Successful Recanalization of a Chronic In-stent Occlusion at the Vertebral Artery Ostium

A Case Report

G. XU*, X. LIU*, L. ZHENG, X. FAN, Q. YIN

Departments of Neurology (GX, XL, XF, QY) and Radiology (LZ), Jinling Hospital, Nanjing University School of Medicine, Nanjing, Jiangsu Province, China

*These two authors contributed equally to this work

Key words: occlusion, recanalization, stent, stroke, vertebral artery

Summary

In-stent restenosis or occlusion has been frequently reported as a complication after angioplasty and stenting in vertebral arteries. Reopening chronic in-stent occlusion in cervical arteries with endovascular techniques has not been reported. Here we describe a case with stent implantation in the origin of right vertebral artery. The stent was occluded one year after the procedure. The patient demonstrated concurrent ischemic symptoms which were relieved after the in-stent occlusion being recanalized successfully with re-angioplasty.

Introduction

Atherosclerotic stenosis in the vertebral artery is an important cause of ischemic stroke. Angioplasty and stenting have been increasingly recommended as an alternative for stroke prevention in patients with symptomatic vertebral artery stenosis refractory to medical treatment¹. But in recent years, frequently reported in-stent restenosis and occlusion have decreased the enthusiasm for this procedure, because an effective treatment for chronic in-stent occlusion has not been established².

Here we describe a patient with in-stent occlusion one year after stent implantation in the vertebral ostium. The patient demonstrated concurrent ischemic symptoms which were relieved af-

ter the in-stent occlusion being reopened successfully with endovascular angioplasty. To our knowledge, this is the first report of recanalization of chronic in-stent occlusion in a cervical artery.

Case Report

The patient was a 62-year-old right-handed man with a ten year history of hypertension. He initially experienced paroxysmal vertigo, dizziness, nausea and amaurosis fugax. Brain magnetic resonance imaging (MRI) scan one month after the initial syndromes revealed multiple infarctions in left occipital lobe and pons. Digital subtraction angiography (DSA) detected occlusion at the bifurcation of the left internal carotid artery, and moderate stenosis (60%) at the ostium of the right vertebral artery (Figure 1A).

The patient was first treated with medications which included anti-platelets, statins, dalteparin sodium, tanshinone and anti-hypertension drugs. Due to poor compliance with the integrated treatments, his ischemic symptoms continuously deteriorated in six months. Because the patient experienced repeated syndromes associated with posterior circulation ischemia, and multiple infarctions in the left occipital lobe and pons were observed, stent implantation for right vertebral artery stenosis was recommended.

The procedure was performed under local anesthesia and full heparinization with activated clotting time around 300 s. After a 6 F vascular sheath being placed in the right femoral artery, a 6 F guiding catheter was progressed to the right subclavian artery. A 0.014 inch guidewire (Cordis; Miami, FL, USA) was gently navigated through the stenosis in the ostium of vertebral artery under the guidance of roadmap fluoroscopy. A balloon-mounted Invastent (3.5x11 mm, maximum diameter, Invatec, Roncadelle, Italy) was advanced over the guidewire. After being located in the stenosis, the stent was deployed. The final angiography displayed elimination of focal stenosis (Figure 1B).

Dual antiplatelets, aspirin and clopidogrel were prescribed. The ischemic syndromes were significantly relieved after the procedure. A follow-up computed tomography angiography (CTA) performed six months after the procedure detected moderate in-stent restenosis (Figure 1C), but the distal part of right vertebral artery had good filling of blood flow. Based on the neuroimaging results, dual antiplatelets were prescribed continuously, but the patient took the medicines irregularly due to his daily work as a businessman. The patient maintained good condition until about one year after the procedure, when he once again experienced vertigo, dizziness, nausea and mild weakness in left extremities. The syndromes relapsed spontaneously and recurred several times with progressive aggravation and prolonged duration. A subsequent brain CT scan failed to show any novel infarction, but a CTA detected in-stent occlusion in the right vertebral artery (Figure 1D). Considering the progression and recurrence of the ischemic syndromes, endovascular recanalization of the occluded stent was recommended.

After a 6 F guiding catheter was progressed to right subclavian artery and angiography confirmed in-stent occlusion (Figure 1E). Selective angiography of the left vertebral artery confirmed the patency of the distal right vertebral artery. Miracle 6g, Miracle 12g and Conquest guidewires (Asahi Intec, Nagoya, Japan) were tried respectively, and finally a PT2 guidewire (Boston Scientific, Miami, FL, USA) crossed the occlusion. Subsequent angiography confirmed that the guidewire was inside the stent and the head end was located in the true lumen of the vertebral artery (Figure 1F). A Maverick 2.0x15mm balloon (Boston Scientific, Miami,

FL, USA) was located in the stent, and was slowly dilated over a span of ten seconds to a maximum pressure of 14 atm. The post-angioplasty fluoroscopy displayed partial opening of the stent (Figure 1H). The stent was further dilated with a larger Maverick 4.0x20 mm balloon under a maximum pressure of 16 atm. The final angiography displayed complete patency of the stent (Figure 1G).

Neurological examination performed shortly after the procedure identified no symptoms *de novo*. The patient improved progressively and no further ischemic events were observed during the three-month follow-up.

