Containing a Clot in the Mid-Basilar Artery Using a Self-Expandable Stent to Prevent Distal Clot Migration during Intra-Arterial Thrombolysis

A Case Report

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Summary

During local intra-arterial thrombolysis (LIT), management of the secondary embolization of a fragmented or dislodged clot can be cumbersome. The fate could be dismal if without pursuit and lysis of the migrated clot. Recently, we successfully managed a patient with acute ischemia due to a large clot impinged in the mid basilar trunk while avoiding distal migration of the clot by containing the impinged clot using a self-expandable stent during LIT.

Introduction

Although to date, the occurrence and significance of clot fragmentation and distal migration during local intra-arterial thrombolysis (LIT) have not been systematically addressed, it is quite common to observe this phenomenon during LIT. It is well-known that clot fragmentation and distal migration are common even when using clot retrieval devices¹. Distal clot migration may hamper the success of a procedure, especially when migrated clots further occlude the arteries having clinically significant perforators or cortical branches. In cases of vertebrobasilar embolic occlusion, the fate of the distal migration could be dismal if we fail to lyse a clot that has migrated and lodged in the

basilar tip^{2,3}. Recently, we successfully managed this situation without distal migration of the clot by containing the impinged clot in the mid portion of the basilar trunk using a self-expandable stent during LIT.

Case Report

An 80-year-old woman presented at our emergency room with sudden vertigo. The interval between the onset of her symptoms and initial neurological examination performed by a neurologist was 70 minutes. On brief neurological examination, she was obtunded but arousable with significant hearing difficulty. Up-beating nystagmus and weakness of the right extremities (MRC grade IV/V) were noted. Her initial National Institutes of Health Stroke Scale (NIHSS) score was 9, but her neurological symptoms gradually progressed.

She had been diagnosed as having atrial fibrillation two months previously and had been placed on aspirin. Her initial systolic/diastolic blood pressure was 165/88 mmHg, pulse rate 114 beat/min., and blood glucose level 150 mg/dL.

As her initial head CT did not show any abnormality, a reduced dose of t-PA (Actylase, Boehringer-Ingelheim, Germany, 0.6 mg/kg) was given intravenously as a bridging treat-

Figure 1 Initial magnetic resonance images. A) On DWI, subtle high-signal lesions were noted in AICA territories. B) Contrast enhanced MR angiography shows segmental non-visualization of the proximal basilar trunk.

ment for possible LIT with the impression of posterior circulation ischemia. Multimodal MR imaging which included fluid-attenuated inversion recovery, gradient echo imaging, diffusion-weighted imaging (DWI), perfusion-weighted imaging, and MR angiography (MRA), were immediately performed. On DWI, subtle high-signal lesions were noted in both anterior inferior cerebellar artery (AICA) territories. A sig-

nificant volume of perfusion abnormality was noted in the left posterior cerebral artery (PCA) territory and in the entire cerebellum. MRA showed segmental non-visualization of the proximal basilar trunk. The right PCA was filled from the right internal carotid artery (ICA) through the posterior communicating artery (Figure 1A,B). Subsequent catheter angiography revealed occlusion of the mid basilar trunk by a well-defined, oval-shaped filling defect which directly occluded both AICAs (Figure 2A,B).

As already documented by Mayer et al⁴, we assumed that distal migration of the fragmented or partially lysed clot would be inevitable. To prevent clot migration, we decided to place a self-expandable metallic stent (Neuroform, Boston Scientific Corp., Fremont, CA, USA) to contain the clot between the stent mesh and the arterial wall. Antiplatelets, i.e. aspirin 100 mg and clopidogrel 300 mg, were given through her nasogastric tube.

The stent (4 mm in diameter and 20 mm in length) was successfully placed through the occlusion segment over a microwire (Transend; Boston Scientific Corp.) which was carefully passed over the occluded segment. The control angiogram obtained immediately after stenting revealed profuse antegrade flow through the

Figure 2 Initial angiographic images obtained using a microcatheter. A) The anterior-posterior view shows a well-defined, oval-shaped filling defect impinging in the mid-portion of the basilar trunk. The branches of both anterior inferior cerebellar arteries are missing. Filling of the distal basilar artery is very faint. B) The lateral view of the selective angiogram was obtained after passing a microcatheter beyond the occluded segment. Branches of the posterior cerebral artery are missing because of the unopacified flow from the internal carotid artery.

