

## CORRESPONDENCE

# Successful endovascular treatment of acute ischemic stroke with persistent hemorrhagic transformation

The most serious complication of intravenous thrombolysis is intracranial hemorrhage, which could lead to poor functional outcomes and high mortality. Therefore, acute ischemic stroke patients with a high risk of bleeding are contraindicated for intravenous thrombolysis. With improvements in devices and advanced techniques, endovascular therapy is increasingly used to treat patients with acute ischemic stroke who are not eligible for intravenous thrombolysis due to high risk of bleeding.<sup>1-4</sup> We performed a safe and successful endovascular recanalization on a patient with acute ischemic stroke due to middle cerebral artery (MCA) occlusion who had a recent cerebral infarction with persistent hemorrhagic transformation in the same territory.

A 70-year-old female was admitted with acute symptoms of right hemiplegia and global aphasia. Endovascular therapy was performed successfully to treat her acute ischemic stroke with left MCA occlusion. Although follow-up brain magnetic resonance imaging (MRI) showed hemorrhagic transformation in the left basal ganglia, her neurologic deficits gradually improved. She had atrial fibrillation and a history of mitral valve replacement surgery. However, anticoagulation was not initiated due to persistent hemorrhagic transformation on follow-up brain computerized tomography (CT). One month after discharge, she was readmitted to our hospital presenting with global aphasia and right hemiplegia. Brain MRI and MR angiography in emergency room showed a left MCA occlusion and an acute ischemic change in the left frontotemporal cortical area. The previous hemorrhagic transformation in the left basal ganglia was observed to be persistent by gradient echo (GRE) (Figure 1 A, B, C). Therefore, intravenous thrombolysis was ineligible as an acute treatment. Endovascular therapy using a Trevo device was performed and successful recanalization was achieved (Figure 1 D). A post-procedure brain CT and a brain MRI 24 hours after the endovascular therapy did not show new intracranial hemorrhage or extension of the previous hemorrhagic transformation in the left basal ganglia (Figure 1 E, F). Three months after discharge, the patient's neurologic deficits gradually recovered to a modified Rankin Scale (mRS) score of 3. She was able to speak simple words and to comprehend language.

Hemorrhagic transformation (HT) is a complication of acute ischemic stroke, often resulting in significant long-term morbidity and mortality. HT is categorized based on radiological features: hemorrhagic infarction and parenchymal hematoma which have different prognostic implications.<sup>5</sup> Because the fundamental mechanisms responsible for HT include increased permeability and disruption of the blood-brain barrier, intravenous thrombolysis is not indicated for patients with acute ischemic stroke who have intracranial hemorrhage.

In a recent report with retrospective analysis, successful recanalization after endovascular therapy was significantly and negatively associated with intracerebral hemorrhage.<sup>6</sup> Results of recent successful endovascular therapy trials also indicate relatively low occurrence rates of symptomatic intracerebral hemorrhage after recanalization treatment using stent-retriever based mechanical thrombectomy. The rates of symptomatic intracerebral hemorrhage were 7.7, 0, 3.6, and 0% in the endovascular therapy arms of the MR CLEAN, EXTEND-IA, ESCPAE, and SWIFT-PRIME trials, respectively.<sup>1-4,7</sup> According to the recent meta-analysis, compared with medical treatment, endovascular therapy may increase the risk of asymptomatic intracranial hemorrhage, but not the risk of symptomatic intracranial hemorrhage in patients with acute ischemic stroke due to large vessel occlusion.<sup>8</sup> Therefore, endovascular therapy may be an alternative reperfusion therapy for patients with acute ischemic stroke who are ineligible for intravenous thrombolysis due to absolute contraindication such as intracranial hemorrhage.

Our patient had a recent large ischemic stroke and persistent hemorrhagic transformation, which were definite contraindications for intravenous thrombolysis. However, the remaining hemorrhagic transformation in the left basal ganglia had no mass effect and the size of ischemic lesion was small on diffusion weighted image (DWI) upon the patient's second presentation at our hospital. For this reason, endovascular therapy was proceeded as an alternative therapy for acute ischemic stroke with a consent of patient's family. Successful recanalization was achieved and no new intracranial hemorrhage was observed. Her initial neurologic deficits partially improved after the endovascular therapy. Although

