

Relationship between Post-Thrombolysis Blood Pressure and Outcome in Acute Ischemic Stroke Patients Undergoing Thrombolysis Therapy

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Background: The management of blood pressure (BP) for acute ischemic stroke (AIS) patients undergoing thrombolysis is still under debate. The purpose of this study was (1) to explore the association between post-thrombolysis BP and functional outcome and (2) to examine whether post-thrombolysis BP can predict functional outcome in Chinese AIS patients undergoing thrombolysis therapy. *Methods:* From December 2012 to November 2016, AIS patients undergoing thrombolysis were reviewed retrospectively in the Department of Neurology at Xuanwu Hospital. The BP levels were measured before and immediately after thrombolysis. Clinical outcomes, which comprised favorable outcome (modified Rankin Scale score 0-2) and unfavorable outcome (modified Rankin Scale score 3-6) at 3 months, were analyzed by logistic regression model. A receiver operating characteristic curve was used to evaluate the predictive value of post-thrombolysis BP. *Results:* Patients with unfavorable outcome at 3 months had a higher post-thrombolysis systolic BP than those with favorable outcome ($P = .015$). Multivariate analysis showed that post-thrombolysis systolic BP below 159.5 mm Hg was associated with favorable outcome. According to the receiver operating characteristic curve, post-thrombolysis systolic BP was a predictor of functional outcome with an area under the curve of .573 (95% confidence interval = .504-.642). *Conclusions:* Our study indicated that post-thrombolysis systolic BP is a predictor of functional outcome for Chinese AIS patients undergoing thrombolysis therapy. It is reasonable for AIS

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Received March 27, 2017; revision received April 21, 2017; accepted May 7, 2017.

Grant support: This study was supported by The National Science Fund for Distinguished Young Scholars (No. 81325007) and the Chang Jiang Scholars Program (No. T2014251).

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1052-3057/\$ - see front matter

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<http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2017.05.011>

patients to keep post-thrombolysis systolic BP below 159.5 mm Hg to obtain a favorable outcome. **Key Words:** Post-thrombolysis—blood pressure—acute ischemic stroke—functional outcome—intravenous thrombolysis.

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Introduction

Stroke is a major cause of death and disability around the world, especially in developing countries.^{1,2} There are 2.5 million new stroke cases and 7.5 million stroke survivors each year in China.³ Stroke has brought a tremendous burden on health-care expenditures. Intravenous thrombolysis with recombinant tissue plasminogen activator is an approved method for acute ischemic stroke (AIS).^{4,5} AIS patients could benefit from the intravenous thrombolysis therapy. Nonetheless, some patients may still have poor prognosis. The causes of this phenomenon are complicated. Nonideal management of blood pressure (BP) could be a reason of poor prognosis.⁶

Over 60% of AIS patients experience an acute hypertensive response within the first 24 hours of symptom onset.⁷ The mechanisms for acute hypertensive response differ. Increased intracranial pressure, stress from critical illness and hospitalization, elevated concentrations of circulating plasma catecholamine and inflammatory cytokine, unrecognized or uncontrolled pre-existing hypertension, the Cushing phenomenon, dehydration, pain or discomfort, nausea, and hypoxia are the potential pathogeneses or critical influences that contribute to the acute hypertensive response.⁸⁻¹⁰ The elevated BP in AIS patients is considered as a compensatory response that is beneficial for the perfusion of ischemic cerebral tissue and saving penumbra, whereas excessively elevated BP will aggravate cerebral edema and cause hemorrhagic transformation,¹¹ especially for patients with thrombolysis therapy. On the other hand, the decreased BP in AIS patients can reduce the risk of hemorrhagic transformation but, at the same time, can bring a poor prognosis by lowering the perfusion to the penumbra area.¹² American Heart Association and American Stroke Association guidelines recommend that a BP goal of less than 185/110 mm Hg should be achieved before thrombolysis therapy, and a BP goal of less than 180/105 mm Hg should be achieved thereafter.¹² Although these recommendations have been suggested to limit the risk of intracranial hemorrhage, we should know that no intracranial hemorrhage does not indicate favorable outcome. The optimal BP ranges for a favorable outcome have not been determined.¹² Actually, the BP targets are always based on clinical judgment at present. Thus, it is necessary to determine a proper BP range to obtain a favorable outcome for AIS patients. Furthermore, in consideration of the ethnic difference between Americans and Chinese, it is meaningful to determine a threshold in the Chinese population.

The purpose of this study was (1) to explore the association between post-thrombolysis BP and functional

outcome and (2) to examine whether post-thrombolysis BP can predict functional outcome in Chinese AIS patients undergoing thrombolysis therapy.

Methods

Patient Population

From December 2012 to November 2016, patients who were diagnosed with AIS and underwent thrombolysis therapy were admitted consecutively in the Department of Neurology at Xuanwu Hospital. Inclusion criteria were (1) patients who were diagnosed with AIS, defined according to the World Health Organization¹³ and further confirmed by computed tomography and magnetic resonance imaging scans,^{14,15} and (2) patients who received a .9 mg/kg dose of intravenous recombinant tissue plasminogen activator within 4.5 hours from the stroke symptom onset. Exclusion criteria were (1) patients with intracranial hemorrhage, major ischemic infarction (those with imaging evidence of ischemic injury involving more than one third of the middle cerebral artery territory),¹² or other diseases such as malignant tumor, epilepsy, and autoimmune disease misdiagnosed as AIS; (2) patients with contraindications for thrombolysis therapy; and (3) patients who underwent endovascular treatment after intravenous thrombolysis. The present study was conducted in accordance with the American Heart Association and American Stroke Association guidelines and was approved by the Ethics Committee of Xuanwu Hospital of Capital Medical University.

Clinical Variables

At baseline, the following demographic and clinical data were recorded: gender, age, body mass index (BMI), history of hypertension (previous diagnosis, under antihypertensive treatment, or BP of $\geq 140/90$ mm Hg before stroke), diabetes mellitus (previous diagnosis, under hypoglycemic agents, fasting plasma glucose level of ≥ 7.0 mmol/L, or random level of ≥ 11.1 mmol/L), dyslipidemia (previous diagnosis, under lipid-lowering therapy, fasting blood cholesterol level of ≥ 5.18 mmol/L, triglyceride level of ≥ 1.70 mmol/L, low-density lipoprotein cholesterol level of ≥ 3.37 mmol/L, or high-density lipoprotein cholesterol level of < 1.04 mmol/L), coronary heart disease (previous angina pectoris or myocardial infarction confirmed by coronary angiography), atrial fibrillation (paroxysmal or permanent atrial fibrillation confirmed by electrocardiogram), previous stroke (including ischemic stroke, intracerebral hemorrhage, or subarachnoid hemorrhage

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