

NIH Stroke Scale

Stroke is the third leading cause of death in the United States and cause more serious long-term disabilities than any other disease. Forty-five percent of all Medicare dollars in the US are spent on rehabilitation of patients with stroke. Stroke obviously represents a serious physical and economic burden to the patient, caregiver, and society as a whole. Having information available about the prognosis of stroke survivors assists patients, caregivers, and rehabilitation professionals in preparing for these burdens guiding best practices and treatments.

Treatment of stroke as quickly as possible has proven to result in improved outcomes for patients. The National Institutes of Health (NIH) have endorsed a scale that is widely used to predict the outcomes of stroke patients. This scale is a quantitative measure of stroke-related neurologic deficit that has proven intra- and inter-rater reliability and has predictive validity for long-term stroke outcome. It includes items to assess level of consciousness gaze, visual fields, facial palsy, motor strength, ataxia, sensation, language, dysarthria and extinction/inattention.

Purpose:

To provide the practicing nurse with the information that he or she needs to understand the NIH Stroke Scale including its purpose, use and implications for care of stroke patients.

Objectives:

Upon completion of this course, the nurse will understand the following principles:

1. Explain the physiology of stroke.
2. Discuss the purpose of the NIH Stroke Scale.
3. Describe the process of administering the NIH Stroke Scale.

Introduction

A stroke or "brain attack" occurs when a blood clot blocks an artery or a blood vessel breaks, interrupting blood flow to an area of the brain. When either of these things happen, brain cells begin to die and brain damage occurs. When brain cells die during a stroke, abilities controlled by that area of the brain are lost. These abilities include speech, movement and memory. How a stroke patient is affected depends on where the stroke occurs in the brain and how much the brain is damaged. Timely recognition and treatment of stroke leads to improved patient outcomes. Approximately two million brain cells die every minute during a stroke, increasing risk of permanent brain damage,

disability or death. Thus, recognizing symptoms and acting quickly to get medical attention can save lives and limit disabilities

The National Institutes of Health (NIH), a part of the [U.S. Department of Health and Human Services](#), is the primary Federal agency for conducting and supporting medical research. NIH is a leader in the research community and is helping to lead the way toward [important medical discoveries](#) that [improve people's health](#) and save lives; NIH scientists investigate ways to prevent disease as well as the causes, treatments, and even cures for common and rare diseases. As part of this research, NIH has endorsed a tool to predict the outcomes for stroke patients. This tool is known as the NIH Stroke Scale (NIHSS.)

Pathophysiology of Stroke

A stroke occurs when blood flow and oxygen are not adequately perfusing the brain. There are two types of stroke. An ischemic stroke occurs when arteries are blocked by blood clots or by the gradual build-up of plaque and other fatty deposits. About 87 percent of all strokes are ischemic. A hemorrhagic stroke occurs when a blood vessel in the brain breaks leaking blood into the brain. Hemorrhagic strokes account for 13 percent of all strokes, yet are responsible for more than 30 percent of all stroke deaths.

Stroke can affect anyone; male or female, of any race. It is important to know the signs and symptoms of stroke so medical attention and treatment can begin as soon as possible. Some of the common symptoms of stroke include:

- Sudden numbness or weakness of the face, arm or leg – especially on one side of the body
- Sudden confusion, trouble speaking or understanding
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, loss of balance or coordination
- Sudden severe headache with no known cause

It is extremely important for anyone experiencing any of these symptoms to seek medical attention immediately.

NIH Stroke Scale

The National Institutes of Health Stroke Scale (NIHSS) is a systematic assessment tool that provides a quantitative measure of stroke-related neurologic deficit. The NIHSS was developed in 1983 by NIH-sponsored stroke research neurologists. This scale was originally designed as a research tool to measure baseline data on patients in acute

stroke clinical trials and for use in the assessment of whether or not the degree of disability caused by a given stroke merits treatment with tissue plasminogen activator (tPA). Tissue plasminogen activator is a powerful blood thinner used to break down artery-clogging blood clots. Once a blood clot has been resolved, the blood flow returns and the amount of brain damage to the stroke patient is reduced.

Now, the scale is also widely used as a clinical assessment tool to evaluate acuity of stroke patients, determine appropriate treatment, and predict patient outcomes. This scale is designed to be a simple, valid, and reliable tool that can be administered at the bedside consistently by physicians, nurses or therapists in five to 10 minutes. The items were selected for inclusion in the NIHSS based on expert opinion and literature review and can be used for patients of all ages, including geriatric patients, who have had a stroke.

