

## ANVC President's Message



### NIHSS: Is It Time For A Change?

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The National Institute of Health Stroke Scale (NIHSS) was introduced over 30 years ago<sup>1</sup> and is the stroke assessment tool most widely used across the world in acute care hospitals. The NIHSS was originally designed for use in clinical trials so that initial stroke deficits and changes in the clinical exam could be quantified. The developers never foresaw the NIHSS as something that would be used routinely in clinical care to assess stroke patients, although today it is standard of care. Similarly, the Glasgow Coma Scale (GCS) is another example of a tool that was not created for ongoing patient assessment; but unlike the NIHSS which was designed for repeat assessments, the GCS was originally intended as a tool to be used only once to prognosticate outcome from traumatic brain injury.<sup>2</sup>

There are several advantages to use of the NIHSS in clinical practice that should be acknowledged, namely the tool is valid as a measure of neurologic deficits in both acute ischemic stroke<sup>1</sup> and also intracerebral hemorrhage;<sup>3</sup> it is also reliable making findings reproducible across providers.<sup>4</sup> The NIHSS can also predict the volume of a brain infarct,<sup>5</sup> stroke severity,<sup>1</sup> and outcome.<sup>6</sup> However, there are also disadvantages and imperfections associated with the NIHSS, and clinicians should be aware of these

limitations. Stroke Clinicians certainly recognize the complexity of stroke symptoms, making creation of one perfect tool that is capable of meeting the needs of all types of stroke challenging.

Some notable limitations of the NIHSS are significant differences in scores for right versus left brain stroke and anterior circulation versus posterior circulation stroke,<sup>6</sup> clinician confusion over management of an NIHSS of 0, the “ceiling effect,” the time it takes to perform the assessments, confusion over scoring of ataxia, and subjectivity of components like dysarthria and facial droop.<sup>7</sup>

Differences in the score of right versus left hemispheric stroke patients were first identified by Woo and colleagues in 1990.<sup>6</sup> Because the NIHSS has a total of 7 possible points tied to language (items 1B, 1C, and 9), patients with left-hemispheric stroke commonly carry higher NIHSS scores than those with right-hemispheric stroke, since neglect (a right hemispheric function; item 11) carries only a maximum of 2 points. Consequently, right hemisphere strokes may be less likely to receive thrombolysis than left sided stroke counterparts.<sup>7</sup> Posterior circulation stroke symptoms are also not well captured by the NIHSS, in fact many posterior strokes score very low or not at all



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on the NIHSS, with more than 75% having an initial score between 0 to 5 points.<sup>7</sup> This leads to the next limitation: NIHSS scores of 0 are often misinterpreted as absence of a stroke or insufficient neurologic deficits to warrant treatment. Since the NIHSS is not all encompassing, further evaluation must occur to determine what additional assessments may be necessary, along with determination of whether the stroke symptoms are disabling.<sup>8</sup> Stroke symptoms like headache, dizziness, dominant hand weakness, dysphagia, and ataxic gait would all score an NIHSS of 0, yet most all stroke patients would consider these symptoms disabling.

Ceiling effect refers to using maximum scores to reflect items that cannot be tested easily in unresponsive or comatose patients; this makes the NIHSS less clinically relevant.<sup>7</sup> The length of the NIHSS has also been criticized as being too time consuming to complete if following the original instructions. Clinicians often make their own adjustments or remove testing of items on the scale to speed up the assessment process, but these changes challenge both the interrater reliability and the validity of the tool.<sup>9</sup> While the NIHSS overall has been found to be reliable, components of the tool remain more subjective or prone to increased examiner error. Items like interpretation of extraocular movements, dysarthria, and facial palsy have poorer reliability than other components of the scale.<sup>7</sup> Examiner errors also tend to occur in items like level of consciousness, visual fields, neglect, and ataxia in relation to underlying motor weakness.

