Endovascular revascularisation of acute tandem vertebrobasilar artery occlusion: seven case series with literature reviews

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ABSTRACT

Background The outcome of acute ischaemic stroke due to tandem vertebrobasilar artery occlusion was poor. Endovascular revascularisation may be a positive approach for acute basilar artery occlusion combined with vertebral ostium stenosis or occlusion. We reported seven patients with acute vertebrobasilar tandem occlusion by using angioplasty or stenting for proximal lesion and thrombectomy for distal occlusion.

Materials and methods Consecutive patients with acute tandem vertebrobasilar artery occlusion at two centres were included in this study. We retrospectively analysed the clinical, technical and functional outcomes of the patients.

Results From March 2016 to March 2017, seven patients were included. The mean age and National Institute of Health Stroke Scale score at admission was 57 years and 22, respectively. A reverse approach was used in five patients. There were no procedural complications. The modified Rankin Scale score was 1–2 for three patients and 4 for one patient at 3 months. Three patients died at 3 months of follow-up.

Conclusions Endovascular revascularisation may be feasible for acute tandem vertebrobasilar artery occlusion, and more researches are needed.

INTRODUCTION

In patients with isolated acute basilar artery (BA) occlusion, the use of modern thrombectomy devices for recanalisation was a better approach to improve recanalisation rates and clinical outcomes. At the same time, the clinical outcome of acute occlusion of the ostial vertebral artery (VA) concomitant occlusion of BA was generally extreme poor. The benefit of the second thrombectomy device has been verified in patients with acute tandem lesions in anterior circulation in Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing Recanalization Times (ESCAPE) and Revascularization with Solitaire FR device VS. Best Medical Therapy in the Treatment of Acute Stroke due to Anterior Circulation Large Vessel Occlusion Presenting within Eight hours of Symptom onset (REVASCAT) trials. However, the efficacy of these devices for patients with tandem vertebrobasilar arterial occlusion remains uncertain.

In this paper, we reported seven patients with acute vertebrobasilar artery tandem lesions treated with endovascular revascularisation techniques to achieve successful recanalisation.

MATERIALS AND METHODS

Patients

This is a retrospective study from two stroke centres in Beijing, China. The time interval of this study ranged from March 2016 to March 2017. The clinical data of patients undergoing endovascular revascularisation of acute vertebrobasilar artery tandem occlusion were collected and analysed. The local ethics committee approved the study and informed consent of the patient was obtained.

Endovascular treatment procedure

The procedure of endovascular treatment was performed under general anaesthesia in all patients. A 6 Fr guiding catheter was placed at the proximal subclavian artery. The procedure was performed in all patients using the endovascular revascularisation approach through the occlusive or stenotic vertebral artery (dirty-road path). The microwire crossed the lesion of VA occlusion or stenosis. Predilation of the VA lesion was performed using a small balloon and then digital subtraction angiography (DSA) was performed to understand the diameter of the VA. Then reverse approach (mechanical thrombectomy of BA occlusion followed by proximal VA stenting angioplasty) or antegrade approach (proximal VA stenting angioplasty followed by mechanical thrombectomy of BA occlusion) was used to perform endovascular treatment. Before stent implantation, 300 mg aspirin and 300 mg clopidogrel were given via a nasal
antegrade technique

A balloon-expandable stent was sent to the ostial vertebral artery over the microguidewire and was implanted at the lesion exactly. The guiding catheter was then navigated to the distal V2 segment through the partially reinflated balloon across the implanted stent gently. Subsequently, the stent-assisted thrombectomy was performed as described above (figure 1B).

RESULTS

Seven patients were identified to have acute tandem vertebrobasilar artery occlusions (seven men, mean age 57 years, range 48–66). Mean National Institute of Health Stroke Scale (NIHSS) score at admission was 22 (range 12–28). One patient received tissue plasminogen activator prior to endovascular treatment.

The reverse approach was used in five patients, while antegrade approach was used in two patients. TICI score 2b-3 was acquired in all patients. There were no technical complications. The modified Rankin Scale (mRS) score was 1–2 for three patients and 4 for one patient at 3 months. Three patients died at 3 months of follow-up. The clinical data, treatment strategy and patient clinical outcomes are presented in table 1.

