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Case Report

A Case of Mechanical Thrombectomy for Acute Occlusion of the Left Internal Carotid Artery Later than 24 Hours after Onset

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Objective: Mechanical thrombectomy is performed on ischemic stroke patients with acute major cerebral artery occlusion within 24 hours of symptom onset. We report a case of delayed mechanical thrombectomy for acute left internal carotid artery occlusion.

Case Presentation: A 76-year-old woman suddenly presented with dysarthria and right hemiparesis was admitted to her previous hospital. She was treated by conservative therapy. The next day, she was transferred to our hospital 26 hours after onset with a diagnosis of ischemic stroke due to left carotid artery acute occlusion. Contrast CT revealed left carotid artery occlusion. Arterial fibrillation was detected. Mechanical thrombectomy through the right brachial artery was immediately performed. Complete recanalization was achieved without hemorrhagic complication. Her postoperative course was uneventful.

Conclusion: In this case, delayed mechanical thrombectomy for acute major cerebral artery occlusion was safely performed 24 hours after symptom onset.

Keywords ▶ mechanical thrombectomy, delayed thrombectomy, transbrachial approach, internal carotid artery occlusion, endovascular

Introduction

Mechanical thrombectomy is indicated for acute major cerebral artery occlusion-related stroke patients with a short interval from onset.[1] Regarding acute occlusion of a major artery with an interval of >6 hours from onset, mechanical thrombectomy was reported to be more advantageous than medical treatment for improving the outcome in patients with a mismatch between clinical symptoms and an ischemic core.[2,3] On the other hand, the effects of mechanical thrombectomy on acute ischemic stroke related to major artery occlusion with an interval of ≥24 hours from onset remain to be clarified. In this study, we report a patient in whom mechanical thrombectomy via the trans-brachial approach for acute occlusion of the left internal carotid artery was performed >24 hours after onset based on preoperative contrast-enhanced CT findings, leading to complete recanalization in the absence of serious complications.

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Case Presentation

A 76-year-old woman with a history of hypertension, type II diabetes, and dyslipidemia was brought to the emergency outpatient unit of our hospital from her previous hospital by ambulance with right hemiplegia, dysarthria, and consciousness disorder. Here activities of daily living were independent, with a modified Rankin Scale (mRS) score of 0. She was not on regular medication.

Present illness: She was admitted to her previous hospital for laser therapy for lower limb varices. At 9:18 a.m., a nurse found that she was unable to speak while leaving the restroom, with weakness of the right lower limb and gait disorder. She was placed in a supine position. After a few minutes, her condition improved, facilitating communication. At 9:52 a.m., head CT was performed, but there was no cerebral hemorrhage. Before 11:00 a.m., dysarthria and aphasia recurred. The symptoms occurred intermittently. As

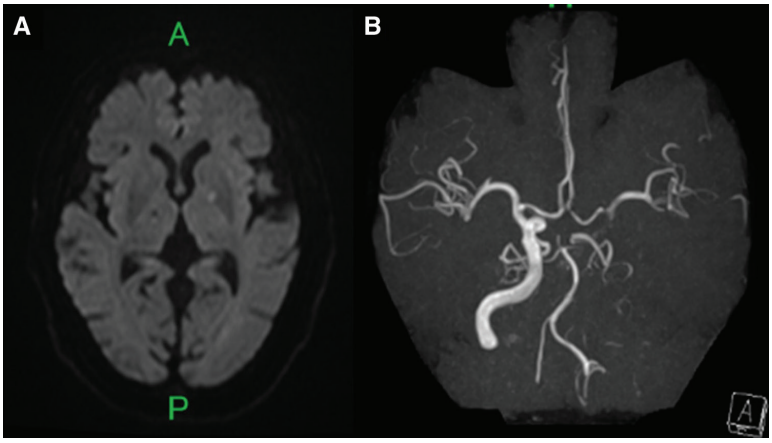

Fig. 1 Cephalic MRI at the previous hospital. (**A**) Diffusion-weighted imaging showed small high-signal-intensity areas in the left basal ganglia. (**B**) Cephalic MRA revealed occlusion of the left internal carotid artery. A: anterior; P: posterior