Discussion

Endovascular treatment of chronically occluded cervical arteries remains a technical challenge for neuro-interventionalists³. Recanalization of chronic in-stent occlusion is an even tougher task, because the struts of the implanted stent may prevent the guidewire or delivery system from passing the occlusion and lead to subintimal tracking^{4,5}. Recanalization may also be influenced by other factors such as the interval between occlusion and procedure, type and size of the implanted stent, nature of the original pathology and residual stenosis after the initial procedure. In this patient, there was no residual stenosis after the initial stenting. CTA performed six months later proved the patency of the implanted stent. But another CTA detected in-stent occlusion shortly before the second procedure (12 months after the initial procedure), and the patient presented concurrent ischemic symptoms. These sequential observations indicated that the stent was occluded recently and the likelihood of recanalization was considerable.

Most chronically developed in-stent occlusions are asymptomatic or with only minor ischemic symptoms, because the interval before stent occlusion may provide a chance and inducement for collateral formation. However, if the occlusion developed over a relatively short time, in the absence of regular anti-platelet treatment, or in the presence of severe stenosis or occlusion in other cervical arteries, the related neurological defects may be conspicuous and outcomes malignant⁶. In this patient, occlusion of the left internal carotid was detected before the initial stenting. The patient took antiplatelets irregularly, and presented with relat-

Figure 1 A-H) Recanalization of the chronic in-stent occlusion at the ostium of right vertebral artery. A) Posterior-anterior fluoroscopy detected a 70% stenosis at ostium of right vertebral artery. B) The stenosis was eliminated after stenting. C) A CTA performed six months after the procedure detected moderate in-stent restenosis (arrow). D) Another CTA performed 12 months after the procedure detected in-stent occlusion (arrow). E) A subsequent DSA confirmed in-stent occlusion. F) Different guidewires were attempted for passing through the occluded stent, and a PT2 guidewire crossed the occlusion. G) The occluded stent was dilated with a 2.0x15mm balloon, and the post-dilatation angiography displayed partial open of the stent. H) The stent was further dilated with a larger 4.0x20 balloon, and the final angiography confirmed complete patency of the stent.

ed ischemic symptoms. These profiles rationalized recanalization of the occluded stent.

For this patient, there was multiple evidence to indicate the causal relationship between the recurrent clinical symptoms and occlusion of the stent. Firstly, there was a time cue for this relationship. The ischemic symptoms were re-

lieved significantly after the initial stent implantation. Six months after the stent implantation, a CTA indicated the patency of the stent, and at that time there were no evident clinical symptoms. One year after the initial stent implantation, similar clinical symptoms recurred, and a consecutive CTA confirmed the occlu-

sion of the stent. Secondly, the clinical symptoms were principally caused by ischemia in the posterior circulation which was supplied by bilateral vertebral arteries. The targeted right vertebral artery was the predominant side and the left vertebral artery was relatively tiny and mild stenosis existed at its ostium (Figure 1C). The posterior communicating arteries were not opened (figures not shown). These neuroimaging results indicated that sufficient blood flow in the posterior circulation via left vertebral and posterior communicating arteries was less possible, and the occlusion of right vertebral artery (in stent) was the cause of the recurrent ischemic symptoms.

Treating in-stent occlusion with endovascular techniques was firstly attempted in coronary arteries. A Frontrunner controlled blunt micro-dissection catheter was reported with facilitated passage of the guidewire^{5,7}. The occluded stent was occasionally crashed by over-

dilation with a larger balloon, and a new stent was implanted to warrant the long-term latency of the artery^{4,5}. In this patient, the guidewire passed the occlusion without strong resistance. The stent recovered its patency completely after two balloon dilatations. Another stent implantation was, therefore, not indicated.

Conclusions

In conclusion, endovascular recanalization of in-stent occlusion is technically feasible and clinically effective in carefully selected patients. However, the long-term effectiveness of the method warrants further study.

Acknowledgement

This study was supported by Natural Science Foundation of China (NSFC #30870847 to XL and NSFC #30870848 to GX).

References

- 1 Dabus G, Moran CJ et Al: Endovascular treatment of vertebral artery-origin and innominate/subclavian disease: indications and technique. *Neuroimaging Clin N Am* 17: 381-392, 2007.
- 2 Weber W, Mayer TE et Al: Efficacy of stent angioplasty for symptomatic stenoses of the proximal vertebral artery. *Eur J Radiol* 56: 240-247, 2005.
- 3 Thomas AJ, Gupta R et Al: Stenting and angioplasty of the symptomatic chronically occluded carotid artery. *Am J Neuroradiol* 28: 168-171, 2007.
- 4 Lee NH, Cho YH, Seo HS: Successful recanalization of in-stent coronary chronic total occlusion by subintimal tracking. *J Invasive Cardiol* 20: E129-E132, 2008.
- 5 Yang YM, Mehran R et Al: Successful use of the Frontrunner catheter in the treatment of in-stent coronary chronic total occlusions. *Catheter Cardiovasc Interv* 63: 462-468, 2004.
- 6 Sherigar R, Bobba RK, Arsura EL: Impact of the duration of antiplatelet therapy after vertebrobasilar artery stent placement. *Eur J Neurol* 13: 428-429, 2006.
- 7 Ho PC: Treatment of in-stent chronic total occlusions with blunt microdissection. *J Invasive Cardiol* 17: E37-E39, 2005.

Gelin Xu, M.D.
Department of Neurology
Jinling Hospital
305# East Zhongshan Road
Nanjing, 210002, Jiangsu, China
E-mail: gelinxu@gmail.com