Predictive Factors for the Spontaneous Recanalization of Large and Middle Cerebral Arteries after Acute Occlusion

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Objective: This study aims to investigate the predictive factors for the spontaneous recanalization of occluded arteries in patients with acute ischemic stroke. *Methods:* A total of 139 patients with consecutive acute ischemic stroke were enrolled from June 2010 to June 2013. The clinical and biochemical parameters were measured in each participant. Occlusion and recanalization of the carotid artery, the middle cerebral artery, and the vertebral and basilar arteries were identified by using computed tomographic angiography or digital subtraction angiography. *Results:* Among the 139 patients, 23 showed spontaneous recanalization, whereas 116 did not. In the patients with spontaneous recanalization, the proportion of atrial fibrillation was significantly lower (0% versus 29.31%, $P = .01$), whereas the proportion of stage 3 hypertension was significantly higher (60.87% versus 32.76%, $P = .01$) than that of those without recanalization. Logistic regression analysis showed that the proportion of atrial fibrillation was negatively (odds ratio [OR]: .117, 95% confidence interval [CI]: .015-.918, $P = .04$) associated with spontaneous recanalization, whereas the proportion of stage 3 hypertension was positively (OR: 4.316, 95% CI: 1.533-12.154, $P = .01$) associated with it. *Conclusions:* Atrial fibrillation is associated with reduced spontaneous recanalization of the large and middle cerebral arteries in patients after acute ischemic stroke-induced occlusion, whereas stage 3 hypertension may contribute to the promotion of the recanalization. **Key Words:** Cerebral arteries—acute occlusion—spontaneous recanalization—risk factors.
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Introduction

Cerebral infarction is a common disease resulting from arterial occlusion, which causes a high rate of disability and mortality.[1] Previous studies have reported that the rate of disability in infarct patients is 75% and the rate of mortality is 45% when the internal carotid artery is occluded.[2] The rate of mortality even rises to 85%-95% when the occlusion occurs in the basilar artery.[3] Yet, studies have shown that 2.3% of stroke patients who suffered an occlusion in the internal carotid artery can recover well as their occluded arteries were found to be recanalized during the follow-up even if they never received a timely thrombolysis therapy.[4,5] The rate of spontaneous recanalization that occurs at the supraclinoid segment of the internal carotid artery and the middle cerebral artery could

range from 17% to 67%.[6,7] So far, the risk factors associated with spontaneous recanalization remain unidentified. Therefore, the aim of the present prospective cohort study is to identify the predictive risk factors responsible for the spontaneous recanalization of large and middle cerebral arteries by using computed tomographic angiography (CTA) or digital subtraction angiography (DSA).

Methods

Subjects

A total of 6513 Chinese adults were diagnosed with consecutive acute ischemic stroke and were hospitalized in the neurology department of our hospital between June 2010 and June 2013. Among these patients, 139, who met the following inclusion criteria, were recruited in our study: (1) an acute occlusion in the common carotid artery, the internal carotid artery, the M1 segment of the middle cerebral artery, and the vertebral or basilar artery identified by CTA or DSA; (2) no therapy of thrombolysis or thrombectomy; and (3) a follow-up of CTA or DSA examination in the same hospital within 3 months after stroke onset. Patients who did not take CTA/DSA re-examinations within 3 months; experienced transient ischemic attack (TIA), severe heart and lung disease, severe liver and kidney disease, blood system disease, late stage of cancer, or coma and consciousness disorder; or were predicted to have short lifetimes were excluded. All the patients were treated with aspirin/clopidogrel and atorvastatin/rosuvastatin, but without anticoagulants, since the early stage of stroke. The patients recruited signed consent forms and agreed to take part in the present study. The study was approved by the Daping Hospital, Research Institute of Surgery, Third Military Medical University Ethical Committee.

Clinical and Biochemical Measurements

The demographic medical data collected in all subjects include age, gender, history of smoking and drinking, history of hypertension and diabetes, blood lipid, history of atrial fibrillation, prothrombin time international normalized ratio (PT-INR), fibrinogen, red cell count, platelet count, and history of drugs.

Blood pressure (BP) was measured on the nondominant arm in a seated position after a 10-minute rest using an electronic BP monitor (Omron BP-203RVIIIC; Omron Healthcare Co., Ltd., Matsusaka, Japan). Fasting plasma glucose was measured by the hexokinase–UV/NAD method (Olympus, Tokyo, Japan). Serum lipids were measured as follows: total cholesterol using the cholesterol oxidase–N-(2-hydroxy-3-sulfopropyl)-*3,5-dimethoxyaniline (HDAOS) method (Wako, Osaka, Japan); triglycerides using the Glycerol-3-phosphate oxidase (GPO)–HDAOS glycerol blanking method (Wako); high-density lipoprotein cholesterol using the immunoinhibition (direct) method (Wako), and low-density lipoprotein cholesterol using the selective protection enzymatic (direct) method (Wako). The PT-INR and fibrinogen were examined by STA Compact Hemostasis System (Diagnostica Stago, Inc., Paris, France). Atrial fibrillation was confirmed by objective tests such as 12-lead electrocardiogram or 24-hour Holter monitoring. The classification of hypertension was based on the guidelines of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) (2003): stage 1 hypertension was defined as 140-159/90-99 mmHg, stage 2 as 160-179/100-109, and stage 3 as 180/110 mmHg or above.[8]

Identification of Recanalization of Arteries with CTA or DSA

The imaging devices, Philips Brilliance 256 iCT (Philips Medical Systems, Eindhoven, The Netherlands), GE LightSpeed VCT (General Electric Company, Fairfield, Connecticut/America), Philips DSA (Philips), and GE DSA (General Electric Company), were used to check the neck and head arteries at the stage of stroke onset and the stage of 3-months of follow-up. The images of occlusion and recanalization of arteries were evaluated by 1 experienced attending physician in the neurology department and 1 experienced technicians in radiology department. Diagnoses of occlusion and recanalization were based on the following findings: definition of vascular occlusion: the CTA or DSA image shows an obvious occlusion end of the criminal blood vessel with no distal extension, or the distal extension blood vessel does not connect to the proximal occlusive criminal blood vessel; definition of vascular recanalization: the CTA or DSA image shows a clear appearance of contrast at the predetermined occlusion ends of the criminal blood vessel, and the image shows the reconnection of distal extension blood vessel to the proximal ends of the criminal blood vessel, indicating the continuous blood flow in the previously occlusive blood vessel.

Statistical Analysis

Statistical analysis was performed using SPSS 18.0 software (International Business Machines Corporation, New York). Data were presented as the means ± standard deviation or numbers. Means of continuous variables were compared between 2 groups using the Student *t*-tests or the Mann–Whitney *U*-test, when appropriate. Means of categorical variables were compared using chi-square test. Binary logistic regression models were used to assess the associations of the risk factors with the occurrence of recanalization. Differences between groups were considered statistically significant at a *P* value less than .05.