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Emergent cervical internal carotid artery angioplasty before endovascular thrombectomy for acute ischemic stroke: a report of clinical and imaging outcome☆,☆☆

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ABSTRACT

A case of tandem occlusion consisting of right internal carotid artery (ICA) origin dissection and middle cerebral artery (MCA) thromboembolism is reported. A 45 year-old male with right-sided neurological symptoms of emergent large vessel occlusion was treated with same-session angioplasty and mechanical thrombectomy of the respective lesions. The complete neurological recovery and radiological investigations are chronicled herein, and a review of the state of tandem occlusion management is discussed.

1. Introduction

Acute tandem occlusions comprise up to one-fifth of acute ischemic strokes [1]. Defined as a large vessel intracranial occlusion and a concomitant cervical internal carotid artery (ICA) stenosis or occlusion, they confer a dismal prognosis if treated solely with systemic thrombolysis or are untreated [2]. In the era of mechanical thrombectomy, there is anecdotal evidence to suggest that this emerging standard of care can be combined with angioplasty with or without stenting, and confers improved outcomes [3]. However, most of the major 2015 stroke trials either excluded tandem occlusions or did not specify management. Nevertheless, the data from two of these trials, A Multicenter Randomized CLinical trial of Endovascular treatment for Acute ischemic stroke in the Netherlands (MR CLEAN) and Endovascular Treatment for Small Core and Proximal Occlusion Ischemic StrokE (ESCAPE), show that these patients likely do benefit from endovascular therapy [4,5].

It remains debated which of the many approaches should be taken to address both the extracranial and intracranial portions of disease, the conventional strategies including carotid angioplasty with or without stenting before or after recanalization of the intracranial occlusion, or alternatively a staged approached with management of the extracranial stenosis/occlusion at a later date. ESCAPE investigators such as those at our site invariably addressed the intracranial occlusion first [1]. In this case report, we demonstrate a striking case of middle cerebral artery (MCA) territory salvage following tandem occlusion with carotid angioplasty during acute thrombectomy, followed by definitive stenting a week later.

2. Case report

A 45-year-old male smoker employed as a software executive with no significant past medical history was watching television when he attempted to rise from his chair and fell onto his left side. EMS was called. On arrival at a community hospital, he had left hemiparesis, left facial droop, left neglect, and right gaze deviation. A diagnosis of right middle cerebral artery (MCA) syndrome was suspected and proven on CTA (Fig. 1). NIHSS was determined to be 13, and he received intravenous tissue plasminogen activator (tPA) at 90 min post-ictus and was transferred to our comprehensive stroke centre for further treatment as there was no neurologic recovery.

On arrival at our institution, NIHSS was graded at 11 (1 point for level of consciousness, 2 for facial palsy, 2 for left motor arm, 2 for left motor leg, 2 for sensory, 1 for dysarthria, 1 for extinction and inattention). Computed tomography (CT) with angiography (CTA) and perfusion (CTP) demonstrated right MCA territory ischemia secondary to probable right ICA dissection with multiple focal thromboembolic occlusions including a large vessel occlusion at the M1 segment of MCA.

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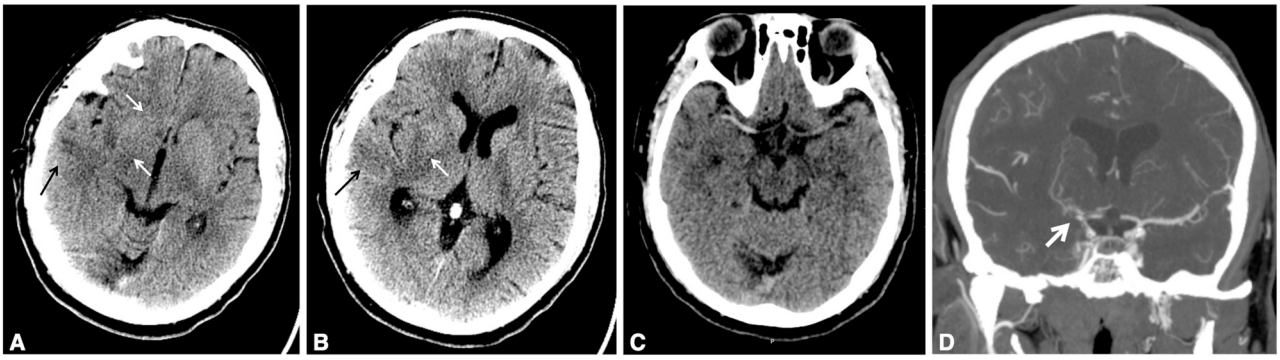

Fig. 1. NCCT (A and B) showing early ischemic changes in the caudate, putamen (thin white arrows) and temporal lobe (black arrow) on the right side. D. NCCT also showing the hyperdense MCA sign. E. Coronal CT angiogram showing right M1 MCA occlusion (thick white arrow).

