Stent-Assisted Thrombolysis in Acute Tandem Carotid and Middle Cerebral Arteries Occlusion

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Intravenous thrombolysis was reported as an alternative treatment, safe and effective, within 3 hours after onset of stroke due to dissection [1]. However, tandem occlusion independently predicts poor outcome after IVT [2]. Recently, stent-assisted endovascular thrombolysis has been performed with some success in patients with acute tandem occlusion and internal carotid artery dissection [3,4]. We report a case of ICA dissection and occlusion combined with middle cerebral artery embolic occlusion, causing a major stroke, which was successfully treated with multiple self-expandable cervical and intracranial stents and intraarterial thrombolysis.

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A 45 year old right-handed man was admitted to our hospital 2.25 hours after an acute episode of aphasia, right-sided hemiplegia, hypoesthesia, and hemianopsia followed by deterioration in consciousness. The National Institutes of Health Stroke Scale (NIHSS) score was 22. His medical history was unremarkable. Head computed tomography demonstrated subtle hypodensity of the left insular ribbon, lentiform nucleus, corona radiata, and body of caudate nucleus, with hemispheric cortico-subcortical sparing. Cervical and cerebral CT angiography revealed complete occlusion of the left ICA and occlusion of the left MCA. The left anterior cerebral artery was visible, with the left ICA supplying both ACAs.

The patient was intubated and angiography was started 4 hours after symptom onset. Endovascular treatment was performed under general anesthesia with an 8F access sheath placed in the right femoral artery. Selective angiography of the left common carotid artery showed a flame-like ICA occlusion and confirmed the diagnosis of ICA dissection [Figure A]. Left hemispheric circulation as analyzed on the right carotid angiogram showed that the A1 segment of the left ACA and the T segment of the left ICA were filled via the anterior communicating artery [Figure B]. The left MCA was occluded at the origin of the lateral lenticulostrate arteries [Figure B].

At the beginning of the procedure the patient received a 2500 IU heparin bolus intravenously. After passing the occluded left ICA dissection with a Vasco microcatheter (Balt, Montmorency, France) and a 0.014 inch guide wire (Transend, Boston Scientific, USA), urokinase (1,600,000 units total dose) was infused at the MCA occlusion [Figure C]. After 40 minutes, angiography showed a complete proximal recanalization of the MCA with residual filling defects in MCA branches. Embolic occlusions of MCA branches were mechanically removed with the aid of a thromboaspiration device (Penumbra...
System, Alameda, CA, USA). ICA recanalization was achieved after implantation of two self-expandable microstents (Leo stent, Balt, Montmorency, France) and a nitinol carotid stent, in a telescoped fashion, to fully cover the petrous and cervical portions of the ICA [Figures D & E]. There was no periprocedural complication. Head CT scan did not show any hemorrhagic transformation, and the patient received clopidogrel (300 mg loading dose followed by 75 mg daily) and aspirin (100 mg daily). He was transferred to the intensive care unit and was extubated the day after interventional therapy. At the end of day 1, he was alert and oriented, presented moderate pure motor dysphasia and moved his four limbs without paresis. CT scan follow-up showed petechial hemorrhages in the frontotemporal area as a sign of reperfusion [Figure F]. On day 6, the patient presented isolated motor dysphasia and was discharged on clopidogrel for 3 months and aspirin indefinitely. He had a favorable outcome at 30 days follow-up (NIHSS 2, modified Rankin scale 1).

**COMMENT**

Our patient, presenting with tandem occlusion and ICA dissection within 3 hours after ischemic symptom onset, was eligible for IVT. However, in the presence of tandem occlusion, ICA occlusion reduces the delivery of recombinant tissue plasminogen activator into the thrombus in the MCA. Furthermore, hemodynamic mechanisms are significant after a major vessel occlusion and may be at least as crucial as thrombotic ones. For all these reasons, and because of the poor chance of revascularization with IVT, we decided on an endovascular approach combining endovascular revascularization and intraarterial thrombolysis. It must be stressed that most cases of ICA dissection do not need endovascular treatment. Most ischemic events secondary to ICA dissection are embolic and thus anticoagulation is usually indicated in the early stages of the disease.

Recently, endovascular treatment with stent deployment for ICA dissection has been proposed in selected cases with hemodynamic stenosis or when anticoagulation failed to prevent embolic stroke [5]. Additionally, stent-assisted endovascular thrombolysis was recently used with some success in a group of patients who had acute tandem occlusion following dissection [3,4].

