

NATIONAL INSTITUTE OF HEALTH STROKE SCALE (NIHSS)

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OBJECTIVES

- Describe the purpose of the NIHSS
- Discuss guiding principles to consider when administering the NIHSS
- Demonstrate and discuss the individual components of the exam
- Describe how to accurately interpret the NIHSS score

HISTORICAL PERSPECTIVE NEUROLOGICAL IMPAIRMENT SCALES

- ◉ Multiple measures, or scales, have been developed to quantify neurological impairment.
- ◉ All involve scoring various modalities of neurological function and then summing the scores to provide an index of neurological status.

STROKE SCALES

- First stroke scale introduced - Mathew et al, 1972
- ◉ 1980s & 1990s - Steadily increase in the number of scales to quantify neurological impairment.
 - ◉ Middle Cerebral Artery Neurological Score
 - *Orgogozo et al, 1983*
 - ◉ Scandinavian Stroke Scale
 - *Scandinavian Stroke Study Group, 1985*
 - ◉ Canadian Neurological Scale
 - *Cote et al, 1986*
 - ◉ National Institutes of Health Stroke Scale
 - *Brott et al, 1989*
 - ◉ European Stroke Scale
 - *Hantson et al, 1994*

NIHSS - PURPOSE

- NIHSS was developed for adjusting final outcome for initial severity of stroke in clinical trials.
- NIHSS has been used to predict outcome despite not having been designed for this purpose.
 - Acute scores on the NIHSS correlate with both CT infarct volume at 7 to 10 days after stroke and functional outcome at 3 months.
- NIHSS scales should not be used as a measure of functional outcome itself, since impairment only partly explain functional health.

WHY DO WE NEED IT?

- Standardized stroke severity scale to describe neurological deficits in acute stroke patients
- Allows us to:
 - Quantify our clinical exam
 - Determine if the patients' neurological status is improving or deteriorating
 - Provide for standardization
 - Communicate patient status

ELEMENTS OF THE NIH STROKE SCALE

- ◉ 11 item scoring system
- ◉ Integrates components of neurological exam
- ◉ Includes testing of LOC, select cranial nerves, motor, sensory, cerebellar function, language, inattention (neglect)
- ◉ Maximum score: 42, minimum score: 0
- ◉ Not a linear scale



THE NEUROLOGICAL EXAMINATION & NIHSS

Neurological Examination

- ◉ LOC
- ◉ Mental status and cognitive function
- ◉ Cranial nerves
- ◉ Motor system
- ◉ Sensory function
- ◉ Cerebellar system (coordination and gait)
- ◉ Reflexes

NIHSS

- ◉ LOC
- ◉ Best gaze
- ◉ Visual field testing
- ◉ Facial paresis
- ◉ Arm & leg motor function
- ◉ Limb ataxia
- ◉ Sensory
- ◉ Best language
- ◉ Dysarthria
- ◉ Extinction & inattention

GUIDING PRINCIPLES TO CONSIDER

- ◉ The most reproducible response is generally the first response
- ◉ Do not coach patients unless specified in the instructions
- ◉ Some items are scored only if definitely present
- ◉ Record what the patient does, not what you think the patient can do



ADMINISTERING & SCORING

Performing Instructions

1a. Level of Consciousness

The investigator must choose a response.

A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.

Scoring Instructions

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

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



ITEM 1A. LEVEL OF CONSCIOUSNESS

- ◉ Determined through interactions with the patient
- ◉ Auditory stimulation (normal → loud voice)
- ◉ Tactile stimulation (light → painful)



SCORING: LEVEL OF CONSCIOUSNESS (0-3)

- ◉ 0 = Alert, keenly, responsive
- ◉ 1 = Not alert, but arousable by minor stimulation
- ◉ 2 = Not alert, requires repeated stimulation to attend, or painful stimulation to make movements
- ◉ 3 = Responds only with reflex motor or autonomic effects or totally unresponsive