A large area of perfusion mismatch in the right MCA territory was noted. The patient was felt to have good collateral circulation, and delayed images showed partial passage of contrast through the M1 occlusion.

Puncture time occurred at 4 h post-ictus. The procedure was performed under general anesthesia. A Flowgate balloon guide catheter (Stryker Neurovascular, Fremont CA, USA) was advanced to the right common carotid artery (CCA). Digital subtraction angiography (DSA) roadmap of right CCA demonstrated trickle flow of right ICA with focal near-occlusive plaque at the ICA origin (Fig. 2). Subsequent manipulation of a Transend 0.014-inch microwire (Stryker Neurovascular) showed complete cessation of flow in the right ICA. The microwire was further navigated across the occlusion and three-fold angioplasty with a 5 × 20 mm Aviator balloon (Cordis, Milpitas, CA, USA) with proximal flow arrest from balloon guide. Repeat AP and lateral cervical runs showed reopening of the occlusion with improved antegrade flow. Cervical and cranial runs showed right carotid terminus occlusion.

A Catalyst 6 distal access catheter (Stryker Neurovascular) was advanced to distal cervical ICA, and a Trevo-18 microcatheter (Concentric Medical) was navigated over the Transend 0.014-inch microwire to the distal ICA and ultimately the superior division of M2 distal to the clot. A Trevo XP Provue 4 × 20 mm Retriever (Concentric Medical) was deployed along the M1 segment, and transient bypass was observed. After 5 min with the stent fully deployed, thrombectomy was performed with proximal balloon guide flow arrest and simultaneous aspiration via the Catalyst 6 distal access catheter. Follow-up hand injections showed full recanalization of the M1 segment and near complete reperfusion of the right MCA branches with slow flow along the distal branches of the inferior division of M2 and distal M4 branch clot. The thrombolysis in cerebral infarction (TICI) score after recanalization was 2b. The final cervical run showed persistent effect of angioplasty, with 50–70% residual stenosis. The guiding catheter and the femoral sheath removed. AngioSeal (Terumo, Somerset NJ) was deployed at the right femoral artery.

At 24 h post thrombectomy, NIHSS assessed was scored at 4 (facial palsy 1, motor left arm 1, sensory 1, extinction 1). At this time, follow-up CT showed interval evolution of hypodensity in the right temporal lobe, insula, posterior lentiform nucleus and internal capsule in keeping with evolving infarct. No hemorrhagic transformation was present. CTA further demonstrated interval reconstitution of flow in the previously-occluded M1 segment of the right MCA and stable residual narrowing of the right ICA at 50–70%. A 24-hour magnetic resonance imaging (MRI) showed expected evolution of subacute infarcts (Fig. 2). The right carotid bifurcation stenosis showed intrinsic T1 shortening and susceptibility suggestive hemorrhagic plaque. At 72 h post-thrombectomy, NIHSS was scored at 1 (facial palsy). Echocardiogram demonstrated no cardiac source of emboli or valvular abnormality.

By day 7, facial palsy had also resolved, and the patient was brought back to the angiography suite for definitive stenting. The patient was preloaded with 325 mg of ASA and 75 mg of clopidogrel. The left femoral artery was accessed under ultrasound and an 8F sheath was inserted followed by a Flowgate balloon guide catheter (Stryker Neurovascular, Fremont CA, USA). AP and lateral cervical runs confirmed persistent high-grade stenosis, unchanged (Fig. 3). A Transend 0.014-inch microwire was navigated to the distal cervical ICA and a distal embolus protection device (Emboshield NAV6; Abbott Park, Illinois) was deployed. The decision was made not to pre-dilate the stenosis. A 10-7 × 40 mm Protege tapered stent (eV3) was advanced across the bifurcation and deployed. Repeat run showed slight improvement of the stenosis, and thus angioplasty with a 5 × 20 mm Aviator balloon (Cordis, Milpitas, CA, USA) was performed. A repeat run showed improvement of the stenosis (Fig. 4). In addition, the previously-seen right A1 non-occlusive thrombus had resolved. AngioSeal (Terumo, Somerset NJ) was deployed at the left femoral artery.

