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Technical Notes

Emergent carotid endarterectomy and mechanical thrombectomy in tandem occlusion

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ABSTRACT

Background: Acute tandem occlusions, or occlusions of the extracranial portion of the internal carotid artery (ICA) with concurrent thromboembolism of the intracranial ICA or middle cerebral artery, poses a major clinical challenge, with patients suffering worse outcomes compared to those with single occlusions. Management of these lesions generally includes a combination of mechanical thrombectomy (MT) of the intracranial occlusion and stenting of the extracranial carotid lesion. In this manuscript, we describe a successful surgical method for achieving revascularization of tandem occlusions in the rare circumstance that the proximal lesion cannot be crossed endovascularly to gain intracranial access.

Methods: Despite using our institution's standard protocol for achieving revascularization of such lesions, the extracranial occlusion could not be crossed endovascularly, and the case was converted to an emergent carotid endarterectomy (CEA) in the operating room. Once the endarterectomy was complete, intraoperative MT was performed before cervical incision closure to revascularization.

Results: The patient recovered well postoperatively and was discharged with NIHSS of 2 due to minor facial palsy and minor dysarthria. Thirty-day follow-up revealed resolution of the prior neurologic deficits and an mRS of 1.

Conclusion: Emergent CEA should be considered in the rare circumstance of being unable to cross the cervical occlusion during management of acute ischemic stroke with tandem occlusion.

Keywords: Carotid occlusion, Endarterectomy, Endovascular, Ischemic stroke, Mechanical thrombectomy, Tandem occlusion

INTRODUCTION

Management of acute tandem occlusions, or occlusions of the extracranial portion of the internal carotid artery (ICA) with concurrent thromboembolism of the intracranial ICA or middle cerebral artery (MCA), poses a major clinical challenge. Approximately 10–15% of large vessel occlusions resulting in acute ischemic stroke (AIS) are related to tandem occlusions; however, despite their prevalence, an optimal management strategy has not been reached.[10] This subset of patients has worse neurologic outcomes compared to those with single occlusions and generally respond poorly to thrombolysis alone, likely due to decreased delivery of the thrombolytic to the intracranial obstruction due to the extracranial obstruction.[5,7,9]

Current endovascular therapeutic strategies include recanalization of the intracranial occlusion through mechanical thrombectomy (MT) followed by stenting of the extracranial ICA (head-first), and the reverse, extracranial stenting followed by intracranial MT (neck-first). Cirillo *et al.* found that endovascular ICA stenting used in management of tandem occlusions led to improved revascularization and had improved long-term morbidity and mortality when compared to non-stenting techniques.[1] This methodology of endovascular intervention, in addition to MT, has been widely accepted as more successful compared to thrombolysis alone. The thrombectomy in tandem lesions collaboration compiled several cases of tandem occlusions involving the anterior circulation to compare the speed and rates of reperfusion in head-first versus neck-first endovascular approaches. The study found similar rates of successful reperfusion in the two approaches, although the head-first approach led to faster reperfusion times.[3] Lockau *et al.* found intracranial thrombectomy before proximal stenting was associated with shorter reperfusion times resulting in overall improved clinical outcomes.[8]

At our institution, a comprehensive stroke center, we have adopted the head-first paradigm, as described previously.[2] However, in this peculiar case, we were unable to cross the cervical occlusion despite various wires, microwires and microcatheters used, so we proceeded with an emergent carotid endarterectomy (CEA) before we were able to perform the intracranial thrombectomy.

CASE PRESENTATION

The patient is a 78-year-old who awakened with aphasia and right hemiparesis. When symptoms persisted, he presented to an outside hospital and was not a candidate for tPA given unknown onset of symptoms. Of note is the patient had suffered sudden loss of vision in the left eye 2 weeks before presentation, was started on aspirin, evaluated by ophthalmology as an outpatient, and was thought to be an ischemic etiology, so a carotid ultrasound was ordered but had not been completed by the time of his presentation. Computed tomography (CT) angiography/CT perfusion was completed (Time 00:00) revealing cervical carotid occlusion and tandem left MCA-M2 occlusion with no core infarct and 50 ml of ischemic penumbra [Figure 1]. After review of the imaging, we recommended loading the patient with 300 mg of clopidogrel and 325 mg of aspirin in preparation for possible carotid angioplasty and stenting. Patient was transferred to our facility by ambulance directly to the angio suite (Time 02:46). Patient was placed under general anesthesia with a targeted systolic blood pressure of 140–180 per our routine for AIS. We proceeded with a right femoral access (Time 02:51) as we have not adopted radial access for anterior circulation stroke given our significantly better times with femoral access. An 8-Fr short sheath was utilized, and 6-Fr Neuron MAX sheath (Penumbra Inc., California, USA) was navigated to the left common carotid artery, over an angled tip 6-Fr Berenstein catheter (Penumbra Inc., California, USA), over on 0.035' glidewire (Terumo, New Jersey, USA). We are routinely able to cross the carotid occlusion with this construct and perform the intracranial thrombectomy before attending to the cervical carotid occlusion on the way out. However, multiple wires, microwires, and microcatheters were attempted but unsuccessful in crossing the cervical occlusion [Figure 2]. Hence, at this point, we decided to transfer the patient to the operating room (Time 04:09) for an emergent CEA. Femoral sheath was kept in place while all catheters were removed. A standard left CEA incision was performed (04:48). After completion of the endarterectomy and closure of the arteriotomy (Time 05:33) [Figure 3], we proceeded with intraoperative thrombectomy