Lastly, the picture cards used for testing language fluency have been heavily criticized.<sup>10</sup> These pictures were initially developed exclusively for an English-

speaking, Western population and therefore do not translate well across other cultures. Additionally, the picture of the woman in the kitchen washing the dishes has perpetuated former stereotypical gender roles. Recently, these pictures were updated to include a more culturally appropriate scenario, along with updated objects to name.<sup>10</sup> The new picture cards have been validated and are available on the NINDS website (Figure 1). Literacy concerns are also tied to the NIHSS phrases, as not all patients can read these, including those without disabilities or stroke.<sup>10</sup>

Several iterations of the NIHSS have been proposed through the years to address these pitfalls. Introduced in 2002, the modified NIHSS (mNIHSS) focused on reducing redundancy and eliminating items with poor reliability,<sup>11</sup> however the mNIHSS has not been widely adopted because of poor detection of posterior stroke symptoms. Later, the shortened NIHSS (sNIHSS) was introduced, but despite multiple slim versions, these scales commonly fail to detect disabling stroke symptoms, especially in the setting of minor stroke and are not recommended.<sup>9</sup> The POST-NIHSS was introduced in 2021 as a measure capable of improving capture of posterior stroke symptoms.<sup>12</sup> The added items on the POST-NIHSS include assessments for ataxic gait and bulbar symptoms such as abnormal cough and dysphagia, and these are weighed higher so that patients with posterior circulation strokes would not be considered “mild” due to a low overall score.<sup>12</sup> The POST-NIHSS also has not been widely adopted, in large part due to the added length of the tool.

While some stroke clinicians believe it is time for a change from the NIHSS, until a



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tool is developed that prioritizes efficiency yet does not compromise the ability to diagnose all types of stroke, the NIHSS – despite its shortcomings – will continue to be utilized. Development of valid and reliable

instruments is not a simple undertaking, typically requiring years of rigorous research. At this point in time arguably, the NIHSS remains the best instrument available to capture stroke disability.

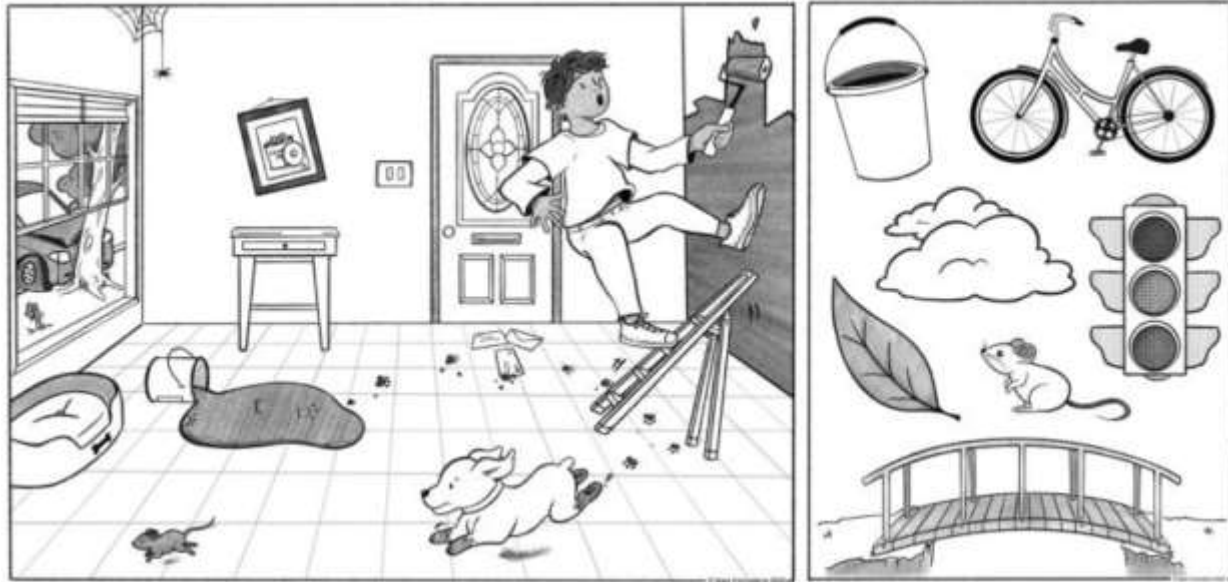


Figure 1: Updated NIH Stroke Scale pictures; available for download from [NIH Stroke Scale Updated with New Visual Stimuli | National Institute of Neurological Disorders and Stroke](#).

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