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Slim Stroke Scales for Assessing Patients With Acute Stroke: Ease of Use or Loss of Valuable Assessment Data?

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Abstract

Background—Scientific guidelines recommend the National Institutes of Health Stroke Scale for ischemic stroke assessment. However, many nurses find “slim” National Institutes of Health Stroke Scale versions or the Glasgow Coma Scale easier to use.

Objective—To compare 3 “slim” versions of the National Institutes of Health Stroke Scale and the Glasgow Coma Scale with the full National Institutes of Health Stroke Scale.

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None reported.

eLetters

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Methods—Components of the full National Institutes of Health Stroke Scale and Glasgow Coma Scale were abstracted from records of consecutive stroke patients. Items were subtracted from the full National Institutes of Health Stroke Scale, with items contained in "slim" versions retained. False-negative rates for neurological disability were calculated for the "slim" versions and the Glasgow Coma Scale.

Results—Data were collected from 172 acute stroke patients (median [interquartile range] 6 [3–12] for National Institutes of Health Stroke Scale, 15 [12–15] for Glasgow Coma Scale): 143 (83%) were ischemic stroke patients (27% posterior circulation strokes) and 29 (17%) were intracerebral hemorrhage patients. The value of "slim" scales and the Glasgow Coma Scale declined in a stepwise manner as the full National Institutes of Health Stroke Scale decreased because of false-negative results despite the presence of a measurable disabling deficit. False-negative rates were 5% to 19% on "slim" versions and 56% with the Glasgow Coma Scale.

Conclusions—Use of "slim" scales, and in particular the Glasgow Coma Scale, substantially decreases the value of a structured neurological assessment, particularly in patients with low National Institutes of Health Stroke Scale scores.

The National Institutes of Health Stroke Scale (NIHSS) was developed as a method to quantify neurological disability in patients with acute ischemic stroke who were enrolled in clinical trials of reperfusion therapies.[1] Use of the scale provides a reliable measure of neurological deficits, whether the scores are obtained directly through in-person examination, gathered indirectly via telemedicine, or calculated from documented clinical findings in medical records.[2–22] Since 1996, use of the NIHSS has become the standard of care for ongoing neurological assessment of ischemic stroke in US stroke centers, and its use is supported by the Brain Attack Coalition guidelines,[23] the American Stroke Association (ASA) guidelines[24] for care of patients with acute ischemic stroke, and the ASA nursing scientific statement[25] for care of patients with acute stroke.

Despite these recommendations, concerns commonly voiced by nursing staff about use of the full NIHSS include the time required to complete the neurological examination and the difficulty in mastering performance and interpretation of some components of the examination, which are more complex than components of other neurological scales such as the Glasgow Coma Scale (GCS). Although some researchers[26–29] have systematically studied methods to shorten the NIHSS yet retain detection of important neurological disabilities and an ability to predict outcome, many nursing units have independently developed unstudied "slim" versions of the NIHSS to provide ease of use and reduced workload. The most common of the slim versions used by nurses is a GCS-like version that retains level of consciousness and motor function measures, but adds language testing. Gochan and Fisher[30] have advocated use of this limited measure set solely when repetitive assessments are ordered more frequently than every 8 hours for patients in stable condition. Additionally, some institutions continue using the GCS as a substitute nursing examination for patients with ischemic stroke, although no data exist documenting the validity of the GCS in detecting neurological deficit in stroke patients. We sought to understand the relationship and agreement between the full NIHSS and 3 slim versions cited in the literature and the GCS in patients with ischemic stroke or intracerebral hemorrhagic to determine the value of the slim nursing assessments in detecting neurological disability.

Methods

Permission was obtained from the Committee for the Protection of Human Subjects at the Comprehensive Stroke Center, University of Alabama at Birmingham, Birmingham, Alabama, to perform a retrospective analysis of NIHSS and GCS scores on a convenience sample of stroke patients admitted to the stroke service during a 4-month period. Inclusion criteria for the study included age greater than 19 years, documentation in the medical record of both an NIHSS and a GCS score, and either a primary admitting diagnosis of acute ischemic stroke verified by diffusion-weighted imaging findings on magnetic resonance imaging or intracerebral hemorrhage as verified by noncontrast computed tomography.