The patient was discharged with an NIHSS and mRS of 0. At six months, the patient had no residual deficit and returned to work at full capacity. A follow-up carotid duplex study demonstrated patency of the right carotid stent.

3. Discussion

The incidence of tandem occlusion is reported to be in the range of 20% (17% in ESCAPE, 32.3% MR CLEAN, 18.6% Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours (REVASCAT)) [4–6]. The rate of recanalization for carotid occlusion or near occlusion with systemic thrombolysis is known to be low, in the range of 9% with tandem ICA and MCA occlusions [7]. This likely relates to the fact that while the extracranial lesion does precipitate thrombus/platelet formation, the nidus is ultimately atherosclerotic plaque which is indifferent to intravenous tPA. Thus, endovascular therapy is largely considered appropriate when mechanical thrombectomy is already planned. We approached our patient as undifferentiated tandem occlusion, as it was not clear whether the patient fell due to hemiparesis from a spontaneous dissection, or whether the fall itself precipitated a traumatic dissection.

In our case, we demonstrate that despite the large ischemic penumbra demonstrated, there is a remarkable salvage of the majority of the MCA territory on follow-up MR as assessed by diffusion-weighted imaging (DWI) (Fig. 3). The subsequent question then pertains to

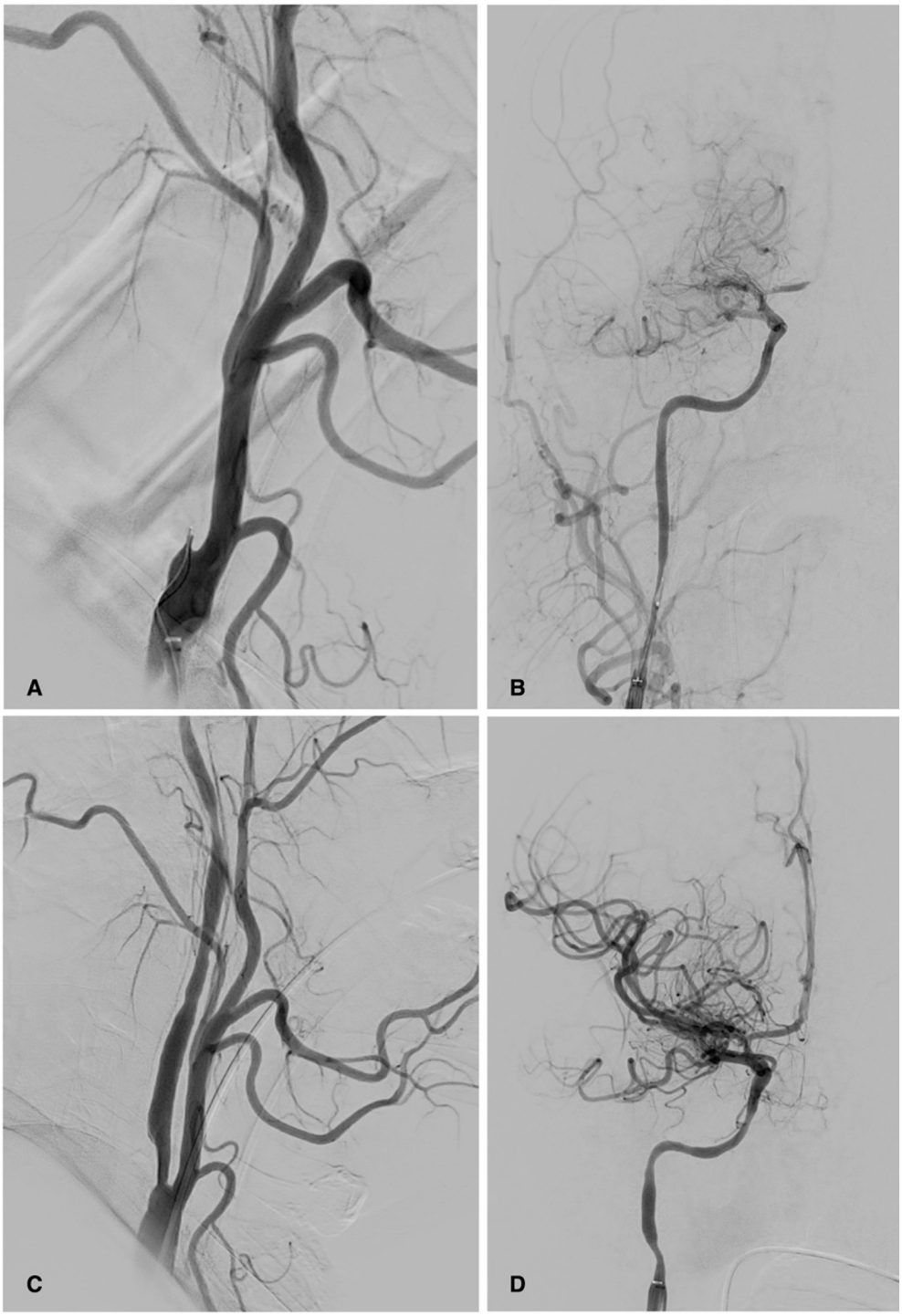

Fig. 2. Initial cervical (A) and cerebral (B) angiography demonstrates complete occlusion of the right internal carotid artery (ICA) origin with a tandem right MCA occlusion. Note the microwire just proximal to the ICA occlusion (A), the distal tip of the balloon guide catheter in the common carotid artery and the intermediate catheter beyond the ICA occlusion in the cervical right ICA (A and B). Final angiographic images demonstrate (C) post balloon angioplasty with reduction of the ICA stenosis from 100% to 70% and (D) TICI 3 intracranial recanalization.

whether the intracranial or extracranial occlusion should first be addressed, another point on which there is no consensus. Importantly, endovascular treatment of tandem occlusion was found to be safe in the two major trials permitting use of the technique [4,5]. In addition, case time was comparable to patients who did not have extracranial intervention. A recent meta analysis by Coelho et al. corroborates this generally except when same-session stenting is performed [8], whereas Wilson et al. suggest no difference in case time in the stenting group and good neurological outcome in more than half of patients [9].

At times, the neurointerventionalist will be unable to cross the stenosis with a catheter, even when a wire passes with ease. In such a situation, angioplasty and/or stenting becomes the mandatory first

