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CASE REPORT

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Significance of Gradient-Echo Magnetic Resonance Imaging in Dural Arteriovenous Fistula Mimicking Hyperacute Ischemic Stroke

Seong-Geun Lee*, Sang-Hun Lee†, Young Bin Park†, Jin-Man Jung†

Department of Emergency Medicine, Korea University College of Medicine*, Seoul; Department of Neurology, Korea University Ansan Hospital, Ansan†, Korea

Dural arteriovenous fistulas (DAVFs) could plausibly increase the risk of intracranial hemorrhage after intravenous (IV) recombinant tissue plasminogen activator (r-tPA) administration in acute stroke, although the actual bleeding risk associated with DAVFs after IV thrombolysis is not yet known. When DAVFs manifest symptoms of stroke, especially within 4.5 hours of onset, diagnostic ambiguity on non-contrast computed tomography makes it difficult to decide whether IV r-tPA treatment should be administered. Waiting for advanced neuroimaging to be performed is not sufficiently time-efficient for the diagnosis of DAVFs in the time window of thrombolysis. Here, we report a case of DAVF mimicking hyperacute stroke where IV r-tPA administration was halted following additional gradient-echo magnetic resonance imaging in a situation that required rapid decision regarding administration of a thrombolytic agent.

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Address for correspondence:
Jin-Man Jung

Department of Neurology, Korea University Ansan Hospital, 123 Jeokgeum-ro, Danwon-gu, Ansan 15355, Korea
Tel: +82-31-412-5150
Fax: +82-31-412-5154
E-mail: sodium75@hanmail.net

Dural arteriovenous fistulas (DAVFs) are characterized by abnormal arteriovenous passages located in the intracranial dura mater. The incidence of DAVFs is unknown but they account for approximately 10-15% of all intracranial vascular malformations.[1,2] DAVFs are typically supplied by the meningeal arteries, including branches of the external carotid artery, and drain into the dural venous sinuses and/or cortical veins.[3] The clinical presentation and features of DAVFs depend primarily upon their specific location and the venous drainage pattern of the arteriovenous shunting. The risk of intracranial hemorrhage could be influenced by the location and venous drainage pattern of DAVFs. Additionally, following intravenous (IV) administration of recombinant tissue plasminogen activator (r-tPA) or increased blood flow after restoration of blood flow to the occluded site in acute stroke, the actual bleeding risk could increase. However, the nature of such risk associated with DAVFs after IV thrombolysis is unknown.[4] Nonetheless, performing advanced neuroimaging is not sufficiently time efficient to diagnose DAVFs in the time window of IV thrombolysis. Here, we report a case of DAVF mimicking hyperacute ischemic stroke where IV r-tPA administration was halted following additional gradient-echo (GRE) magnetic resonance imaging (MRI) in a situation that required a rapid decision regarding thrombolytic agent use.

CASE REPORT

A 79-year-old woman arrived at our emergency department because of sudden sensory aphasia that had occurred one hour before. She had no past medical history, was a non-smoker, and did not drink alcohol. Her initial vital signs were blood pressure, 201/99 mmHg; heart rate, 98 bpm; respiratory rate, 18 breaths/min; and body temperature, 36.4°C. Her initial National Institutes of Health Stroke Scale (NIHSS) score was 8. Her symptoms were suspected to be the result of an acute

stoke, and IV r-tPA was indicated if her brain computed tomography (CT) revealed no hemorrhagic stroke. In fact, brain CT revealed no abnormalities (Fig. 1A). To exclude stroke mimics, such as convulsion disorder presenting with pure aphasic-like symptoms[5] and seizure, diffusion-weighted imaging (DWI) MRI was performed as soon as possible after brain CT and 90 minutes after her symptoms had developed. A diffusion-restricted lesion corresponding to her aphasia was found in the left middle and posterior temporal lobe, suggesting hyperacute ischemic stroke (Fig. 1B, C). However, on additional GRE images, there were multiple dot-like low signal intensities located in the same areas (Fig. 1D). We suspected that the findings were more likely reflective of vascular malformation combined with an ischemic lesion. We decided not to start IV r-tPA and considered further evaluation. The next day, she underwent digital subtraction angiography and the presence of DAVFs in the vein of Labbe was confirmed (Fig. 2A). Routine MRI showed gyral swelling and combined venous congestion (Fig. 2B, C). Electroencephalography was performed to exclude aphasic seizure, and no abnormal findings were observed. After admission, she received nadroparin 2,850 IU through subcutaneous injection and cilostazol 100 mg. The patient's symptoms improved after treatment. Her NIHSS score on the 3rd day was measured at two points. The patient was discharged 7 days later with only mild aphasia.

