Five-Minute Neurologic Exam:

A Primer on the NIH Stroke Scale

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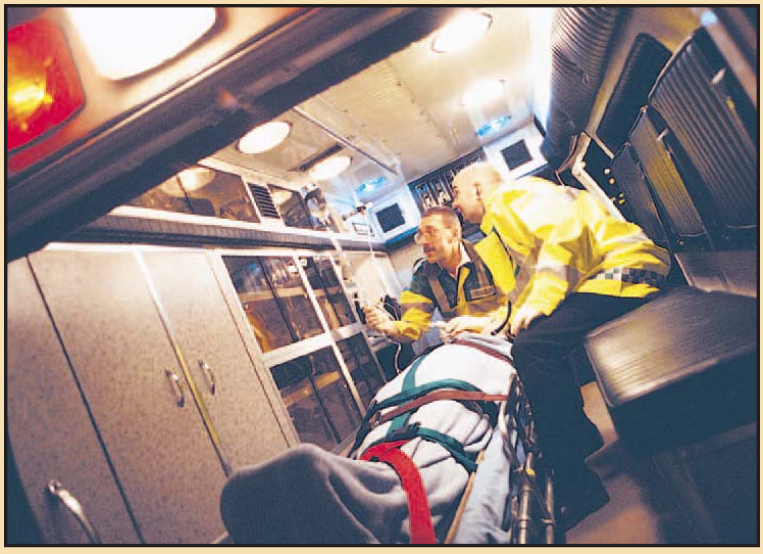
In this article:

1. What is the National Institutes of Health Stroke Scale?
2. How to perform a rapid assessment for acute stroke.

Case

A 65-year-old man is brought to the emergency department after he collapsed at home 90 minutes before. He has difficulty speaking and has weakness in his right arm and leg. The provisional diagnosis is acute stroke.

How does one perform a rapid neurologic examination to determine stroke severity, assess prognosis and guide treatment decisions? This article will address these questions.



Practice Pointer

National Institutes of Health Stroke Scale (NIHSS):

- The NIHSS is a global neurologic deficit rating scale that is becoming a standard tool for rapid assessment of acute stroke.
- Its content reflects the neurologic functions most likely affected by acute cerebral pathology.
- It can be performed in just a few minutes, and the score correlates well with stroke severity, infarct size and long-term outcome.

Why is a rapid assessment necessary?

Rapid neurologic assessment is necessary in the initial management of neurologic and neurosurgical emergencies where "time is brain." The neurologic examination traditionally taught in medical school is long, complex and time-consuming. It often requires detailed testing and equipment and does not lend itself to the emergency situation. The purpose of this article is to familiarise clinicians with the National Institutes of Health Stroke Scale (NIHSS) – a brief neurologic assessment instrument that can be of practical value in the hospital ward and emergency department.[1]

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Originally developed as a stroke-specific index for use in clinical trials, the NIHSS is now becoming a standard clinical tool for efficient evaluation of acute hemispheric stroke. Management of acute stroke often requires rapid evaluation, because some patients can be treated with "hyperacute" interventions that aim to salvage dying brain tissue.[2] For example, intravenous administration of the clot-dissolving drug tissue plasminogen activator (t-PA) is a treatment option that must be given within three hours of ischemic stroke onset and, therefore, requires physicians to act quickly to minimise the "door-to-needle" time.

What are the benefits of using the NIHSS?

The NIHSS is a global neurologic deficit rating scale that quantifies stroke severity on a score ranging from 0 (normal) to 42 (severe impairment). Its content reflects the neurologic functions most likely affected by acute cerebral pathology (*i.e.,* lateralized deficits — hemiparesis, hemisensory loss, aphasia, neglect and visual field defect) (Table 1). The score correlates well with other stroke scales, infarct size and long-term outcome.[1,3] It is easy to administer, requires no special equipment, has very good inter- and intra-rater reliability and validity, and can be performed equally well by neurologists, non-neurologists and nurses.[4-8] Scoring forms and detailed instructions can be downloaded from the Internet

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Table 1

National Institutes of Health Stroke Scale

Level of Consciousness
0 Alert
1 Not alert, but arousable with minimal stimulation
2 Not alert, requires repeated stimulation to attend
3 Coma

Orientation: Ask Patient the Month and His/Her Age
0 Answers both correctly
1 Answers one correctly
2 Both incorrect

Comprehension: Ask Patient to Close Eyes and Make a Fist
0 Obeys both correctly
1 Obeys one correctly
2 Both incorrect

Horizontal Eye Movements
0 Normal
1 Partial gaze palsy
2 Forced deviation

Visual Fields
0 No visual field loss
1 Partial hemianopia
2 Complete hemianopia
3 Bilateral hemianopia (blind including cortical blindness)

