Specific Factors to Predict Large-Vessel Occlusion in Acute Stroke Patients

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Background: The effectiveness of thrombectomy for acute ischemic stroke has been established, and earlier treatment produces better outcomes. If possible to identify large-vessel occlusion (LVO) at the prehospital phase, eligible patients can be shipped directly to a hospital that can perform thrombectomy. The purpose of this study was to determine factors that are specific to LVO and can be known before hospital arrival. *Methods:* The subjects were stroke patients during the period between July 2014 and June 2016, who had a National Institutes of Health Stroke Scale (NIHSS) score of 8 or higher and came to our hospital within 6 hours of onset. These patients were divided into an LVO group and a non-LVO group, and background factors, mode of onset, individual NIHSS item scores, and blood pressure at the time of the visit were retrospectively investigated. The selected factors were compared with LVO prediction scales reported in the past. *Results:* There were 196 stroke patients who had NIHSS scores of 8 or higher and arrived at the hospital within 6 hours. Of these 196 patients, 56 had LVO. This LVO group included a significantly higher number of patients with the 2 items of atrial fibrillation (odds ratio [OR], 11.5: 95% confidence interval [CI], 4.04-32.9; $P < .0001$) and systolic blood pressure of 170 mm Hg or lower (OR, 2.99: 95% CI, 1.33-6.71, $P = .008$). These 2 items predicted LVO equally to existing LVO prediction scales. *Conclusions:* The 2 items of atrial fibrillation and systolic blood pressure of 170 mm Hg or lower were significantly correlated with LVO. **Key Words:** Mechanical thrombectomy—large-vessel occlusion—prehospital.

Introduction

In recent years, it has been demonstrated that thrombectomy rather than intravenous thrombolytic therapy alone leads to better outcomes in patients with cerebral infarction from large-vessel occlusion (LVO).[1-5] It has also become clear that earlier treatment produces better outcomes.[6] However, facilities that can perform thrombectomy are limited, and even in those where thrombectomy can be performed, an endovascular therapist is not necessarily on duty at all times. Thus, early prediction of the presence or absence of LVO is beneficial. Emergency medical services perform triage using a prehospital stroke scale, but it is very difficult to distinguish using these scales whether a patient has LVO or not.[7-9] Patient information

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at the time of visit was analyzed, and factors that predict LVO were investigated.

Subjects and Methods

The subjects were patients diagnosed with stroke (cerebral infarction or cerebral hemorrhage only; subarachnoid hemorrhage was excluded) at our hospital during the period from July 2014 to June 2016, who had a National Institutes of Health Stroke Scale (NIHSS) score of 8 or higher and came to the hospital within 6 hours of onset. The definition of LVO was internal carotid artery occlusion, middle cerebral artery segment M1 or M2 occlusion, or basilar artery occlusion confirmed with computed tomography angiography or magnetic resonance angiography. It did not include occlusion of M3 or more distal arteries or posterior cerebral artery occlusion. For patients whose time of onset was unknown, those who arrived at the hospital within 6 hours from the time they were last known to be well were taken as subjects. The subjects were divided into an LVO group and a non-LVO group, and they were retrospectively compared for age, sex, mode of onset (sudden onset or not), medical history (stroke, atrial fibrillation, heart failure, hypertension, hyperlipidemia, diabetes, renal disease, dialysis), lifestyle habits (drinking, smoking), family history of stroke, medication history (anticoagulant or antiplatelet drugs, statins), NIHSS items, and blood pressure at the time of the visit (systolic, diastolic). In cases of a significant difference between continuous variables, the optimal threshold was determined from the receiver operating characteristic curve, and a comparison was made. Patient scores were calculated and compared using a stroke prediction scale known as the Cincinnati Prehospital Stroke Scale (CPSS),[7] and LVO prediction scales including the 3-Item Stroke Scale (3ISS)[10]; the Rapid Arterial Occlusion Evaluation (RACE)[11]; the Cincinnati Prehospital Stroke Severity Scale (CPSSS)[12]; the Prehospital Acute Stroke Severity (PASS) scale[13]; the Field Assessment Stroke Triage for Emergency Destination (FAST-ED)[14]; and the NIHSS-8.[15]

Statistical analysis was done using JMP ver. 13 (SAS Institute Inc. Cary, NC), with $P < .05$ indicating a significant difference. A statistical comparison of data was performed using the chi-square test for categorical variables, and the Mann–Whitney U test for continuous variables. Multivariable logistic regression analysis was used to identify independent predictors of LVO.