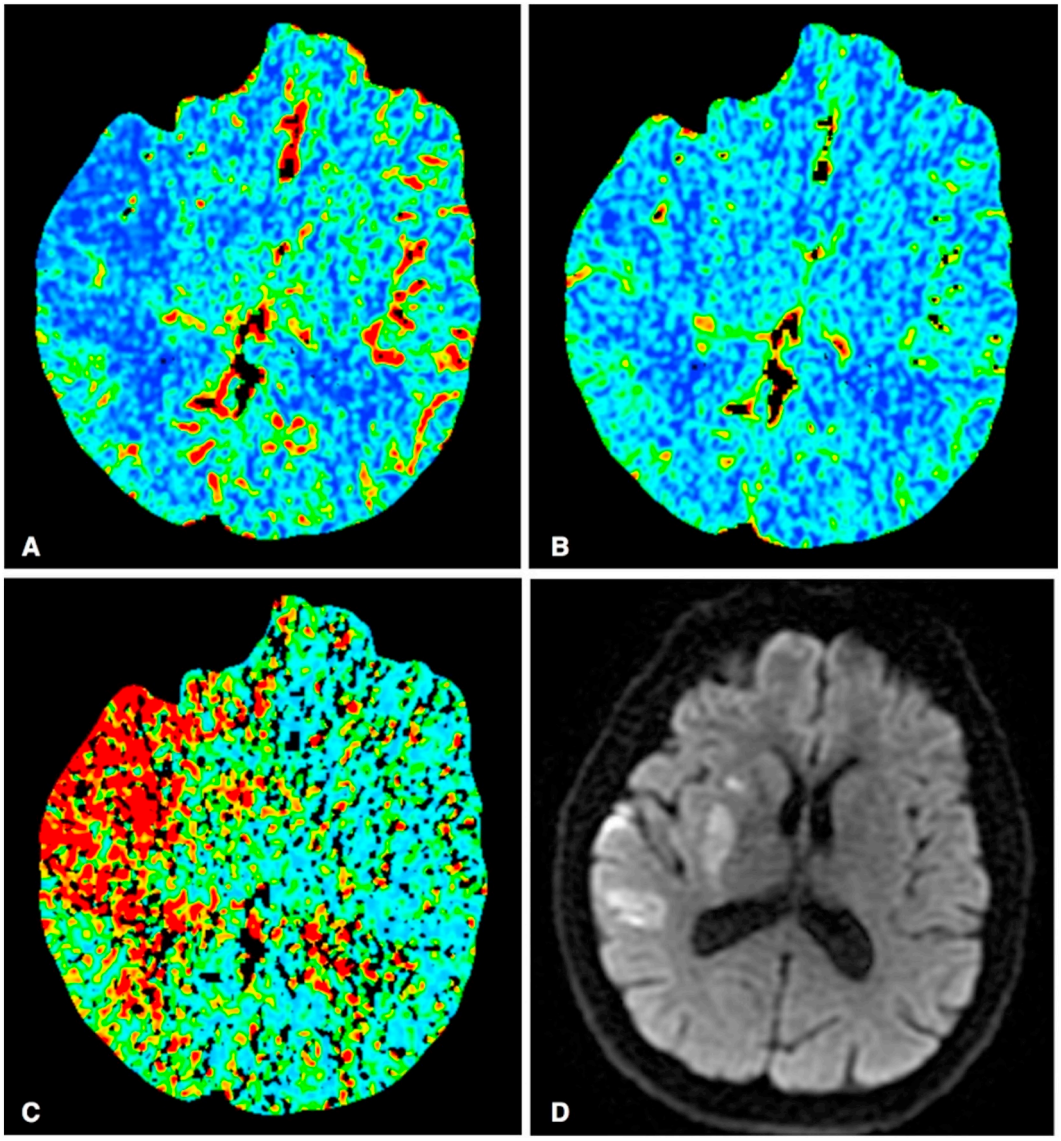

Fig. 3. Comparison of pre-procedural CT perfusion cerebral blood flow (A), cerebral blood volume (B) and mean transit time (C) images with DWI (D) obtained 48 h after the right ICA angioplasty and right carotid terminus and MCA occlusion shows salvage of a substantial proportion of the territory previously at risk.

manoeuvre. When it is not mandatory, proponents argue that improving the opportunity for collateral flow is an important way to reduce the rate of infarction. Moreover, access to the distal clot is easier and allows for a more facile thrombectomy/aspiration and withdrawal through the cervical carotid [10]. Conversely, those who prefer to correct the distal occlusion first argue that the "time is brain" law should remain the central dogma of acute stroke [8]. Although there is a theoretical risk of increased complications and distal embolization, it is currently unclear whether this is true in practice as the procedure appears safe. Distal protection devices are commonplace and dedicated devices are under development for mechanical thrombectomy [11]. In addition, angioplasty and stenting can conceivably require general anesthesia, which is undesirable for those who prefer to address large vessel occlusions under neuroleptanesthesia [12].