weakness of the right lower limb made walking difficult, she was taken to an operating room in a wheelchair to undergo laser therapy. After laser therapy, the Japan Coma Scale (JCS) score was 3, and the manual muscle testing (MMT) scores of the right upper and lower limbs were 2. Intermittent aphasia progressed to persistent aphasia. At 5:21 p.m., cephalic MRI was performed. Diffusion-weighted images demonstrated small high-signal-intensity areas in the left frontal lobe and basal ganglia, in addition to interruption of the left internal carotid artery (**Fig. 1**). Under a diagnosis of atherothrombotic cerebral infarction, drip infusion of an anti-thrombin drug was started. At 11:00 a.m. the day after onset, she was referred to the Department of Neurosurgery for consultation. At 11:47 a.m., the JCS score was 20, and the MMT scores of the right upper and lower limbs were 0 and 1, respectively; symptom deterioration was noted in comparison with the state on the previous day. Considering the possible indication of mechanical thrombectomy, she was transported to our hospital.

Physical examination on admission: The height, body weight, blood pressure, pulse, and body temperature were 150 cm, 71 kg, 183/139 mmHg, 71 times/minute (irregular), and 37.0°C, respectively. Concerning the consciousness level, the JCS score was 20 and the Glasgow Coma Scale (GCS) score was 8 (Eye: 3, Verbal: 1, Motor: 4). Right hemiplegia was observed (MMT score of the right upper limb: 0, that of the right lower limb: 1). The National Institutes of Health Stroke Scale (NIHSS) score was 25.

Laboratory data on admission: The leukocyte count, platelet count, serum creatinine level, prothrombin time-international normalized ratio (PT-INR), D-dimer level, and HbA1c value were 7400/mL, 103000/mL, 0.93 mg/dL, 1.42, 1.4 mg/mL, and 6.6%, respectively. There were no abnormalities in the other blood biochemistry parameters. Electrocardiography demonstrated atrial fibrillation, with a pulse of 67 times (irregular). Cephalic CT did not reveal early CT signs or intracranial hemorrhage (**Fig. 2A**). A bovine arch was observed on contrast-enhanced CT. The left internal carotid artery was not visualized, but the left anterior and middle cerebral arteries were enhanced (**Fig. 2B** and **2C**). There were diffuse high-signal-intensity areas in the cerebral hemisphere involving the left basal ganglia on cephalic MRI-diffusion-weighted imaging. The number of these areas increased compared with that on the images obtained at the previous hospital (**Fig. 2D**).

Course: The patient arrived at our hospital at 1:07 p.m. Head plane CT and contrast-enhanced CT were conducted at 1:32 p.m. MRI was performed at 1:46 p.m. The patient was admitted to an angiography room at 2:02 p.m. Emergency percutaneous thrombectomy was performed. Due to the bovine arch, an approach via the right brachial artery was selected (puncture was performed at 2:11 p.m., interval from arrival until puncture: 1 hour and 4 minutes). Under local anesthesia, a 6-Fr Axcelguide 7.5-90 (Medikit, Tokyo, Japan) was inserted into the left common carotid artery through the right brachial artery using a 4-Fr Glidecath Simmons 120 (Terumo, Tokyo, Japan). On left common carotid angiography, the distal left external carotid artery was favorably visualized, but the petrous part to distal area of the left internal carotid artery was not visualized, suggesting acute occlusion of the left internal carotid artery (**Fig. 3A**). As the activated coagulation time (ACT) was 218 seconds, 2000 units of heparin were administered. Subsequently, mechanical thrombectomy was started. A

