Clinical Case Report

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Protective effect of the microcatheter placed at the normal vertebral artery in intracranial stent-assisted angioplasty for vertebral artery stenosis

A case report

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Abstract

Rationale: A carefully designed intracranial stent-assisted angioplasty (SAA) is presented here that may prevent subsequent branch artery occlusion.

Patient concerns: A 72-year-old man with a 3-month history of progressive and intermittent vertigo without any obvious trigger, accompanied by nausea.

Diagnoses: Intracranial atherosclerotic disease.

Interventions: the patient underwent intracranial SAA in accordance with the procedure described here.

Outcomes: The patient's paroxysmal vertigo completely subsided, with no complications during the short-term follow-up.

Lessons: This novel intracranial SAA procedure is safe and may reduce the risk of subsequent artery occlusion.

Abbreviations: MRI = magnetic resonance imaging, PTAS = percutaneous transluminal angioplasty and stenting, SAA = stent-assisted angioplasty.

Keywords: angioplasty, branch artery, occlusion, stent, vertebral artery

1. Introduction

Intracranial stenosis is an important cause of ischemic stroke. Studies show that 5% to 10% of all strokes, and transient ischemic attacks, are secondary to intracranial atherosclerotic disease.[1,2] Twenty percent of all ischemic strokes occur in the posterior circulation.[3] The vertebral arteries are the major blood supply of the posterior circulation, and intracranial stenosis can lead to multiple symptoms of posterior circulation ischemia.[4]

Drug therapy is the primary treatment for intracranial atherosclerotic disease,[5] yet the latest aggressive drug therapy has failed to reduce the recurrence rate of stroke in selected patients, and is reportedly 12.2% and 20% at 1 and 2 years, respectively.[6]

When drug therapy fails, stent-assisted angioplasty (SAA) may be an alternative, while intracranial percutaneous transluminal angioplasty and stenting (PTAS) has gradually become more widely used. However, PTAS carries an increased risk of stroke from perioperative branch/perforator vascular occlusion or restenosis. These are disappointing results.

Herein, we describe some procedures for SAA that may ensure the safety of angioplasty, with low risk of postoperative cerebrovascular events.

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2. Case presentation

The study was approved by the ethical committee of first Affiliated Hospital of Dalian Medical University, China. Written consent was obtained.

A 72-year-old man was admitted October 8, 2015 with a 3-month history of progressive and intermittent vertigo without any obvious trigger, accompanied by nausea. These symptoms lasted about 40 min each time with no discomfort during the interim, and there was no residual neurological deficit. The patient had been treated in the Department of Otolaryngology, and the relevant examination ruled out peripheral vertigo, including benign paroxysmal positional vertigo, vestibular neuronitis, Meniere disease, and labyrinthitis.

In this patient, lacunar infarction was observed in the right basal ganglia and pons on cerebral magnetic resonance imaging (MRI). Digital subtraction angiography (DSA) revealed that the right vertebral artery was dominant in blood supply, and significant stenosis of 84% in the left intracranial vertebral artery (ICVA) near the initial part of the posterior inferior cerebellar artery (PICA; Fig. 1) was found (with reference to the North American Symptomatic Carotid Endarterectomy Trial [NASCET] criteria). High-resolution MRI showed plaque at the site of stenosis as high-intensity signals on T1-weighted image enhancement (Fig. 2).

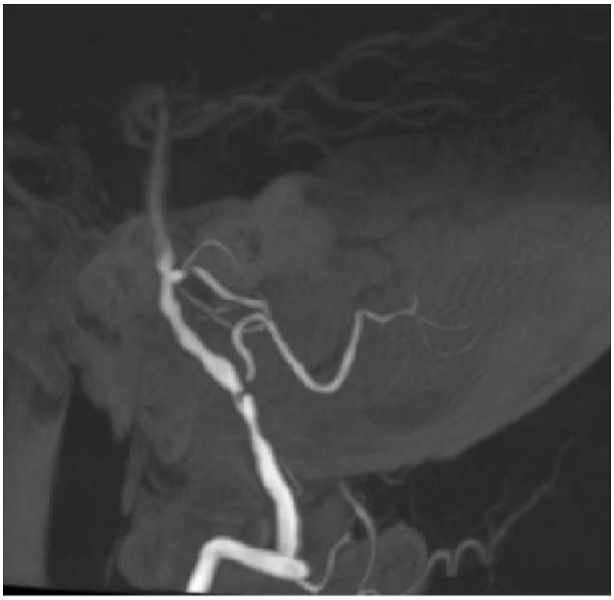

Figure 1. Severe stenosis in the intracranial left vertebral artery near the initial part of the posterior inferior cerebellar artery (digital subtraction angiography; July 9, 2015).

