CASE REPORT

Stentriever thrombectomy with distal protection device for carotid free floating thrombus: a technical case report

Suresh Giragani,¹ Ankit Balani,² Vikas Agrawal³

¹Department of Neuroradiology and Interventional Radiology, Yashoda Super Specialty Hospitals, Secunderabad, Telangana, India

²Department of Radiodiagnosis, Yashoda Super Specialty Hospitals, Secunderabad, Telangana, India

³Department of Neurology, Yashoda Super Specialty Hospitals, Secunderabad, Telangana, India

Correspondence to

Dr Ankit Balani, Department of Radiodiagnosis, Yashoda Super Specialty Hospitals, Secunderabad, Behind Hari Hara Kala Bhawan, Alexander Road, Secunderabad, Telangana 500003, India; drankitbalani@gmail.com

Accepted 22 December 2016

SUMMARY

We report the clinical details, imaging findings and management of a 45-year-old man who presented with recurrent transient ischemic attacks due to carotid free floating thrombus. Free floating thrombus of the carotid artery is a very rare condition with a high risk of distal embolic shower. The optimal treatment options are debatable and include medical management, surgical thrombectomy and endovascular thrombectomy. We describe the use of a stentriever with filter protection in the management of carotid free floating thrombus as a novel treatment option.

BACKGROUND

Free floating thrombus (FFT) of the carotid artery is an extremely rare condition that frequently manifests as recurrent transient ischemic attacks due to distal embolization (microemboli) of the thrombus. Prompt detailed evaluation is warranted to assess the urgency and need for further investigations. The etiology is diverse, including atheromatous plaque complications and hypercoagulable states. The natural history and treatment options are debatable and include medical management, surgical thrombectomy and endovascular thrombectomy. This report illustrates the use of endovascular thrombectomy using a stentriever with filter in the management of FFT of the carotid artery as a novel treatment option.

CASE PRESENTATION

A 45-year-old man presented to the emergency department of the hospital with the chief symptom of right-sided weakness and aphasia for 3 hours. There was associated history of similar transient episodes in the past 3 days. There was a history of cigarette smoking for the last 20 years, nearly 5–10 cigarettes per day. There was no past history of hypertension/diabetes or any significant family history. The patient underwent a comprehensive neurological evaluation and had a National Institute of Health Stroke Scale (NIHSS) score of 10 at admission with right upper motor neuron palsy, right hemiparesis and diminished reflexes on the right side. The power on the right side was 1/5 in both the upper and lower limbs. There were no sensory/cognitive deficits.

INVESTIGATIONS

The initial laboratory investigations including prothrombin time and partial thromboplastin time

were unremarkable. MRI brain was performed which showed multiple foci of abnormal signal intensity which were hyperintense on fluid-attenuated inversion recovery (FLAIR) and showed restriction of diffusion with corresponding low ADC values in the left high frontoparietal cortical/subcortical region, suggesting embolic shower in the territory of the left middle cerebral artery (figure 1 A, B). There was no evidence of blooming on gradient sequence. MR angiography of the intracranial vessels was normal (figure 1C). The patient was treated with intravenous thrombolysis using recombinant tissue plasminogen activator which resulted in significant improvement in the right side weakness. The patient was further evaluated with CT angiography of the neck and intracranial vessels, two-dimensional (2D) echocardiography and ultrasound carotid Doppler to look for the cause of the stroke. CT angiography (figure 2A, B) and ultrasound Doppler (figure 3A, B) confirmed the presence of a 23×4×3 mm non-flow limiting FFT in the left mid common carotid artery as a cause of the embolic shower. There was no evidence of dissection on CT angiography. The transthoracic 2D echocardiography was unremarkable with no cardiac thrombus or arrhythmia.