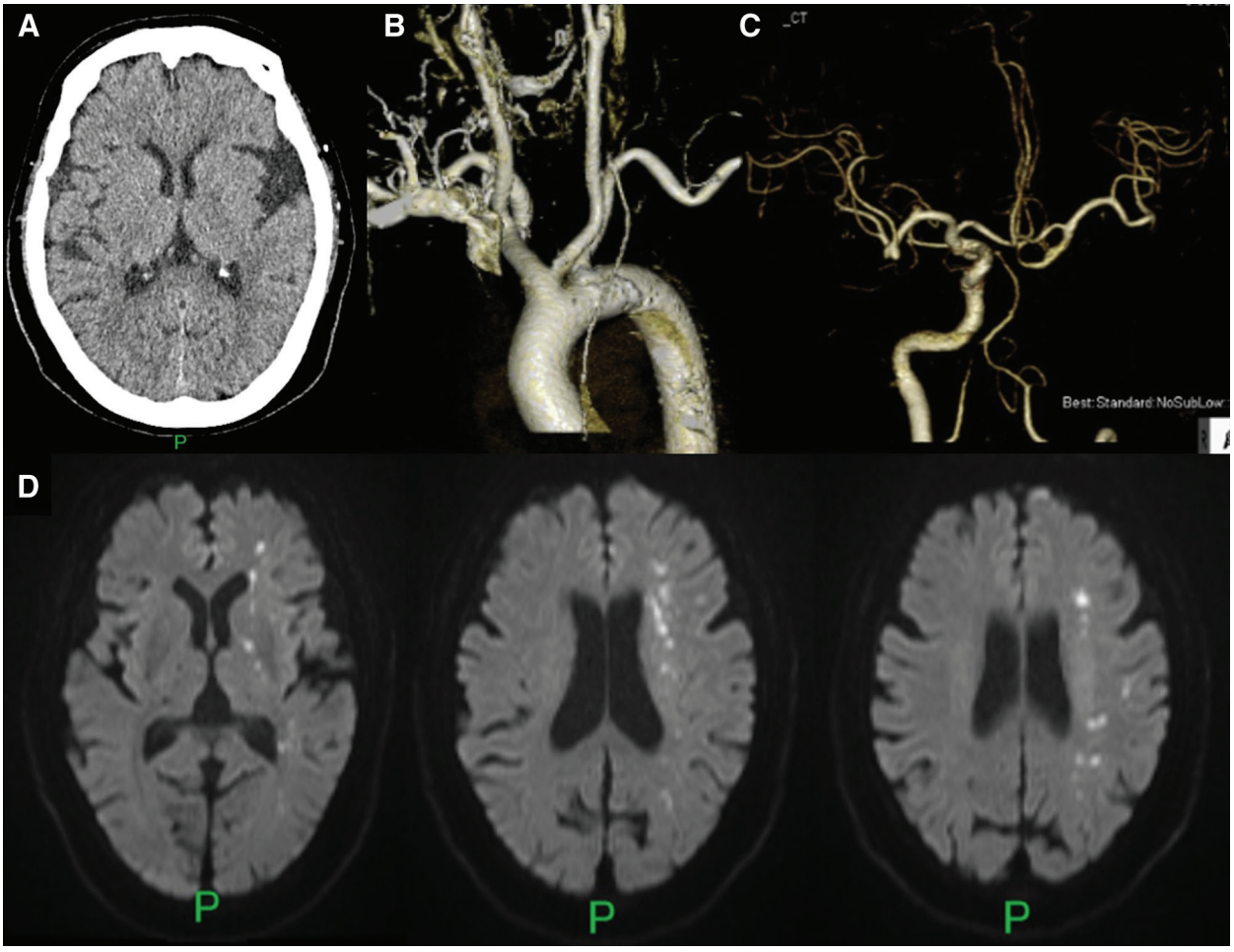

Fig. 2 Imaging findings on arrival. (**A**) Cephalic CT showed normal findings. (**B**) Contrast-enhanced CT of the trunk showed a bovine arch. (**C**) Contrast-enhanced cephalic CT revealed interruption of the left internal carotid artery. (**D**) Diffusion-weighted imaging showed scattered high-signal-intensity areas in the left cerebral hemisphere. P: posterior