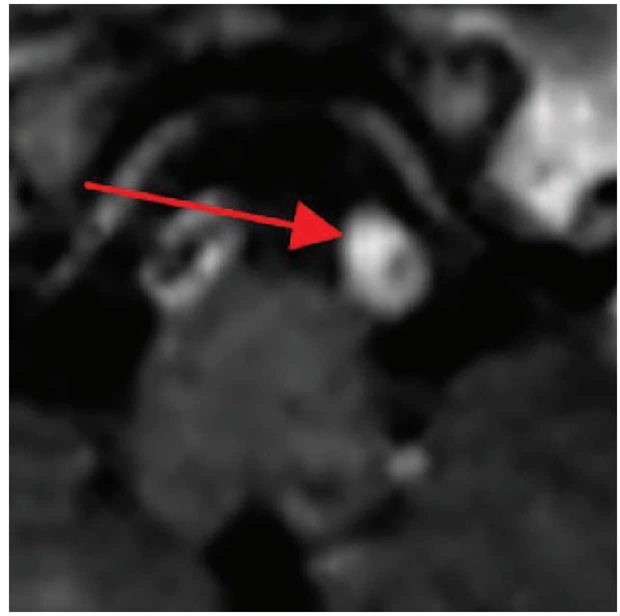

Figure 2. An unstable plaque at the stenosis site (magnetic resonance imaging; July 11, 2015).

The patient received standard drug treatment, including dual-antiplatelet therapy with daily doses of 100 mg of aspirin, 75 mg of clopidogrel, and atorvastatin 40 mg once per night. After 3 months, the vertigo had remained. One week prior to the second admission, his symptoms worsened, and endovascular recanalization of the left ICVA under general anesthesia was planned.

The surgery was done via a bilateral femoral artery puncture approach. First, 2 6F guide catheters were placed in the V2 segments of the bilateral vertebral arteries; a Synchro-14 300-cm microguidewire (Boston Scientific Massachusetts) guided the Echelon-10 microcatheter (EV3 Missouri) through the right vertebral artery into the left PICA, passing by the basilar artery reversely. The microcatheter and microguidewire were placed as protection.

Another Synchro-14 300-cm microguidewire was positioned into the narrow segment, passing by the left vertebral artery. The distal part of the microguidewire was placed in a P2 segment of the left posterior cerebral artery, and a Gateway 1.5 × 15 mm and a 2.0 × 15 mm balloon (Boston Scientific Massachusetts) was moved to the narrow segment of the left ICVA and pre-expanded progressively (Fig. 3A and B). An Enterprise 4.5 × 28 mm self-expanding stent (Cordis Minneesota) was then deployed in the narrow segment (Fig. 3C).

The angiogram indicated complete coverage of the stenotic segment. The stent patency was satisfied, the stenosis rate decreased to 28% (with reference to NASCET criteria), the blood perfusion in the distal segment of the stenosis improved, and the left PICA was well protected (Fig. 4).

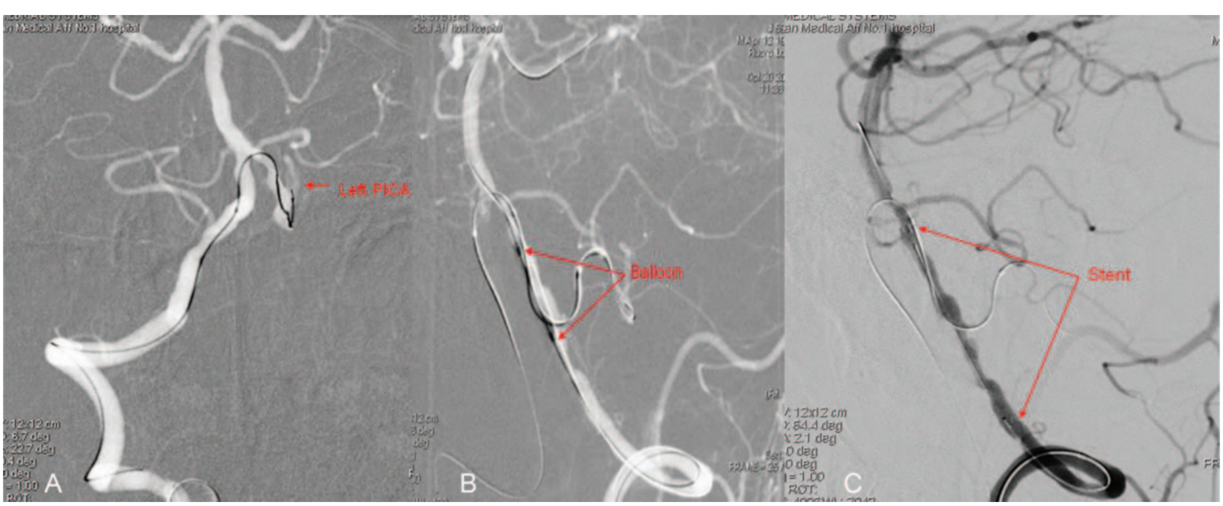

Figure 3. Microcatheter and multistaged balloon inflation (October 20, 2015). The microguidewire guided the microcatheter, as discussed in the text. (A) Micro guidewire guided the microcatheter through the right vertebral artery into the left posterior inferior cerebellar artery passing by the basilar artery reversely. (B) A balloon was sent into the narrow segment of the left intracranial vertebral artery and progressively pre-expanded. (C) The self-expanding stent at the targeted lesion site.