Lavallée et al. [3] compared the clinical outcomes of 10 consecutive patients presenting with tandem occlusion and ICA dissection within 3 hours after symptom onset, treated by either endovascular stent-assisted thrombolysis (6 patients) or intravenous rt-PA when an endovascular therapist was unavailable (4 patients). Before treatment, mean NIHSS scores were high and comparable in the two groups, but the 3 month outcome was worse in the IVT group. In the endovascular group, four patients (66.6%) had a favorable outcome (mRS = 0), while three patients (75%) in the intravenous rt-PA group had a poor outcome (mRS ≥ 3).

There are three major benefits of endovascular stent-assisted thrombolysis [5]. First, immediate recanalization of ICA blood flow allows direct access to the MCA thrombus with thrombolytic therapy. Second, the deployment of the stent along the length of dissection, covering the intimal tear, reduces the risk of early reocclusion, potential cerebral emboli, and new stroke by hemodynamic mechanisms. Third, no routine anticoagulation is required after the procedure. However, due to the stent implantation, antiplatelet therapy was necessary in this patient.

The main difficulty of treatment with stent-assisted endovascular thrombolysis is navigating the microcatheter through the true arterial lumen of the occluded segment [5]. The theoretical risks include distal embolism, vascular perforation, and enlargement of the dissection. The microcatheter placed above the level of the occlusion allowed us to inject contrast in order to be sure of its position in the true arterial lumen. Then, after achieving MCA recanalization, the same microcatheter was used for placement of...
the telescopied self-expandable stents at petro-cervical locations.

These stents were originally designed for stent-assisted coil embolization and are more flexible than those usually used for cervical atherosclerotic stenosis. This characteristic, associated with good vessel adaptability, adequate radial strength, and a low-profile, make the stents a good option for petro-cervical dissections.

Endovascular stent placement associated with intraarterial thrombolysis may be an immediately effective, safe and attractive alternative treatment for symptomatic tandem occlusion with ICA and associated with intraarterial thrombolysis. These stents were originally designed with carotid artery dissection. Further large randomized studies are required to confirm the data and determine the indication and the optimal endovascular approach.

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References

Capsule

Structural insights into the assembly and activation of IL-1β with its receptors

Interleukin 1β (IL-1β) is a key orchestrator of inflammation and host defense that exerts its effects through IL-1 receptor type I (IL-1RI) and IL-1 receptor accessory protein (IL-1RacP). How IL-1RacP is recruited by IL-1β–IL-1RI to form the signaling-competent complex remains elusive. Wang et al. present the crystal structure of IL-1β bound to IL-1 receptor type II (IL-1RII) and IL-1RacP. IL-1β–IL-1RII generated a composite binding surface to recruit IL-1RacP. Biochemical analysis demonstrated that IL-1β–IL-1RI and IL-1β–IL-1RII interacted similarly with IL-1RacP. It also showed the importance of two loops of IL-1 receptor antagonist (IL-1Ra) in determining its antagonism. These results provide a structural basis for assembly and activation of the IL-1 receptor and offer a general cytokine-receptor architecture that governs the IL-1 family of cytokines.

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Eitan Israeli

Capsule

The CRISPR/Cas bacterial immune system cleaves bacteriophage and plasmid DNA

Bacteria and Archaea have developed several defense strategies against foreign nucleic acids such as viral genomes and plasmids. Among them, clustered regularly interspaced short palindromic repeats (CRISPR) loci together with cas (CRISPR-associated) genes form the CRISPR/Cas immune system, which involves partially palindromic repeats separated by short stretches of DNA called spacers, acquired from extrachromosomal elements. It was recently demonstrated that these variable loci can incorporate spacers from invading bacteriophages and then provide immunity against subsequent bacteriophage infections in a sequence-specific manner. Gameau et al. show that the Streptococcus thermophilus CRISPR1/Cas system can also naturally acquire spacers from a self-replicating plasmid containing an antibiotic-resistance gene, leading to plasmid loss. Acquired spacers that match antibiotic-resistance genes provide a novel means to naturally select bacteria that cannot uptake and disseminate such genes. The authors also provide in vivo evidence that the CRISPR1/Cas system specifically cleaves plasmid and bacteriophage double-stranded DNA within the proto-spacer, at specific sites. These data show that the CRISPR/Cas immune system is remarkably adapted to cleave invading DNA rapidly and has the potential for exploitation to generate safer microbial strains.

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“Whatever you want to say, there is only one noun to express it, one verb to animate it and one adjective to qualify it”

Guy de Maupassant (1850-1893), popular French writer, considered one of the fathers of the modern short story