ITEM 1B. LOC QUESTIONS

- Ask the patient their age ... wait for a response...
- Ask the patient the current month ...wait for a response...
- Note:
 - Do not give credit for being “close”
 - Do not coach or give non verbal cues

SCORING: LOC QUESTIONS (0-2)

- 0 = Answers both questions correctly
- 1 = Answers one question correctly
- 2 = Answers neither question correctly
- Note:
 - Aphasic patients who do not comprehend the questions will score 2
 - Patients unable to speak due to endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier or any other problem not secondary to aphasia are given a 1



ITEM 1C. LOC COMMANDS

- Ask patient: open and close your eyes and grip and release the nonparetic hand.
 - Give credit if an unequivocal attempt is made but not completed due to weakness
 - If patient does not respond to command, the task should be demonstrated

SCORING: LOC COMMANDS (0-2)

- 0 = Performs both tasks correctly
- 1 = Performs one task correctly
- 2 = Performs neither task correctly
- Note:
 - Score only the first attempt



ITEM 2: BEST GAZE

- Ask the patient to "follow my finger" across horizontal eye movements
 - Aphasic or confused patients: use tracking
 - Unconscious patients: use oculocephalic maneuver
 - OK to coach

ITEM 2: GAZE TESTING

- Tracking: establishing eye contact and moving about the patient from side to side and observing if the patient's eyes follow
- The oculocephalic reflex (doll's eyes) assessed by briskly rotating the patient's head side to side.
- Note:
 - Normal response: eyes move in the opposite direction to head movement
 - Abnormal response: the eyes are fixed in one position and follow the direction of passive rotation



SCORING: BEST GAZE (0-2)

- ⦿ 0 = Normal horizontal eye movements
- ⦿ 1 = Partial gaze palsy - abnormality in one or both eyes, but forced deviation is not present
- ⦿ 2 = Forced deviation, or total gaze paresis (not overcome with oculoccephalic maneuver)



ITEM 3: VISUAL FIELDS

- ◉ Stand 2 feet from patient at eye level. Both examiner and patient cover one eye. Ask patient to look directly into your eyes.
- ◉ Test upper and lower visual fields by confrontation (4 quadrants of each eye).
- ◉ Examiner compares this to the “norm” (their own vision)
- ◉ To test both fields with eyes open, ask pt to indicate where they see movement (choices: L side, R side or both)



SCORING: VISUAL (0-3)

- 0 = No visual loss
- 1 = Partial hemianopia (sector or quadrantanopia)
- 2 = Complete hemianopia
- 3 = Bilateral hemianopia (blind)
- Note:
 - If patient sees moving fingers, this can be scored as normal
 - If there is unilateral blindness or enucleation, score visual fields in the other eye
 - If there is extinction during double simultaneous stimulation score a 1 and use the results to answer question 11



ITEM 4: FACIAL PALSY

- Ask the patient or use pantomime
 - “Show me your teeth, raise your eyebrows and close your eyes tightly”
- Score symmetry of grimace to noxious stimulation in the aphasic or confused patient (tickle each nasal passage one at a time using a cotton-tipped applicator and observe facial movement)



SCORING: FACIAL PALSY (0-3)

- 0 = Normal symmetrical movement
- 1 = Minor paralysis: (i.e., 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 (absence of facial movement in the upper and lower face)
- Note:
 - Aphasic or confused patient: Score symmetry of grimace to noxious stimulation



ITEMS 5 & 6: MOTOR ARM AND LEG

- Test each limb independently
- Start with non-paretic arm
- Place the limb in the appropriate position
 - Extend arm (palm down) 90° sitting/45° supine
 - Leg 30 degrees (supine)
- Drift = arm falls before 10 sec. or leg before 5 sec.
- DIP vs DRIFT
 - Dip: very small change with instantaneous correction
 - Drift: limb lowers to any significant degree. Drift is never normal.
- COUNT OUT LOUD & using your fingers in patient's view
 - Aphasic patient: Use urgency in voice and pantomime to encourage



