatic hypertrophy by devascularizing the prostate gland, and the treatment of morbid obesity via left gastric embolization. Another treatment that may be developed is neuromodulation via manipulation of the parasympathetic nervous system, currently applied to hypertension control, but with potential additional applications that will require further investigation.

The next decade will see an increase in less invasive treatments for cardiac and vascular conditions. These advances will need multidisciplinary collaboration among staff who will need to continue to learn new procedures. Obstacles to cardiologists supporting the neuro-interventional space will include turf battles in locations where a true multidisciplinary/interdisciplinary team approach has not been put in place, and gaining access to the procedure suite. Hopefully, the multiple successes of a multidisciplinary team approach using hybrid operating rooms (percutaneous aortic valve replacement and aortic stent grafting) will pave the way for neurointerventions to follow.

Advances in care that result in less invasive endovascular procedures will lead to less surgery, less general anesthesia, reduced hospital stays, and more rapid recovery. Drug-coated stents and drug-eluting balloons have the potential to transform the endovascular intervention field in the next 5 years because they are adaptable to any type of vessel in any location. However, effective management of acute stroke, which is currently lacking, may rely in great part upon creating a registry to include all stroke patients and on developing more effective technologies. The involvement of cardiologists is essential, and they would be a better choice to design and conduct stroke trials than non-interventionists. The future of effective therapy for stroke, like the effective use of cardiac-related endovascular therapies, also depends on development of multidisciplinary teams and centers.