This NIHSS is important in that it can be used as a clinical stroke assessment tool to evaluate and document neurological status in acute stroke patients. The stroke scale is valid for predicting lesion size and can serve as a measure of stroke severity. The NIHSS has been shown to be a predictor of both short and long term outcome of stroke patients. Additionally, the stroke scale serves as a data collection tool for planning patient care and provides a common language for information exchanges among healthcare providers.

There is not a complete consensus among providers regarding when and how often the NIHSS should be performed. During the original clinical trials the NIHSS was completed at baseline prior to treatment, at 2 hours post-treatment, at 24 hours, at 7-10 days, and at 3 months. Today, hospital protocols vary in the frequency with which they perform the scale on acute stroke patients.

According to Laura Sauerbeck, Assistant Professor of Research at the University of Cincinnati, *"The NIHSS should always be performed at baseline in the emergency room because of its tremendous predictive value. It should be performed again in conjunction with t-PA or other therapies, and should be repeated often in the first 24 hours. At the very least, the scale should be used at discharge and on a daily basis during a patient's hospital stay to measure the effect of your treatments on the patients."*

The NIHSS should be performed by trained providers. This could be physicians, nurses, therapists, or other trained health care providers. It is important for evaluators to be properly educated on administration of the NIHSS to ensure the validity and reliability of the data collected. There are many ways to obtain NIHSS certification. Some healthcare organizations offer education internally; there is also a myriad of resources online. Some educational resources have a video component that is helpful and allows learners to see an examination performed correctly. Currently there are no national standards in

place as to how often an individual needs to re-certify for the NIH Stroke Scale. Hospital and clinical trial organizations determine their own protocol on certification standards. Although the National Stroke Association recommends certification every six months, the average re-certification is one year. Some centers train and test their RNs on the NIHSS as a part of annual stroke nurse competencies.

NIHSS Administration Process

The NIHSS items are to be administered in the designated order. This helps to maintain the tool's reliability or reproducibility and validity. Performance in each category is to be recorded after each subscale exam. Examiners should not go back and change any scores and the examiner must always score the patient's first attempt. Some patients may later correct an error, but scores should not be changed. Examiners are to follow the directions provided for each exam technique. Scores recorded should reflect what the patient does, not what the clinician thinks the patient can do. The clinician should record answers while administering the exam and work quickly. Except where indicated, the patient should not be coached (i.e., repeated requests to patient to make a special effort).

Performing the NIHSS typically takes five to 10 minutes. Experience or familiarity with the exam techniques may increase efficiency. Patients who have impaired attention or language ability will require more evaluation time even with the most experienced examiner.

Establishing confidence in performing the NIHSS assessment can be achieved through structured practice and constructive comparison or discussion of actual patient exam findings with nurse or physician colleagues. Building confidence in one's ability to perform a neurologic exam is important as it is the nurse's ability to assess and detect change that may be the key to identifying and affecting patient outcome in the acutely ill stroke patient.

NIHSS Item Instructions & Scale Definitions

The first group of items on the NIHSS is intended to assess wakefulness or level of consciousness (LOC). A decrease in a patient's LOC can indicate deterioration in clinical status. The pathophysiology for this decline can be metabolic (hypoxia, systemic organ failure, toxins, infections or ischemia), structural (injury or compression of the brainstem, as a result of direct mass lesions, such as intracranial hematomas or secondary mass volume such as cerebral edema), or a combination of the two.

1a. Level of Consciousness

This is an evaluation of the overall impression of alertness. The examiner assesses the patient's response to random verbal stimuli. The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.

Scale Definition:

0 = Alert; keenly responsive.

1 = Not alert; but arousable by minor stimulation to obey, answer, or respond.

2 = Not alert; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped.)

3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid and areflexic.

1b. LOC Questions

The patient is asked the month and his/her age. The answer must be correct — there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not “help” the patient with verbal or non-verbal cues.

Scale Definition

0 = Answers both questions correctly.

1 = Answers one question correctly.

2 = Answers neither question correctly.

1c. LOC Commands

This evaluates the patient's ability to follow one-step commands. The patient is asked to open and close his or her eyes and then to grip and release the non-paretic hand. The examiner may substitute another simple one-step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to the command, the task should be demonstrated to the patient and the result scored. Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands and only the first attempt is scored.

Scale Definition

0 = Performs both tasks correctly.

1 = Performs one task correctly.

2 = Performs neither task correctly.

The second and third items of the NIHSS are intended to evaluate a stroke patient's vision. Visual field cuts and impaired eye movements are frequently demonstrated by patients with acute stroke.