TREATMENT

The patient was started on anticoagulation and antiplatelet therapy in view of the stable neurological condition, absence of flow limiting thrombus in the common carotid artery and absence of large intracranial vessel occlusion; however, the patient had two more transient ischemic attacks of the same vascular territory during the next 36 hours in spite of optimal medical therapy. Doppler ultrasound showed no regression of the size of the thrombus. A decision for endovascular thrombectomy using a stentriever with an antiembolic device was therefore taken with the patient's consent after counseling him.

Bilateral femoral accesses were used. A 7 Fr femoral sheath was inserted in the right femoral artery and a 6 Fr femoral sheath was inserted in the left femoral artery. A 5 Fr Judkin's right guiding catheter (Cordis, Milpitas, California, USA) was placed in the left common carotid artery and using rapid exchange over 0.014 balance middleweight wire (Abbott Vascular, Santa Clara, California, USA); a distal protection device (Spider FX; eV3, Plymouth, Minnesota, USA) was placed in the cervical segment of the left internal carotid artery.

To cite: Giragani S, Balani A, Agrawal V. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2016-012904

Figure 1 (A) Axial diffusion weighted and (B) fluid-attenuated inversion recovery (FLAIR) sections of MRI brain showing foci of restriction of diffusion in the left high frontoparietal cortical/subcortical region which are FLAIR hyperintense. (C) MRI time of flight angiography maximum intensity projection image showing normal proximal intracranial vessels.

Figure 2 (A, B) Sequential axial sections of CT angiography of extracranial vessels showing non-flow limiting free floating thrombus in the left mid common carotid artery (white arrows).

Figure 3 (A, B) Longitudinal high resolution ultrasound sections with color Doppler (B) showing non-flow limiting free floating thrombus in the left mid common carotid artery with pedicle attaching it to the posterior wall (black arrows).

Figure 4 (A) Anteroposterior projection of digital subtraction angiography of the left common carotid artery injection showing free floating thrombus in the left mid common carotid artery (long solid black arrow). (B) Lateral projection showing the distal protection device (dotted black arrow) in the proximal left internal carotid artery. (C) Anteroposterior projection showing the stentriever (short black arrow) placed across the thrombus.

Following this, a 5 Fr catheter was retracted in the arch of the aorta. A 6 Fr Envoy guiding catheter (Cordis) was placed in the left proximal common carotid artery. A Rebar 27 microcatheter (eV3) was passed through the guiding catheter and a Solitaire 6×30 mm (eV3) was deployed through the Rebar catheter across the thrombus (figure 4A–C). During the procedure ultrasound guidance was used to confirm the adherence of the clot to the stentriever struts, as the clot was not clearly delineated on digital subtraction angiography. Once approximation of the clot with the stentriever was confirmed, the clot was retrieved en bloc with the stentriever and microcatheter while applying continuous suction in the guiding catheter. The entire clot was retrieved in two passes (figure 5A).

OUTCOME AND FOLLOW-UP

The post-procedure check angiogram showed complete recanalization of the left common carotid artery with non-visualization of the FFT (figure 5B). Post-thrombectomy ultrasound showed only a non-flow limiting atherosclerotic plaque at the base of the FFT with disappearance of the FFT (figure 5C). The procedure was uneventful and the patient was discharged on antiplatelet therapy and statins. The results of the laboratory investigation including antithrombin III, protein C, protein S and serum homocysteine levels were unremarkable. On

follow-up over the next 24 months there have been no further ischemic attacks and residual plaque is stable with disappearance of the FFT.

DISCUSSION

FFT is defined as a thrombus with elongated or protrusive morphology, originating from or attached to the arterial wall with circumferential blood flow at its distal aspect with cyclical motion relating to cardiac cycles.^{1 2} FFT of the carotid artery is extremely rare, with around 150 cases reported in the literature^{1 3} and an incidence of 0.4–1.5% in previous angiographic studies of cases of ischemic cerebrovascular disease;^{2 4} however, this may be an underestimation of the disease. Ruptured plaques at the carotid bifurcation are more common causes of acute ischemic stroke. The etiology of these is diverse, with atheromatous plaque complications (ulceration, intraplaque hemorrhage) being the most common cause. Other causes and associations include hypercoagulable states, autoimmune disorders, carotid aneurysms, cardiogenic emboli and arterial dissections.⁴ Our patient had a non-stenotic atheromatous plaque at the level of the FFT. There was no evidence of primary or acquired hypercoagulability.

