

Utility of Items of Baseline National Institutes of Health Stroke Scale as Predictors of Functional Outcomes at Three Months after Mild Ischemic Stroke

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Background: Predicting outcomes of acute stroke patients initially presenting with mild neurologic deficits is crucial in decision making regarding thrombolytic therapy. We examined the utility of individual National Institutes of Health Stroke Scale (NIHSS) score items or clusters of items as predictors of functional outcomes at 3 months after mild stroke. *Methods:* Using a multicenter stroke registry database, we identified patients with acute ischemic stroke who presented within 4.5 hours of symptom onset and had baseline NIHSS scores less than or equal to 5. Functional outcomes at 3 months were dichotomized as favorable (modified Rankin

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Scale [mRS] score 0 or 1) or unfavorable (mRS 2-6). Individual NIHSS items, clusters of items, and the total score were tested for their ability to predict outcomes in multivariable models. Area under the receiver operating characteristic curve (AUC) was used to assess model performance. **Results:** Of the 2209 patients who met eligibility criteria, 588 (26.6%) exhibited unfavorable functional outcomes at 3 months. Of the 15 items of the NIHSS, all except item 8 (sensory) and item 11 (extinction) were significantly associated with unfavorable functional outcomes in bivariate analysis (P 's < .05). Among the multivariable models, the model with the total NIHSS score exhibited an AUC similar to that of the model with all NIHSS items in predicting functional outcomes (.758 [95% confidence interval .739-.775] versus .759 [.740-.776]; $P = .75$ for pairwise comparison). **Conclusions:** Simply using the total NIHSS score was as effective as using all individual items in predicting outcomes of mild stroke patients. **Key Words:** Mild stroke—outcome assessment—NIHSS—prognosis.

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Introduction

Because most pivotal intravenous thrombolysis (IVT) stroke trials have excluded patients presenting with mild stroke symptoms, the effectiveness of IVT in mild stroke patients is as yet uncertain.¹⁻³ Approximately one third of patients who were not treated with IVT due to mild stroke symptoms eventually had unfavorable functional outcomes at discharge or at 3 months after stroke onset.⁴⁻¹⁰ Current stroke guidelines recommend IVT for patients with mild but *disabling* stroke symptoms such as complete hemianopia, severe aphasia, extinction, and significant weakness.¹¹ However, there is substantial variation in the use of IVT in patients with mild stroke symptoms in clinical practice possibly because of treatment decision on patients who have initially *nondisabling* stroke symptoms.¹² Additionally, lack of consensus among stroke physicians defining mild but *disabling* stroke symptoms could further contribute to the practice variation in the use of IVT in those patients. In fact, a randomized clinical trial is currently underway to evaluate effectiveness of the IVT among mild stroke patients.¹³ In the absence of high-level evidence from randomized clinical trials, it is quite important for clinicians to identify patients who will potentially have unfavorable outcomes despite their initially mild stroke symptoms.

The National Institutes of Health Stroke Scale (NIHSS) is the most widely accepted tool for measuring stroke severity and it correlates well with stroke outcomes in general.¹⁴ The NIHSS consists of 15 items which enable an examiner to score the neurologic impairment caused by stroke. Although several items of individual NIHSS score such as motor weakness, level of consciousness, extinction, and ataxia have been suggested as predictors of unfavorable functional outcome in patients with mild stroke, the predictive ability of the NIHSS item in mild stroke is very controversial.¹⁵⁻¹⁸ Recently, NIHSS item profiles were reported to be associated with functional outcomes and mortality in moderate to severe stroke pa-

tients receiving IVT based on data from a clinical trial and also from a tissue plasminogen activator (tPA) postmarketing cohort.^{19,20} However, the use of a sole cutoff point of total NIHSS score was unsatisfactory for decision making regarding IVT in mild stroke patients, as the individual items of the NIHSS are not equal in their potential to lead to disability.^{21,22} Alternatively, specific clinical syndromes defined by the NIHSS item clusters were evaluated for predicting outcomes after mild stroke, but failed to exhibit any significant associations.²³ We thus examined the utility of individual NIHSS items or clusters of NIHSS items as predictors of 3-month functional outcomes after mild stroke using a large number of cases from a prospective multicenter stroke registry database.

Methods

Study Subjects

We used the Clinical Research Center for Stroke-5 (CRCS-5) registry, which is a web-based prospective, multicenter, nationwide registry of patients with acute ischemic stroke. The registry started enrolling patients from 9 academic centers in 2008, and as of March 2014, it incorporated data from 12 centers across South Korea. The registry was approved by the institutional review boards (IRBs) of all participating centers. Use of the registry database and additional collection of information by chart review for conducting and publishing this study were also approved by all of the IRBs. Detailed information regarding the structure, coverage, and case characteristics of the registry has been published previously.^{24,25}

From the registry database, we identified study subjects using the following inclusion criteria: (1) acute ischemic stroke patients hospitalized between April 2008 and March 2014; (2) aged 18 years or older; (3) time interval from symptom onset to hospital arrival less than or equal to 4.5 hours; and (4) baseline NIHSS score less than or equal to 5. The exclusion criteria were as follows: (1) prestroke

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