Slim versions of the full NIHSS selected for the study (see Table) were derived from the literature as follows: version 1 (subtraction of items 1B, 1C, 5A, 5B, 7, 8, 11)[26]; version 2 (subtraction of items 1A 1B, 1C, 4, 5A, 5B, 7, 8, 10, 11)[26]; and version 3 (subtraction of items 1B, 1C, 2, 3, 4, 7, 8, 10, 11).[30] Elements of the full NIHSS not included in each of the 3 slim versions were subtracted from the true total NIHSS score to determine scores for slim versions 1, 2, and 3. Total possible scores were zero to 23 for slim version 1, zero to 16 for slim version 2, zero to 21 for slim version 3, and zero to 42 for the full NIHSS.

The individual component scores for the full NIHSS and GCS were abstracted from medical records and were verified for accuracy against both the documented corresponding clinical examination and the stroke center data repository system. Data were collected and verified by 4 NIHSS-certified practitioners: 1 nurse who abstracted medical record data; 1 nurse and 1 physician who verified the agreement and accuracy of the NIHSS with the documented clinical examination and stroke registry findings; and the senior investigator who, along with biostatisticians, verified overall accuracy of data entry and slim scale calculations. Discrepancies in scores were vetted by the physician director of the stroke center and the senior investigator to ensure accuracy of all assessment scores.

> Three “slim” versions, the Glasgow Coma Scale, and the National Institutes of Health Stroke Scale were compared.

Statistical analyses were performed by using SPSS, version 15.0. software (SPSS Inc). Continuous data are presented as means and standard deviations or as medians and interquartile ranges (IQRs). Rates of false-negative scores, whereby a slim version total score was zero and the full NIHSS indicated the presence of a neurological disability, were calculated.

Results

A total of 239 medical records were screened for inclusion in the study; of these, 172 met the criteria for inclusion. The mean age of the patients was 62 years (SD, 15), and 51% were women. Of the 172 patients included in the study, 143 (83%) had ischemic stroke, and 29 (17%) had intracerebral hemorrhagic stroke. Among the 143 with ischemic stroke, 39 (27%) had posterior circulation stroke.

The median full NIHSS score was 6 (IQR, 3–12), and the median GCS score was 15 (IQR, 12–15). Figure 1 shows the ranges and median scores for each slim version in relation to the

range and median score of the full NIHSS and the GCS. The value of using the slim-NIHSS versions and the GCS declined in a stepwise manner as the full NIHSS score decreased because of false-negative (ie, "Slim-NIHSS" = 0; GCS = 15) results despite the presence of a measurable disabling deficit on the full NIHSS (Figure 2). Slim version 1 incorrectly categorized 8 of 172 patients (5%) as having no neurological deficit when the full NIHSS measured actual neurological deficits, whereas slim versions 2 and 3 both incorrectly categorized 33 of 172 patients (19%) as having no neurological deficit when the full NIHSS showed neurological deficits. The GCS incorrectly categorized 97 of 172 patients (56%) as having no neurological deficit, when neurological disability was detectable on the full NIHSS. With a full NIHSS score of less than 7, slim versions 2 and 3 had 10% false-negative results, whereas the GCS had 90% false-negative results. Slim version 1 demonstrated an ability to detect some aspects of neurological disability until the full NIHSS score totaled 3 or less.

Discussion

Our findings underscore the value of using the full NIHSS to detect neurological disability at key intervals in the treatment and hospitalization of patients with acute stroke, particularly patients with low NIHSS scores for whom the substitution of a slim version may result in false-negative results. Although scores on the NIHSS may not indicate findings obtained with a classical neurological examination, such as hand clumsiness and gait disturbances, the scores do provide standardization of examination across disciplines and allow quantification of neurological disability. Additionally, in acute disability-threatening circumstances, completion of a thorough classical examination is impractical; for example, gait testing is not feasible in most patients with stroke during the hyperacute phase of care.

A common complaint about use of the NIHSS among nursing staff is the length of time required to complete the examination. However, Shafqat et al[8] found that completion of the NIHSS takes 9.7 minutes via telemedicine compared with 6.5 minutes with direct in-person completion. For nurses for whom the NIHSS is new, the examination may take slightly longer, but speed and accuracy in performance are well supported by training and practice,[31–35] making arguments related to the time required to complete the neurological examination inappropriate. Once a score on the full NIHSS has been obtained, use of a customized version that focuses solely on the abnormal elements detected with the full NIHSS, or use of the 8-item slim version 1,[26] which provided the best results in our study, might be suitable alternatives in time-sensitive circumstances if a shortened examination time is required.

