

Thrombolytic Therapy in Acute Cerebral Infarction Complicating Diagnostic Cardiac Catheterization

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Diagnostic and interventional percutaneous coronary catheterization is associated with stroke. Many of such strokes are asymptomatic, but some are devastating. Once the diagnosis of acute cerebral infarction is confirmed, thrombolytic therapy should be administered within the time window of 3 hours. We report a 61-year-old woman who suffered from an acute cerebral infarction during diagnostic cardiac catheterization for unstable angina, which manifested as sudden onset of global aphasia, right hemiplegia and gaze preponderance to the left side. Computed tomography of the head performed immediately after recognition of the symptoms showed a hyperdense middle cerebral artery (MCA) sign. Following prompt recognition and diagnosis, intravenous thrombolytic therapy was administered 2 hours after symptom onset. The patient had a favorable outcome. Initially, National Institutes of Health Stroke Scale score was 21, and 24 hours later it improved to 9. The hyperdense MCA lesion had resolved on the 24-hour follow-up scan. This case illustrates the clinical benefit of thrombolytic therapy in the setting of acute stroke associated with cardiac catheterization. [*J Formos Med Assoc* 2006;105(10):848–851]

Key Words: cerebral infarction, heart catheterization, thrombolytic therapy

Stroke is a relatively uncommon but sometimes devastating sequela of diagnostic cardiac catheterization. It may be due to either hemorrhage or infarction.¹ The symptoms of catheterization-associated stroke include almost all the stroke symptoms that are encountered in daily practice. Thrombolytic therapy using recombinant tissue plasminogen activator (rt-PA) is the state-of-the-art therapy in patients presenting less than 3 hours after the onset of stroke symptoms, provided that there is no reason to doubt the diagnosis of cerebral infarction and no contraindications to rt-PA use are present.² However, the application

of this therapy in patients with cerebral infarction while undergoing cardiac catheterization has seldom been reported. We report a patient who benefited from prompt recognition and treatment with rt-PA.

Case Report

A 61-year-old woman weighing 64 kg was admitted to Li-Shin Hospital with clinical symptoms suggestive of unstable angina. Her past history included diabetes mellitus, hypertension for 6 years

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with medical treatment, and hyperlipidemia. She had suffered from cerebral infarction 3 years previously without any significant sequelae. Physical examination was unremarkable except for blood pressure of 150/98 mmHg at admission. Resting 12-lead electrocardiogram showed sinus rhythm with deep T wave inversion over the left precordial leads. Transthoracic echocardiography showed apical and anteroseptal wall hypokinesis with preserved left ventricular ejection fraction. Cardiac enzymes were normal. Cardiac catheterization was performed via the transradial approach with Seldinger techniques. Five-French Judkins right 3.5 cm and left 3.5 cm catheters were used. An intravenous bolus of 5000 U unfractionated heparin was injected. Difficulty in cannulation of the coronary arteries was encountered due to tortuosity of the right subclavian artery and a dilated aortic root. The right coronary artery was poorly engaged but selective arteriography showed a patent artery. A 5-French Judkins 4.0 cm catheter was used after several unsuccessful attempts to cannulate the left coronary artery. Selective left coronary arteriography showed a 50% discrete stenosis in the midportion of the left anterior descending artery. The procedure was prolonged (about 50 minutes) due to technical difficulty in the coronary cannulation. Aortography to identify

possible anomalies of the aortic arch was planned. However, the patient became unresponsive with eyes deviated to the left side and she was unable to withdraw her right limbs in response to painful stimulation. The procedure was terminated and computed tomography (CT) of the head (Figure 1) was performed immediately due to suspicion of cerebral infarction. CT showed neither intracranial hemorrhage nor obvious parenchymal hypodensity, but hyperdensity was noted within the left middle cerebral artery (MCA).

Immediate neurologic consultation showed that the patient was awake but aphasic, with poor verbal expression and comprehension. Pupils were isocoric and the patient had a gaze preference to the left side. Mild right facial palsy of the central type, and severe right hemiparesis (muscle power 1/5 in the right upper limb and 2/5 in the right lower limb), was observed. The National Institutes of Health Stroke Scale (NIHSS) score was 21. The clinical, neurologic and radiologic evaluations were completed within 1 hour after the onset of symptoms. All laboratory data were unremarkable. After excluding all contraindications according to the protocol designed by the National Institute of Neurological Disorders and Stroke (NINDS) rt-PA Stroke Study Group,² rt-PA 50 mg was administered (0.78 mg/kg) 2 hours after the onset



Figure 1. Computed tomography shows a left hyperdense middle cerebral artery sign (arrow).



Figure 2. Follow-up computed tomography 24 hours later shows hypodensity in the left temporal area (arrows).

of symptoms. The NIHSS score was 9 on the follow-up examination 24 hours later. CT performed 24 hours later showed hypodensity of the left temporal lobe (Figure 2). One week later, the NIHSS score was 3. The modified Rankin scale score was 4 at onset, and 2 and 1 at 1 and 3 months later, respectively.

