Progressive Symptomatic Carotid Dissection Treated With Multiple Stents

Alessandra Biondi, MD; Jeffrey M. Katz, MD; Janardhan Vallabh, MD; Alan Z. Segal, MD; Y. Pierre Gobin, MD

Background and Purpose—Internal carotid artery (ICA) dissection remains a major cause of stroke in the young. Although systemic anticoagulation and antiplatelet therapy allow healing of the dissection in most patients, medical treatment can fail or be contraindicated. In selected cases of carotid dissections, the use of endovascular stent-assisted angioplasty has been reported to permit reconstruction of the extracranial ICA.

Methods—We report a case of symptomatic spontaneous carotid dissection which progressively extended from the cervical to the supraclinoid segments of the ICA in a 48-year-old patient under anticoagulant therapy. Because of failed medical therapy and further transient ischemic attacks (TIAs), the patient was treated by 5 tandem stents deployed in an overlapping fashion from the terminal ICA to the cervical segment.

Results—Postprocedure angiography demonstrated reconstitution of the luminal diameter of the ICA. The patient progressively improved and no further TIAs were observed. At 8-month follow-up, the vessel remained patent with a slight intra-extracranial reduction in size suggesting myointimal hyperplasia. Neurological exam was normal.

Conclusions—The successful angiographic and clinical results observed in our case of intra-extracranial stenting of a long dissection contributes to the literature of carotid dissection treated with multiple stents. The excellent mid-term follow-up in our patient confirms the efficacy of this treatment and good tolerance to multiple stents. To our knowledge this is the first case of spontaneous dissection treated with stenting including the distal supraclinoid segment, through an extensive proximally dissected artery. (Stroke. 2005;36:e80-e82.)

Key Words: angioplasty ■ carotid artery, internal, dissection ■ carotid stenosis ■ ischemic attack, transient ■ stents

Internal carotid artery (ICA) dissection remains a major cause of stroke in the young.1,2 Although systemic anticoagulation and antiplatelet therapy allow healing of the dissection in most patients, medical treatment can fail or be contraindicated.3,4 In selected cases of carotid dissections, the use of endovascular stent-assisted angioplasty has been reported to permit reconstruction of the extracranial ICA.5–8 We report a case of symptomatic spontaneous carotid dissection that progressively extended from the cervical to the supraclinoid segments of the ICA in a patient under anticoagulant therapy. The patient was then treated by multiple stents deployed from the terminal ICA to the cervical segment. To our knowledge, this is the first case of spontaneous dissection treated with stenting including the distal supraclinoid segment, through an extensive proximally dissected artery.

Case Reports
A 48-year-old man with no history of trauma presented with left hemihypesthesia and mild hemiparesis. MRI revealed multiple small acute/subacute infarcts of the right hemisphere border zone regions. Magnetic resonance (MR) angiography disclosed minimal narrowing of the distal right cervical ICA suggestive of a dissection, and warfarin therapy was begun. Over the next 3 months, the patient experienced additional transient ischemic attacks (TIAs), predominantly occurring when the international normalized ratio was <2, and progressive weakness of his left hand. Subsequent MR with diffusion-weighted images demonstrated new lesions and worsening of the dissection with extension to the carotid siphon. Because of failed medical therapy, stent placement was planned for treatment of the dissection.

Three days before the procedure, the patient was started on 75 mg per day of clopidogrel and 325 mg per day of aspirin. Angiography with 3D reconstruction confirmed the diagnosis of dissection and showed that the ICA reached a maximum stenosis of 50% (Figure). Multiple distal occlusions of the middle cerebral artery branches suggesting embolic phenomena were also observed. The endovascular treatment was performed under neuroleptoanalgesia and full heparinization with an activated clotting time of >300 ms. During the procedure, a total of 10 mg abciximab and 2 mg verapamil...
were intra-arterially injected because, as frequently observed in this technique, we noticed some small emboli and carotid vasospasm. Over a Transend 14 micro-guide wire, 5 tandem stents were deployed in an overlapping fashion from the terminal ICA, just above the origin of the posterior communicating artery, to the cervical segment. The first stent was a self-expanding Neuroform2 Treo stent 4.5/20 mm (Boston Scientific), positioned from the supraclinoid segment to the cavernous segment. Then 4 balloon-expandable stents were deployed from the cavernous segment to the cervical ICA, including 2 Driver stents (4×9 mm and 4×12 mm; Medtronic) and 2 Palmaz Genesis stents (5×12 mm and 5×18 mm; Johnson & Johnson). Postprocedure angiography demonstrated reconstitution of the luminal diameter of the ICA. The patient progressively improved and no further TIAs were observed. At 8-month follow-up, the vessel remained patent with a slight intraextracranial reduction in size, suggesting myointimal hyperplasia (Figure). Neurological examination was normal.