2. Best Gaze

This item evaluates extraocular movements. Abnormal findings can indicate pathophysiology involving the frontal lobe, brainstem, cerebellar or vestibular dysfunction or generalized dysfunction of the cerebral cortex.

Only horizontal eye movements are tested, however these can be voluntary or reflexive. If the patient is alert and able to follow commands, the evaluator will ask the patient to follow his or her fingers with his or her eyes from left of midline to right of midline while keeping the head still. A patient with pre-existing blindness can be asked verbally to move the eyes to the right, left, up and down. If the patient does not understand or attend to command, gaze can be assessed by establishing eye contact and then moving one's face to the right and left of midline. If the patient is unresponsive, this item can be scored using the oculocephalic reflex (doll's eyes maneuver.) This technique requires the rapid rotation of the patient's head side to side with the eyelids held open and observing for movement in the direction opposite to the head turn.

Scale Definition

0 = Normal. Able to move both eyes left to right across midline.

1 = Partial gaze palsy. Gaze is abnormal in one or both eyes, but forced deviation, or total gaze paresis is not present. Able to move one or both eyes, but may not be able to cross midline.

2 = Forced deviation. Total gaze paresis is not overcome by the oculoccephalic maneuver.

3. Best Visual.

This item is a visual field assessment. Abnormalities here usually arise from damage of the optic radiations or occipital lobes. This item tests the upper and lower quadrants of vision by confrontation exam. The examiner positions himself or herself opposite the patient's face. The patient is then asked (while looking at the examiners nose) to count the fingers of the examiner as they are introduced in the patient's visual field quadrants. Patients can be encouraged as appropriate. Stroke patients who are unable to understand these instructions can be evaluated by response to moving fingers displayed by confrontation. These patients will often look in the direction of moving fingers displayed by the assessor in the four quadrants without comprehension of the examination. Such patients can also be tested by visual threat. This is done by introducing a striking hand threat into the patient's visual fields. A blink response implies that vision is intact. If there is unilateral blindness or enucleation, the test is completed for the functioning eye.

Scale Definition

0 = No visual loss.

1 = Partial hemianopia. Includes loss in only one quadrant.

2 = Complete hemianopia. Loss of vision in both top and bottom quadrants on the right or left side of a patient's visual field.

3 = Bilateral hemianopia. Blindness of any cause, including cortical blindness, or if visual loss is noted on both right and left sides of the visual fields.

The next several items of the NIHSS are intended to assess voluntary movement of the stroke patient.

4. Facial Palsy.

This item evaluates symmetry or equality of facial movement. Facial asymmetry is often seen even in minor strokes and can be the first clue to the presence of swallowing difficulties or dysphasia. The examiner asks the patient or gestures for the patient to show his or her teeth, raise eyebrows and squeeze eyes closed. In poorly responsive patients or patients who are unable to follow commands or gestures, painful stimuli can be introduced by a sternal rub and a grimace can be evaluated. If facial trauma/bandages orotracheal tape, or other physical barriers obscure the face, these should be removed to the extent possible. Pathologic findings on this item indicate a lower motor neuron lesion of ipsilateral cranial nerve VII. Bilateral findings can indicate brainstem lesions.

Scale Definition

0 = Normal. Symmetrical movements.

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 of face. Absence of movement in the upper and lower face.

5. Motor Arm. (a. Left Arm, b. Right Arm)

This item evaluates symmetry of voluntary movement in both upper extremities. The arms are evaluated one at a time by instructing or demonstrating to the patient to lift his or her arm up (palm up) to a 90 degree angle (45 degrees if lying down.) and holding it up for a count of 10. Gestures or pantomime may be used to gain cooperation of the aphasic or confused stroke patient but noxious stimuli should not be used. The score is determined by the patient's ability to resist gravity. After one extremity is scored, the process is repeated and scored for the opposite extremity. The non-paretic arm is tested first. Only in cases of amputation or joint fusion at the shoulder should an examiner record a score of untestable (UN) and clearly write the reason for this choice.

Scale Definition

0 = No drift. Limb holds 90 (or 45) degrees for a full 10 seconds.

1 = Drift. Limb holds 90 (or 45) degrees, but then drifts down before full 10 seconds; does not hit bed or other support.

2 = Some effort against gravity. Limb cannot get to or maintain 90 (or 45) degrees, drifts down to bed, but has some effort against gravity.

3 = No effort against gravity. Limb falls.

4 = No movements. Flaccid extremities with no effort noted.