Motor: Face
0 Normal symmetrical movement
1 Minor paralysis (flattened nasolabial fold, asymmetry on smiling)
2 Partial paralysis (total or near total paralysis of lower face
3 Complete paralysis of one or both sides

Motor: Arm (Right and Left)
0 Normal (extends arms 90 [or 45] degrees for 10 seconds without drift)
1 Drift
2 Some effort against gravity
3 No effort against gravity
4 No movement
9 Untestable (joint fused or limb amputated)

Motor: Leg (Right and Left)
0 Normal (holds leg in 30 degree position for 5 seconds)
1 Drift
2 Some effort against gravity
3 No effort against gravity
4 No movement
9 Untestable (joint fused or limb amputated)

Limb Ataxia
0 No ataxia
1 Present in one limb
2 Present in two limbs

Sensation to Pinprick (Right and Left Sides)
0 Normal
1 Mild to moderate decrease in sensation
2 Severe to total sensory loss

Language (Describe Picture, Naming, Reading)
0 No aphasia
1 Mild to moderate aphasia
2 Severe aphasia
3 Mute

Speech
0 Normal articulation
1 Mild to moderate slurring of words
2 Near unintelligible or unable to speak
9 Intubated or other physical barrier

Extinction and Neglect
0 Normal
1 Inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities
2 Severe hemi-inattention or hemi-inattention to more than one modality

Adapted from: Brott T, Adams HP, Olinger CP, et al: Measurements of acute cerebral infarction: A clinical examination scale. Stroke 1989; 20:864-70.

Table 2

Brief Aphasia Screening Assessment

- Listen to the patient's spontaneous speech: Ask open-ended questions. Have the patient describe a picture (Figure 1). Assess fluency, intonation/prosody, effort, word-finding difficulty, paraphasic errors (word or syllable substitutions).
- Naming: Assess for anomia, word-finding difficulty or paraphasias by asking patient to name common objects in the room, body parts or pictures in a magazine. Test both high frequency and low frequency words.
- Repetition: Ask the patient to repeat words or phrases (*i.e.,* "No ifs, ands or buts" or "He is the one who did it.")
- Auditory comprehension: Check if the patient can respond correctly to "yes/no" questions (*i.e.,* "Is your name Mr. Smith? Do you live in Toronto?"), simple commands (*i.e.,* "point to the ceiling") and more complex commands.
- Reading comprehension: Have the patient read words, phrases and follow written commands (*i.e.,* "close your eyes").
- Writing.: Ask the patient to write a sentence. Agraphia is a sign of an aphasic disturbance. Writing should be preserved if the patient's speech is dysarthric but not aphasic.

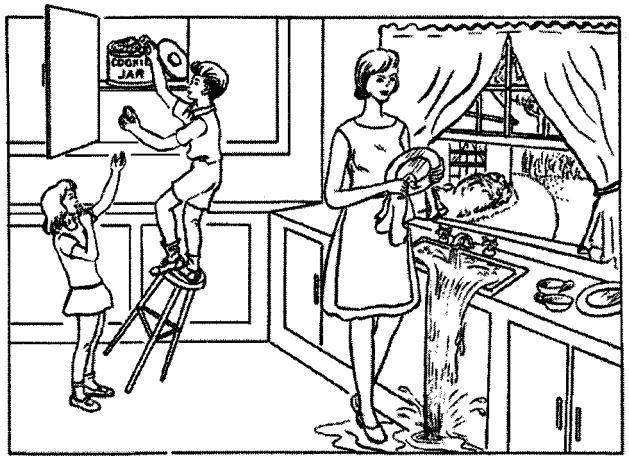

Figure 1. Cookie-theft picture. Goodglass H, Kaplan E: The assessment of aphasia and related disorders. Philadelphia: Lea and Febiger; 1972. Chapter 4, Test procedures and rationale.

Stroke Center (*www.strokecenter.org/trials/scales/nihss.html)*. Video teaching tapes are available, and lab coat pocket reference cards can be ordered from the American Academy of Neurology (*www.aan.com/public/icd9m/ acutestroke.htm)*.