**Discussion**

Symptomatic dissections of the cervical ICA can be spontaneous or traumatic, including iatrogenic. Although spontaneous dissections of the ICA are often associated with a good prognosis,3 these lesions remain a major cause of stroke in the young.1,2 A subintimal dissection causes narrowing or occlusion of the vessel; if the hemorrhage also extends into the subadventitial plane, a so-called dissecting aneurysm can be formed. Thrombus in and around the dissected intima can embolize distally and be responsible for ischemic phenomena.1 In ICA dissections, as observed in our case, most strokes or TIAs are embolic in nature; however, in some patients, they can be also related to hemodynamic hypoperfusion.2 Despite the potential risk of worsening the stenosis because of progression of intramural hemorrhage into the dissected arterial wall, anticoagulation is commonly used to prevent thromboembolic strokes and can allow restoration of vessel anatomy.4 However, some dissections can progress, and failure of anticoagulation, more often in traumatic dissec-
tions, can occur. Persistent pseudoaneurysms can also constitute a continual risk of embolization and bleeding.

Endovascular stent-assisted angioplasty has been reported in selected cases of spontaneous, traumatic, or iatrogenic carotid dissection. The criteria for stent therapy include: (1) clinical failure of medical therapy (presence of recurrent TIAs, fluctuating neurological signs, or neurological deterioration), (2) impending stroke attributable to significant stenosis/occlusion with poor collateral circulation and reduced parenchymal perfusion on the angiographic capillary phase or computed tomography and MR studies, (3) contraindication to anticoagulation because of intracranial or systemic hemorrhage, (4) evidence of symptomatic thromboembolic occlusion of cerebral vessels, (5) contralateral carotid stenosis/occlusion, (6) need for elective occlusion of the contralateral ICA for other pathology, and (7) need to avoid flow increase through the anterior communicating artery because of an associated aneurysm. In our case, the supraclinoid extension of the dissection represented an aggravating factor because of the risk of fatal subarachnoid hemorrhage and maintaining this patient on warfarin carried an additional risk.

The deployment of a stent provides the necessary centrifugal force to permit apposition of the dissected segment to the vessel wall, obliterate the false lumen, and treat the stenosis. Even in case of occlusion, initial recanalization of the dissected artery can be achieved using a microcatheter and a micro-guide wire positioned in the intracranial circulation followed by deployment of the stent. In addition, the stent can be used as a scaffold through which coils can be positioned in a dissecting aneurysm. In case of an extensive dissection, a long stent that can span the entire dissection and be navigated through the carotid segments is not available at the present time. The use of multiple tandem stents deployed in an overlapping fashion to reconstruct the extracranial ICA has been reported in a few small series, including a case in which the stent was deployed in the petrocavernous segment. In our case, the first of 5 stents was deployed in the terminal ICA. Although stents can be deployed in intracranial locations, positioning of a stent distally in the ICA can be challenging because of sharp curves in the carotid siphon, especially in the presence of a limiting anatomy or pathology of the cervical carotid segment. We used a self-expanding stent that is flexible enough to permit distal navigation beyond the curves of the carotid siphon. Despite its moderate radial force, this stent enabled a satisfactory result by tacking down the dissection flap. In the remaining segments of the ICA, we used 4 balloon-deliverable stents, which have a higher radial force. To our knowledge, distal intracranial stent deployment associated with a dissected proximal segment has not been reported.

Periprocedural risks of stenting a carotid artery dissection include embolization of thrombotic fragments during deployment of the stent, worsening or extension of the dissection in the weakened vessel wall, and vessel rupture, especially in the intracranial segment. Postprocedural risks include symptomatic stent stenosis or occlusion. A rigorous pharmacological preprocedural, periprocedural, and postprocedural regimen can avoid some of these complications. In addition, intraarterial injection of platelet antagonists and vasodilators can overcome thrombotic and vasospastic procedure-induced phenomena. One case of stenting for cervical carotid dissection followed by intra-arterial thrombolysis for a thrombus in the carotid siphon has been reported. No procedure-related mortality or significant morbidity has been reported in the stent-assisted angioplasty of extracranial carotid dissections.

The successful angiographic and clinical results observed in our case of intraextracranial stenting of a long dissection contributes to the literature of carotid dissection treated with multiple stents. Although long-term angiographic outcome after stent placement for spontaneous carotid dissections is not reported, the excellent mid-term follow-up in our patient presenting with a progressive dissection confirms the efficacy of this treatment and good tolerance to multiple stents.

References
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