6. Motor Leg. (a. Left Leg, b. Right Leg)

This item is evaluated similarly to item 5. Each lower extremity is evaluated separately, beginning with the non-paretic leg. Patients should always be in supine position. The leg is lifted or elevated to 30 degrees off the bed and held for a count of five seconds. The aphasic patient can be encouraged using urgency in the voice or pantomime, but again, no noxious stimuli should be used for this item. Only in the case of amputation or joint fusion at the hip should the examiner record a score of untestable and clearly write the reason for this choice.

Scale Definition

0 = No drift. Leg holds 30 degree position for full five seconds.

1 = Drift. Leg falls by the end of the five second period, but does not hit bed.

2 = Some effort against gravity. Leg falls to bed by five seconds, but has some effort against gravity.

3 = No effort against gravity. Leg falls to bed immediately.

4 = No movement. Flaccid extremities with no effort noted.

7. Limb Ataxia.

This is used to evaluate the stroke patient's coordination of movements which may indicate a unilateral cerebellar lesion. A weakened extremity can appear poorly coordinated when evaluating ataxia, but item 7 is scored as present only if the ataxia or poorly controlled movements are out of proportion to the extremity weakness noted in items 5 or 6. Each limb is evaluated and scored separately with the patient's eyes open. The exam technique is finger to nose or heel to shin testing. The examiner instructs the patient to touch his or her finger to touch the examiner's finger, then to repeatedly touch their nose and retouch the examiner's finger. This is done for each upper extremity and

scored. If the patient cannot understand the command or is unable to move his arm, ataxia is scored as absent. Lower extremity ataxia is evaluated by instructing the patient to lift his or her leg and slide the heel of his or her foot down the opposite shin, and repeat the motion at least twice. Only in the case of amputation or joint fusion should the examiner record a score as untestable and the reason should be noted. In case of blindness, test by having the patient touch own nose from extended arm position.

Scale Definition

0 = Absent.

1 = Present in one limb.

2 = Present in two limbs.

8. Sensory.

Sensory and perceptual deficits are common in stroke patients and need to be carefully evaluated to ensure patient safety. Abnormal findings or sensory loss usually indicate lesions or dysfunction involving the contralateral thalamus or parietal lobe cortex. Tactile sensation is tested by sensation or grimace to pin prick or withdrawal to noxious stimulus for the obtunded or aphasic patient. The body areas that should be tested include at least the face, arms (not hands) legs (not feet) and trunk. The ability to sense pin prick from the left to right side is tested for normal or abnormal feelings, whether it “feels different” from the opposite side. The patient is asked, “Do you feel the pin?” and “Does it feel the same on both sides?” A score of two should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous or aphasic patients will therefore probably score 1 or 0. The patient with brainstem stroke with bilateral sensory loss will score 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a = 3) automatically score 2 on this item

Scale Definition

0 = Normal. No sensory loss.

1 = Mild to moderate sensory loss. Patient feels pin prick is less sharp or is dull on the affected side or there is a loss of superficial pain with pin prick, but patient is aware of being touched.

2 = Severe to total sensory loss. Patient is not aware of being touched on the face, arm and leg.

9. Best Language.

Language deficits are known to be common in stroke patients. Disturbances in speech and communication most commonly indicate lesions involving the Broca's Area, Wernicke's Area or the frontal, parietal, or parieto-occipital areas of the left hemisphere. The primary language center is located in the left cerebral hemisphere in most people. A small number of people will have language function centered in the right hemisphere. A great deal of information about comprehension will be obtained in the preceding sections of the examination. The NIHSS uses a standardized set of visual stimuli (pictures, sentences, word list, appendix A) that are shown to the patient, and the patient is instructed to describe the picture, name the objects, read the sentences or say the words. Accommodations for patients with limited vision or education can be made by eliciting enough verbal feedback to introduce stimuli to determine the scoring described below. The examiner may ask the patient to identify common objects placed in the hand or repeat and produce speech. The intubated patient should be asked to write. The patient in a coma (item 1a = 3) will score 3 on this item. The examiner must choose a score for the patient with stupor or limited cooperation, but a score of 3 should only be used if the patient is mute and follows no one-step commands.

Scale Definition

0 = No aphasia. Normal fluent speech.

1 = Mild to moderate aphasia. Some obvious loss of fluency or facility of comprehension without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension however, makes conversation about provided materials difficult or impossible. For example, in conversation about provided materials, examiner can identify picture or naming card content from patient's response.

2 = Severe aphasia. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. Often limited to one-word answers. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response.

3 = Mute. Global aphasia. No usable speech or auditory comprehension.

10. Dysarthria.

This item assesses the quality of the stroke patient's speech. This exam is done by having the patient read a list of words (Appendix A) or having the patient repeat single words. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. The examiner should record this item as untestable only if the patient is intubated or has other physical barriers to producing speech and the reason should be clearly recorded. The NIH recommends that the examiner not tell the patient why he or she is being tested.

