

Severe Vasospasm of the Middle Cerebral Artery after Mechanical Thrombectomy Due to Infective Endocarditis: An Autopsy Case

Wataru Nishino, MD,* Yosuke Tajima, MD, PhD,* Toru Inoue, MD, PhD,†
 Michihiro Hayasaka, MD,* Bi Katsu, MD,‡ Koichi Ebihara, MD,*
 Daisuke Kawauchi, MD,* Masaaki Kubota, MD,* and Sumio Suda, MD*

Untreated infective endocarditis (IE) often produces infective emboli in major cerebral arteries. We describe a case of middle cerebral artery occlusion due to IE, which caused severe vasospasm and reocclusion after mechanical thrombectomy (MT). We present the pathologic findings of the occluded middle cerebral artery and investigate the precautions to be taken while performing MT due to IE. A 72-year-old man with atrial fibrillation treated with dabigatran presented with right hemiparesis and aphasia. A diffusion-weighted image showed a high-intensity area in the left temporoparietal junction, and magnetic resonance angiography revealed a left M2 occlusion. Because of an elevated activated partial thromboplastin time, the thrombolytic therapy was contraindicated; instead, MT was performed. Just after the withdrawal of a stent retriever, the left M2 segment showed severe vasospasm. The next day, the left M2 segment reoccluded. Transthoracic echocardiogram and blood culture findings revealed IE. On the ninth day, the patient died. According to the autopsy report, the cause of death was pulmonary embolism. Pathologic analysis of the occluded M2 segment revealed fibrin thrombi containing vast amounts of neutrophils and invasion of neutrophils into the internal elastic lamina. Severe vasospasm was thought to have occurred because the vascular injury caused by the stent retriever in the vessel had a marked inflammation background. Our findings suggest that devices that are less invasive to the vascular wall are required for performing MT due to IE. The Penumbra aspiration system is thought to be a suitable device. **Key Words:** Infective endocarditis—mechanical thrombectomy—severe vasospasm—middle cerebral artery. © 2017 National Stroke Association. Published by Elsevier Inc. All rights reserved.

From the *Department of Neurosurgery; †Department of Pathology; and ‡Department of Cardiology, Kimitsu Chuo Hospital, Kisarazu City, Chiba, Japan.

Received April 27, 2017; revision received May 15, 2017; accepted June 1, 2017.

Address correspondence to Yosuke Tajima, MD, PhD, Department of Neurosurgery, Kimitsu Chuo Hospital, 1010 Sakurai, Kisarazu City, Chiba 292-8535, Japan. E-mail: tajima5615@yahoo.co.jp.

1052-3057/\$ - see front matter

© 2017 National Stroke Association. Published by Elsevier Inc. All rights reserved.

<http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2017.06.002>

Introduction

Untreated infective endocarditis (IE) often produces infective emboli in major cerebral arteries.¹ A few articles have reported on successful mechanical thrombectomy (MT) in stroke related to IE.²⁻⁴ We describe a case of middle cerebral artery occlusion due to IE that caused severe vasospasm and subsequent reocclusion after MT. We also present the pathologic findings of the occluded middle cerebral artery and investigate the precautions to be taken while performing MT due to IE.

