

Angioplasty and Stenting of Basilar Artery

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Symptomatic basilar artery stenosis has a poor prognosis. Surgical bypasses are technically demanding and of no proven benefit. A new generation of intravascular stents that are flexible enough to navigate the tortuosities of the vertebral artery may provide a new therapeutic approach. We report two cases of vertebrobasilar ischemia with repeat vertigo and falls. Magnetic resonance angiography revealed severe middle basilar artery stenosis in case 1. A Transcranial Doppler (TCD) showed severe vertebrobasilar artery stenosis in the second case. The patients underwent uncomplicated angioplasty and stenting of the basilar arteries. The patients were well and free of symptoms after 12 months and 8 months follow up, respectively. The new flexible intravascular stents may provide a novel therapeutic approach for patients with basilar artery stenosis.

Keywords: Basilar artery; Vertebral artery; Angioplasty; Stenting.

Introduction

The outcome of symptomatic basilar artery stenosis is poor, with most patients experiencing significant morbidity or death from recurrent ischemic events, despite optimal medical therapy.¹–⁴ Surgical therapy is technically demanding, associated with considerable morbidity and significant rates of complication and failure.³,⁵,⁶ Angioplasty of basilar artery stenosis has been proposed as a novel therapeutic approach.⁷–⁹ Although, there have been some encouraging results, intraplaque dissection, plaque dislodgment, and vessel recoil with restenosis may occur.¹⁰–¹² Other authors showed that the restenosis rate after intracranial angioplasty is high.¹³ Percutaneous angioplasty of the intracranial arteries still carries the risk of dissection, with acute closure and embolization.¹⁴ The advantages of stent-assisted angioplasty over angioplasty alone include the exclusion of dislodged plaque and regions of dissection from the vessel lumen, as well as the prevention of vessel recoil and rupture.¹² We describe two patients with angioplasty and stenting for a symptomatic atherosclerotic stenosis of the basilar arteries.

Case Reports

Case 1

The 57 year-old man with history of hypertension and history of recurrent vertigo and repeat drop attack referred in October 2003 to our institution for angioplasty of a basilar artery stenosis. Brain magnetic resonance imaging scans showed no infarction within the territories of both posterior cerebral arteries. Magnetic resonance angiography showed severe middle basilar artery stenosis. The patient was given warfarin therapy. Our patient did not recover completely and he continued to experience daily episodes of vertigo and drop attacks. Cerebral angiography confirmed the presence of high-grade middle basilar artery stenosis (Fig. 1(A)).

Case 2

The 52 year-old man with history of repeat severe vertigo and falls referred in March 2004 for angioplasty of a basilar artery stenosis. Brain magnetic resonance imaging scans showed no infarction within the distal field territories of both posterior cerebral arteries. Transcranial Doppler showed severe stenosis in proximal of basilar artery. The patient was given warfarin therapy. Our patient did not recover completely by medical therapy. Cerebral angiography

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confirmed a large plaque with severe stenosis in distal of left vertebral artery and proximal of the basilar artery (Fig. 2(A)).

**Operative technique**

After the insertion of a 7-French femoral sheath, 5000 U of heparin was injected IV followed by a continuous infusion of 3000 U/h to obtain an activated clotting time at 200 s. Two hundred and fifty milligrams of acetylsalicylic acid and 400 mg Clopidogrel were also given. A 7-French right coronary guide catheter was placed over an exchange wire in the proximal vertebral arteries. A 0.014-in. guidewire was then navigated across the basilar arteries stenosis, and the guidewire tip was secured into the left posterior cerebral artery. The pressures immediately proximal to the stenotic lesion were measured (120 mmHg in case 1 and 140 mmHg in case 2). The microguidewire and microcatheter were then advanced through the stenosis. Pressure measurements distal to the stenotic lesions revealed a significant gradient across the stenosis. Angioplasty predilation was performed with a $2.0 \times 15 \text{ mm}^2$ balloon in case 1 and $2.5 \times 20 \text{ mm}^2$ balloon in case 2. A balloon-expandable coronary stent with a diameter of 3.0 mm and a length of 18 mm (Medtronic AVE, S7; coronary stent, for case 1 and AVE, driver; coronary stent, for case 2) was deployed with no residual stenosis. (Figs. 1(B) and 2(B)). The second patient experienced a syncopal episode during balloon inflation. The episode resolved immediately after balloon deflation. A control angiogram showed the stents mesh covering the entire atherosclerotic basilar segments and excellent basilar arteries patency, with no residual stenosis (Figs. 1(C) and 2(C)). The proximal margin of the stent extended 1 mm into the left vertebral artery in case 2. However, patency of the right vertebral artery outflow was not impaired. No complications occurred during or after the stents deployment. Continuous intravenous heparin infusion was administered for 12 h after the procedure, to maintain a partial thromboplastin time 1.5–2.0 times the normal value. The same day, 250 mg of aspirin and 400 mg of Clopidogrel were administered and continued for 6 months. During follow-up (12 months in case 1 and 8 months in case 2), the patients were well and free of symptoms.

