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Efficacy of carotid thrombus penetration with a balloon guiding catheter to fast recanalization of acute extra- and intra-cranial carotid artery tandem occlusion - a preliminary report

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Abstract: Acute ischemic stroke with ipsilateral Internal carotid artery (ICA) stenosis presents a great management dilemma. We present our preliminary report of retrograde retrieval of clot from middle cerebral artery (MCA) followed by delayed carotid artery stenting (CAS) with dual anti platelet therapy (DAPT).
Key words: Carotid artery stenosis, Ischemic stroke, Carotid artery stenosis

Introduction

Ten-to-twenty percent of patients with acute ischemic stroke have a high-grade ipsilateral extracranial ICA stenosis, which usually causes major stroke if an additional intracranial large artery occlusion of the anterior circulation is present. (1,2) IV thrombolysis alone has a very limited rate of successful recanalization in such patients.(3) An option in such cases is endovascular therapy with stent implantation at the level of ICA stenosis along with mechanical thrombectomy. A major concern in these patients is the risk of post interventional symptomatic intracranial hemorrhage (sICH), which may be influenced by the mandatory antiplatelet medication of the stent-placement procedure, which has been reported to vary from 0% to 20%. (4-6)

The limited time duration for intervention in these patients along with delayed arrival of these cases to the neruointerventionists makes the task all the more difficult.

We describe our experience of retrograde retrieval of clot from middle cerebral artery (MCA) followed by delayed carotid artery stenting (CAS) with dual anti platelet therapy (DAPT).

Materials and methods

We included four cases in the present study. Patients presenting with sudden onset hemiparesis within four hours were included. These patients had an embolic intracranial vessel occlusion of the anterior circulation and at the same time presented with atherosclerosis-related high-grade cervical ICA stenosis or ICA occlusion. Patients with arterial dissections were excluded from this analysis. On admission, CT/CTA or MR imaging/MRA, including diffusion and perfusion imaging, was performed to evaluate the extension of the ischemic lesion and the potential tissue at risk (penumbra). Patients were selected for endovascular stroke treatment if they had CTA-proved vessel occlusion of the distal ICA or M1/2 segment and absence of early signs of an extensive and advanced infarction (more than one-third of the MCA territory) on CT- or MRA-proved vessel occlusion of the distal ICA or M1/2 segment, a DWI lesion less than one-third of the MCA territory.

Interventional procedure

All procedures were performed with the patient under local anesthesia. As vascular access, a 9F sheath was placed in the right common femoral artery. Then, a 9F guiding catheter was placed in the ipsilateral common carotid artery, and the cervical ICA stenosis was passed with a 0.035-inch microwire and 5-F JB2 coaxially. The balloon guide microcatheter was advanced through the thrombus in the MCA, and the tip was placed distal to the thrombus. For thrombectomy, the stenting device and microcatheter were simultaneously pulled back under continuous aspiration through the catheter. In case of incomplete recanalization, thrombectomy was repeated. This process clears the thrombus and paves way for the blood to flow with the stipulated time (Figure 1).

The patient is then placed on heparin for three days and dual anti platelet therapy (DAPT) and two weeks later, CAS is performed using a 9F sheath in the right common femoral artery, followed by 9F guiding catheter in the common carotid artery till ICA stenosis is passed. A self-expanding stent was advanced to cover the stenosis. After stent implantation, balloon dilatation was performed. If necessary, the stenosis was predilated with a percutaneous transarterial angioplasty balloon to allow fast access to the intracranial vasculature (Figure 2).

Angiographic images were analyzed regarding the following data: time to flow restoration (time interval between the first diagnostic angiographic image and the first image with evidence of re-established perfusion within the occluded MCA vessel segment), and time to complete revascularization (time interval between the first diagnostic image and the completion angiogram).

The breakage of primary thrombus and its emboli in the MCA leading to hemiparesis is dealt with in the emergency setting. Later, after heparin for three days and DAPT is given for 2 weeks, CAS is performed (Figure 3).

We avoided emergency simultaneous CAS due to high risk of in-stent thrombosis, as no anti platelets were used.

