

Discrimination of Acute Ischemic Stroke from Nonischemic Vertigo in Patients Presenting with Only Imbalance

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Some patients who present with an acute feeling of imbalance are experiencing an ischemic stroke that is not evident on computed tomography (CT) scans. The aim of this study was to compare ischemic stroke and nonischemic vertigo patient groups and to investigate independent factors associated with ischemic stroke. We examined 332 consecutive patients with an acute feeling of imbalance who showed no neurologic findings or responsible lesions on CT scan at the hyperacute phase. We examined their clinical backgrounds, physical findings, and laboratory examinations, with ischemic stroke diagnosed by later CT and/or magnetic resonance imaging (MRI). We identified 41 (12.3%) ischemic stroke patients. Atrial fibrillation (odds ratio 4.1; 95% confidence interval 1.4-11.5), white blood cell count ($10^3/\mu\text{L}$, 1.4; 1.2-1.6), head and/or neck pain (4.6; 2.1-10.3), first attack of imbalance feeling (3.3; 1.1-12.2), and dizziness (3.7; 1.7-8.3) were significant and independent factors associated with ischemic stroke among patients with an acute feeling of imbalance. We used these factors to calculate an "imbalance score"; 1 point was given for the presence of each factor and a score of 3-5 points was independently associated with ischemic stroke. An awareness of these factors may indicate that further examinations including MRI are necessary to rule out ischemic stroke. **Key Words:** Ischemic stroke—imbalance—vertigo—cerebral infarction—emergency neurology.

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Introduction

Ischemic stroke is rarely diagnosed in patients presenting with only a dizzy feeling, including vertigo, dizziness, and a feeling of imbalance, and no other neurologic

deficits.^{1,2} Many patients with a feeling of imbalance show lesions in the cerebellum or brainstem,³⁻⁵ where infarction often deteriorates because of hydrocephalus, progression of arterial thrombosis, or dissection during the acute phase of the stroke.^{6,7} In emergency rooms, it is difficult to diagnose ischemic stroke in patients with a feeling of imbalance by history taking, physical examinations, or computed tomography (CT) scan, which cannot detect infarcts during their hyperacute phase.^{8,9} In addition, in many institutions, it is impossible to perform magnetic resonance imaging (MRI) in all patients who present with imbalance in the emergency room. Moreover, and during the hyperacute phase, some infarcts, especially in the brainstem, are not revealed on MRI, including those shown in diffusion-weighted images (DWI).¹⁰⁻¹⁴

Therefore, the clinical characteristics of patients presenting with imbalance because of ischemic stroke would be useful for clinical decision making, including an

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Received May 26, 2013; revision received July 17, 2013; accepted July 21, 2013.

Conflicts of interest: None.

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1052-3057/\$ - see front matter

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<http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2013.07.029>

indication for performing hyperacute MRI or a follow-up radiological study. Although there are some studies concerning feelings of imbalance because of ischemic stroke,^{2-4,15-22} to our knowledge, no studies have examined the predictive factors of stroke using multivariate analysis.

The aim of the present study was to investigate the frequency and predictive factors of ischemic stroke in patients presenting at emergency room with only a feeling of imbalance.

Subjects and Methods

Saiseikai Kumamoto Hospital is an emergency hospital in Kumamoto City, Japan. All the patients presenting with imbalance underwent head CT scans and were then examined by neurologists because of the lack of otologists in our hospital. The neurologists evaluated gaze nystagmus, hearing disturbance, dysarthria, limb ataxia, dysdiadochokinesia, intentional tremor, hypotonia, rebound phenomenon, and loss of deep sensations. However, they were unable to perform some otoneurologic evaluations, including head impulse testing,²³ because many of the patients had severe positional or positioning vertigo with vomiting. Of the patients with a feeling of imbalance, those diagnosed with urgent diseases, including acute ischemic stroke, were emergently admitted to our department; the others were treated with drip infusion of half saline and antiemetic in the emergency room. If their symptoms persisted for several hours after this treatment and they complained of difficulties in standing or walking, then they were also admitted to our department. The patients who reported that the feeling of imbalance was completely resolved and who showed no neurologic deficits or recent lesions on radiological examinations were released.

Subjects analyzed in the present study were those patients who were consecutively admitted to our department from April 2004 to March 2006 and whose clinical information was collected prospectively. Inclusion criteria were the following: (1) presenting with an acute feeling of imbalance, including vertigo and dizziness (a sensation of rotating was defined as vertigo and a sensation of floating was defined as dizziness); (2) no other neurologic signs or symptoms except a feeling of imbalance, head and/or neck pain, nausea, and nystagmus based on neurologic examination on admission; and (3) no lesion responsible for a feeling of imbalance on initial CT scan or radiologically diagnosed by referral physicians.

All patients diagnosed with ischemic stroke were classified at discharge into one of the clinical categories defined in the Trial of Org 10172 in Acute Stroke Treatment study.²⁴ As the definition of transient ischemic attack (TIA) was not mentioned in the Trial of Org 10172 in Acute Stroke Treatment classification, it was defined

in the present study as reversible episodes of neurologic deficits of vascular origin that resolve completely within 24 hours. Patients whose deficits were solely feeling of imbalance were not diagnosed with TIA. Thereafter, patients were treated with conventional interventions, including antithrombotic, neuroprotective, or glycerol-based agents, depending on clinical category and site of lesions. Patients with motor or speech deficits underwent physical or speech therapies, respectively. Their outcomes at discharge were evaluated by the modified Rankin Scale.²⁵

Carotid echography, transthoracic echocardiography, and 24-hour electrocardiographic monitoring were performed in all patients during the acute phase, and transesophageal echocardiography and/or intra-arterial digital subtraction angiography were also performed if indicated, with the permission of patients. Thereafter, patients were assigned to a final category of ischemic stroke. All patients gave informed, written consent to participate in the study.

Clinical Characteristics

The following clinical data were obtained from all patients: age, gender, visits by emergency medical services, history of ischemic heart disease, ischemic cerebral disease, acute feeling of imbalance attacks, and vascular risk factors for stroke, including hypertension, diabetes mellitus, hypercholesterolemia, and current smoking. We measured and recorded systolic and diastolic blood pressure and body temperature on admission. We also checked for the presence or absence of the following associated symptoms and signs: head and/or neck pain, nausea and vomiting, nystagmus, acute deafness, acute tinnitus, type of feeling of imbalance, and vertigo or dizziness. Laboratory examinations, including white blood cell count, hematocrit, platelet count, fasting blood sugar, prothrombin time/international normalized ratio, and C-reactive protein, were performed within 48 hours of admission.

Radiological Examinations

On admission, all the patients were examined by CT scan and MRI if they had no contraindications (metal implants, claustrophobia). The final diagnosis of ischemic stroke was performed by diagnostic imaging during the patient's clinical course in our hospital. The patients who showed a persistent feeling of imbalance over 2 days were examined again by MRI or CT scan. MRI studies were performed using a Toshiba 1.5-T Excelart MR unit with echo-planar capability. We carried out conventional MRI studies with T1-weighted (repetition time [TR]/echo time [TE], 500/15), T2-weighted (TR/TE, 4200/100), and fluid-attenuated inversion recovery images (TR/TE, 6000/120) and MR angiography. Diffusion-weighted imaging studies were performed

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