Lastly, there is considerable debate about when a stent should be placed, if indeed angioplasty is felt to be insufficient. In our case, we felt that the calibre of the ICA following angioplasty alone was insufficient to offset risk of recurrence. We elected to do this at day 7 not only because the effect of intravenous tPA is commonly accepted to be inconsequential by this time, but also because the patient had returned to an NIHSS and mRS of 0. The latter fact provided incentive to the patient and the multidisciplinary team that minimizing chance of recurrence was imperative. However, current evidence is unclear as to whether stents can be placed at the time of hyperacute intervention. The primary concern is that of superimposing antiplatelet agents to prevent instent thrombosis with systemic thrombolysis, with some studies showing an increase in intracranial hemorrhage [13]. Moreover, it is not clear whether this practice would be better-tolerated in patients who proceed directly to mechanical thrombectomy without thrombolysis, as this is not standard practice at this time.

Fig. 4. Lateral DSA before (A) and after (B) stenting with a 10-7 × 40 mm Protege stent and subsequent angioplasty (not shown). The stent remained patent and there is no NASCET-significant stenosis to-date.

4. Conclusion

We present a case of tandem occlusion treated with same-session MCA mechanical thrombectomy and ICA angioplasty followed by definitive stenting at 7 days, with remarkable radiological and clinical recovery from a potentially-devastating event. It remains unclear in which tandem lesions should be addressed, and the optimal time for stent placement.

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