Discussion

Neurologic complications are infrequently associated with diagnostic cardiac catheterization, but may be devastating to the patient and the family. The reported frequency of clinically apparent stroke ranges from 0.03% to 0.38%,^{1,3,4} while the reported frequency of silent stroke may be much higher, up to 15%.⁵ The recent shift to more frequent catheterization of older patients with severe coronary disease has led to the need for more emphasis on the determination of risk factors for catheterization-associated cerebral infarction, as well as its prevention, rapid diagnosis and treatment.

Acute neurologic complications of cardiac catheterization may present in many different ways. Lazar et al's⁷ study of a large series of patients found the most common symptoms included visual disturbance, hemiparesis and facial weakness. Final diagnoses included cerebral infarction (55%), transient ischemic attack (15%) and contrast reaction or toxicity (15%).⁷ Total MCA occlusion was one of the most severe complications.

The present case had a large area of infarction in the left MCA territory, which was diagnosed on symptoms and neuroimaging findings. Head CT scan performed immediately after symptom onset (Figure 1) showed neither signs suggestive of intracerebral hemorrhage nor significant brain edema, but a hyperdense MCA was found, which is considered to be a sign of an embolus within the MCA.⁸ Twenty-four hours later, the hyperdense MCA sign had resolved on the follow-up CT scan, and only hypodensity within the left temporal lobe was seen (Figure 2). The hyperdense MCA sign has been recognized in large cerebral

infarctions, and is associated with unfavorable prognosis, especially in patients with an initial NIHSS score > 10.⁹ The clinical and neuroimaging findings in our patient suggested that she had suffered from an initial total occlusion of the left MCA, which later recanalized after thrombolytic therapy. Tsao et al¹⁰ reported a similar case with clinical improvement and resolution of the hyperdense MCA sign on CT scans following rt-PA injection.

The reported independent risk factors for catheterization-associated cerebral infarction varied in different studies, and include prolonged fluoroscopy time,^{4,5} difficulty in cannulation of the vessels,⁵ use of additional catheters,⁵ age > 80 years,⁴ left ventricular hypertrophy,⁵ depressed ejection fraction^{4,7} and performance of levocardiography.⁵ However, a prospective study using diffusion-weighted magnetic resonance imaging (DWMRI) by Busing et al⁵ demonstrated that duration of the procedure was the only independent predictor of occurrence of cerebral infarction. The results of these previous studies suggest that the most relevant risk factors in the present case were the prolonged duration of catheterization, and the use of multiple catheter exchanges in vessels that were difficult to cannulate.

In this case, embolism was the presumed mechanism of acute cerebral infarction associated with cardiac catheterization based on the clinical features as well as the evidence from neuroimaging.^{4,5} The lesions found on DWMRI after cardiac catheterization were compatible with patterns of embolism in the prospective study by Busing et al.⁵ The emboli could come from plaques broken off from the ascending aorta or the aortic arch, blood clots from the tip of the catheter and from degenerative aortic valves on performing levocardiography.⁵

Busing et al⁵ found that cardiac catheterization bears a surprisingly high risk of cerebral infarction, although none of their patients were symptomatic. Immediate recognition of focal neurologic symptoms during and after cardiac catheterization and prompt neurologic consultation is crucial to the appropriate prescription and the effectiveness of thrombolytic therapy. The diagnosis

of these neurologic complications should be carefully made. Rare causes of neurologic complications, such as reaction to contrast medium and air embolization,¹¹ should be excluded by the appropriate neurologic and neuroimaging evaluation.

Thrombolytic therapy is contraindicated in patients with prolongation of the prothrombin time (PT) or activated partial thromboplastin time (APTT), including prolongation due to anticoagulant use. Our patient had normal PT and APTT values on admission. Although a bolus of heparin 5000 U was given in the procedure, 3 hours and 25 minutes before rt-PA injection, we still considered it appropriate to prescribe rt-PA due to the short half-life of heparin (mean half-life, 90 minutes). Because intravenous rt-PA for the treatment of acute ischemic stroke has only been approved in Taiwan since 2003, the Taiwanese experience with thrombolytic therapy has been limited. We used an rt-PA dose consistent with the recommendations of the Taiwan Stroke Society (0.7–0.9 mg/kg). Although the rt-PA dosage was 0.9 mg/kg in the protocol used in the NINDS rt-PA study,² the optimal dosage for the ethnic group in Taiwan has not been established.

Intra-arterial thrombolysis in pericoronary angiography ischemic stroke has been reported as an alternative to intravenous thrombolysis.^{12,13} This technique has the advantage of direct visualization of the response to treatment, and provides an opportunity for catheter-based mechanical clot disruption or clot retrieval. However, it was associated with a higher rate of symptomatic intracerebral hemorrhage (14%)¹² than that reported in the NINDS trial of intravenous thrombolysis (6%).² Further prospective comparison studies should be initiated to determine the efficacy and risks of the use of these routes of thrombolytic therapy.

In conclusion, coronary catheterization carries a considerable risk for stroke, which may be underestimated because many cases are asymptomatic. To reduce the stroke risk, patients undergoing this procedure may benefit from a reduction of the overall procedure duration, as well as avoidance of unnecessary levocardiography, especially in those with aortic stenosis. This case may remind readers

of the importance of being aware that prolonged procedure duration and changing of multiple catheters are risk factors for stroke.

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