

Updated Review of NIH Stroke Scale/Score (NIHSS)

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Abstract

This calculator quantifies stroke severity in the acute setting based on weighted evaluation findings. It also monitors for neurological changes over time.

I. HOW TO USE

When to Use

The NIHSS can help physicians quantify the severity of a stroke in the acute setting.

Pearls / Pitfalls

The National Institutes of Health Stroke Scale (NIHSS) was developed to help physicians objectively rate severity of ischemic strokes.

- Increasing scores indicate a more severe stroke and have been shown to correlate with the size of the infarction on both CT and MRI evaluation.
- NIHSS scores when assessed within the first 48 hours following a stroke have been shown to correlate with clinical outcomes at the 3-month and 1-year mark.
- Patients with a total score of 4 or less generally have favorable clinical outcomes and have a high likelihood of functional independence regardless of treatment.

Points to keep in mind

- Many guidelines and protocols warn that administering tPA in patients with a high NIHSS score (>22) is associated with increased risk of hemorrhagic conversion.
- These patients, however, are also the most severely debilitated and dependent from their strokes as well.
- Some components of the NIHSS have lower inter-rater reliability (i.e. facial movement, limb ataxia, neglect, level of consciousness, and dysarthria), and some may be quite limited due to altered mental status, for example.
- According to a 2023 study, one in three initial NIHSS scores had a clinically meaningful difference in scores between neurologists and nurses, further supporting the need for improvement in interrater reliability. ([Comer et al 2023](#))
- To combat this, there is ongoing research concerning automatic grading of stroke symptoms to eliminate the issue of interrater reliability. One small 2020 study used sensors to grade muscle weakness and found that the automatic system could grade NIHSS scores with an accuracy of 83.3% ([Park et al 2020](#))

- A simpler, modified version of the NIHSS has been found to have greater interrater reliability with equivalent clinical performance, although it has not been as widely adopted as the original NIHSS.
- The patient with even a large territory posterior circulation stroke syndrome may still have a low or normal NIHSS, highlighting one of its important limitations.

Why Use

- There are nearly 800,000 cases of acute stroke in the United States every year, with 165,000 associated deaths (5th leading cause of death in Americans). ([CDC 2022](#))
- The NIHSS can help physicians determine the severity of a stroke and predict clinical outcomes.

II. NEXT STEPS

Advice

- Consult Neurology immediately (if available) for all patients presenting with ischemic stroke.
- Evaluate whether the patient is a potential candidate to receive intravenous thrombolysis.
- Consider further imaging including CT, CT angiography and MRI/MRA.

Management

In patients who present with symptoms concerning for ischemic stroke:

- Consult Neurology.
- Determine the onset of stroke symptoms (or when the patient last felt or was observed normal).
- Obtain a stat head CT to evaluate for hemorrhagic stroke.
- In appropriate circumstances and in consultation with both neurology and the patient, consider IV thrombolysis for ischemic strokes in patients with no contraindications.
- Always consider stroke mimics in the differential diagnosis, especially in cases with atypical features (age, risk factors, history, physical exam), including:
 - Recrudescence of old stroke from metabolic or infectious stress
 - Todd's paralysis after seizure
 - Complex migraine
 - Pseudoseizure, conversion disorder

Critical Actions

- The NIHSS is broadly predictive of clinical outcomes, but it is important to recognize that individual cases will vary and that management deci-

sions must be made in consultation with the patient whenever possible.

- Patients with a score of <4 are highly likely to have good clinical outcomes.
- Whenever possible, patients with acute stroke should be transferred to a stroke center for their initial evaluation and treatment, as holistic care (medical optimization, early initiation of PT and OT, patient and family education and discharge planning) is associated with improved clinical outcomes; some argue that most of the gains in stroke morbidity and mortality are due to these improvements in stroke care.

III. EVIDENCE

Evidence Appraisal

- The first iteration of the NIH stroke scale was derived by Brott et al in a pilot study of 10 patients who were evaluated within 3-weeks of having an ischemic stroke. Authors applied the Toronto Stroke Scale, the Oxbury Initial Severity Scale and the Cincinnati Stroke Scale to these patients, analysed the results and then created a composite scale. This was intended for use in an NIH-sponsored trial of naloxone for stroke ([Brott 1989](#)).
- Brott's Cincinnati/Naloxone stroke scale was modified by Lyden and colleagues (1994) for use in the National Institute of Neurological Disorders and Stroke (NINDS) study on tissue plasminogen activator (tPA) in patients with ischemic stroke ([NINDS 1995](#)).
- A retrospective review of 1281 subjects with ischemic stroke found that for every 1 point increase in the NIHSS decreased the likelihood of an excellent outcome by 24% at 7 days and 17% at 3 months ([Adams 1999](#)).
- In a trial of 94 patients, authors found that each 1 point increase in the NIHSS when performed within 24 hours of the stroke correlated with a decreased likelihood of the patient being discharged ([Schlegel 2003](#)).
- A study of 893 patients found that their initial NIHSS score (performed within 72 hours of the ischemic event) was predictive of whether the patient would need to be placed in a nursing home or need to be sent to rehabilitation. Patients with moderate (6-13 points) or severe (>14 points) NIHSS scores were 3 times more likely to be placed in a nursing home after discharge and 8 more times likely to require rehabilitation therapy ([Rundek 2000](#)).
- A study of 377 patients found that when performed 24-48 hours after an ischemic stroke, that the NIHSS was broadly predictive of group outcomes at 1-year, with 75% of patients who had a score of

4 or less being functionally independent (Appelros 2004).

- Median score in this study was 6, with 33% of patients dying within the first year after their event.
- A prospective trial of 54 patients found that combining diffusion weighted MRI imaging with the NIHSS score was more predictive of clinical outcomes at 3 months (70%) than with using the score (43%) or imaging (54%) alone (Yoo 2010).
- In an analysis of 312 subjects from the NINDS trials, authors found that an NIHSS of >20 was associated with a 17% rate of intracranial hemorrhage with tPA vs. a 3% hemorrhage rate in patients with a score of <10 (The NINDS t-PA Stroke Study Group 1997).

Race is not included in the score, but research shows that race/ethnicity and socioeconomic status are determinants in the likelihood that patients with ischemic stroke receive certain interventions. This appears to be independent of NIH stroke scale scores per a 2021 study in Neurology (Havenon et al 2021)

Formula

Addition of the selected points, as above.

FACTS & FIGURES

Graphic, see calc on web

In 2024, new picture stimuli were added to the scale to make the test more applicable to modern and more widespread testing (Stockbridge 2024)

NIH Stroke scale updated PDF 2024 with new picture stimuli: https://www.ninds.nih.gov/sites/default/files/2024-05/KnowStroke_NIH-StrokeScale_May2024_508c.pdf

LITERATURE

Original/Primary

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Validation

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infarction; a clinical examination scale. Stroke. 1989 Jul;20(7):864-70. PubMed PMID: 2749846.

CDC stats page for leading causes of death in the U.S.

<https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm>

Last reviewed: October 25, 2024

NIH link to updated NIH Stroke Scale 2024

<https://www.frontiersin.org/journals/neurology/articles/10.3389/fneur.2022.1093392/full>

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