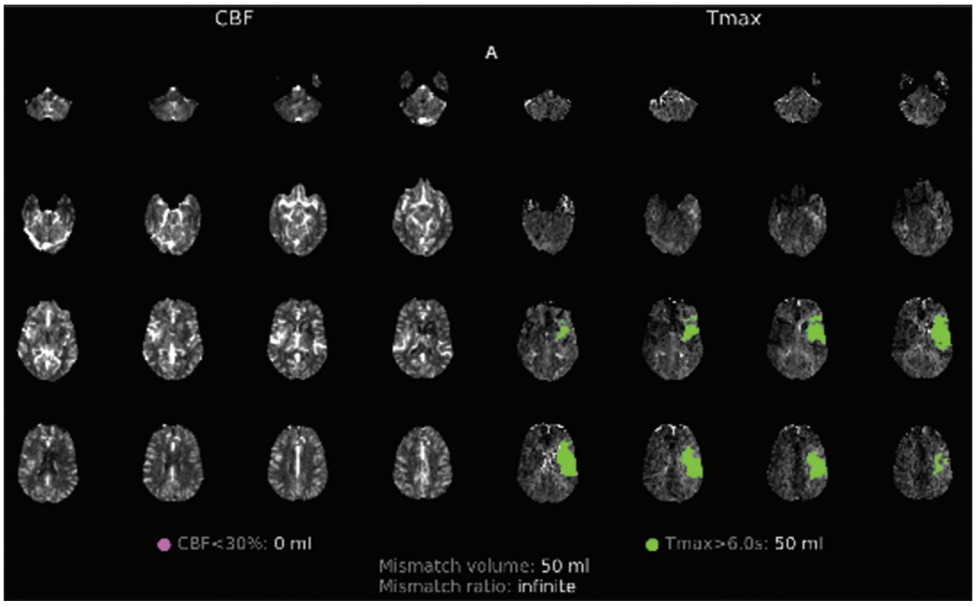

Figure 1: Postprocessed computed tomography perfusion images revealing no core infarct and 50 cc salvageable brain tissue (Penumbra).

before cervical incision closure. We reaccessed (Time 05:56) the same femoral sheath, and utilizing the C-Arm, we navigated the Neuron MAX to the vertical petrous carotid over an angled tip 6-Fr diagnostic catheter over a glidewire. We then achieved revascularization (Time 06:14) with a Red 68 reperfusion catheter (Penumbra Inc., California, USA) in combination with a solitaire retrievable stent (Medtronic, California, USA) [Figure 4]. The patient recovered well postoperatively, with persistence of light perception only in the left eye, and otherwise was discharged with NIHSS of 2 due to minor facial palsy and minor dysarthria. Magnetic resonance imaging demonstrated left subcortical infarct with no complication [Figure 5]. At 30-day follow-up, the patient's visual deficit persisted, but with resolution of the prior neurologic deficits and an mRS of 1.

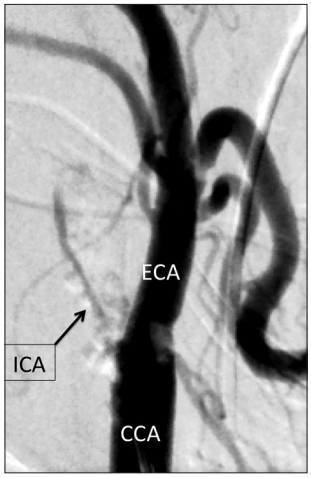

Figure 2: Digital subtraction angiography and common carotid artery injection revealing persistent atherosclerotic occlusion of the cervical internal carotid artery (ICA).