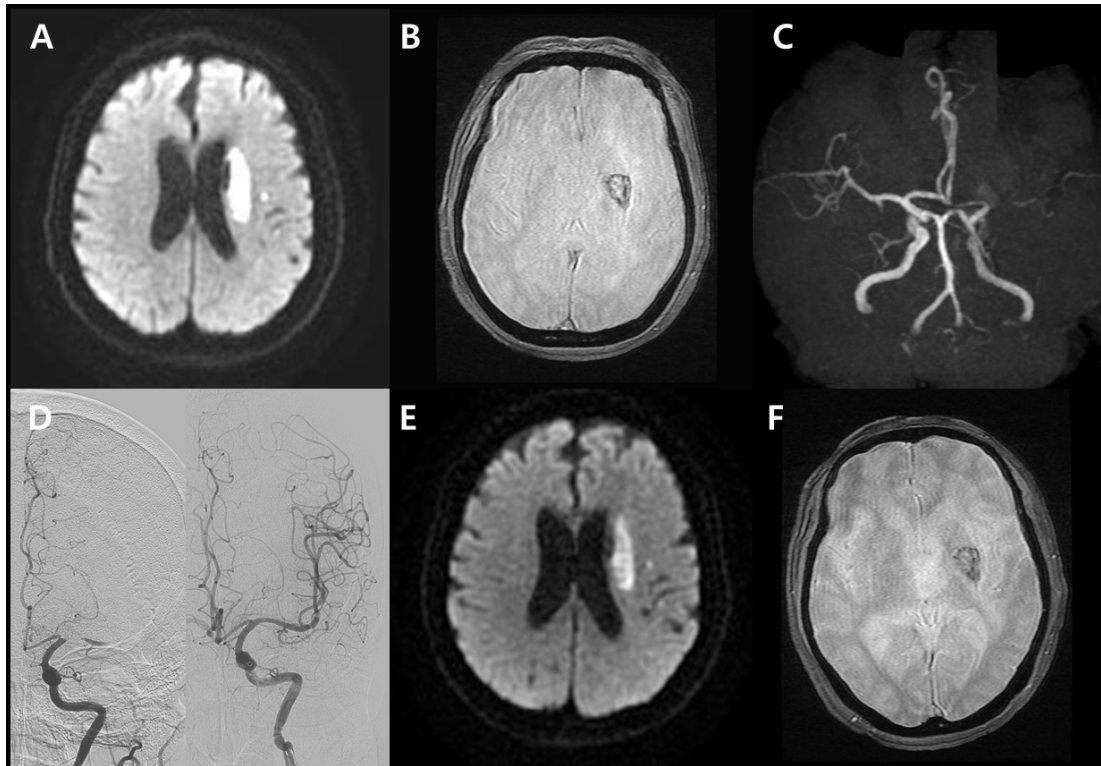


Figure 1. Initial Brain MRI and Successful endovascular treatment, follow-up brain MRI (A) Axial DWI shows a lesion with restricted diffusion in the left basal ganglia and border zone area. (B) Persistent hemorrhagic transformation after a recent cerebral infarction on GRE image. (C) Left proximal MCA occlusion on MRA. (D) Cerebral angiography shows complete recanalization of the left MCA after mechanical thrombectomy. (E, F) There was no remarkable change of the initial acute ischemic lesion volume on the follow-up DWI. The hemorrhagic transformation was also not increased on the follow-up GRE image 24 hours after endovascular recanalization treatment. Abbreviation: DWI, diffusion weighted imaging; MRI, magnetic resonance imaging; MRA, magnetic resonance angiography; GRE, gradient echo; MCA, middle cerebral artery

it was very rare and anecdotal case report, it reproved safety of endovascular therapy. Endovascular therapy using stent-retriever might be considered as an alternative therapeutic option for patients with acute ischemic stroke due to large vessel occlusion who are not eligible intravenous thrombolysis even there is hemorrhagic transformation in the same territory of the brain.

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## REFERENCES

1. Berkhemer OA, Fransen PS, Beumer D, *et al.* A randomized trial of intraarterial treatment for acute ischemic stroke. *N Engl J Med* 2015;372:11-20.

2. Goyal M, Demchuk AM, Menon BK, *et al.* Randomized assessment of rapid endovascular treatment of ischemic stroke. *N Engl J Med* 2015;372:1019-30.
3. MacIsaac RL, Khatri P, Bendszus M, *et al.* A collaborative sequential meta-analysis of individual patient data from randomized trials of endovascular therapy and tpa vs. Tpa alone for acute ischemic stroke: Thrombectomy and tpa (treat) analysis: Statistical analysis plan for a sequential meta-analysis performed within the vista-endovascular collaboration. *Int J Stroke* 2015;10(Suppl A100):136-144
4. Campbell BC, Mitchell PJ, Kleinig TJ, *et al.* Endovascular therapy for ischemic stroke with perfusion-imaging selection. *N Engl J Med* 2015;372:1009-18.
5. Hacke W, Kaste M, Fieschi C, *et al.* Intravenous thrombolysis with recombinant tissue plasminogen activator for acute hemispheric stroke. The european cooperative acute stroke study (ecass). *Jama* 1995;274:1017-25.
6. Wang DT, Churilov L, Dowling R, *et al.* Successful recanalization post endovascular therapy is associated with a decreased risk of intracranial haemorrhage: A retrospective study. *BMC neurology* 2015;15:185.
7. Powers WJ, Derdeyn CP, Biller J, *et al.* 2015 american heart association/american stroke association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: A guideline for healthcare professionals from the american heart association/american stroke association. *Stroke* 2015;46:3020-35.
8. Hao Y, Zhang Z, Zhang H, *et al.* Risk of intracranial hemorrhage after endovascular treatment for acute ischemic stroke: Systematic review and meta-analysis. *Interv Neurol* 2017;6:57-64