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In the wake of the SAPPHIRE trial and subsequent approval of carotid stenting (CAS) devices by the Food and Drug Administration (FDA) in the United States, CAS is poised to explode in the frequency of its application in North America. Although the results of the Carotid Revascularization Stenting versus Endarterectomy Trial (CREST), the largest randomized controlled trial comparing carotid endarterectomy to CAS, are years away, many practitioners in multiple disciplines have already entered the competition for patients and remuneration. Despite the absence of evidence to support CAS over carotid endarterectomy2,3 and the need to continue recruiting patients to CREST,4 cardiologists, vascular surgeons, neurologists, neurosurgeons, general interventional and neurointerventional radiologists are all vying to treat carotid stenoses, many of which are <70% in severity, and asymptomatic.2,5,6 Attempts are being made to establish training, competency and credentialing standards for performance of CAS, and they vary widely between specialties.7,8,9 Computer simulations are playing a larger role in this process10 and may help to address the mismatch between training opportunities and interested practitioners. There have been concerns about the SAPPHIRE trial11 and the incidence of restenosis in previous case series.3,12 The techniques of CAS are still variable, with some operators advocating the use of cerebral protection devices,13 whereas others found that distal emboli might be more common with their usage.14 Although abnormalities on diffusion-weighted MRI after CAS are not uncommon (up to 30% of patients), most of these are asymptomatic.15 Patient related risk factors might be important determinants of complication rates after CAS, with those presenting with hemispheric strokes at particularly high risk.16 There may be a role for preoperative ultrasound in the identification of friable plaque, which may be more likely to generate distal emboli during CAS procedures.17

Intracranial Angioplasty and Stenting for Atherosclerosis

As technology and experience evolve, this procedure is becoming increasingly effective and safe for the treatment of intracranial atherosclerotic disease, and guidelines are being developed for its use.18,19 Although still performed relatively infrequently,20 the risks of perioperative stroke and death have been reported to be as low as 8.3%, with the annual risk of stroke in the territory of the treated vessel between 3% to 5%.21 Balloons and stents are considerably softer and more flexible than earlier cardiology devices, and a new self-expanding stent specifically designed for intracranial use has recently become available.18,19 This procedure, however, remains hazardous with up to 50% of patients showing new, ipsilateral ischemic lesions on diffusion-weighted MR images.22 Angioplasty alone may be safer than the combination with stenting,21 and drug-eluting stents, although showing promise in coronary and canine vessels for the prevention of restenosis,18 are still not ready for human cerebral arteries because of differing histology and questions of drug neurotoxicity.

Acute Stroke Interventions

The limitations of intravenous (IV) and intra-arterial (IA) chemical thrombolysis for reperfusion in acute stroke are becoming more apparent. The MERCI (Mechanical Embolus Removal in Cerebral Ischemia) trial of a dedicated device for mechanical embolectomy in stroke has been updated to include 141 patients who presented within 8 hours of their acute event.23 A 48% recanalization rate was obtained using this device, with a trend toward improved neurological outcome at 90 days in these patients, although symptomatic hemorrhages occurred in almost 28% of patients and overall mortality in the series was 44%. The high mortality may have been attributable to the initial severity of the strokes, the large number of basilar and internal carotid terminus emboli, and the advanced age of the patients compared with other series. Another series24 reported an 80% recanalization rate in 10 patients treated with this device, although the mortality rate was still 50%. There is some evidence that a very aggressive, multimodality approach using IV or IA GP IIb/IIa antagonists abciximab or tirofiban, IA recombinant tissue plasminogen activator or urokinase, and percutaneous angioplasty and stenting may result in more favorable outcomes, with promising results in small numbers of patients.25,26,27 Preliminary results suggest that endovascular ultrasound probes can accelerate thrombolysis;28 however, externally applied ultrasound combined with IV recombinant tissue plasminogen activator may increase the risk of hemorrhage.29 There are at least 3 commercial devices in development for selective, endovascular, locally induced hypothermia to limit brain damage during...
mains the most reliable imaging modality to identify middle cerebral artery vasospasm, and perfusion CT and MRI are being used more frequently to identify brain at risk for infarction from vasospasm.

Imaging

As noninvasive imaging and carotid stenting become more popular, the precise measurement of atherosclerotic carotid stenosis becomes more critical. Conventional digital subtraction angiography (DSA) is being replaced as the gold standard for carotid stenosis measurement by 3-dimensional computed rotational angiography. DSA has long been suspected of underestimating the disease burden, and contrast-enhanced magnetic resonance angiography may actually correlate best with 3-dimensional computed rotational angiography. DSA remains the gold standard for target definition in radiosurgery of BAVMs.

References


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