Endovascular Treatment of Multiple Severe Atherosclerotic Stenoses with Cerebral Hypoperfusion

Case Report

N. UCHIYAMA, Y. OKADA, S. HIGASHI

Department of Neurosurgery, Keiju Medical Center, Nanao-city, Ishikawa; Japan

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Summary

A 60-year-old man presented with syncope and transient left-sided motor weakness. Cerebral angiography revealed multiple severe atherosclerotic stenoses of bilateral internal carotid arteries, bilateral intracranial vertebral artery (VA), and left VA origin. A SPECT study showed poor cerebral perfusion and vascular reserve in the right cerebral hemisphere and the posterior circulation. We performed angioplasty and stentings for the VA stenoses first by using balloon-expandable stents.

The patient had shown no syncope attack ever since, which might be due to an increased vascular reserve in the posterior circulation. The following bilateral carotid angioplasty and stentings could be performed safely. Angioplasty and stenting is feasible, and can improve cerebral perfusion even in a patient with multiple severe atherosclerotic stenoses by pre-operative appropriate haemodynamic assessment.

Introduction

Although angioplasty and stenting is becoming an increasingly common treatment for high-grade symptomatic stenoses involving the extracranial and intracranial arteries¹⁻⁴, it is relatively difficult to treat a patient with multiple severe stenoses associated with cerebral hy-

poperfusion by endovascular intervention^{5,6}. We report a case of successful endovascular restoration of multiple severe atherosclerotic stenoses with cerebral hypoperfusion.

Case Report

History and Examination

A 60-year-old man with a history of hypertension, diabetes mellitus, hypercholesterolemia, and smoking presented with syncope and transient left-sided motor weakness. On arrival at our hospital, he was alert and displayed no neurological deficits. Although magnetic resonance images showed no abnormal signal intensities, hypoperfusion was detected in right middle cerebral artery (MCA) territory on ¹²³I-IMP single-photon emission computerized tomography (SPECT) scans, and an acetazolamide challenge test revealed impaired perfusion reserve in the right MCA territory as well as the posterior circulation (data not shown). Cerebral angiography revealed multiple severe atherosclerotic stenoses of right cervical internal carotid artery (ICA) (95%, figure 2C), left cervical ICA (90%, figure 2A), right intracranial vertebral artery (VA) (90%), left intracranial VA (90%, figure 1C), and left VA origin (90%, figure 1A). The patient repeated transient ischemic attacks (TIAs) of syncope and/or left hemiparesis despite the administra-

Figure 1 Left subclavian artery and left vertebral artery (VA) angiograms before and after angioplasty and stentings. A) A short-segment stenosis of left VA origin. B) After a Palmaz stent deployment, the degree of stenosis decreases from 90% to 10%. C, A) stenosis of left intracranial VA (arrow). D) After an S660 stent deployment, the degree of stenosis decreases from 90% to 0%.

tion of an antiplatelet drug. We diagnosed the patient's TIA as haemodynamic ischemia given the hypoperfusion of the right cerebral hemisphere and the posterior circulation.

First Operation

We decided to perform angioplasty and stenting for left VA stenoses first to improve perfusion of the posterior circulation. Left VA origin stenosis was pre-dilated by a 3.5 x 20 mm balloon catheter (Savvy; Cordis Endovascular,

Miami, FL) and a 4 x 10 mm balloon-expandable stent (Palmaz; Cordis Endovascular) was placed (figure 1B). Another 2.5 x 9 mm balloon catheter (Gateway; Boston Scientific, Fremont, CA) was guided through the Palmaz stent and inflated at the stenotic lesion of intracranial VA. Since the angiography after the intracranial PTA showed abrupt occlusion at dilation site, a 2.5 x 9 mm stent device (S660, Medtronic, Minneapolis, MN) was immediately advanced to the lesion and placed.

