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Impact of diabetes and prediabetes on the short-term prognosis in patients with acute ischemic stroke

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ABSTRACT

Objective: We aimed to explore the association between abnormal glucose metabolism such as diabetes, prediabetes, and short-term prognosis in patients with acute ischemic stroke.
Methods: Of 242 consecutive acute ischemic stroke patients, a 75-g oral glucose tolerance test was administered to 116 patients without previously diagnosed diabetes. One hundred forty patients were classified into diabetes, 52 patients were prediabetes (impaired glucose tolerance or impaired fasting glucose or both), and 50 patients were normal glucose tolerance (NGT). The association between each glycemic status and early neurological deterioration (END; increase in the NIH Stroke Scale (NIHSS) of ≥2 points during the first 14 days after admission) or poor short-term outcome (30-day modified Ranking Scale [mRS] score 2–6) was evaluated.
Results: In multivariable analysis, the risk of END was significantly higher in the diabetes group than in the NGT group (ORs = 11.354; 95% CI, 1.492–86.415; p = 0.019), even after adjustment for possible confounding factors (ORs = 12.769; 95% CI, 1.361–119.763; p = 0.026). Similar but insignificant associations were observed between prediabetes and NGT groups (ORs = 6.369; 95% CI, 0.735–55.177; p = 0.093). The risk of poor outcome (30-day mRS 2–6) was significantly higher in the diabetes group (ORs = 3.667; 95% CI, 1.834–7.334; p < 0.001) than in the NGT group, even after adjusting for confounding factors (ORs = 3.340; 95% CI, 1.361–8.195; p = 0.008). Similar but insignificant associations were observed between prediabetes and NGT groups (ORs = 2.058; 95% CI, 0.916–4.623; p = 0.08).
Conclusion: In our patient population, both diabetes and prediabetes were associated with a poor early prognosis after acute ischemic stroke.

1. Introduction

Because of rapid changes in diet and life-style and an increasing elderly population, patients with diabetes mellitus (DM) are increasing in Japan [1]. It has also been shown that stroke patients with comorbid diabetes are increasing [2]. In accordance with alteration of risk factors, subtypes of ischemic stroke are changing [3]. Lacunar infarction is decreasing, whereas the incidence of atherothrombotic infarction and cardioembolism is increasing [4,5]. Diabetes mellitus is a major independent risk for stroke as well as hypertension (HT) and clearly associated with poor outcome after stroke [6–8]. Because the patients with diabetes exhibit a worse long-term vascular prognosis than non-diabetic patients after stroke [9], special attention should be paid to patients with diabetes after stroke. In addition to increasing number of diabetes, the incidence of prediabetes such as impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), are also increasing [3], and are considered important risk factors for cardiovascular events [10]. We previously reported high incidence of abnormal glucose metabolisms (AGM; including previously or newly diagnosed DM, or IFG and IGT) among Japanese ischemic stroke patients [11]. However, the association among each AGM such as diabetes, prediabetes, normal glucose tolerance, and short-term prognosis in acute ischemic stroke patients remains unclear. The present study aimed to clarify the association between AGM and the short-term prognosis such as early neurological deterioration (END) within

Abbreviations: AGM, abnormal glucose metabolism; DM, diabetes mellitus; preDM, prediabetes; IGT, impaired glucose tolerance; IFG, impaired fasting glucose; NGT, normal glucose tolerance; END, early neurological deterioration; RS, in-hospital recurrence of stroke; OGTT, oral glucose tolerance test; CT, computed tomography; MRI, magnetic resonance imaging; ATI, atherothrombotic infarction; LI, lacunar infarction; CE, cardioembolic infarction; UE, undetermined etiology; TIA, transient ischemic attack; BAD, intracranial branch atheromatous disease; BMI, high-body mass index; HT, hypertension; DL, dyslipidemia; LDL, low density lipoprotein; HDL, high density lipoprotein; mRS, modified Ranking Scale; NIHSS, National Institutes of Health Stroke Scale.

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14 days and a poor short-term outcome (30-day modified Ranking Scale (mRS) 2–6), based on each abnormal glucose metabolism in Japanese acute stroke patients.