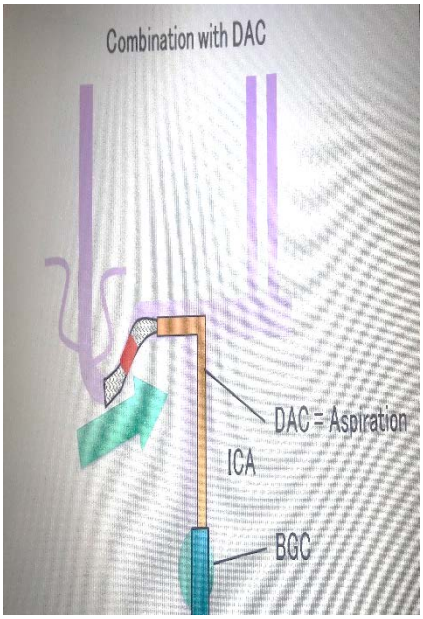

Figure 1

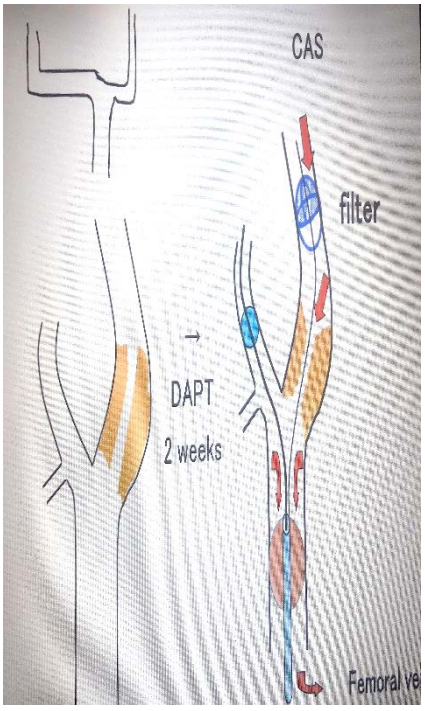

Figure 2

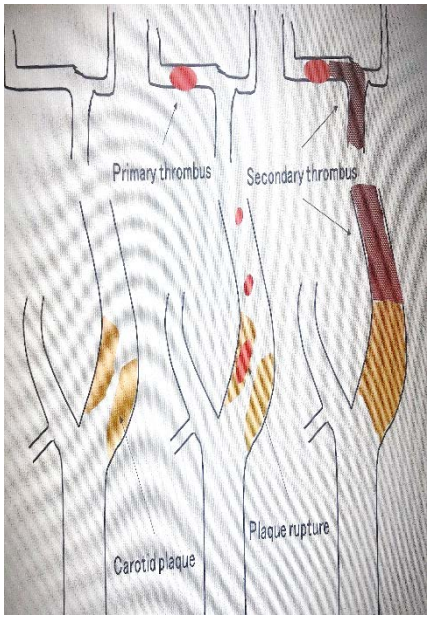

Figure 3

Illustrated case 1

A 62 years non- diabetic male presented with sudden onset left hemiparesis within three hours of onset. He had no previous history of medications. MRI DWI images suggested hyperintense signals in right MCA distribution (Figure 4). A 9F balloon guide catheter was inserted in ICA and its stenosis seen along with thrombus in right MCA. Emergent clot retrieval from right MCA was performed, and blood flow restored (Figure 5,6). Unstable plaque was noted in right ICA in the neck on MR imaging (Figure 7). Heparin was given for three days and DAPT for two weeks, following which CAS was performed (Figure 8).