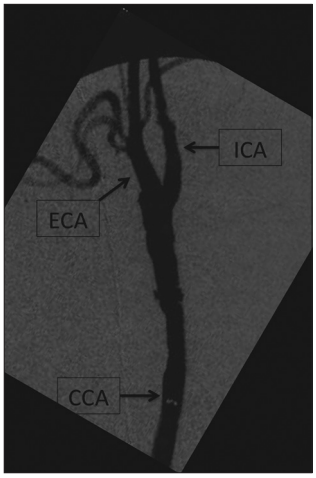

Figure 3: Digital subtraction angiography, postendarterectomy, and demonstrating revascularization of the cervical ICA following carotid endarterectomy.

DISCUSSION

In our case, proceeding with an emergent CEA was the reason MT was feasible. Although not classically performed in the setting of tandem occlusions, CEA served as a crucial step in the management of this patient. As stated previously, thrombolysis has poor efficacy in patients with tandem occlusions and the endovascular technique is superior.[9] However, when endovascular techniques fail to recanalize the extracranial ICA, gaining access to the intracranial occlusion

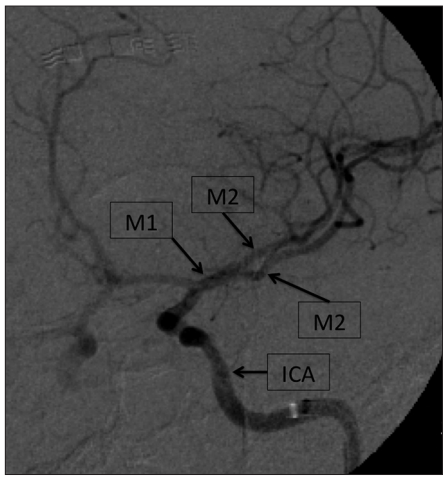

Figure 4: Digital subtraction angiography post mechanical thrombectomy, ICA injection, and demonstrating revascularization of intracranial flow achieving thrombolysis in cerebral infarction score 3.

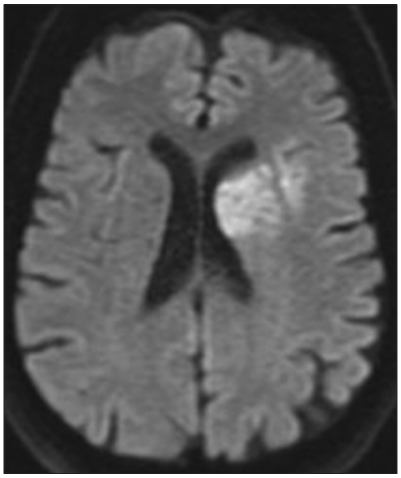

Figure 5: Postprocedure magnetic resonance imaging, axial diffusion-weighted imaging sequence, and revealing left subcortical infarct.

for revascularization is rarely possible. Utilizing the circle of Willis and accessing the occlusion from the contralateral carotid or posterior circulation is sometimes feasible, but in our patient was not an option. Reperfusing the ischemic penumbra allows a chance for neurologic recovery in patients with large vessel occlusions. As in this patient, there is actually potential for complete neurologic recovery.

To consider introducing emergent CEA as a management option, the treating facility has to be equipped for rapid conversion to operative intervention. For patients undergoing urgent CEAs, the rate of perioperative complication is higher than those who undergo elective CEA, and this is especially true regarding neurologic and cardiac complications.[6] Most notably, these risks include potential for cerebrovascular accident, myocardial infarction, cranial nerve injury, and bleeding during the perioperative period.[4] Karkos *et al*. analyzed the safety of CEA within 24 h of acute change in neurologic function in 114 patients who underwent CEA for evolving stroke.[6] The risk of perioperative stroke was 16.9%, stroke/death was 20.0%, and stroke/death/major cardiac events was 20.8%.[6] Although this does not entirely apply in the setting of the tandem occlusions, it must be taken into consideration when making the decision to utilize this approach.

Despite the good neurologic outcome, the time to achieve reperfusion was suboptimal and leaves room for improvement. Had emergent CEA been a prior consideration, we would have saved significant time to achieve revascularization. Less time would have been spent on the failed attempts at coursing the occlusion, the OR would have been notified sooner, and a few minutes could have been saved in every step to achieve reperfusion had we have this approach planned for and protocoled previously. Similar to direct carotid puncture for difficult access, since it became a consideration, our preparedness and ability to safely utilize it became more timely and efficient.

CONCLUSION

This case highlights how the emergent CEA made reperfusion of the tandem occlusion possible and did not result in adverse events. We believe, this option is important to consider in the rare circumstance of being unable to cross a cervical occlusion in the setting of tandem occlusion during management of AIS.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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