Figure 3 A) A collection of serially obtained lateral views of the right vertebral arteriogram. Flow through the stented segment was restored as soon as the stent was deployed. Gradual decrease of the filling defect caused by the contained clot was noted during the local infusion of urokinase. The residual filling defect had disappeared on the 24-hour follow-up CT angiogram. B) Final angiogram shows patent left PCA, both SCA, and left AICA.

partially expanded lumen of the stent. The tip of a microcatheter was placed just proximal to the filling defect for local infusion of urokinase (10,000 IU/min.). The control angiograms revealed gradual decrease of the volume of the filling defect, and there was no visible distal clot migration. We stopped the infusion when a total amount of 300,000 IU was administered because the patient showed improvement of her symptoms despite a small residual filling defect (Figure 3). The patient's NIHSS score at that time point was 2 due to her mild ataxia and dysarthria.

The CT angiogram obtained the following day revealed complete resolution of the filling defect with good patency of the stent (Figure 3). Follow-up DWI revealed evolution of the infarction involving both AICA territories but without an additional lesion. The patient was discharged on dual antiplatelets with some residual hearing difficulty.

Discussion

Combining both pharmacological and mechanical thrombolytic techniques has become a common technical method of LIT⁵. Migration of the fragmented clots during LIT is a frequent incident heralding a good response to

the procedure in most cases. We usually pursue the clot using a microcatheter/wire for further lysis of the clot if the fragments are still in the proximal portion of the affected territory or if they still compromise the flow of the major perforating arteries. In that sense clot migration is usually regarded as a sign of successful LIT.

However, distal migration could be deleterious in some situations, which might have been true in this patient as well. Occlusion of the tip of the basilar artery might have been inevitable if we had applied the conventional LIT method in this specific patient who showed a large clot lodged in and firmly clogging the mid-portion of the basilar artery without any occlusion distally. Even with the MERCI device, as with other mechanical retrieval devices, we cannot guarantee complete clot removal without any distal clot migration^{1,4,6}.

Use of a balloon-expandable stent is another option. Unlike elective intracranial stenting for atherosclerotic stenosis, however, stenting an occluded artery in an acute ischemic lesion may have some limitations such as the difficulty in choosing the optimal stent diameter, over-expansion of the affected artery by the inevitable mass effect of the clot itself, and limitations in stent delivery to the target lesion. In other re-

spects, a self-expandable stent is relatively easy to deliver and has a wider latitude in the selection of the stent diameter. The relatively low radial force of the currently available intracranial self-expandable stents may carry a lower possibility of arterial injury⁷. Furthermore the self-expanding design may help the stent continuously accommodate to the size of the gradually increasing lumen during lysis of the lodged clot over time⁸.

There have been several reports regarding the successful application self-expandable stents as a primary or adjuvant method of intra-arterial thrombolysis. The technique can be

used as a rescue maneuver in cases of recalcitrant occlusion^{5,8,9}.

In conclusion, we successfully managed a mid-basilar embolic occlusion with LIT. We managed to avoid distal clot migration by containing the clot using a self-expandable stent during local infusion of thrombolytics.

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References

- 1 Liebig T, Reinartz J et Al: Comparative in vitro study of five mechanical embolectomy systems: effectiveness of clot removal and risk of distal embolization. *Neuroradiology* 50: 43-52, 2008.
- 2 Schulte-Altedorneburg G, Bruckmann H et Al: Ischemic and hemorrhagic complications after intra-arterial fibrinolysis in vertebrobasilar occlusion. *Am J Neuroradiol* 28: 378-381, 2007.
- 3 Cross DT, 3rd, Moran CJ et Al: Relationship between clot location and outcome after basilar artery thrombolysis. *Am J Neuroradiol* 18: 1221-1228, 1997.
- 4 Mayer TE, Hamann GF, Brueckmann HJ: Treatment of basilar artery embolism with a mechanical extraction device: necessity of flow reversal. *Stroke* 33: 2232-2235, 2002.
- 5 Lee DH, Na DG et Al: Review of the current status of intra-arterial thrombolysis for treating acute cerebral infarction: a retrospective analysis of the data from multiple centers in Korea. *Korean J Radiology* 8: 87-93, 2007.
- 6 Bergui M, Stura G et Al: Mechanical thrombolysis in ischemic stroke attributable to basilar artery occlusion as first-line treatment. *Stroke* 37: 145-150, 2006.
- 7 Howington JU, Hanel RA et Al: The Neuroform stent, the first microcatheter-delivered stent for use in the intracranial circulation. *Neurosurgery* 54: 2-5, 2004.
- 8 Fitzsimmons BF, Becske T, Nelson PK: Rapid stent-supported revascularization in acute ischemic stroke. *Am J Neuroradiol* 27: 1132-1134, 2006.
- 9 Sauvageau E, Levy EI: Self-expanding stent-assisted middle cerebral artery recanalization: technical note. *Neuroradiology* 48: 405-408, 2006.

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