SCORING: MOTOR ARM AND LEG (0-4,X)

- 0 = No Drift - limb holds steady for full count
 - 10 sec-arm, 5 sec-leg
- 1 = Drift BUT limb does not hit bed or other support
- 2 = Drifts towards bed, BUT pt has some effort against gravity
- 3 = Limb falls, NO effort against gravity. Trace muscular contraction present in limb
- 4 = No movement
- X = Amputation, joint fusion

ITEM 7: LIMB ATAXIA

“FINGER-NOSE-FINGER” & “HEEL TO SHIN”

- Finger-Nose-Finger: The examiner raises their finger midline, 2 ft from the patient
 - Patient is asked, “With your right hand, touch my finger, then touch your nose; do this as fast as you can.” Repeat with the other arm.
- Heel to Shin: Pt can be lying on their back or sitting
 - Ask pt to slide one heel down shin of the opposite leg, then repeat the same procedure on the other side
- Dysmetria: the inability to accurately control the range of movement in muscle action with the resultant overshooting of the mark



ITEM 7: LIMB ATAXIA

- ◉ Detects unilateral cerebellar lesion & limb movement abnormalities in relation to sensory or motor dysfunction
- ◉ Use “finger-nose-finger” and “heel to shin” tests
- ◉ Test non-paretic side first
- ◉ Look for smooth, accurate movements
- ◉ Consider limb weakness when looking for dysmetria
- ◉ Non verbal cues are permitted
- ◉ Test all four limbs separately



SCORING: LIMB ATAXIA (0-2, X)

- 0 = Absent
- 1 = Present in one limb
- 2 = Present in two limbs
- Note:
 - Ataxia is only scored if present. In patient who can't understand the exam or who is paralyzed, a score of 0 (absent) is given
 - If patient has mild ataxia and you cannot be certain that it is out of proportion to demonstrated weakness, give a score of 0



ITEM 8: SENSORY

- Use sharp object on face, arms (not hands), trunk and legs
- Compare pinprick in same location on both sides. Ask patient if they can feel the pinprick, if it is different from side to side, and how it is different
- Record grimace or withdrawal from noxious stimulus in obtunded or aphasic patients
- Only record sensory loss due to stroke
- Only record sensory loss if it is clearly demonstrated



SCORING: SENSORY (0-2)

- 0 = Normal, no sensory loss
- 1 = Mild to moderate sensory loss; patient is aware of being touched but pinprick is less sharp/dull on the affected side
- 2 = Severe to total sensory loss; patient is not aware of being touched in the face, arm and leg
- Note:
 - A score of 2 should only be given when severe or total loss of sensation can be clearly demonstrated
 - Stuporous and aphasic patients will probably score 1 or 0



ITEM 9: BEST LANGUAGE

- Incorporates information collected in preceding sections
- Ask patient to perform the following:
 - Name all the objects on the card
 - Read all the sentences
 - Describe what is happening in the picture
- Give patient adequate time
- Patient can write answers
- If visual loss prevents standard examination:
 - Place objects in patient's hand (naming),
 - Ask patient to repeat sentences on the card
 - Ask patient to produce speech by asking a question



SCORING: BEST LANGUAGE (0-3)

- ◉ 0 = No aphasia, normal fluency and comprehension
- ◉ 1 = Mild to mod aphasia: some obvious loss of fluency or comprehension, but able to “get their ideas across”
- ◉ 2 = Severe aphasia: all communication limited, examiner must guess what the pt is trying to communicate
- ◉ 3 = Mute, global aphasia: no useable speech, no auditory comprehension. Pt unable to follow any one step commands.
- ◉ Note:
 - To choose between a score of 1 or 2, use all provided materials. It is anticipated that a patient who missed more than two thirds of the naming objects and sentences or who followed only few and simple one step commands would score a 2.



