CASE REPORT

Last resort: case of clot translocation in intra-arterial stroke therapy

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SUMMARY

A patient was taken for emergent intra-arterial stroke therapy for an acute left middle cerebral artery stroke syndrome, with CT angiography showing a left internal carotid artery (ICA) occlusion. Through a 6 F Neuron MAX sheath, a 5 Max ACE Penumbra aspiration catheter was advanced to the thrombus and direct suction was performed through the ACE catheter and Neuron MAX sheath. Upon pull back, the thrombus became wedged in the Neuron MAX sheath and despite several attempts to aspirate the thrombus, no clot could be obtained. The Neuron MAX sheath was withdrawn to the left common carotid artery, and gently advanced to the origin of the external carotid artery (ECA). A glide wire was advanced and the thrombus dislodged into the ECA. Another pass with the 5 Max ACE was used to remove a remaining thrombus in the left ICA terminus, resulting in Thrombolysis in Cerebral Infarction (TICI) 3 flow. With improved devices for embolectomy, large and rigid emboli that exceed the inner diameter of large guide sheaths and balloon guide catheters can become lodged, and cannot be withdrawn through a catheter. While uncommon, strategies to overcome this are important to keep in mind during acute stroke intervention.

BACKGROUND

New mechanical embolectomy devices, such as the new generation Penumbra aspiration catheters (Penumbra Inc, Alameda, California, USA) and stent retrievers, have improved recanalization rates compared with older generation devices.^{1–3} With new devices, large clot fragments are more frequently being mobilized and retrieved. Infrequently, mobilized clot may be of such rigidity and size that it cannot be aspirated into a guide catheter. Interventionalists need to be prepared with strategies to overcome such an obstacle. We report such a case, and discuss the possible strategies which could be employed to deal with guide catheter occlusion with thrombus. In our case, the clot was translocated to the external carotid artery (ECA).

CASE PRESENTATION

A patient was admitted to the cardiology service following a syncopal episode. Pertinent past medical history included hypertension, type II diabetes mellitus, non-ischemic cardiomyopathy (left ventricular ejection fraction of 25%), status post implantable cardioverter defibrillator placement and atrial fibrillation on anticoagulation with warfarin. Shortly after admission, the patient developed acute onset of aphasia and right hemiparesis

suggestive of a left middle cerebral artery stroke syndrome, with a National Institutes of Health Stroke Scale score of 27. International normalized ratio was 1.3. CT head revealed no hemorrhage, and CT angiography showed a left internal carotid artery (ICA) thrombus in the petrous segment. After discussion with the family, intravenous tissue plasminogen activator was administered 63 min after symptom onset and the patient was taken for emergent intra-arterial stroke therapy. Following diagnostic angiography which confirmed the left ICA occlusion with faint and delayed reconstitution at the cavernous segment (figure 1), a 6F Neuron MAX sheath (Penumbra Inc) was placed in the left ICA, and a 5 Max ACE Penumbra aspiration catheter was advanced to the thrombus. Direct suction with a 60 mL syringe was performed through the 5 Max ACE Penumbra catheter and Neuron MAX sheath.³

Upon mobilization and withdrawal of the clot under direct aspiration, the thrombus became wedged at the tip of the Neuron MAX sheath and despite several attempts to aspirate the thrombus, no clot could be obtained. Several options were considered. The Neuron MAX sheath was withdrawn to the left common carotid artery, angled, and then very gently advanced to the origin of the left ECA. A roadmap of the carotid bifurcation was available from before, facilitating precise manipulation of the sheath. A glide wire was advanced and the thrombus dislodged into the ECA. An angiogram obtained subsequently demonstrated thrombus in the left ECA with patency of the left ICA, and subocclusive thrombus in the ICA terminus (figure 2). Another pass with the 5 Max ACE was used to remove a remaining thrombus in the left ICA terminus, resulting in TICI 3 flow (figures 3 and 4).

OUTCOME AND FOLLOW-UP

The patient improved over the next 24 h with complete resolution of symptoms (National Institutes of Health Stroke Scale score of 0 at 24 h). CT head 24 h post procedure did not show any evidence of ischemic stroke. Repeat CT head imaging and examination at 3 months was stable, with no new complaints.

DISCUSSION

With the newest generation aspiration techniques, it is now possible to remove unfragmented large thrombi in a single pass, potentially reducing the risk of embolic showers during embolectomy by avoiding thromboembolism. However, large whole

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Figure 1 Angiography pre-intervention with lateral views at the neck and head. The cervical view shows tapering occlusion of the left internal carotid artery (white arrow) and the cranial view demonstrates occlusive thrombus at the petrous–cavernous segment (black arrow) with distal reconstitution through the ophthalmic artery.

rigid clot may be larger than what a guide catheter can accommodate, and may pose a particular challenge in the setting of intra-arterial acute stroke therapy. During this case, several options were considered.