Results

During the study period, 722 stroke patients (cerebral infarction or cerebral hemorrhage only; subarachnoid hemorrhage was excluded) were admitted. Of these 722 patients, 461 had cerebral hemorrhage, and 261 had cerebral infarction. Of them, 423 patients arrived at the hospital within 6 hours from onset. There were 201 cerebral hemorrhage patients and 222 cerebral infarction patients. Of the patients who arrived at the hospital within 6 hours, 196 had NIHSS scores of 8 or higher, including 117 patients with cerebral hemorrhage and 79 patients with cerebral infarction. These 196 patients comprised 56 LVO patients and 140 non-LVO patients (cerebral hemorrhage 117, cerebral infarction 23) (Fig 1).

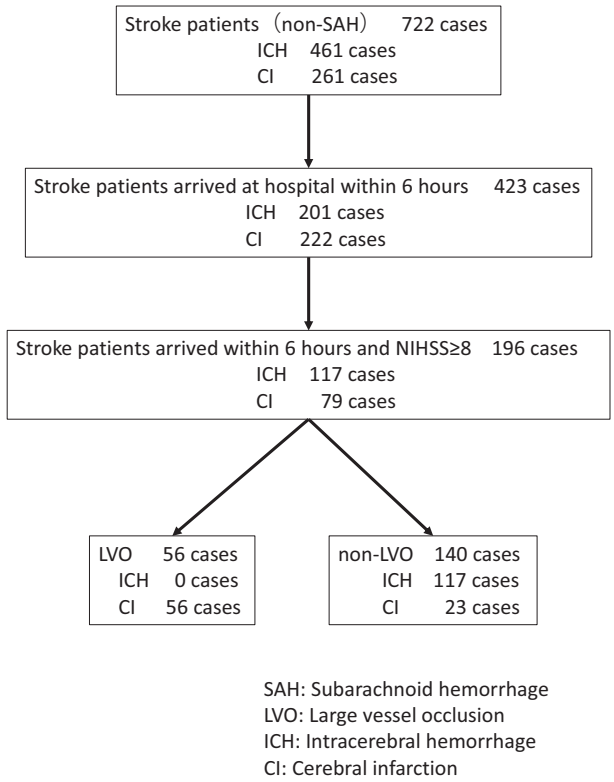

Figure 1. *Flowchart of study patients.*

LVO and non-LVO patients are compared in Table 1. No significant differences were seen between the groups in age, sex, or whether the onset was sudden. For medical history, no significant differences were seen between the 2 groups in cerebral infarction, hypertension, diabetes, renal disease, or maintenance dialysis. Atrial fibrillation was seen in 32 (57.1%) patients in the LVO group versus 15 (10.7%) in the non-LVO group, a clear, significant difference ($P < .0001$). Heart failure was seen in 9 patients (16.1%) in the LVO group versus 5 patients (3.6%) in the non-LVO group. Although the number of patients was small in both groups, a significant difference was seen ($P = .0021$). Hyperlipidemia was seen in 16 patients (28.6%) in the LVO group versus 21 (15%) in the non-LVO group, showing a significant difference ($P = .03$). No significant differences were seen between the groups in the lifestyle habits of smoking and drinking. Family history of stroke was about 10% in both groups, with no significant difference. Among medications, 10 patients (17.9%) in the LVO group took oral anticoagulants versus 6 (4.3%) in the non-LVO group, a significant difference ($P = .002$).