AXS Catalyst 6 Distal Access Catheter (Stryker, Kalamazoo, MI, USA), Marksman microcatheter (Medtronic, Minneapolis, MN, USA), and CHIKAI 14 (Asahi Intecc, Aichi, Japan) were coaxially guided into the left internal carotid artery. As occlusion at the siphon part of the internal carotid artery was suggested, lesion crossing was conducted by allowing the Marksman to follow the CHIKAI 14, and its tip was guided to the proximal M1 segment (**Fig. 3B**). The Catalyst 6 was placed at the siphon part in waiting. Angiography through the Marksman confirmed that the tip of the Marksman reached an area beyond thrombi. A Trevo XP 6.0/25 mm (Stryker) was deployed 1 minute prior to waiting. The Catalyst 6 was connected with a Penumbra system (Medicos Hirata, Osaka, Japan) and continuous aspiration was started. Although a proximal balloon was absent, thrombectomy was attempted by pulling the Trevo into the Catalyst 6 in accordance with stent-retrieving into an aspirator using the proximal balloon technique (ASAP).[4] Red thrombi were retrieved, but recanalization was not achieved. A similar procedure was additionally performed to further retrieve red thrombi. However, no change in the thrombotic state was noted on angiography. Subsequently, the procedure was switched to continuous aspiration prior to intracranial vascular embolectomy (CAPTIVE)[5] to retrieve thrombi (**Fig. 3C** and **3D**). A total of three passes were conducted. Thrombolysis in Cerebral Infarction (TICI) grade 3 recanalization was achieved (interval from puncture until recanalization: 2 hours and 26 minutes) (**Fig. 4**). At first, the thrombi were red, and each time they were retrieved, they gradually became whitish. Finally, the thrombi retrieved for the last time were white. Head CT confirmed the absence of postoperative intracranial hemorrhage and anticoagulant therapy with heparin was started. It was switched to an oral anticoagulant the following day. Diffusion-weighted MRI the day after surgery revealed a slight increase in the extent of

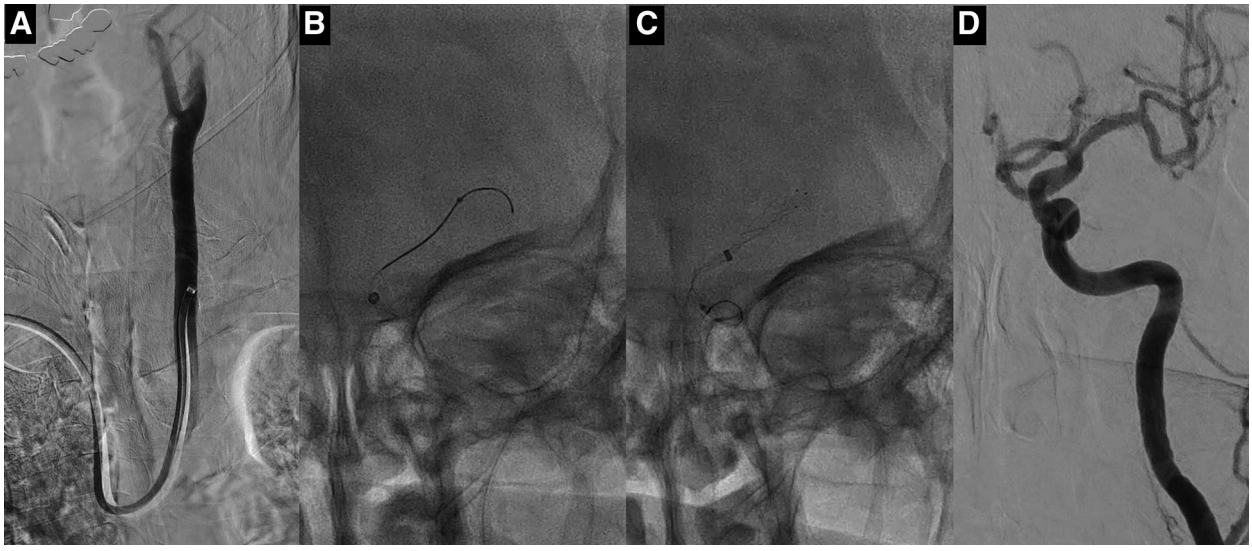

Fig. 3 Imaging findings during mechanical thrombectomy. (**A**) Left common carotid angiography through a 6-Fr Axcelguide 7.5-9 (Medikit, Tokyo, Japan) inserted through right brachial artery puncture showed interruption of the left internal carotid artery. (**B**) A Marksman microcatheter (Medtronic, Minneapolis, MN, USA) and CHIKAI 14 (Asahi Intecc, Aichi, Japan) were guided into the left middle cerebral artery for lesion crossing. (**C**) CAPTIVE was performed using a stent and aspiration catheter. (**D**) Angiography immediately after mechanical thrombectomy confirmed recanalization. CAPTIVE: continuous aspiration prior to intracranial vascular embolectomy

infarction involving the left basal ganglia and corona radiata. However, on diffusion-weighted MRI immediately before discharge, the high-signal-intensity areas were unclear and FLAIR images demonstrated no new high-signal-intensity areas (**Fig. 5**). During the course of admission, there was no progression of consciousness disorder or new abnormal neurological finding. On the 22nd postoperative day, the patient was referred to another hospital for rehabilitation with an NIHSS score of 14, right upper/lower limb MMT scores of 0 and 1, and mRS score of 4.