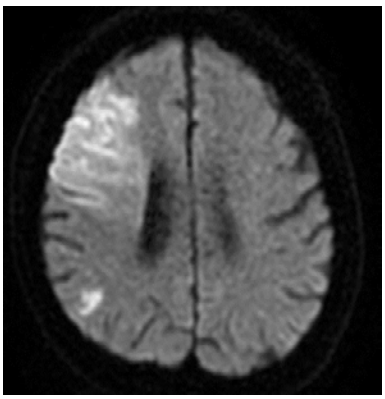

Figure 4

Figure 5

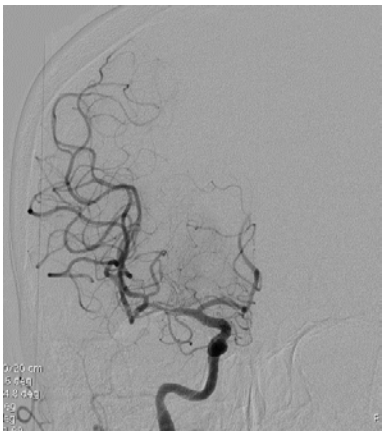

Figure 6

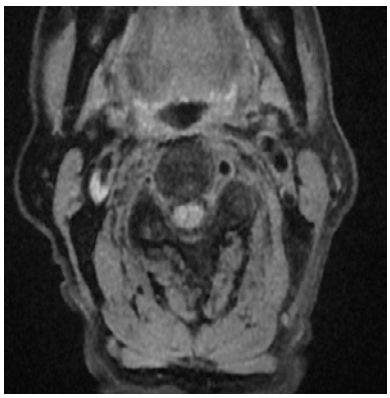

Figure 7

Figure 8

Illustrated case 2

A 73 years male presented with sudden onset right hemiplegia two hours after onset. MR imaging showed small left capsular infarct (Figure 9). Immediate DSA was performed which showed left ICA stenosis and thrombus in left MCA (Figures 10, 11). Emergent retrieval of the blood clot was done from the MCA and blood flow restored (Figure 12). MRI neck showed unstable plaque in left ICA (Figure 13). Heparin was given for three days and DAPT for two weeks. CAS was done after two weeks (Figure 14) in order to prevent in stent thrombosis.

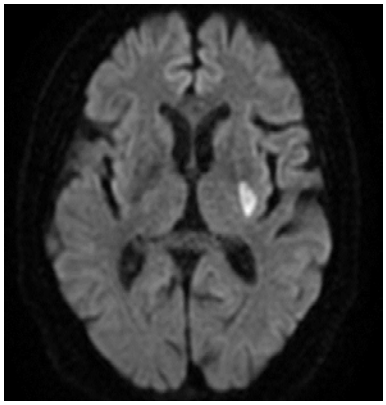

Figure 9

Figure 12

Figure 10

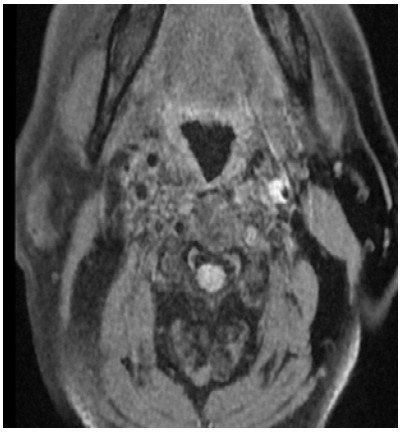

Figure 13

Figure 11

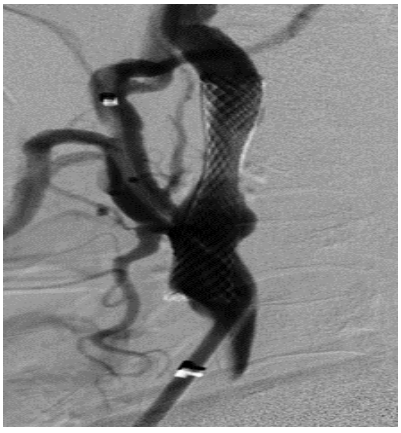

Figure 14

Discussion

In acute ischemic stroke, fast recanalization of the occluded vessel is probably the most important precondition for favorable clinical outcome.(7,8) However,< 20% of patients (9) with intracranial vessel occlusion have additional high-grade cervical ICA stenosis or even total occlusion. Interventional procedures are a promising treatment option using combination of ICA stent placement and intraarterial thrombolysis which seems to improve the outcome.(10)

