CASE REPORT

Crossover balloon technique for vertebral artery thrombus: a novel method

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drvikramhuded@gmail.com**SUMMARY**

A 54-year-old man presented with recurrent episodes of transient ischemic attacks and acute stroke secondary to a floating thrombus in the right vertebral artery (VA) with narrowing of the right VA. He was initially treated medically with anticoagulation, antiplatelets and statins but developed multiple fresh infarcts. He was then referred for endovascular treatment, which was performed in a novel way.

BACKGROUND

Vertebrobasilar territory strokes account for 6–10% of large vessel strokes.¹ Current guidelines state that patients with evidence of thrombus in the vertebral artery (VA) should be given medical treatment.² Death rates for patients treated with only medical management are around 88%.³ At present there are no clear guidelines for endovascular treatment if a patient fails medical management. We used a novel technique to prevent embolization of vertebral thrombus during endovascular intervention called the ‘crossover balloon technique’.

CASE PRESENTATION

A 54-year-old man presented with a history of recurrent episodes of giddiness over a period of 15 days. Initially he was treated as a case of vertigo with betahistine. On day 12 of his illness he developed severe giddiness for which he was evaluated at a tertiary care centre. Clinically he was ataxic and had dysarthria. His National Institutes of Health Stroke Scale (NIHSS) score was 4. MRI of the brain showed multiple areas of diffusion restriction in the cerebellum (figure 1) and a CT angiogram showed stenosis of the right VA and evidence of a thrombus distal to the stenosis (figure 2). There was also a high-grade stenosis of the left internal carotid artery. He was started on medical treatment with low molecular weight heparin, antiplatelets and statins. Three days after admission his clinical condition worsened, his vertigo increased, he developed persistent vomiting and also dysphagia. On examination he had right-sided Horner syndrome, nystagmus, right facial palsy, bulbar weakness and he was severely ataxic. His NIHSS score increased to 5 due to worsening of dysarthria. A repeat MRI diffusion sequence showed fresh infarcts in the brainstem, cerebellum and occipital region (figure 3). He was then referred to our centre for endovascular treatment as medical management had failed.

Figure 1 MRI diffusion imaging on day 1.

INVESTIGATIONS

Cerebral angiography showed a right-sided V2 segment narrowing with a floating thrombus distal to it. The rest of the vertebrobasilar circulation was normal. He also had a high-grade stenosis of the left internal carotid artery.

TREATMENT

Since the patient had already failed medical management, endovascular treatment was considered. The challenge during endovascular clot retrieval

Figure 2 CT angiogram showing floating thrombus in right vertebral artery.

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Figure 3 MRI diffusion imaging on day 3.

and stenting is embolization of clot to the basilar artery, so a novel technique was used.

Crossover balloon technique

Bilateral femoral arterial accesses were obtained using a 6 F sheath. A 6 F guiding catheter was introduced into the right VA, followed by another 6 F guiding catheter into the left VA (figure 4). A 5×15 mm Hyperglide balloon (ev3, Irvine, California, USA) was negotiated from the left VA to the right VA and placed distal to the thrombus via the vertebrobasilar junction (figure 5). The balloon was inflated there by occluding the right VA distal to the thrombus, thus preventing the thrombus from embolizing into the basilar artery. Mechanical aspiration of the clot was done through the guiding catheter which was placed in the right VA using a 25 ml syringe. Following mechanical aspiration, the right VA was stented using a 3.5×23 mm bare metal balloon-mounted stent (Vision; Abbott Vascular) and the balloon stent was inflated to 8 mm. Following stenting, mechanical aspiration was performed proximal to the Hyperglide balloon using a Slipcath (Cook Medical) 125 cm catheter and 25 ml syringe (figure 6). The Hyperglide balloon was then deflated and the post-procedure angiogram showed no residual narrowing and no evidence of thrombus (figure 7).

OUTCOME AND FOLLOW-UP

The patient was extubated after the procedure and had no worsening of deficits. He was then transferred to the medical intensive care unit. Twelve hours after the procedure he began complaining of headache and was becoming drowsy. A plain CT scan of the brain showed edema in and around the infarcted area of the cerebellum with a small area of

Figure 4 Angiogram of the right vertebral artery showing floating thrombus with narrowing.

Figure 5 Road map showing balloon crossing from left vertebral artery to right vertebral artery.

Figure 6 Post-stenting image showing aspiration proximal to balloon using a Slipcath.

hemorrhagic transformation of the infarct with hydrocephalus. He underwent emergency posterior fossa decompression. He was extubated on postoperative day 1 and his condition progressively improved. Fourteen days after admission he was discharged. At the time of discharge he was conscious, cooperative, able to swallow both solids and liquids, his speech had improved, he was able to walk with one person's support and was independent for activities of daily living. His NIHSS score at discharge was 4. His Barthel index improved from 5 to 65 at discharge.

DISCUSSION

Posterior circulation stroke is associated with an extremely poor prognosis. The risk of recurrent stroke is approximately 35% over 5 years if left untreated.⁴ The incidence of VA stenosis in posterior circulation strokes is high. Around 40% of strokes are due to atheromatous plaques at the VA origin.⁵ A large population-based study conducted by Marquardt *et al* showed that the incidence of >50% stenosis of the VA in patients who had a transient ischemic attack (TIA) or minor stroke of the posterior circulation was significantly higher than that of patients who had a minor stroke involving the anterior circulation. They also showed that patients with >50% stenosis of the VA usually presented with multiple TIAs and the risk of early stroke was high.⁶ The incidence of stroke was 8.5% and the 5-year survival rate was 60% in follow-up studies of

Figure 7 Post-stenting final angiogram showing no residual stenosis and thrombus.

patients with VA stenosis compared with 85% in the normal population.⁴

The management of symptomatic VA stenosis is by medical, endarterectomy or endovascular treatment. The use of endovascular techniques by experienced interventionists shows a risk reduction in 85% of patients.⁷ The Carotid and Vertebral Transluminal Angioplasty trial failed to show a benefit of endovascular treatment of VA stenosis, but the numbers of patients included was small. Larger randomized trials are required to determine whether VA stenting is justified in patients with a higher risk of vertebrobasilar stroke.⁸

The risk of recurrent stroke, however, remains high, particularly when an acute thrombus is seen in the posterior circulation vasculature. Canyigit *et al* described a patient with an acute thrombus at the stenotic right VA origin which resolved within 4 days of initiation of medical treatment. This was followed by successful angioplasty and stenting of the stenotic right VA origin.⁹ Amole *et al* described a patient with acute thrombus in the VA with stenosis which was treated with VA stenting with flow reversal and distal protection.¹⁰ Currently there are no clear guidelines for endovascular treatment if a patient fails medical management.

Stenting of the VA in the presence of a thrombus is difficult owing to the risk of embolization, as is the case with placement of distal protection through the same artery. In our patient the balloon was placed in the diseased VA distal to the thrombus using the opposite VA, thus preventing the possibility of embolization into the basilar artery. This was then followed by aspiration and stenting of the diseased VA. We believe that, in patients with VA thrombus who fail medical treatment, this is a safe and novel technique.

Learning points

- ▶ In patients with vertebral artery thrombus the chance of recurrent stroke is high.
- ▶ Endovascular intervention is an option in patients who fail medical management in the presence of thrombus. The major risk during intervention is distal embolization.
- ▶ This is a novel technique to prevent distal embolization during endovascular intervention.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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