Discussion

In the present case, mechanical thrombectomy for acute ischemic stroke related to acute occlusion of a major artery, with an interval of ≥24 hours from onset, led to recanalization. We reviewed the latest reports to compare procedures. Furthermore, there are many cases in which the brachial artery is more appropriate than the femoral artery as an access route, suggesting the usefulness of contrast-enhanced CT before mechanical thrombectomy.

Recently, the role of mechanical thrombectomy has become more important among acute-phase treatments for cerebral infarction. Based on the results of large-scale randomized controlled trials,[6–9] mechanical thrombectomy was established as a standard treatment for cerebral infarction within 6 hours after onset. In addition, mechanical thrombectomy is indicated for some patients with acute ischemic stroke (interval from onset: ≤24 hours) in whom there is a mismatch between the ischemic core volume on cephalic imaging and clinical symptoms[1] based on the results of the DEFUSE-3[2] and DAWN[3] trials. In the present case, the NIHSS score on arrival was 25 and the clinical symptoms suggested ischemia involving an extensive area of the left cerebral hemisphere. On the other hand, diffusion-weighted imaging on arrival demonstrated scattered small high-signal-intensity areas in the left anterior and middle cerebral artery regions. On contrast-enhanced CT, the left anterior and middle cerebral arteries were visualized through a collateral pathway mediated by the anterior communicating artery; the progression of ischemia may have been slow. Briefly, patients with a small ischemic core despite a specific interval from the onset of cerebral infarction are referred to as slow progressors, and a penumbra to be saved may remain because the progression of ischemia is slow in the presence of a collateral pathway.[10] Our patient was also regarded as a slow progressor. In the present case, MRI-perfusion imaging was unable to be performed and mechanical thrombectomy was conducted in the absence of detailed ischemic core/penumbra assessment; we may have acted in haste as medical treatment may have led to a similar outcome. However, on diffusion-weighted MRI on arrival, there were significant increases in the number/extent of high-signal-intensity areas in comparison with MRI findings at the previous hospital. In addition, the NIHSS score was 25. Considering the ischemic area estimated based on these physical findings, cerebral

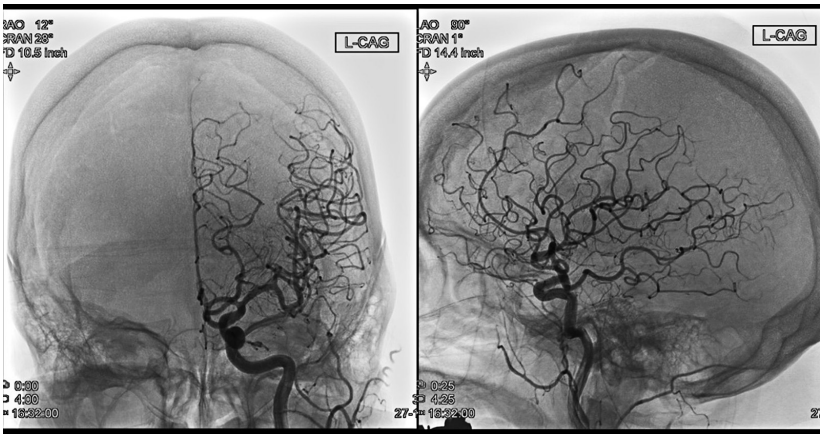

Fig. 4 Left common carotid angiography immediately after mechanical thrombectomy confirmed TICI grade 3 recanalization. TICI: Thrombolysis in Cerebral Infarction