Figure 2 A,B) Left common carotid angiograms showing severe stenosis of the proximal internal carotid artery (ICA) (A), and restoration of the ICA flow recovered by carotid angioplasty and stenting (CAS) (B). C,D) Right common carotid angiograms showing severe stenosis of the proximal ICA (C), and excellent restoration of the ICA flow recovered by CAS (D).

In addition, an injection of 120,000IU urokinase was required for recanalization of the VA. Postdeployment angiography demonstrated excellent restoration of the VA, basilar artery, and bilateral posterior cerebral arteries (PCA, figure 1D). At the end of the procedure, the patient was slightly drowsy, and showed mild left motor weakness. Computerized tomography scans of his head performed on the next day revealed cerebral infarction of the right PCA territory. The patient had applied himself to rehabilitation of mild left haemiparesis for a half of a year.

Second Operation

A SPECT study with an acetazolamide challenge test obtained four months after the first operation demonstrated an improvement of vascular reserve in the posterior circulation, but it also showed that the vascular reserve remained poor in the anterior circulation (figure 3A). One month later, the patient suddenly experienced transient aphasia and right hemiparesis lasting a few minutes. We performed an urgent angioplasty for severe stenosis of left

cervical ICA (figure 2A), using a 4 x 20 mm balloon catheter (Gateway; Boston Scientific). Although 50% stenosis of the left ICA remained, a flow of left ICA was restored and symptoms were completely disappeared next

Figure 3 Cerebral blood flow pattern on ^{123}I -IMP SPECT scans with acetazolamide challenge before and after carotid angioplasty and stentings (CASs). A) Vasodilatory capacity in bilateral thalamus and left occipital lobe (the posterior circulation) was high in comparison with in the anterior circulation after angioplasty and stentings for left vertebral artery (VA) stenoses. B) Remarkable improvement of vasodilatory capacity in the anterior circulation could be observed after bilateral CASs.

day. Ten days later, the patient underwent carotid angioplasty and stenting (CAS) for left residual ICA stenosis. The stenotic lesion was pre-dilated by a 3 x 20 mm balloon catheter (Savvy; Cordis Endovascular), covered by a 7 x 40 mm self-expandable stent (SMART; Cordis Endovascular), and post-dilated using a 4 x 20 mm balloon catheter (Slalom; Cordis Endovascular, figure 2B). All procedures were performed under the GuardWire Plus system (PercuSurge Inc., Sunnyvale, CA).

Third Operation

The patient underwent CAS for right ICA stenosis using same devices and techniques one month after the CAS for left ICA stenosis (figure 2C,D). Postoperative course was uneventful and a SPECT study demonstrated an improvement of vascular reserve in the entire brain except right occipital cerebral infarction area (figure 3B). The patient is currently living independently with his wife and has exhibited no new symptoms.

Discussion

Which stenotic lesion should we have treated first? This is an important point. At first, we

had planned CAS for right ICA stenosis, because the patient showed transient left motor weakness and the SPECT study demonstrated hypoperfusion and poor vascular reserve in the right cerebral hemisphere.

However, the patient had also repeated syncope with poor vascular reserve in the posterior circulation. Since we feared a brain stem infarction would be caused by poor collateral circulation during CAS for the right ICA stenosis, angioplasty and stenting for the left VA stenoses was performed first to improve cerebral perfusion and vascular reserve of the posterior circulation.

The patient had shown no syncope attack ever since and a SPECT study demonstrated improvement of vascular reserve in the posterior circulation after the restoration of the VA, and the following CASs for bilateral ICA stenoses could be performed safely without any other complications. We think starting the VA stenoses was probably the best choice.

Angioplasty and stenting is feasible, and can provide an improved cerebral perfusion even in a patient with multiple severe atherosclerotic stenoses. Pre-operative haemodynamic assessment is indispensable for the success of endovascular recanalization.

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Naoyuki Uchiyama, M.D.
Department of Neurosurgery
Keiju Medical Center
94 Tomioka-cho, Nanao-city
Ishikawa, 926-8605, Japan
E-mail: nuchiyama-nsu@umin.ac.jp