Another common complaint of nurses is that mastery of the complex neurological tests for extraocular movement (item 2), visual fields (item 3), ataxia (item 7), and extinction (item 11) in the full NIHSS is difficult. Although version 1 was the best of the slim versions we tested, nurses who wish to eliminate difficult test elements would find little advantage in using this version because it retains many of the more complex assessment components commonly found objectionable. In other words, mastery of the full NIHSS supports an ability to appropriately perform the slim version 1. Therefore, we support the ASA nursing

scientific statement,[25] which recommends that registered nurses who provide care to patients with acute stroke should know how to use the full NIHSS.

Use of the full NIHSS for both the initial assessment and assessments repeated at key intervals also supports consistency of interdisciplinary communication among nurses and physicians in their written descriptions and verbal discussions of stroke disabilities. Accuracy in communication is essential to patients' safety because it ensures interdisciplinary awareness of key findings and the potential need for emergency intervention, further indicating the importance of having nurses adhere to use of a valid and reliable standardized method for assessment of patients with acute stroke. Because of the low rates in the United States of treatment with intravenous tissue plasminogen activator in patients with acute ischemic stroke, nursing units that choose to use slim versions of the NIHSS must clearly communicate this choice to physicians. Otherwise, physicians may mistake a truly disabled patient as deficit-free or as having a nondisabling stroke, particularly because mild or resolving deficits are often used as reasons not to treat patients with intravenous tissue plasminogen activator. Additionally, low NIHSS scores that may be missed when slim versions are used should not be assumed to reflect minimal neurological deficit that does not meet criteria for treatment with tissue plasminogen activator. Scores of 3 or less may include neurological findings such as visual field cuts and cortical blindness, hemineglect, or pure expressive aphasias that are highly disabling and should be recognized as warranting treatment with intravenous tissue plasminogen activator.

Whether or not a patient is a candidate for reperfusion therapy, all patients with ischemic stroke should have the full NIHSS when they are admitted to obtain a baseline measure, throughout their hospital stay to document improvement or deterioration in their neurological status, and at discharge to document hospital outcome. However, use of the full NIHSS for neurological assessments conducted every 15 to 30 minutes to meet standard-of-care requirements in patients undergoing intravenous or intra-arterial reper-fusion treatments may not be realistic. Although current guidelines do not specify what components of the neurological assessment should be used during these frequent repeat assessments, we propose that the following assessment practice be adopted:

1. Use the full NIHSS to obtain a baseline score before reperfusion therapy is started.
2. Obtain full NIHSS scores a minimum of every 2 hours for the first 24 hours during reperfusion; after that obtain full NIHSS scores at least every 4 hours, increasing the time between assessments as dictated by changes in a patient's status.
3. During neurological assessments done at 15- to 30-minute intervals, use a customized NIHSS that focuses on the patient's disabilities. For example, if the patient has weakness of the right upper extremity, the face, and the lower extremity along with expressive aphasia, the examination should focus on these elements. Alternatively, the slim version 1 might be considered, although depending on the neurological territory involved, this slim version may or may not contain elements specific to the patient's signs and symptoms.

4. At any time, if a patient's neurological status improves or deteriorates, a full NIHSS score should be obtained and documented, and the frequency of neurological assessments should be reconsidered.

We also found that use of the GCS as an assessment measure in patients with acute stroke provides little information about neurological disability and important changes in the clinical examination that warrant notification of the stroke team and the potential need for intervention. This finding was clearly evident in our study from both the median GCS score of 15 and the high degree of discordance between full NIHSS scores as high as 13, of which 40% were in patients with normal GCS scores. We conclude that institutions that use the GCS as their primary assessment measure for patients with ischemic stroke or diagnoses associated with a high risk for stroke (eg, transient ischemic attack, carotid revascularization), should reevaluate their practice and adopt use of the full NIHSS and the strategies for frequent repeated assessments that we propose.