DISCUSSION

DAVFs can develop anywhere within the intracranial dura mater. The clinical symptoms of DAVFs are di-

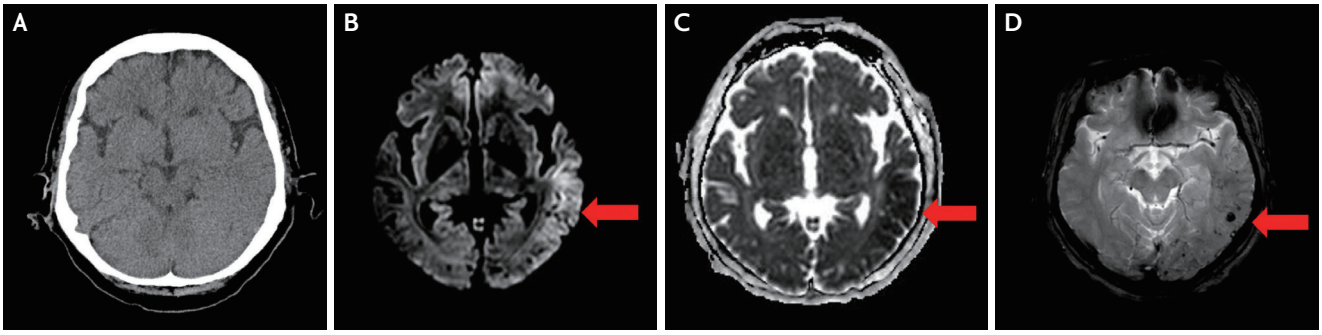

Fig. 1. No hemorrhagic lesion is seen on brain computed tomography (A). A lesion (red arrow) in the left temporo-occipital lobe is seen on diffusion-weighted (B) and apparent diffusion coefficient images (C). Multiple hemorrhagic foci and multiple small dot lesions characterized by engorged meningeal veins can be seen on gradient-echo image in the same area (red arrow) (D).

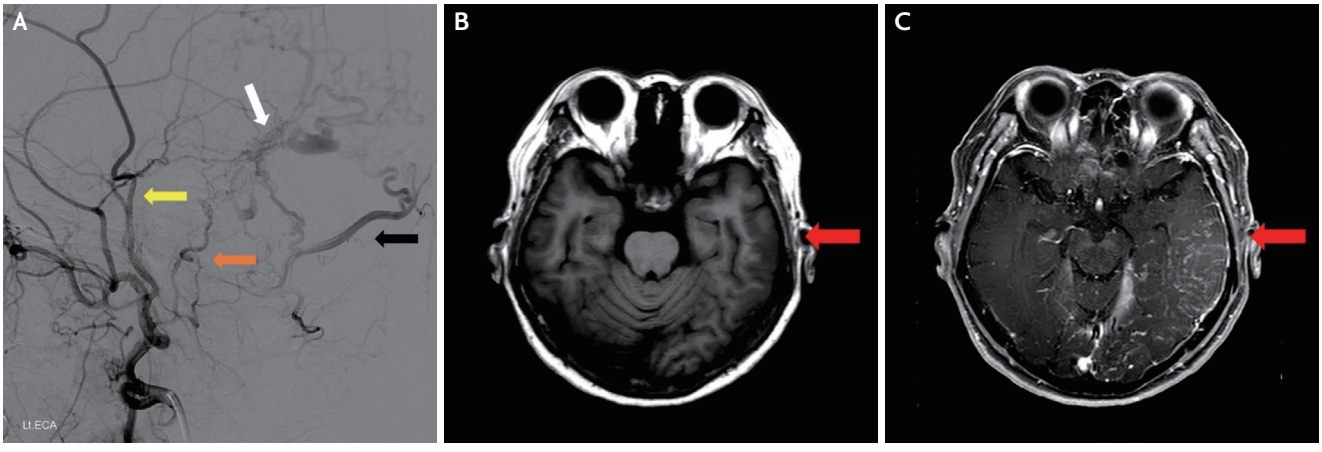

Fig. 2. A fistula from the left occipital (black arrow), middle meningeal (yellow arrow), and ascending pharyngeal (orange arrow) arteries to the vein of Labbe (white arrow) with cortical venous reflux is seen on digital subtraction angiography (A). Venous congestion and gyral swelling (red arrow) in the corresponding area in follow-up T1-weighted (B) and T1 contrast-enhanced images (C) can be seen.

verse, ranging from mild (such as headache and tinnitus) to more severe (such as aphasia, hemiparesis, and coma) symptoms depending upon its location and the venous drainage pattern of arteriovenous shunting.[6,7] Like our case, DAVFs could be confused with acute stroke in the case of patients who arrived during the time window available for IV thrombolysis and presented with stroke-like symptoms. In addition, DAVFs are not seen on non-contrast CT and/or DWI, which are performed to diagnose stroke and reduce the time until IV injection of r-tPA. Although a diagnosis of DAVF is always challenging, susceptibility- or perfusion-weighted MRI has been recently reported to corroborate diagnostic clues of DVAFs.[8,9]

The time window for applying IV thrombolysis in ischemic stroke is limited and fixed to 4.5 hours after symptom onset. Therefore, the decision regarding the use of thrombolytic agents must be made as quickly as possible. Even though the actual risk of using thrombolytic agents in the setting of a DAVF is not still known, an increased risk of intracranial hemorrhage is expected. Brain vascular malformations, including arteriovenous malformation, intracranial aneurysms, and DAVFs, require careful attention and an individualized approach with regards to intravenous thrombolysis.[10] In addition, this case illustrates that GRE MRI is helpful in finding hidden DAVF and plays an important role in the decision making regarding the use of IV thrombolysis.

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