Effect of Blood Pressure Variability on Cardiovascular Outcome in Diabetic and Nondiabetic Patients with Stroke

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Background: The association between blood pressure (BP) variability and stroke outcome is controversial, and there are few studies that have focused on the impact of BP variability in diabetic patients with stroke. Therefore, we aimed to examine the impact of BP variability on cardiovascular outcome in diabetic and nondiabetic patients with stroke. *Methods:* A total of 373 ischemic stroke patients with large artery atherosclerosis were recruited and followed up. Ambulatory BP monitoring was performed in all patients and divided according to the 25th and 75th percentiles interval of SD of daytime systolic BP (SBP). Kaplan-Meier analysis and Cox regression were used to assess the relationship between BP variability and cardiovascular outcomes including stroke recurrence, vascular events and cardiovascular death. *Results:* The 339 patients were included in the final analysis. During an average follow-up of 19.0 ± 5.1 months (.6-26.8 months), 69 (20.4%) cardiovascular events occurred in all patients. Kaplan-Meier analysis found that there were no differences in cardiovascular events-free survival among the different BP variability groups in diabetic patients (P = .995); however, nondiabetic patients with greater BP variability showed a lesser cardiovascular events-free survival (P = .039). Through Cox regression we found the SD of daytime SBP (hazard ratio 1.103; 95% CI 1.011-1.203) was associated with cardiovascular outcomes in nondiabetic patients with stroke. *Conclusions:* We show that SBP variability is associated with cardiovascular outcomes in stroke patients without diabetes, but we didn't find a correlation between SBP variability and cardiovascular outcomes in stroke patients with diabetes. **Key Words:** Ischemic stroke—outcome—ambulatory blood pressure monitoring—blood pressure variability—diabetes mellitus.

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Introduction

Ambulatory blood pressure monitoring (ABPM) not only provides information on blood pressure (BP) levels but on the diurnal changes in BP as well.[1] Previous studies have indicated that BP variability is an important trigger of vascular events[2-4] and can provide a more precise estimate of individual cardiovascular risk.[5]

The association between BP variability and cardiovascular outcomes in patients with stroke has been investigated. Because of the methodologic differences, patient selection differences, and other differences, previous published studies were vague on the association of BP variability with stroke outcome. Some studies found that increased BP variability during an acute ischemic stroke (IS) was associated with worse clinical outcomes during a short period after an acute phase of stroke.[6-11] On the contrary, some reports suggested that increased BP variability is of little prognostic value[12-15] or may even indicate a good prognosis.[16,17]

Recently, diabetes mellitus has been shown to be an independent risk factor for IS.[18] The prevalence of diabetes ranges from 21% to 44.4% among patients with acute IS.[19] Jia et al[19] suggested that the prevalence of abnormal glucose regulation was 68.7% among all the patients with acute stroke in China. In addition, some evidence indicates that the BP variability is increased in diabetic subjects[20] and diabetes is associated with greater mortality from stroke.[17,21]

Up to now, there are few studies focusing on BP variability of diabetic patients with stroke. Therefore, we aimed to examine the impact of BP variability on cardiovascular outcomes in diabetic and nondiabetic patients with IS.

Patients and Methods

Patients

We performed an observational study of prevalent patients with IS who were admitted to the Cerebrovascular Center of Beijing Tiantan Hospital, People's Republic of China, between May 2010 and August 2011. The patients were diagnosed with IS according to the World Health Organization criteria, which was confirmed by computed tomography (CT) or magnetic resonance imaging (MRI) of the brain. The enrolled IS patients, who were older than 18 years of age, were classified as having large-artery atherosclerosis according to the TOAST (ie, Trial of Org 10172 in Acute Stroke Treatment) criteria. None of patients suffered from infective endocarditis, atrial fibrillation, valvular heart disease, or malignant tumor that could lead to stroke. The patients who had any severe alimentary tract hemorrhage, infectious disease, diseases known to affect the autonomic nervous system, or severe heart failure (left ventricular ejection fraction <45%) were excluded from the present study. In addition, patients with intracranial aneurysm who were confirmed by brain CT or MRI were not also included in our study. Therefore, 373 IS patients were recruited. The ethical committee of Beijing Tiantan Hospital approved the study protocol, and all patients or their designated relatives provided informed consent.

Baseline Characteristics

The following baseline characteristics were investigated: age, gender, height, body weight, and duration of hypertension. Patients were defined as having

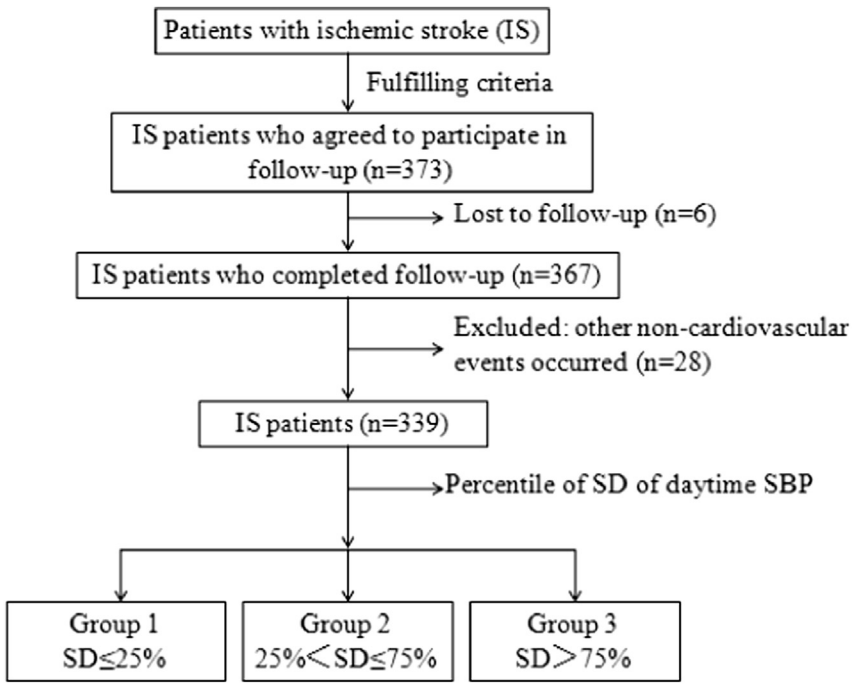

Figure 1. *The patient selection flow in this study. Abbreviations: IS, ischemic stroke; SBP, systolic blood pressure.*