We did not address the validity of the full NIHSS in patients with strokes due to intracerebral hemorrhage. However, our findings indicate that use of the GCS alone may not reflect the severity of neurological deficits regardless of stroke subtype. Future research on whether the NIHSS may be a valid standardized neurological assessment in patients with intracerebral hemorrhage is clearly warranted. Because the intracerebral hemorrhage score focuses on prediction of mortality and should be obtained near the time of hemorrhage, concurrent NIHSS assessments may provide a complimentary picture of evolving neurological disability in patients with intracerebral hemorrhage.

In conclusion, our findings support the Brain Attack Coalition guidelines[23] and ASA scientific statements[24,25] for use of the full NIHSS to quantify neurological deficit in patients with acute stroke. Nurses' use of the full NIHSS provides important information on the severity of the stroke, promotes comparisons with NIHSS examinations performed by other interdisciplinary members of the stroke team, and allows detection and prompt communication of deficits that might otherwise not be evident when a slim version of the NIHSS is the sole assessment used. Although guidelines currently do not specify what scale should be used for high-frequency assessments after reperfusion therapy, we propose that use of customized versions of the NIHSS would provide the best alternative for detecting neurological change in a time-sensitive manner.

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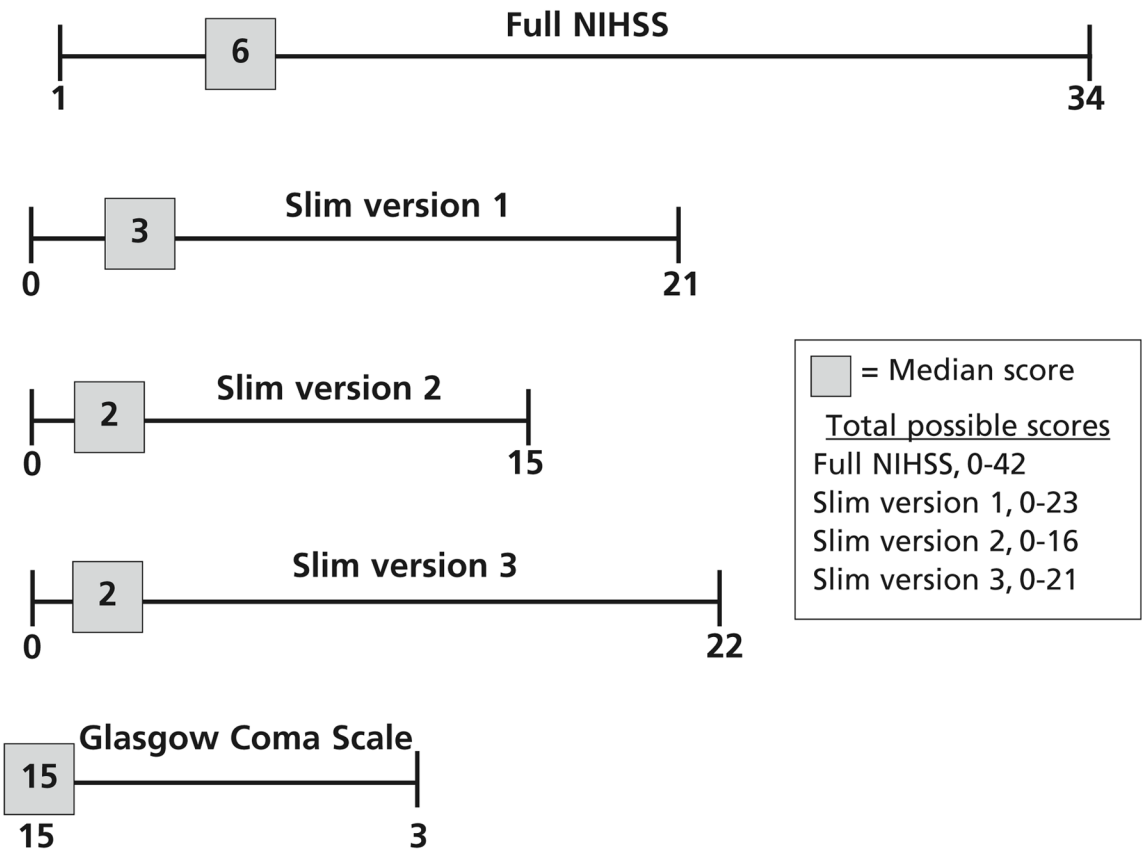

Figure 1.

Ranges and medians of each slim version and the Glas-gow Coma Scale[a] compared with the full National Institutes of Health Stroke Scale (NIHSS).