2. Methods

2.1. Subjects

Among the 338 consecutive patients diagnosed with acute ischemic stroke who were admitted to Juntendo Urayasu Hospital between April 2008 and May 2010 (excluding mRS ≧3 before the onset, other types of stroke such as arterial dissection, associated with caner and collagen disease, recurrence of stroke during enrolment), 39 with severe disability (modified Ranking Scale [mRS] score >3) or impaired swallowing, and 57 who did not provide informed consent were also excluded from OGTT evaluation. Thus we assessed 242 patients in the final outcome analysis. All patients underwent brain computed tomography (CT) or magnetic resonance imaging (MRI) and electrocardiography. According to the Classification of Cerebrovascular Disease III (Committee of the National Institute of Neurological Disorders and Stroke), and the diagnostic criteria of the Trial of Org 10172 in Acute Stroke Treatment study for cerebral infarction subtypes [12], ischemic stroke was divided into 6 subtypes: atherothrombotic infarction (ATI), lacunar infarction (LI), cardioembolic infarction (CE), undetermined etiology (UE), transient ischemic attack (TIA), and intracranial branch atheromatous disease (BAD) of the lenticulostriate arteries(>10 mm diameter infarcts on axial slice, visible on ≥3 axial slices of 8-mm slice thickness), and anterior pontine arteries (unilateral infarcts extending to the basal surface of the pons) [13]. We first assessed the prevalence of DM, prediabetes (preDM), and NGT, in patients with each stroke subtype. Among the 338 patients, 126 (37.3%) had a previous type 2 diabetes mellitus and were not subjected to OGTT. Of the remaining 198 patients, 39 with severe disability (modified Ranking Scale [mRS] score >3) or impaired swallowing, and 57 who did not provide informed consent were excluded from OGTT and from outcome analysis (Fig. 1A). Eventually, 116 patients underwent OGTT and 242 acute ischemic stroke patients were assessed for short-term prognosis, including early neurological deterioration (END increase in the National Institutes of Health Stroke Scale (NIHSS) of ≥2 points during the first 14 days after admission) and a poor outcome (30-day mRS 2–6). Blood samples for DM diagnosis were taken after clinical stroke subtype determination, and the mean interval between hospital admission and OGTT performance was 18 ± 9.7 days. We also assessed baseline cardiovascular risks, including, high-body mass index (BMI kg/m^2), hypertension (history of hypertension or antihypertensive drug use), diabetes (HbA1c ≥6.5%, high blood sugar ≥200 mg/dL, or history of anti-diabetic drug or insulin use), dyslipidemia (low density lipoprotein [LDL] ≥140 mg/dL, high density lipoprotein [HDL] <40 mg/dL, TG ≥150 mg/dL or lipid lowering drug

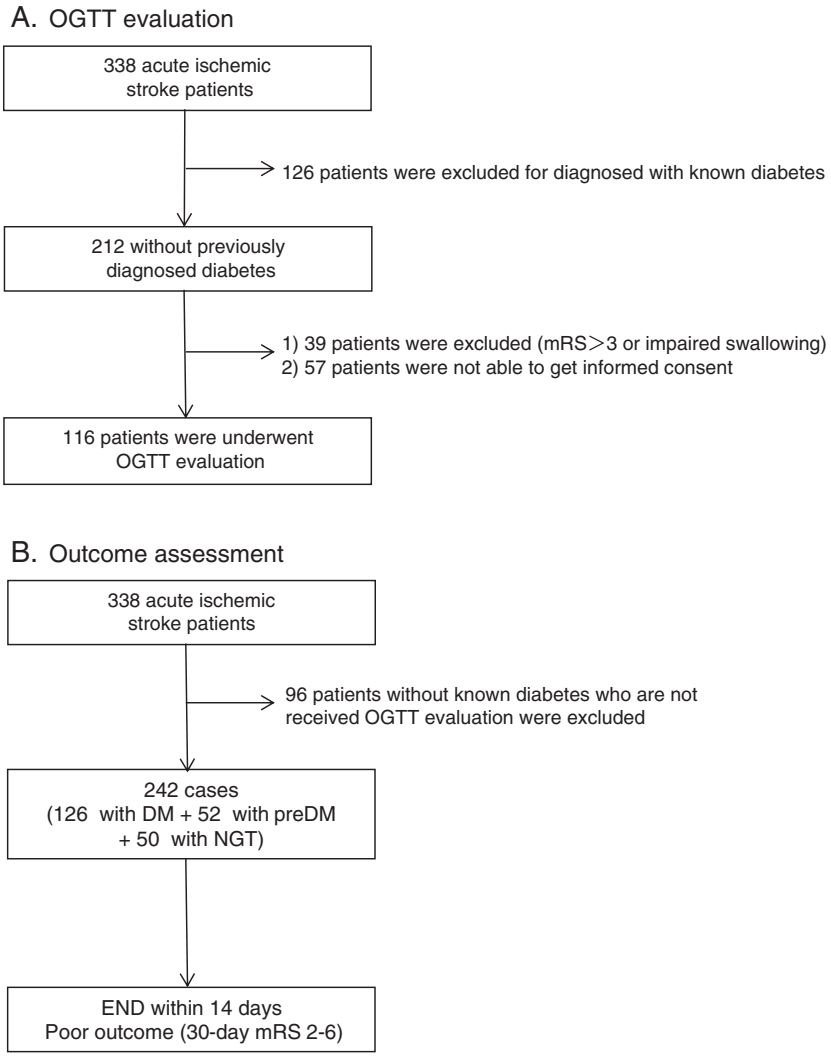

Fig. 1. A, A flowchart of the patient selection for the OGTT. B, A flowchart of the clinical outcome assessment based on the glycemic status. OGTT, oral glucose tolerance test; mRS, modified Ranking Scale; DM, diabetes mellitus; preDM, prediabetes; NGT, normal glucose tolerance; END, early neurological deterioration.