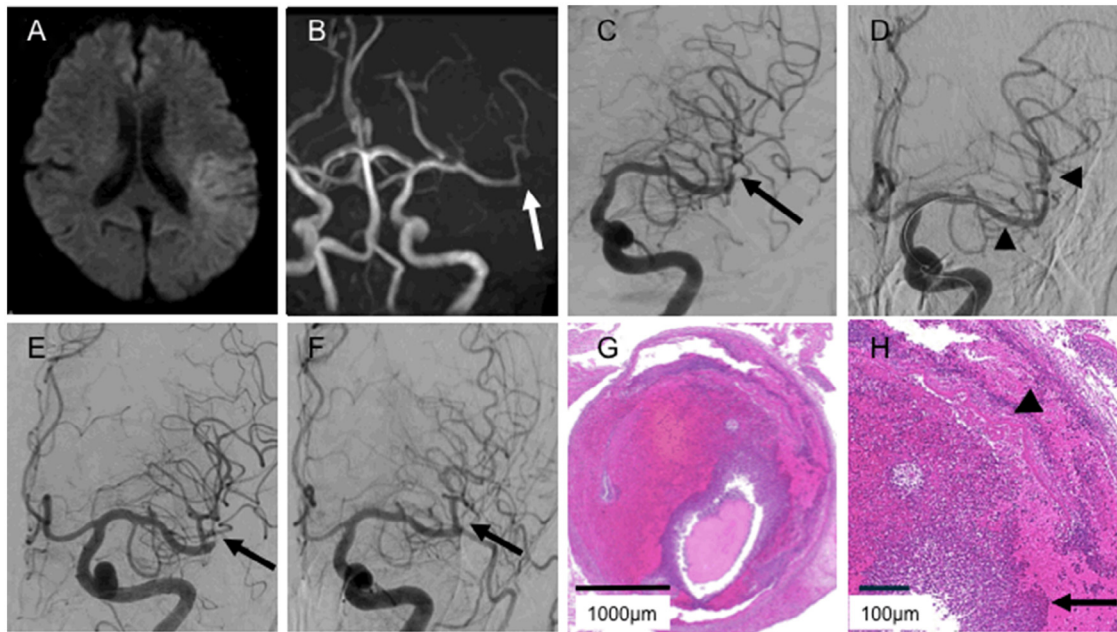


Figure 1. (A) Diffusion-weighted imaging shows a hyperintensity lesion in the left temporoparietal junction. (B) Magnetic resonance angiography shows M2 inferior branch occlusion of the left MCA (arrow). (C) Angiography shows M2 inferior branch occlusion of the left MCA (arrow). (D) After deploying a ReVive SE stent retriever (arrowheads), the M2 inferior branch was immediately reperused. (E) DSA shows severe vasospasm at the M2 inferior branch just after the withdrawal of the stent retriever (arrow). (F) One day after the mechanical thrombectomy, DSA of the left common carotid artery showed reocclusion of the left M2 segment (arrow). (G, H) Pathologic analysis of the occluded M2 segment revealed fibrin thrombi containing vast amounts of neutrophils (arrow) and invasion of neutrophils into the internal elastic lamina (arrowhead). Abbreviations: DSA, digital subtraction angiography; MCA, middle cerebral artery.

Case

A 72-year-old man with atrial fibrillation treated with dabigatran presented with right hemiparesis and aphasia. A diffusion-weighted image showed a high-intensity area in the left temporoparietal junction (Fig 1, A), and magnetic resonance angiography revealed a left M2 occlusion (Fig 1, B). Because of an elevated activated partial thromboplastin time (>40 seconds) due to dabigatran treatment, thrombolytic therapy was contraindicated; instead, MT was performed. A ReVive SE 4 × 20-mm stent retriever (Codman & Shurtleff, Inc., Raynham, MA) was deployed from the left M2 segment to the M1 segment and slowly withdrawn (Fig 1, D). Following this, the M2 segment showed severe vasospasm (Fig 1, E). Fasudil hydrochloride was injected into the M2 segment and helped achieve its dilation. The next day, the left M2 segment reoccluded (Fig 1, F). A transthoracic echocardiogram showed vegetation on the mitral valve. *Streptococcus salivarius* growth was observed in the blood culture sets, confirming the diagnosis of IE. On the ninth day, the patient died unexpectedly. According to the autopsy report, the cause of death was pulmonary embolism. Pathologic analysis of the occluded M2 segment revealed fibrin thrombi containing vast amounts of neutrophils and invasion of neutrophils into the internal elastic lamina (Fig 1, G,H).

Discussion

To the best of our knowledge, this is the first report of a severe vasospasm after MT. We believe that the vasospasm occurred due to 2 main causes. One was a marked inflammation of the vessel, which was shown in the pathologic study as vast amounts of neutrophils. Inflammation has been shown to be implicated in vasospasm.⁵ The other cause was mechanical stimulation from the stent retriever. Vasospasm has been observed in 3.0%-22.5% of cases after stent retriever thrombectomy.⁶ Severe vasospasm was thought to have occurred because the vascular injury caused by the stent retriever in the vessel had a marked inflammation background.

Our findings suggest that devices that are less invasive to the vascular wall are required for performing MT due to IE. The Penumbra aspiration system (Penumbra Inc., Alameda, CA) creates less endothelial denudation than stent retrievers.⁷ Moreover, the Penumbra has a lower frequency of vasospasm than stent retrievers (3.3%-3.7%).⁸ Therefore, the Penumbra is a suitable device for performing MT due to IE.

References

1. Walker KA, Sampson JB, Skalabrin EJ, et al. Clinical characteristics and thrombolytic outcomes of infective endocarditis-associated stroke. *Neurohospitalist* 2012;2:87-91.

2. Kang G, Yang TK, Choi JH, et al. Effectiveness of mechanical embolectomy for septic embolus in the cerebral artery complicated with infective endocarditis. *J Korean Med Sci* 2013;28:1244-1247.
3. Kim JM, Jeon JS, Kim YW, et al. Forced arterial suction thrombectomy of septic embolic middle cerebral artery occlusion due to infective endocarditis: an illustrative case and review of the literature. *Neurointervention* 2014;9:101-105.
4. Sveinsson O, Herrman L, Holmin S. Intra-arterial mechanical thrombectomy: an effective treatment for ischemic stroke caused by endocarditis. *Case Rep Neurol* 2016;31:229-233.
5. Provencio JJ, Fu X, Rasmussen PA, et al. CSF neutrophils are implicated in the development of vasospasm in subarachnoid hemorrhage. *Neurocrit Care* 2010;12:244-251.
6. Akins PT, Amar AP, Pakbaz RS, et al. Complications of endovascular treatment for acute stroke in the SWIFT trial with solitaire and Merci devices. *AJNR Am J Neuroradiol* 2014;35:524-528.
7. Teng D, Pannell JS, Rennert RC, et al. Endothelial trauma from mechanical thrombectomy in acute stroke: in vitro live-cell platform with animal validation. *Stroke* 2015;46:1099-1106.
8. Penumbra Pivotal Stroke Trial Investigators. The penumbra pivotal stroke trial safety and effectiveness of a new generation of mechanical devices for clot removal in intracranial large vessel occlusive disease. *Stroke* 2009;40:2761-2768.