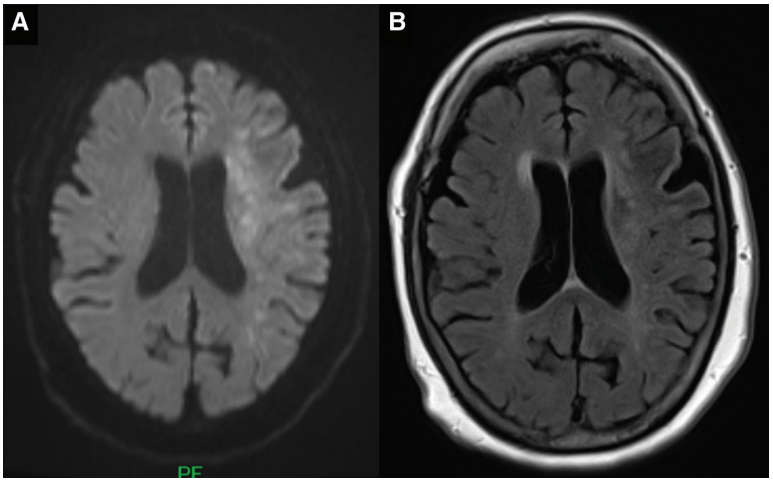

Fig. 5 Cerebral MRI immediately before discharge. (**A**) On diffusion-weighted imaging, high-signal-intensity areas were unclear. (**B**) FLAIR images demonstrated no increase in the high-signal-intensity areas.

infarction may not have been complete on arrival and reperfusion may have prevented symptom progression. Indeed, high-signal-intensity areas on FLAIR imaging 15 days after admission were limited to those on diffusion-weighted imaging at the time of admission. As for physical findings, the NIHSS score was 14, and there was no consciousness disorder or extensive cerebral infarction requiring emergency decompression craniotomy, although severe paralysis remained. Few studies have reported endovascular treatment for cerebral infarction with an interval of ≥24 hours from the final confirmation of a healthy state.[11] From this viewpoint, the present case is significant. Briefly, mechanical thrombectomy is possible even ≥24 hours after the final confirmation of a healthy state. In the present case, mechanical thrombectomy was possible in the absence of serious complications.

We compared surgical procedures in the present case with those previously reported.[2,11] In the DAWN trial, a Trevo alone was used in 102 of 105 patients in whom mechanical thrombectomy was performed. The number of passes was 2.4 ± 1.5 and the recanalization rate immediately after surgery was 84%.[2] In a retrospective study involving mechanical thrombectomy under Beyond-DAWN conditions,[11] an aspiration catheter was used in 24% and a stent retriever was used in 76%. The number of passes was 2.5 ± 2 and the recanalization rate was 81%. In the present case, a combined technique with a Trevo and Catalyst 6 was adopted, leading to TICI grade 3 recanalization. However, five passes were required until recanalization.

Concerning the properties of thrombi retrieved in the present case, the color changed from red to white with an

increasing number of passes. According to a previous study, some cardiogenic emboli are white.[12] Furthermore, blood flow congestion may induce mixed thrombi primarily consisting of red thrombi.[13] The thrombi retrieved in the present case consisted of several small red and white thrombi; therefore, they may have been atrial-fibrillation-related emboli and mixed thrombi related to post-occlusion blood flow congestion. Regarding the order of retrieval, red thrombi with a low frictional resistance were initially retrieved,[14] followed by white thrombi with a high frictional resistance.

In the present case, the trans-brachial approach was appropriate and preoperative contrast-enhanced CT was useful. Mechanical thrombectomy is routinely performed through right femoral artery puncture, but it is often difficult to reach a cerebral blood vessel via femoral approach.[15] In the protocol prepared at our hospital, neurosurgeons/neurologists are responsible for the initial management of patients with symptoms for which mechanical thrombectomy may be indicated. When highly acute occlusion of a major artery is suspected in the absence of early CT signs or cerebral hemorrhage on plain CT, contrast-enhanced head to pelvic CT is performed prior to transportation to the MRI room. Although it is important to shorten the interval from arrival until recanalization, an optimal approach route should be selected before puncture if possible, considering that intracranial artery cannot be reached in 5.1% of patients.[15]

Conclusion

We reported a patient with acute major artery occlusion in whom mechanical thrombectomy ≥24 hours after onset led to reperfusion in the absence of serious hemorrhagic complications. This patient was a slow progressor regarding the development of a collateral pathway mediated by the anterior communicating artery, and the progression of cerebral infarction may have been prevented despite an interval of >24 hours from onset.

Disclosure Statement

The authors declare no conflicts of interest.

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