Clinically, these patients show a male predominance and present at a comparatively younger age than patients with

Figure 5 (A) Clinical photograph showing the stentriever with extracted thrombus. (B) Anteroposterior projection of digital subtraction angiography of the left common carotid artery showing no residual free floating thrombus with complete recanalization of the vessel. (C) Longitudinal high resolution ultrasound showing stable residual plaque in the left mid common carotid artery with disappearance of free floating thrombus.

atherosclerotic carotid disease. The patients are usually symptomatic, presenting with cerebrovascular events due to microemboli.¹ The cyclical motion of these plaques during the cardiac cycle causes repetitive stress on the intimal pedicle attaching it to the arterial wall and, over time, results in detachment and distal embolization. The most serious complication is detachment leading to complete occlusion of distal cerebral arteries. The internal carotid artery is the most commonly involved vessel followed by the common carotid artery and carotid bifurcation.¹

Diagnostic evaluation is done using carotid ultrasonography with Doppler, CT angiography, MR angiography and digital subtraction angiography, with the free floating nature of the thrombus depicted best with real-time carotid ultrasonography. CT and MR angiography show the entire extent of the thrombus, the extent of luminal compromise and location of the thrombus. The diagnosis may be challenging, with cross-sectional studies with atherosclerotic stenosis and arterial dissection mimicking FFT.

Due to the rarity of the disease, the treatment of FFT of the carotid artery is not standardized. The treatment options include medical management with anticoagulation and antiplatelet therapy, surgical thrombectomy, endarterectomy, carotid angioplasty and stenting and endovascular suction thrombectomy.^{1 3–7} The largest review done by Bhatti *et al* of 145 cases showed that neither medical nor surgical management was clearly superior in the treatment of FFT.¹ They concluded that medical management for stabilizing neurological deficits has less risk and less benefit than surgical intervention and thus serves as a ‘middle of the road’ option. The patients are usually treated with anticoagulation initially and surgical intervention is performed in cases of inadequate response.

Medical management using anticoagulant therapy may, however, make a friable clot more prone to embolization.⁴ Surgical cut down and embolectomy theoretically lacks early distal protection and chances of distal emboli.

Recent advances in endovascular devices and techniques have meant that the minimally invasive management of FFT is a reality. Chakhtoura *et al*⁵ proposed carotid angioplasty and stenting as a potentially preferable option for the treatment of mobile floating carotid plaque in patients at high risk with medical comorbidities, post-surgical stenosis and anatomically inaccessible lesions. Ottawa *et al*⁸ attempted ultrasonography-guided endovascular treatment where they successfully aspirated FFT into a Penumbra aspiration catheter under proximal balloon protection. Park *et al*⁹ described the role of self-expandable stents with distal antiembolic devices, suction thrombectomy using a balloon-tipped catheter and parent vessel trapping for the management of FFT in four patients.

Stentriever is microcatheter delivered, highly flexible and fully retrievable nitinol stents designed specifically for intracranial use. They were developed to facilitate the endovascular treatment of wide-necked aneurysms, although they are now more commonly used for endovascular mechanical thrombectomy.¹⁰ The use of stentriever is a minimally invasive technique commonly used for thrombectomy in large intracranial vessel occlusions including the internal carotid artery and M1 segment of the middle cerebral artery with excellent results. However, we have used a similar technique with additional distal protection device with a good result for FFT in the common carotid artery.

In our case we started with medical management; however, the patient had two more transient ischemic attacks in the same vascular territory so further intervention was deemed necessary.