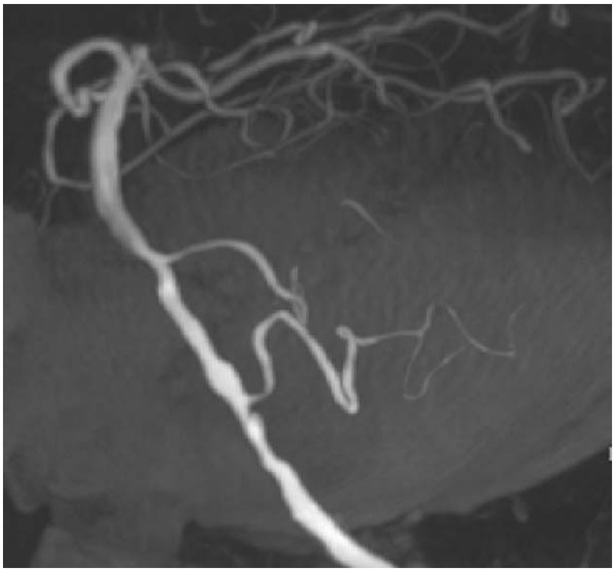

Figure 4. The well-positioned stent without gaps, satisfactory stent patency, and well-protected left posterior inferior cerebellar artery. Angiogram (October 20, 2015).

After the operation, the patient received anticoagulation therapy (low-molecular weight heparin 4250 IU, subcutaneous injection, every 12 h, for 2 days), antiplatelet aggregation (aspirin, 100 mg/d, plus clopidogrel, 75 mg/d; after 6 months, long-term 100 mg/d aspirin), and lipid-regulating therapy (atorvastatin 40 mg once per night; after 6 months, long-term atorvastatin 20 mg once per night, and regular monitoring of liver function). During the 6-month follow-up, the patient recovered well, without recurrence of vertigo or new symptoms. The computed tomographic angiography showed a patent stent site without significant restenosis, with normal blood flow in the left PICA (Fig. 5).

3. Conclusion

Posterior circulation ischemia is a common ischemic cerebrovascular disease.

In 2014, the final results of SAMMPRIS (stenting in high-risk patients with intracranial artery stenosis) showed that, although aggressive medical management has substantially lowered the risk of stroke in these patients compared with traditional medical management, there are still subgroups of patients at high risk of stroke.[5]

This patient had transient vertigo without other neurologic deficits, which was considered central isolated vertigo. Most such diseases are caused by the medial branch of the posterior inferior cerebellar artery.[6] The intracranial segment of the left vertebral artery near the initial part of the PICA had significant stenosis of 84%, so this is considered the responsible lesion.

According to the American Heart Association/American Stroke Association guidelines, patients with intracranial atherosclerotic stenosis of 70% to 99%[5] and recent stroke or transient ischemic attack can be treated with aspirin plus clopidogrel for 90 days. If the symptoms are unrelieved, simple balloon angioplasty or stent angioplasty may be indicated.

Branch artery occlusion is a common complication in intracranial SAA, and may have fatal consequences. In this patient, the PICA originated from the stenotic segment of the left

Figure 5. The patent stent site without significant restenosis, and normal blood flow in the left posterior inferior cerebellar artery. CTA, 6 months postsurgery. CTA = computed tomographic angiography.

ICVA. Based on the MRI, the plaque in the narrow section appeared unstable[7] (Fig. 2), and could have easily dislodged, resulting in a PICA occlusion, leading to Wallenberg syndrome.

Small balloon predilation was progressively applied, and the risk of branch artery occlusion caused by shedding plaques was lessened with self-expanding stents. For further protection, the microcatheter was placed into the PICA. It can occupy the endovascular space and reduce the chance of branch artery occlusion caused by the shedding plaque and thrombus. However, if acute occlusion occurs perioperatively, the balloon can be inserted into the artery and the angioplasty performed immediately. With the microcatheter, local thrombolysis can be accomplished to obtain vascular reperfusion.

Considering that high radial forces from the stent may result in intimal hyperplasia and increase the rate of restenosis as a prolonged stimulation,[1] in this case we chose the Enterprise closed-cell stent, which has smaller radial force compared with the open-cell Wingspan stent. Another study also confirmed that the Enterprise stent was safe and effective for patients with intracranial artery stenosis, and the incidence of stent-related ischemic stroke was 2.2% during the mean follow-up of 10.2 months.[8]

However, considering that this study involved only 1 patient and did not include a long-term follow-up, we will confirm our observations in subsequent clinical trials. The risk of branch artery occlusion should be quantified, and innovative surgical methods should be explored.

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