CASE REPORT

Angiographic warning of hemorrhagic transformation after stent retriever thrombectomy procedure

Andrew T Vollman,¹ Charles A Bruno Jr,² Shifali Dumeer,³ Hani Malone,⁴ Philip M Meyers⁵

¹Wayne State University School of Medicine, Detroit, Michigan, USA

²Department of Radiology, Columbia University, New York, New York, USA

³Department of Neuroradiology, Columbia University, New York, New York, USA

⁴Department of Neurosurgery, Columbia University, New York, New York, USA

⁵Department of Neurointerventional Surgery, Columbia University, New York, New York, USA

Correspondence to

Andrew Vollman,
andrew.vollman@gmail.com
Philip M Meyers, MD, FAHA.
Departments of Radiology and
Neurological Surgery, Columbia
University, College of
Physicians & Surgeons,
New York, New York, USA

SUMMARY

This study reports cerebral angiographic findings observed after stent retriever thrombectomy that is suggestive of a higher risk of hemorrhagic transformation (HT). A woman aged 65–75 presented with a right middle cerebral artery syndrome confirmed by non-contrast CT brain scan. Endovascular revascularization using the Solitaire device was placed across the thromboembolic occlusion and thromboembolectomy was performed. Angiography showed complete recanalization of the left internal carotid artery, anterior and middle cerebral artery branches. Twelve hours following the procedure the patient had a hemorrhagic conversion of the ischemic infarct with significant mass effect causing herniation. Despite surgical intervention (hemicraniectomy) the patient died. The angiographic features following revascularization of the vessels distal to the occlusion showed subtle dilations which were visualized at the branch points of the vessels. This may be a warning sign of increased risk of HT.

BACKGROUND

Hemorrhagic transformation (HT) is a potential complication of acute ischemic stroke resulting from collateral circulation to the ischemic brain.¹ Modern treatment of acute ischemic stroke focuses on rapid recanalization of the occluded vessel which has well-documented better clinical outcomes.² Early recanalization causes reperfusion of ischemic brain tissue, potentially with an increased risk of HT following intervention.^{2–3} This paper reports on one cerebral angiographic finding observed after stent retriever thrombectomy which suggests that patients are at higher risk of HT.

CASE PRESENTATION

A woman aged 65–75 with hypertension, hyperlipidemia and atrial fibrillation with rapid ventricular response on dabigatran etexilate presented with a right middle cerebral artery syndrome. A non-contrast CT brain scan showed a dense left middle cerebral artery sign but no definite infarction or hemorrhage (figure 1A). The NIH Stroke Scale score was 29. No diffusion-weighted images or perfusion studies were performed.

TREATMENT

Catheter cerebral angiography confirmed a distal left carotid occlusion extending from the distal left internal carotid artery into the anterior and middle cerebral arteries (figure 1B). Endovascular revascularization with a Solitaire device (Covidien/eV3, Maple Grove, Minnesota, USA) was subsequently started. Under fluoroscopic guidance, a 6×20 mm Solitaire stent retriever device was deployed through a Marksman catheter and placed across the thromboembolic occlusion. After 5 min, mechanical thromboembolectomy was performed under flow arrest. No antiplatelet or anticoagulant medication was given to the patient during or after the procedure.

OUTCOME AND FOLLOW-UP

Control arteriography following placement of the stent retriever demonstrated partial recanalization of the distal left internal carotid artery and anterior and middle cerebral artery branches. Control arteriography following thromboembolectomy showed complete recanalization of the left internal carotid artery, anterior and middle cerebral artery branches (figure 1C). Following the procedure, the patient was transferred to the neurological intensive care unit (NICU) for ongoing management.

Twelve hours after the procedure the patient developed lethargy and left mydriasis. An emergency CT brain scan showed hemorrhagic conversion of the ischemic infarct with significant mass effect causing herniation (figure 1D). The patient underwent urgent hemicraniectomy and continuous monitoring in the NICU but she developed multi-system organ failure and died.

DISCUSSION

The overall clinical benefits of endovascular procedures—delivery of fibrinolytic drugs or mechanical removal of the occlusive thrombus—are well documented.^{2–3} However, these benefits come with the risk of HT of the ischemic infarct which may be life-threatening.^{3–4} The risk of HT of an acute ischemic stroke without any intervention is nearly 0.6%.⁵ Intra-arterial pharmacologic and mechanical interventions increase this risk to 15.4%⁴ and 10%,³ respectively.