Case example 1

A 57-year-old patient with a history of coronary heart disease and diabetes mellitus was transferred to our emergency room due to quadriplegia. The NIHSS score was 12 and posterior circulation Acute Stroke Prognosis Early CT Score (ASPECTS) on diffusion-weighted imaging (DWI) was 8. DWI showed pontine infarction, and MRA revealed BA occlusion. The time from the onset to femoral artery puncture was 402 min.

Cerebral DSA showed the left dominant VA and BA tandem occlusion (figure 2A, D) and the right contralateral non-dominant VA ending in the posterior inferior cerebellar artery (figure 2C). So the left occlusive VA (dirty-road path) was the only access to perform mechanical thrombectomy for BA occlusion.

A 6 Fr Envoy guiding catheter (Cordis, Miami Lakes, Florida, USA) was placed at the proximal subclavian artery, and the Transcend microguidewire (Boston Scientific, Freemont, California, USA) crossed the lesion of the VA occlusion. Predilation of the VA ostial occlusion was performed using a 2 mm x 15 mm balloon (Boston Scientific), and then the balloon was exchanged with a 4 mm x 18 mm balloon-expandable Apollo stent (MicroPort, Shanghai, China). After the stent was placed, the balloon of the stent was partially reinflated and the 6 Fr guiding catheter was advanced into V2 segment through the stent over the partially reinflated balloon (figure 2B). A microcatheter (Stryker Neurovascular, Freemont, California, USA) was placed at the right posterior cerebral artery over the microguidewire, and then a Trevo stentriever (Stryker Neurovascular) was used to perform mechanical thrombectomy. Follow-up angiography
showed complete BA reperfusion (figure 2E) and the final status of the left ostium VA stent (figure 2F). The time from femoral puncture to reperfusion was 90 min. Follow-up CT scan revealed no cerebral haemorrhagic transformation. The mRS was 1 at 3 months.

Case example 2
A 58-year-old patient with a history of diabetes mellitus and hypertension was transferred to our hospital due to vertigo and consciousness disturbance. The time from onset to femoral artery puncture was 855 min, and the NIHSS score was 16. The posterior circulation ASPECTS on DWI was 7 and MRA showed distal BA occlusion.
Cerebral DSA showed left VA ostium occlusion (figure 3A), right vertebral artery ostium severe stenosis (figure 3B) and distal BA clot. A 6 Fr guiding catheter (Cordis) was placed at the right subclavian artery and a microguide-wire (Abbott, USA) crossed the stenosis segment to the V2 segment. Predilation was performed using a 3.0x20mm balloon (Boston Scientific) (figure 3C). The guiding catheter was sent to V2 segment through the stenosis segment over the partially reinflated balloon. Angiography showed that the distal BA occluded (figure 3D). A 4 mm x 20 mm Solitaire stentriever (Irvine, California, USA) was used to perform mechanical thrombectomy. Follow-up angiography showed successful recanalisation of the distal BA occlusion (figure 3E). A 4 mm x 15 mm balloon-expandable stent (Boston Scientific) was implanted at the right vertebral artery stenosis (figure 3F). The time from puncture to recanalisation was 77 min. Follow-up CT scan showed no cerebral haemorrhage. The mRS was 2 at 3 months.

DISCUSSION

In this case series, we reported the endovascular revascularisation for the acute tandem occlusion of vertebrobasilar artery through the occlusive or stenotic road path (dirty-road path).

Ecker et al. reported six patients with acute vertebral occlusion below a basilar thrombus were treated with endovascular reconstruction of VA occlusion prior to basilar thrombectomy, and one-third of the patients died due to progressive infarction.

Cohen et al. detailed seven patients who suffered from acute tandem vertebrobasilar occlusion and underwent emergent endovascular revascularisation, and two patients died. Though the device and approach for endovascular revascularisation were different, the clinical outcome was similar.

It was more complicated and difficult to perform endovascular revascularisation in the patients with acute tandem vertebrobasilar occlusion than that in the patients with an isolated acute BA occlusion. Generally, in tandem vertebrobasilar artery occlusion, the contralateral VA (clean-road path) was the priority access to perform mechanical thrombectomy of the BA occlusion.