**Discussion**

Symptomatic vertebrobasilar artery stenosis portends a poor prognosis with medical therapy. Patients with
intracranial vertebrobasilar artery (VBA) atherosclerotic occlusive disease have few therapeutic options. Unfortunately, VBA transient ischemic attacks (TIAs) herald a lethal or devastating event within 5 years in 25–30% of patients. Anticoagulation and antiplatelet therapy has been proposed to prevent acute basilar artery thrombosis and its catastrophic consequences. A recent randomized study suggested that the administration of prescription drugs is inadequate. Further atheromatosis progression was not stalled by long-term therapy, and stroke rates reported for patients with basilar artery stenoses on anticoagulant therapy were as high as 10% per year. This observation lead to the suggestion that aggressive therapy such as angioplasty should be considered for high-grade stenoses.

Until recently, intracranial stenting was limited by the rigidity of available devices, making navigation through the tortuous proximal intracranial circulation difficult. The availability of intravascular stents that can be navigated through tortuous intracranial vessels has initiated a new era in endovascular therapy. Endovascular treatment of basilar artery stenosis has been advocated for recurrent symptoms that are refractory to medical treatment. It may be offered routinely as an alternative therapy to patients with medically refractory posterior circulation disease that may develop catastrophic VBA insufficiency. Vessel tortuosity and compromise of the brainstem perforators originating from the basilar artery are less common problems with proximal stenoses. A slow and undersized dilation of the stenosis are necessary to protect vessels that do not have supporting tissue, in order to prevent a sudden rupture, intimal dissection, acute vasospasm, or thrombosis. However, the likelihood of such potentially dramatic complications may be minimized by stent implantation, which also allows a more aggressive anatomic correction.

Stents have been used in the treatment of intracranial carotid stenosis, with encouraging results. Two reports have suggested that stent-assisted angioplasty may represent a viable therapeutic option for vertebral artery and basilar artery atheromatous stenoses. Our cases suggest that stent-assisted angioplasty may represent a viable therapeutic option for patients with basilar artery stenosis. However, antithrombotic medication in cerebral angioplasty has not been standarized and antiplatelet regimens administered during and after intracranial stenting remain empirical. The use of acetylsalicylic acid and Clopidogrel and stent implantation may also confer complementary long-term clinical benefits for patients undergoing intracranial angioplasty, similar to benefits for patients undergoing coronary stenting. New treatments modalities,
such as the use of direct thrombin inhibitors and antibodies to platelet glycoprotein IIb/IIIa, seem to be more effective for prophylaxis and treatment than conventional anticoagulation and antiplatelet therapies. There is concern that occlusion of the ostia of small side branches and perforating arteries by stent placement may result in ischemia or infarction in the territory of these vessels. However, experimental evidence suggests that small lateral carotid branches in dogs, which approximate human intracranial perforating vessels with respect to their diameter and angle of origin, tend to remain patent if less than 50% of the ostial diameter is covered by the stent struts. Similarly, no difficulties involving perforating branch occlusions were encountered after stenting in our cases. Our procedures were balloon angioplasty to predilate the lesions. Subsequently the delivered the balloon-expandable stent was deployed. Long-term follow-up data and additional clinical experience are required to effectively assess this novel approach for the treatment of vertebrobasilar occlusive disease.

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References


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