One cause of hemorrhagic conversion following stent retriever thrombectomy may be barotrauma secondary to loss of autoregulation. Similar findings causing HT have been demonstrated following

To cite: Vollman AT, Bruno Jr CA, Dumeer S, et al. *BMJ Case Reports* Published online: [please include Day Month Year] doi:10.1136/bcr-2012-010607

Figure 1 (A) CT scan of a dense left middle cerebral artery sign with no signs of hemorrhage (arrow). (B) Lateral angiographic image of the left common carotid artery with a radiolucent thrombus in the distal left internal carotid artery with complete occlusion. (C) Lateral angiographic image after stent retriever thrombectomy showing complete recanalization of the internal carotid artery. Magnified view highlighting punctate subtle dilations at the branch points (arrows). (D) CT scan of hemorrhagic conversion after recanalization.

stent revascularization for symptomatic intracranial atherosclerotic disease. Following revascularization, vessels distal to the occlusion show subtle dilations which can be visualized at the branch points of the vessels (figure 1C). This may provide insight into the severity of injury to the vessels beyond the occlusion indicating that the patient is at higher risk of HT.

Similar radiographic features (punctae at branch points) have been described in the literature following angioplasty and stenting of a stenotic intracranial carotid and middle cerebral artery.⁶ Using intraoperative transcranial Doppler, the patient had increased blood flow and decreased pulsatility distal to the stent placement. These findings further support our theory that the vessels distal to an area in the brain where blood flow has been restored are less tolerant of higher pressures.

The implications of this finding are important in the post-operative management of the patient. More aggressive blood pressure control could help prevent hemorrhage after recanalization; a reduction in blood pressure of 25–30% depending on the preoperative baseline is recommended.⁶ Close

monitoring and augmentation with insulin to keep the blood glucose levels below 200 mg/dl will also decrease rates of hemorrhage after recanalization.⁷ Expectant management

Learning points

- ▶ Endovascular recanalization of a vessel in the setting of acute ischemic stroke has documented clinical benefits.
- ▶ Intra-arterial pharmacologic and mechanical interventions increase the risk of hemorrhagic transformation (HT) in patients with acute ischemic stroke.
- ▶ After recanalization of a vessel, punctae may be visualized at branch points of small vessels which is a warning that the patient is at a higher risk of HT.
- ▶ If angiographic punctae are visualized, expectant management can help prevent HT or optimize recognition of an HT for a quicker response time.

could help to prevent HT or provide more rapid recognition and intervention should it occur.

Funding None.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Lyden PD, Zivin JA. Hemorrhagic transformation after cerebral ischemia: mechanisms and incidence. *Cerebrovasc Brain Metab Rev* 1993;5:1–16.
- 2 Smith WS, Sung G, Saver J, *et al.* Mechanical thrombectomy for acute ischemic stroke: final results of the Multi MERCI trial. *Stroke* 2008;39:1205–12.
- 3 Meyers PM, Schumacher HC, Connolly ES Jr, *et al.* Current status of endovascular stroke treatment. *Circulation* 2011;123:2591–601.
- 4 del Zoppo GJ, Higashida RT, Furlan AJ, *et al.* PROACT: a phase II randomized trial of recombinant pro-urokinase by direct arterial delivery in acute middle cerebral artery stroke. PROACT Investigators. Prolyse in Acute Cerebral Thromboembolism. *Stroke* 1998;29:4–11.
- 5 Feske SK. Thrombolytic therapy of acute stroke. *Circulation* 2012;125:2662–6.
- 6 Brus-Ramer M, Starke RM, Komotar RJ, *et al.* Radiographic evidence of cerebral hyperperfusion and reversal following angioplasty and stenting of intracranial carotid and middle cerebral artery stenosis: case report and review of the literature. *J Neuroimaging* 2010;20:280–3.
- 7 de Carvalho FA, de Figueiredo MM, Silva GS. Acute stroke: postprocedural care and management of complications. *Tech Vasc Interv Radiol* 2012;15:78–86.

Copyright 2013 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