Scale Definition

0 = Normal

1= Mild to moderate dysarthria. Patient slurs at least some words and at worst, can be understood with some difficulty.

2 = Severe dysarthria. Patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia or is mute.

11. Extinction and Inattention (formerly neglect).

This item primarily evaluates the contralateral parietal lobe cortex. A stroke patient's ability to perceive needs to be evaluated, documented and incorporated into the plan of care as early as possible. The recognition of visual, tactile, special or personal inattention deficits can help prevent patient falls, one of the most common complications after stroke. This item is last on the stroke scale because it requires the examiner to consider information obtained during prior sections of the scale. Sensory information may be sufficient to score a patient, but in situations where abnormalities are not clear, double simultaneous stimulation (DSS) is recommended. To perform tactile DSS testing the patient is first asked to close his or her eyes. The examiner then introduces touch stimuli alternatively from the left to right side. The patient is asked to discriminate which arm or leg is being touched. After a consistent response is produced, the examiner introduces tactile stimulation to both sides at once. The normal individual can identify sensation on both sides. A stroke patient without sensory impairment on individual limb testing may have difficulty with DSS and extinguish or neglect the weaker sensory information on the affected side. Thus, he or she will only feel simultaneous information on the "good" side. If a patient is aphasic but appears to attend to both sides, the score is normal. The concept of DSS is also applicable to visual fields testing and, in cooperative patients, testing of hearing.

Scale Definition

0 = Normal

1 = Visual, tactile, auditory, special or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.

2 = Profound hemi-inattention or extinction to more than one modality. Patient does not recognize own hand or orients to only one side of space.

Scoring and Outcomes

Upon completion of all items, the examiner compiles the patient's score. Total scores on the NIHSS range from 0 to 42, with higher values reflecting more severe cerebral infarcts. The level of stroke severity as measured by the NIH stroke scale scoring system is further stratified as follows:

- 0= no stroke
- 1-4= minor stroke
- 5-15= moderate stroke
- 15-20= moderate/severe stroke
- 21-42= severe stroke

Unlike total scores for other assessment scales, the NIHSS total score has limited meaning. As an ordinal scale, the score on the NIHSS can be the sum totaled from many possible arithmetic combinations. The exact clinical findings vary with each possible numeric combination of total score from zero to 42. Therefore, clinically it is often more useful to think of this tool as a way to quantify neurologic findings and measure change, such as an upward deterioration or downward improvement relative to an individual patient over time.

Rigorous testing has been done on the NIHSS to demonstrate its reliability, reproducibility and validity for all patients with stroke. The NIHSS has proven to have predictive validity for stroke outcome with higher predictive value at high and low scores and less accuracy in the middle ranges. Early and frequent evaluation of stroke patient's deficits, progress toward recovery and prognosis allows for better planning and management of care for stroke patients.

Summary

The National Institute of Health (NIH) stroke scale (NIHSS) is a standardized method used by physicians and other health care professionals to measure the level of impairment caused by a stroke. Neurologic assessment skills are the key to planning and providing effective, efficient and safe care for acutely ill stroke patients.

Neurological assessments need to be clearly documented as patients move between levels of care (i.e. ED to ICU to acute care.) The NIHSS is a research tool which can easily be incorporated into bedside care. Stroke scale check lists can be used to clearly document neurologic outcomes, plan safe nursing care and provide consistency to the informal exchanges between nurses and other health care professionals.

The NIH stroke scale serves several purposes, but its original use in clinical medicine was in the assessment of whether or not the degree of disability caused by a given stroke merits treatment with [tPA](#) (clot-busting medication.) Another important use of the NIHSS is in research, where it allows for the objective comparison of efficacy across different stroke treatments and rehabilitation interventions.

The NIH stroke scale measures several aspects of brain function, including consciousness, vision, sensation, movement, speech, and language. A certain number of points are given for each impairment uncovered during a focused neurological examination. A maximal score of 42 represents the most severe and devastating stroke. Current guidelines as of 2008 allow strokes with scores greater than 4 points to be treated with tPA. The NIHSS has proven to be a useful tool in the management and care of stroke patients.

Appendix A
Cookie Jar Picture

Object Naming Picture

Dysarthria Words

MAMA

TIP-TOP

FIFTY-FIFTY

THANKS

HUCKLEBERRY

BASEBALL PLAYER

Reading Comprehension Phrases

You know how.

Down to earth.

I got home from work.

Near the table in the dining room.

**They heard him speak on the radio
last night.**

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