ITEM 10: DYSARTHRIA

- An adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list even if patient is thought to be normal
- If the patient has aphasia, the clarity of articulation of spontaneous speech can be rated

SCORING: DYSARTHRIA (0-2, X)

- 0 = Normal
- 1 = Mild to moderate; patient slurs some words but can be understood
- 2 = Severe; patient's speech is so slurred/unintelligible in the absence of or out of proportion to any dysphasia, or is mute
- X = Intubated or other physical barrier



ITEM 11: EXTINCTION & INATTENTION (NEGLECT)

- ◉ Sufficient information to identify neglect may be obtained during prior testing.
- ◉ If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal.
- ◉ If the patient has aphasia but does appear to attend to both sides, the score is normal.
- ◉ The presence of visual spatial neglect or anosognosia may also be taken as evidence of abnormality.
- ◉ Since the abnormality is scored only if present, the item is never untestable.



SCORING: EXTINCTION & INATTENTION (NEGLECT) (0-2)

- 0 = No abnormality
- 1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.
- 2 = Profound hemi-inattention or hemi-inattention to more than one modality. Does not recognize own hand or orients to only one side of space.

IMPORTANT POINTS

- If patient is not co-operative explanation must be clearly written on the form.
- NIHSS items are rarely untestable.



NIHSS AND PATIENT OUTCOMES

- Total scores range from 0-42 with higher values representing more severe infarcts - Max Possible Score of 38. Can not score complete weakness and ataxia. Can not be mute and dysarthric
 - >25 Very severe neurological impairment
 - 15-24 Severe impairment
 - 5-14 Moderately severe impairment
 - <5 Mild impairment
- Adams, HP, et al. (1999). Neurology: 53: 126-131.
- A 2-point (or greater) increase on the NIHSS administered serially indicates stroke progression. It is advisable to report this increase.



NIHSS AND PATIENT OUTCOMES

- ◉ Initial score of 7 was found to be important cut-off point
 - NIHSS >7 demonstrated a worsening rate of 65.9%.
 - NIHSS <7 demonstrated a worsening rate of 14.8% and were almost twice (1.9x) as likely to be functionally normal at 48 hours (45%).

(DeGraba et al., 1999)

- ◉ NIHSS <5 most strongly associated with D/C home
- ◉ NIHSS 6-13 most strongly associated with D/C to rehab
- ◉ NIHSS >13 most strongly associated with D/C to nursing facility

(Schlegel et al., 2003)

- ◉ Likelihood of intracranial hemorrhage:
 - NIHSS > 20 = 17% likelihood
 - NIHSS < 20 = 3% likelihood

(Adams et al., 2003)



COMMUNICATING NIHSS RESULTS

- ◉ Total NIHSS score is an important piece of information to relate patient status along with a full patient assessment.
- ◉ Communicate the following
 - Which neurological area has changed
 - How it has changed
 - Other new findings (vital signs, pupils, cranial nerve deficits, mental status etc)
- ◉ Document your assessment, intervention plans and follow-up.



WHEN TO COMMUNICATE NIHSS RESULTS

- ◉ Neurological decline
- ◉ New focal deficit
- ◉ Advancing neurological deficit
- ◉ Other concern



DOCUMENTATION - NIHSS IN CPRS

- VHA Acute Ischemic Stroke Directive mandates that each stroke care facility develops methods to document and report the percentage of patients with symptoms of AIS that have the NIH Stroke Scale completed:
 - a. Within 45 minutes of arrival for patients within the 120 minute window for r-tPA administration, or
 - b. Within 24 hours of admission for patients presenting outside of the window for r-tPA administration.

WHERE CAN I GET CERTIFIED

◎ NINDS



http://www.ninds.nih.gov/doctors/stroke_scale_training.htm

◎ AHA/ASA



<http://learn.heart.org/ihtml/application/student/interface.heart2/nihsscomputer.html>

◎ NSA



<http://nihss-english.trainingcampus.net/uas/modules/trees/windex.aspx>