1. *Direct aspiration of thrombus.* Two 60 mL syringes had been used to aspirate from both the 5 Max ACE Penumbra and the guide sheath during the initial attempt at embolectomy. With the clot lodged, repeated aspirations of the guide sheath were attempted with the 60 mL syringe and Penumbra aspiration system, but were unsuccessful.
2. *Re-attempt with 5 Max ACE aspiration.* Trying to readvance the 5 Max ACE to the thrombus within the guide sheath

was attempted, and although a good seal was obtained, the thrombus remained wedged and could not be retrieved.

3. *Use of stent retriever or separator wire.* Consideration was given to advancing a stent retriever, but it was felt this was very likely to dislodge the thrombus back into the left ICA, so was not attempted. A separator wire to debulk the thrombus was also considered, but was not attempted due to the risk of dislodging the thrombus back to the ICA or embolization to more distal vessels.
4. *Removal of Neuron MAX sheath from the body.* We considered removing the Neuron MAX sheath from the body with the thrombus. However, due to the patient being on

Figure 2 Lateral view at the neck shows clot that was placed in the left external carotid artery, resulting in its occlusion (black arrow), but patency of the internal carotid artery with distal thrombus in the terminus (white arrow) seen on the anteroposterior view of the head.

Figure 3 Anteroposterior and lateral views of the head following embolectomy showing restoration of Thrombolysis in Cerebral Infarction (TICI) 3 cerebral blood flow.

intravenous tissue plasminogen activator, there was great concern of leaving a 6 F arteriotomy in the femoral artery and the potential risk of severe groin hemorrhage. An attempt to place an exchange wire was entertained, but this was again felt to be likely to dislodge the thrombus.

5. *Clot translocation to the descending aorta or iliac arteries.* One could consider releasing the thrombus in other arteries, but concerns of limb ischemia or ischemia of other organs existed.
6. *Clot translocation to the ECA.* As the face and scalp circulation is robust due to the great collateral capacity of the ECAs, one can often occlude the ECA with no or little consequence. Risk of ischemic complications from ECA occlusion are very rare. Review of endovascular treatment of epistaxis or ECA ligation in the setting of neck tumors gives us an indirect estimate of complications. Cases of necrosis of the nasal ala, septum, columella, oral mucosa, and facial skin have been previously noted, particularly with bilateral treatment.⁴ These occur as a consequence of over embolization of the internal maxillary and facial arteries. In addition, there is the risk of embolization across ECA-ICA anastomosis, including the vidian artery, middle meningeal artery, accessory meningeal artery, and superficial temporal arteries. This could lead to major complications, such as cerebral infarction or retinal artery occlusion.^{5 6} As such, it was decided to maneuver the guide sheath into the ECA and then dislodge the thrombus into the external carotid origin. Navigating the sheath in the absence of a guiding catheter runs the risk of arterial wall

injury, including arterial dissection. This risk was considered, and translocation to the ECA was still felt to be the best choice weighing the pitfalls of other options. Navigation of the sheath was performed with extreme caution, as described above.

Learning points

- ▶ New embolectomy devices for intracranial vascular thrombus are more effective, with large clots now able to be retrieved.
- ▶ Despite the use of large guide catheters, large thrombi may exceed the luminal size of the guide catheter and thus be unable to be aspirated, posing a significant intra-procedural challenge.
- ▶ While uncommon, strategies to overcome this are important to keep in mind during acute stroke intervention.
- ▶ Placing clot fragments in the ECA is a potential strategy, as the collateral circulation makes this a very forgiving arterial bed.

Contributors All authors were involved in the conception and design, or analysis and interpretation of the data; drafting the article or revising it critically for important intellectual content; and provided final approval of this version of the manuscript.

Competing interests None.

Patient consent Obtained.

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Figure 4 Large thrombus removed by 5 Max ACE aspiration catheter.

REFERENCES

- 1 Saver JL, Jahan R, Levy EI, *et al.* Solitaire flow restoration device versus the Merci retriever in patients with acute ischaemic stroke (SWIFT): A randomised, parallel-group, noninferiority trial. *Lancet* 2012;380:1241–9.
- 2 Nogueira RG, Lutsep HL, Gupta R, *et al.* Trevo versus Merci retrievers for thrombectomy revascularization of large vessel occlusions in acute ischaemic stroke (TREVO 2): A randomised trial. *Lancet* 2012;380:1231–40.
- 3 Turk AS, Spiotta A, Frei D, *et al.* Initial clinical experience with the ADAPT technique: A direct aspiration first pass technique for stroke thrombectomy. *J NeuroIntervent Surg.* Published Online First: 27 Apr 2013. doi:10.1136/neurintsurg-2013-010713
- 4 Sadri M, Midwinter K, Ahmed A, *et al.* Assessment of safety and efficacy of arterial embolisation in the management of intractable epistaxis. *Eur Arch Otorhinolaryngol* 2006;263:560–6.
- 5 Leppanen M, Seppanen S, Laranne J, *et al.* Microcatheter embolization of intractable idiopathic epistaxis. *Cardiovasc Intervent Radiol* 1999;22:499–503.
- 6 Willems PW, Farb RI, Agid R. Endovascular treatment of epistaxis. *AJNR Am J Neuroradiol* 2009;30:1637–45.

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