Cohen et al. reported only two patients who underwent thrombectomy through the clean-road path.

In this case series, the contralateral VA of five patients was non-dominant artery and another two patients’ contralateral dominant VA was severe stenosis. So endovascular revascularisation was performed through the occlusive VA in five patients and the contralateral stenotic VA in another two patients.

There was usually no need for the predilation of the senotic VA prior to implanting the stent for reducing the risk of artery embolism. However, in the case of VA occlusion or extremely severe stenosis, we predilate the lesions with a small balloon, and then angiography was performed to understand the extent and width of the VA before the stent was implanted.

Cohen et al. described two techniques (antegrade technique and reverse technique) that were used to perform endovascular revascularisation when the access was dirty-road path. In Cohen et al’s report, five patients underwent endovascular recanalisation through occlusive VA; reverse technique was used for four patients and anterograde technique was used for one patient. They thought there were risks of delaying reperfusion, stent slipping towards the subclavian artery and increasing the difficulty to advance the guiding catheter through the stent.

However, for the reverse technique, the guiding catheter could not cross the occlusion of VA with severe residual stenosis after primary VA angioplasty or the blood flow was very slow when the guiding catheter advanced into the V2 segment. Finally, there was the risk of re-embolisation when the stent of the ostial VA was implanted. In this case series, antegrade technique was used for two patients without stent slipping and deformation; reverse technique was used for five patients without re-embolisation.

For antegrade strategy, how to deliver the guiding catheter to the V2 segment through the stent was a technological challenge. A partially reinflated balloon within the stent can help deliver the guiding catheter to the VA. In this procedure, the guiding catheter passed through the stent over a partially reinflated balloon when we used the antegrade technique. Because each of these methods has its advantages and disadvantages, it needs careful consideration to choose antegrade or reverse revascularisation technique.

The limitations of this study were the small number of patients, retrospective analysis and selection bias. In addition, this study was not a randomised controlled design. The long-term outcomes of these patients were uncertain.

CONCLUSIONS

In this case series, endovascular revascularisation of acute vertebrobasilar artery tandem occlusion through dirty-road path can be performed successfully without technical complications and may be feasible, while more studies are needed.

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REFERENCES

1. Mokin M, Sonig A, Sivakanthan S, et al. Clinical and procedural predictors of outcomes from the endovascular treatment of posterior circulation strokes. Stroke 2016;47:782-788.

2. Yoon W, Kim SK, Heo TW, et al. Predictors of good outcome after stent-retriever thrombectomy in acute basilar artery occlusion. Stroke 2015;46:2972-5.

3. Singer OC, Berkefeld J, Nolte CH, et al. Mechanical recanalization in basilar artery occlusion: the ENDOSTROKE study. Ann Neurol 2015;77:415-24.

4. Cohen JE, Leker RR, Gomori JM, et al. Emergent revascularization of acute tandem vertebrobasilar occlusions: endovascular approaches and technical considerations—confirming the role of vertebral artery ostium stenosis as a cause of vertebrobasilar stroke. J Clin Neurosci 2016;34:70-6.

5. Savitz SI, Caplan LR. Vertebrobasilar disease. N Engl J Med 2005;352:2618-26.

6. Ecker RD, Tsujiura CA, Baker CB, et al. Endovascular reconstruction of vertebral artery occlusion prior to basilar thrombectomy in a series of six patients presenting with acute symptomatic basilar thrombosis. J Neurointerv Surg 2014;6:379-83.

7. Goyal M, Demchuk AM, Menon BK, et al. Randomized assessment of rapid endovascular treatment of ischemic stroke. N Engl J Med 2015;372:1019-30.

8. Jovin TG, Chamorro A, Cobo E, et al. Thrombectomy within 8 hours after symptom onset in ischemic stroke. N Engl J Med 2015;372:2296-306.

9. Du B, Wong EH, Jiang WJ. Long-term outcome of tandem stenting for stenoses of the intracranial vertebrobasilar artery and vertebral ostium. AJNR Am J Neuroradiol 2009;30:840-4.