Like other neurologic scales that have become a universal language (*i.e.,* Glasgow Coma Scale, Folstein Mini Mental State Examination), the NIHSS can facilitate communication among health-care team members. The total NIHSS score gives an immediate impression of the overall severity of neurologic impairment. It can guide stroke treatment decisions in the acute stage by helping physicians determine which stroke patients are candidates for clot-dissolving or potential neuroprotective interventions. Serial assessments can be used to monitor patient improvement or deterioration.[9]

The NIHSS score provides important prognostic information regarding stroke outcome.[10]

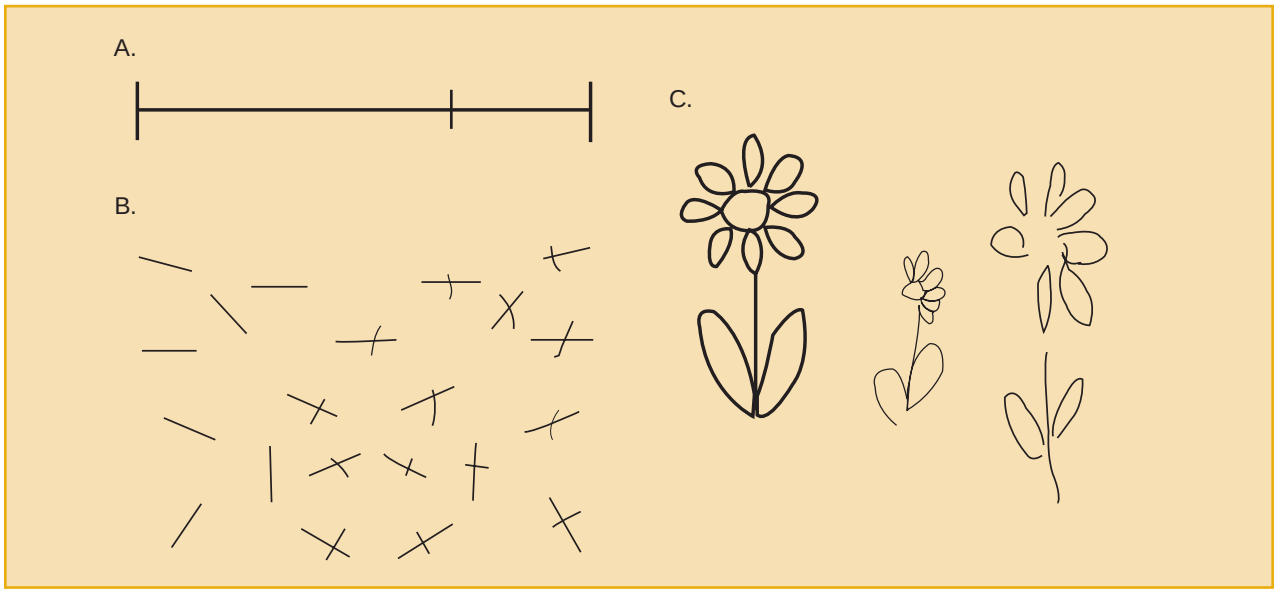

Figure 2. Bedside Tests for Neglect: Examples of left visuoconstructive hemispatial neglect in a patient with right cerebral hemisphere stroke. A: Line bisection. The patient is asked to mark the centre of a 10 cm horizontal line. B: Line cancellation task. The patient is asked to strike through each line on the page. C: Drawing and copying. The patient is asked to draw and copy a flower. Adapted from: Leibovitch FS, Black SE, Ebert PL, et al: A short bedside battery for visuoconstructive hemispatial neglect: Sunnybrook Neglect Assessment Procedure (SNAP).

For example, NIHSS < 7 (mild stroke) correlates with a good outcome, NIHSS > 15 (moderately severe) carries a high chance of severe disability, and NIHSS > 20 (severe) carries a 45% mortality rate for patients over the age of 75.[11-14]

As a teaching tool, the NIHSS provides a useful framework for students to learn how to perform a rapid neurologic examination. The scale contains a minimum set of items for the evaluation of patients with an acute cerebral hemispheric syndrome. It can and should be expanded to include additional examination items where appropriate. For an outline of the complete neurologic examination, see Gladstone and Black or standard textbooks on the subject.[15]

Any additional tests?

Motor function of the hands and feet, reflexes, gait and balance are not measured by NIHSS, which results in a "ceiling effect" (*i.e.,* patients can score 0 [normal] yet still have significant deficits). Midline cerebellar disease can be missed if patients are not examined for stance and gait. Aphasia assessment can be expanded to include additional items (Table 2). The assessment of right hemisphere dysfunction (*i.e.,* hemispatial neglect) is under-represented, and can be supplemented with specific tests, such as line bisection, figure cancellation and drawing of a flower (Figure 2).[16] Evaluation of pupil size and reactivity, nystagmus and fundoscopy are needed to supplement the NIHSS. Patients in a comatose state require examination for eye findings, brainstem function and meningismus. The

NIHSS is not designed to assess patients with spinal or peripheral nervous system disorders.

The three items that correlated best with a diagnosis of stroke were facial palsy, upper limb weakness and dysarthria (100% sensitivity, 92% specificity).[17] A modified NIHSS has recently been proposed for clinical trials.[18] In this modified version, assessment of consciousness, facial weakness, dysarthria and limb ataxia are eliminated and sensory loss is scored as being present or absent. CME

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