The primary cause of symptoms and clinical outcome are mainly because of thrombus in the MCA rather than occlusion of the cervical ICA.(11) The lenticulostriate arteries (LSAs) are functional end-arteries without collateral. Thrombus in the proximal segment of the MCA may lead to occlusion of the orifices of these arteries and cause cerebral infarction.(12) The final status of LSAs and time for restoration of blood flow determines the outcome. In the absence of sufficient leptomeningeal collaterals, expansion of the infarct core into surrounding hypoperfused tissue occurs earlier. Several published studies of intra-arterial thrombolytic therapy indicate that treatment initiated within 3 to 4 hours of symptom onset is associated with higher rates of recanalization and better outcome.(13,14) Moreover, successful recanalization of ICA and MCA vessels may not reflect clinical outcome because of evolving cerebral infarction. Prompt reperfusion of initially still viable tissue and prevention of subsequent expansion of cerebral infarction are the critical factors to achieve a favorable neurologic outcome.

Usually micro guidewires and catheters can easily traverse the freshly occluded vessels, blind probing may result in vessel perforation or dissection or entering into the false lumen. Moreover, possibility of dislodgement of thrombus into the distal segment is always present. Emergent angioplasty of ICA carries an increased risk of hyperperfusion syndrome, although there are chances of higher recanalization rate but at the risk of expanding brain infarction.

The final status of LSAs and time for restoration of blood flow determines the outcome.

Previously, antegrade approach was performed in which firstly, CAS or carotid PTA was done followed by MCA clot retrieval. This may lead to valuable loss of time and ultimately, irreversible neurological deficit. We followed retrograde approach and MCA clot retrieval was done emergently. This was followed by DAPT for two weeks and heparin for three days. A 2mm lumen of ICA is kept for two weeks. Two weeks later, CAS was performed. An additional benefit apart from saving immediate valuable time in blood restoration was prevention of in stent thrombosis, as usage of DAPT for two weeks reduced it significantly.

Matsubara et al (15) published a report on 16 patients with acute cervical carotid occlusions caused by atherosclerosis, atrial fibrillation, or dissection. Ten of their patients had additional intracranial tandem occlusions. The patients were treated with various recanalization techniques. No stent retrievers were used. Recanalization was successful in a high number of patients with cervical

occlusion (81.3%). In 43.8% of their patients, successful extracranial and intracranial flow was reached. Although one-third of their whole patient cohort presented with a favorable clinical outcome, only 20% of their patients with cervical and intracranial occlusion reached an mRS score of 0–2. Malik et al (16) reported their experience with recanalization procedures of 77 patients with tandem occlusion. They used various recanalization devices and techniques and achieved a high recanalization rate (75.3%).

Not surprising, ICA stent implantation leads to a prolonged procedure time until recanalization. In one of our patients, the time taken for retrieval of clot from MCA was just under 11 minutes.

In carotid artery stent placement, antithrombotic medication is administered to prevent acute stent thrombosis. However, it bears a potential risk of intracranial hemorrhage. The antithrombotic treatment concept differs in the literature. In the study of Matsubara et al, (15) patients received a loading dose of aspirin and another antiplatelet drug, depending on the clinical conditions, if the postprocedural imaging showed no hemorrhage. The hemorrhage rate (6.3%) was low. The hemorrhage rate (10.4%) reported by Malik et al(16) was slightly higher. In their study, glycoprotein IIb/IIIa inhibitor was administered before stent placement, and an oral load of clopidogrel and aspirin was initiated if postprocedure imaging showed no hemorrhage.

We have further reduced the risk of thrombosis by using DAPT two weeks prior to CAS. None of our patients suffered post procedure hemorrhage and all had an improved outcome. The data published by Heck and Brown(17) and Stampfl et al(18)was 21% and 17% respectively for spontaneous ICH. The high rate of sICH in the Heck and Brown cohort might be associated with the use of abciximab and a high mean age of their patients.

Several limitations have to be considered when interpreting the current data, most important a small study design, and the missing control groups which might have biased. The usage of the retrograde technique was at the sole discretion of the endovascular neurosurgeon.

Conclusion

Emergent clot retrieval from the MCA followed by two weeks of DAPT and then finally CAS appears an effective way to reduce the valuable time in these ischemic patients along with faster restoration of blood flow. The authors clearly understand that more patients are needed to validate the results.

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