Endovascular options available included suction thrombectomy, carotid stenting and stentriever thrombectomy with distal protection device. Trapping the clot with a properly sized self-expanding stent following antiplatelet loading is an option which would have been performed with only one working platform; however, it has an associated theoretically low risk of distal embolization due to intrastent thrombus protrusion¹¹ and the need to keep the patient on lifelong antiplatelet therapy due to the inherent nature of carotid stenting of metal in situ in the body. Hence, after informed consent, stentriever thrombectomy with a distal protection device was preferred as the treatment option in our case. To the best of our knowledge, the use of a stentriever for the management of FFT has not previously been described in the English literature. However, this novel technique may have limitations in patients with large common carotid arteries because of the limited size options of currently available stentriever.

CONCLUSIONS

This report highlights the clinical and imaging features of a case of FFT of the carotid artery and the role of endovascular management using a stentriever. Endovascular management is minimally invasive, safe and effective in thrombectomy of FFT of the carotid artery and can potentially be preferred over surgical therapeutic options. However, this needs further consideration with other studies in a larger sample size.

Learning points

- ▶ Carotid free floating thrombus is a rare cause of stroke.
- ▶ Early diagnosis is needed for optimum management.
- ▶ Diagnosis can be made by cross-sectional imaging or Duplex ultrasonography.
- ▶ Endovascular intervention may have a role if optimum medical therapy fails.
- ▶ Thrombectomy with a stentriever with distal protection is a safe, effective and novel treatment option.

Contributors All authors contributed significantly to the planning, conduct and reporting of the work described in the paper.

Competing interests None declared.

Patient consent Obtained.

Ethics approval Ethics approval was obtained from the institutional review board.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Bhatti AF, Leon LR Jr, Labropoulos N, *et al*. Free-floating thrombus of the carotid artery: literature review and case reports. *J Vasc Surg* 2007;45:199–205.
- 2 Chua HC, Lim T, Teo BC, *et al*. Free-floating thrombus of the carotid artery detected on carotid ultrasound in patients with cerebral infarcts: a 10-year study. *Ann Acad Med Singap* 2012;41:420–4.
- 3 Graham R, Blaszczyński M. Spontaneous free floating carotid artery thrombosis. *BMJ Case Rep* 2013;2013: pii: bcr2013008710.
- 4 Watanabe M, Mori T, Imai K, *et al*. Distal migration of a floating carotid thrombus in a patient using oral contraceptives: a case report. *J Med Case Rep* 2009;3:8389.
- 5 Chakhtoura EY, Goldstein JE, Hobson RW. Management of mobile floating carotid plaque using carotid artery stenting. *J Endovasc Ther* 2003;10:653–6.
- 6 Eljovich L, Mainali S, Doss V, *et al*. Medical management of free-floating carotid thrombus. *Clin Neurol Neurosurg* 2013;115:1532–5.
- 7 Alurkar A, Karanam LS, Nayak S, *et al*. Idiopathic thrombus in the common carotid artery on digital subtraction angiography. *J Clin Imaging Sci* 2012;2:20.

- 8 Otawa M, Kinkori T, Watanabe K, *et al.* [A case of carotid free-floating thrombus treated by carotid ultrasonography-guided endovascular approach]. *No Shinkei Geka* 2016;44:489–94.
- 9 Park JW, Lee DH, Choi CG, *et al.* Various endovascular approaches to the management of free floating carotid thrombi: a technical report. *J Neurointerv Surg* 2012;4:336–8.
- 10 Henkes H, Flesser A, Brew S, *et al.* A novel microcatheter-delivered, highly-flexible and fully-retrievable stent, specifically designed for intracranial use. Technical note. *Interv Neuroradiol* 2003;9:391–3.
- 11 Ferrero E, Ferri M, Viazzo A, *et al.* Carotid stent removal of symptomatic plaque protrusion after carotid angioplasty stenting. *Interact Cardiovasc Thorac Surg* 2010;11:254–6.

Copyright 2017 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.

BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow