

Factors Associated with the Misdiagnosis of Cerebellar Infarction

Yoko Masuda, MD,* Hideaki Tei, MD,† Satoru Shimizu, PhD,‡
and Shinichiro Uchiyama, MD*

Background: Cerebellar infarction is easily misdiagnosed or underdiagnosed. In this study, we investigated factors leading to misdiagnosis of cerebellar infarction in patients with acute ischemic stroke. *Methods:* Data on neurological and radiological findings from 114 consecutive patients with acute cerebellar infarction were analyzed. We investigated factors associated with misdiagnosis from the data on clinical findings. *Results:* Thirty-two (28%) patients were misdiagnosed on admission. Misdiagnosis was significantly more frequent in patients below 60 years of age and in patients with vertebral artery dissection, and significantly less frequent in patients with dysarthria. It tended to be more frequent in patients with the medial branch of posterior inferior cerebellar artery territory infarction, and infrequent in patients with the medial branch of the superior cerebellar artery territory infarction. Thirty out of 32 (94%) misdiagnosed patients were seen by physicians that were not neurologists at the first visit. Twenty-four of 32 (75%) misdiagnosed patients were screened only by brain CT. However, patients were not checked by brain MRI or follow-up CT until their conditions worsened. *Conclusions:* Patients below 60 years of age and patients with vertebral artery dissection are more likely to have a cerebellar infarction misdiagnosed by physicians other than neurologists. **Key Words:** Cerebellar infarction—misdiagnosis—neurologic deficits—risk factor—vascular territory—vertigo.

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Vertigo and headache are common symptoms at the onset of cerebellar infarction (CI), although many patients present with few neurologic deficits.¹ CI is easily misdiagnosed or underdiagnosed.¹ However, early correct diagnosis is crucial to help prevent treatable but potentially fatal complications, such as brainstem compression and obstructive hydrocephalus.²

In a previous study,¹ we investigated the relationships of clinical characteristics, misdiagnosis, and outcome in 33 patients with CI. Many patients presenting with vertigo or headache were seen by general physicians, who overlooked or underestimated CI. Many patients with CI were misdiagnosed on admission.

In this study, we analyzed factors commonly associated with misdiagnosis in consecutively admitted patients with acute CI.

Methods

Neurologic and radiologic findings from 114 consecutively admitted patients with a final diagnosis of acute CI (84 men; age range 32-94 years; mean age 64 years) were analyzed. The 114 patients with CI were admitted to the Department of Neurology, Tokyo Women's Medical University Hospital (Tokyo, Japan) or the Department of Neurology, Toda Central General Hospital (Saitama,

From the *Department of Neurology; ‡Medical Research Institute, Tokyo Women's Medical University, Tokyo; and †Department of Neurology, Toda Central General Hospital, Saitama, Japan.

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Address correspondence to Yoko Masuda, MD, Department of Neurology, Tokyo Women's Medical University School of Medicine, 8-1 Kawada-cho, Shinjuku-ku, Tokyo, Japan. E-mail: yoko.masuda@orion.ocn.ne.jp.

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Japan) between March 1999 and March 2009. We investigated factors commonly associated with misdiagnosis from the patients' clinical findings.

We investigated the relationships between misdiagnosis with (1) neurologic symptoms, such as vertigo and headache; (2) neurologic deficits, including disturbance of consciousness, dysarthria, nystagmus, and ataxia; (3) age (<60 years of age); (4) sex; (5) lesion (right or left); (6) outcome (1 month after stroke); (7) vascular territories (medial branch of posterior inferior cerebellar artery [mPICA], lateral branch of posterior inferior cerebellar artery [lPICA], anterior inferior cerebellar artery [AICA], medial branch of superior cerebellar artery [mSCA], or lateral branch of superior cerebellar artery [lSCA]); (8) mechanism of infarction (cardioembolism, atherothrombosis or arterial dissection); and (9) vascular risk factors (hypertension, diabetes mellitus, hyperlipidemia, smoking, and atrial fibrillation).

Incorrect diagnoses on admission were peripheral-type vertigo (n = 14), sudden deafness (n = 2), dehydration (n = 2), old infarction (n = 1), vertebrobasilar insufficiency (n = 1), metastatic brain tumor (n = 1), otitis media (n = 1), Bell's palsy (n = 1), hypertensive encephalopathy (n = 1), hypertension (n = 1), gastritis (n = 1), myocardial infarction (n = 1), and cervical spondylosis (n = 1).

Hypertension was defined as systolic blood pressure >140 mm Hg or diastolic blood pressure >90 mm Hg on admission, or a history of high blood pressure requiring medical treatment. The diagnosis of diabetes mellitus was made if a patient was treated with oral glucose depressants or insulin, or if their glycosylated hemoglobin levels were $\geq 6.5\%$, based on the criteria of the Japan Diabetes Mellitus Society.³ Hyperlipidemia was defined as an elevated fasting serum total cholesterol level of >220 mg/dL or a history of hyperlipidemia requiring treatment.

Statistical analyses were performed using JMP software (version 8; SAS Institute Inc, Cary, NC). We selected appropriate explanatory variables using the method of model building by forward and backward elimination. An appropriate regression model equation was determined using the coefficients applied to the variables as parameters. A multivariable model was used to compare

misdiagnosed patients with others. We calculated an odds ratio from the parameter-estimated value. $P < .05$ was considered statistically significant.

Results

Thirty-two of 114 (28%) patients were misdiagnosed on admission. At the first visit, 30 of 32 (94%) misdiagnosed patients were seen by physicians who were not neurologists. Twenty-four of 32 (75%) misdiagnosed patients were screened only by computed tomographic (CT) scans of the brain. Only 3 (13%) patients were found to have lesions in the cerebellum on CT. Two of the 3 patients were diagnosed with an old infarction, and another patient was not found to have any responsible lesion. However, patients were not checked by magnetic resonance imaging (MRI) scans of the brain or follow-up CT scans until their conditions worsened.

The average time from onset to diagnosis was 1.5 days in all 114 patients, while it was 2.7 days in the 32 misdiagnosed patients.

Between the 32 misdiagnosed and 82 correctly diagnosed patients with CI, we compared neurologic symptoms (vertigo and headache) and deficits (disturbance of consciousness, dysarthria, nystagmus, and ataxia). In terms of neurologic symptoms, there was no difference in the prevalence of vertigo or headache between the 2 groups. For neurologic deficits, dysarthria was significantly less frequent in patients with than without misdiagnosis (25% v 48%; $P = .014$; Table 1).

For age, sex, lesion, and outcome, patients <60 years of age were misdiagnosed more frequently than older patients (56% v 27%; $P = .009$; Table 2). Sex, lesion, or outcome was not different between the groups.

As to the vascular territory of infarction, mPICA infarcts in the territory of lPICA, AICA, mSCA, and lSCA were identified in 61 (54%), 17 (15%), 10 (9%), 24 (21%), and 33 (29%) patients, respectively. We excluded patients with AICA territory infarctions because there were too few patients for model building by forward and backward elimination. We investigated the relationships between misdiagnosis and vascular territories in the other

Table 1. Relationships between misdiagnosis and neurologic deficits in patients with acute cerebellar infarction

Neurologic deficits	Misdiagnosis		β coefficient	OR (95% CI)	<i>P</i> value*
	Yes (n = 32)	No (n = 82)			
Vertigo	28 (88%)	65 (79%)	.3238	1.38 (.71-2.99)	.371
Headache	17 (53%)	35 (43%)	.2631	1.30 (.84-2.04)	.244
Disturbance of consciousness	7 (22%)	19 (23%)	.2851	1.33 (.73-2.43)	.347
Dysarthria	8 (25%)	39 (48%)	-.6332	.53 (.31-.86)	.014
Nystagmus	18 (56%)	39 (48%)	.1834	1.20 (.77-1.90)	.422
Ataxia	24 (75)	53 (65)	.2780	1.32 (.81-2.23)	.275

*Multivariable model.

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