[a]Presented inverse to the NIHSS and slim version ranges because a score of 15 is considered normal.

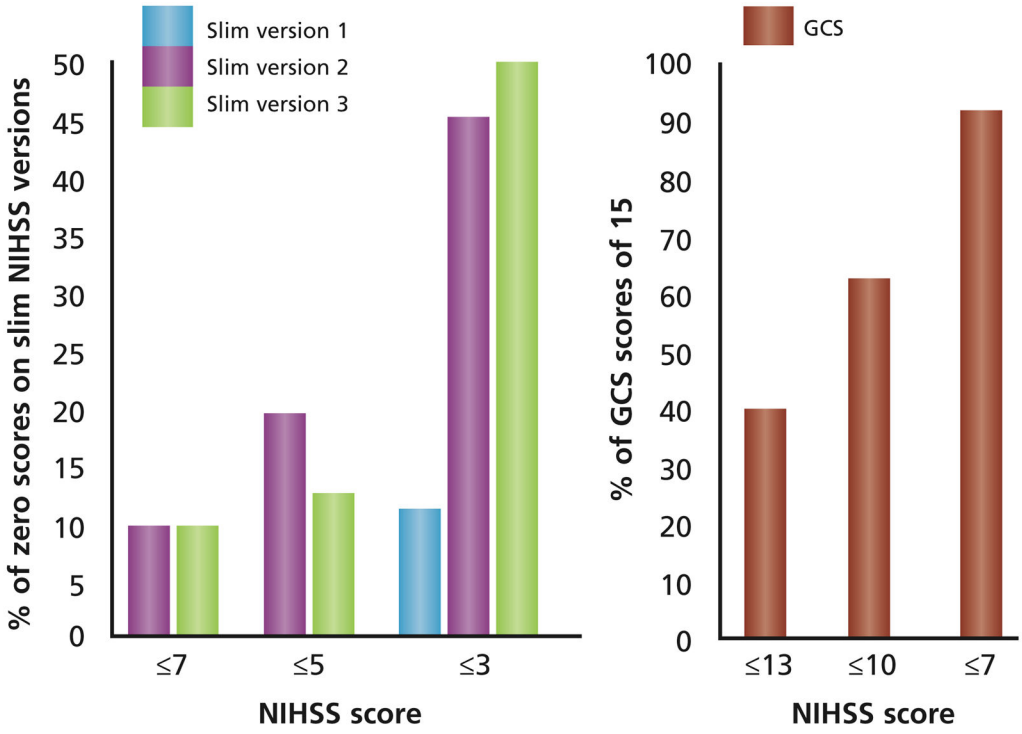

Figure 2.

Poor agreement of slim versions and the Glasgow Coma Scale (GCS) with the full National Institutes of Health Stroke Scale (NIHSS). As the full NIHSS score decreases, the rate of false-negative scores on the 3 slim versions and the Glasgow Coma Scale increases.

Table

Examination components of the 3 “slim” versions of the National Institutes of Health Stroke Scale selected for study

Items retained or removed from the full scale	Slim version		
	1[a]	2[a]	3[b]
Retained	Level of consciousness item 1A (wakefulness) Best gaze item 2 Visual fields item 3 Facial weakness item 4 Motor legs items 6A and 6B Language item 9 Dysarthria item 10	Best gaze item 2 Visual fields item 3 Motor legs items 6A and 6B Language item 9	Level of consciousness item 1A (wakefulness) Motor arms items 5A and 5B Motor legs items 6A and 6B Language item 9
Removed	Level of consciousness items 1B (questions) and 1C (commands) Motor arms items 5A and 5B Limb ataxia item 7 Sensory item 8 Extinction item 11	Level of consciousness items 1A (wakefulness), 1B (questions), and 1C (commands) Facial weakness item 4 Motor arms items 5A and 5B Limb ataxia item 7 Sensory item 8 Dysarthria item 10 Extinction item 11	Level of consciousness items 1B (questions) and 1C (commands) Best gaze item 2 Visual fields item 3 Facial weakness item 4 Limb ataxia item 7 Sensory item 8 Dysarthria item 10 Extinction item 11

[a]Derived from Tirschwell et al.[26]

[b]The “common” nursing version. Based on information from Gochan and Fisher.[30]