

Speaking the Same Language: The Role of Stroke Scales in the Emergency Department Evaluation of Stroke Patients

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Global Objectives

- Understand how stroke scales are used in the care of stroke patients
- Understand how stroke scales impact the medical literature
- Discuss the role of NIHSS in the acute EM treatment of stroke patients
- Discuss how the Modified Rankin and Barthel Index are used in stroke clinical trials that impact EM treatment of stroke patients

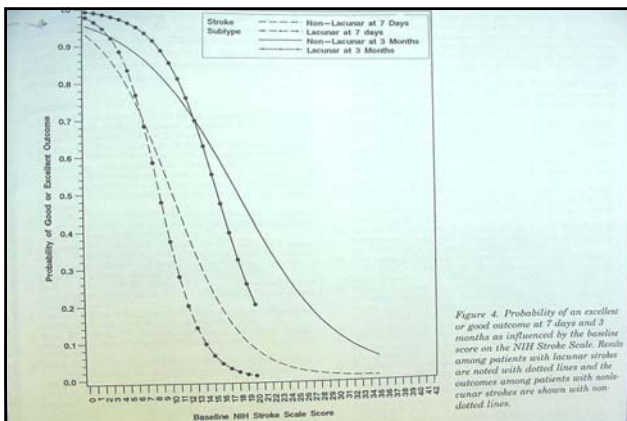
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The NIH Stroke Scale (NIHSS)

- Stroke scoring system used acutely in the ED
- Composed of 11 items that correlate closely with the neurological exam
- Predictive of outcome

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NIHSS: Scoring


- There are five areas tested in the NIHSS
 - Mental status
 - Speech
 - Motor and sensory deficits
 - Vision
 - Inattention/neglect.

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NIHSS: Scoring

- Stroke patients can have a NIHSS between 0 (no deficit) and 42 (worst deficit in every item)
- Scores of 0-1 are correlated with a good to excellent outcome and functioning
- Scores higher than 10-15 are associated with a severe stroke.

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National Institutes of Health Stroke Scale

1a. Level of consciousness (LOC)	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 flexic
1b. LOC questions	0 = answers both questions correctly 1 = answers 1 question correctly 2 = answers neither question correctly
1c. LOC commands	0 = performs both tasks correctly 1 = performs 1 task correctly 2 = performs neither task correctly
2. Best gaze	0 = normal 1 = partial gaze palsy; gaze abnormal in 1 or both eyes, but forced deviation or total gaze paresis not present 2 = forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver

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National Institutes of Health Stroke Scale

3. Visual	0 = no visual loss 1 = partial hemianopia 2 = complete hemianopia 3 = bilateral hemianopia (blindness, including cortical blindness)
4. Facial palsy	0 = normal symmetric movements 1 = minor paralysis (flattened nasolabial fold, asymmetry on smiling) 2 = partial paralysis (total or nearly total paralysis of lower face) 3 = complete paralysis of 1 or both sides (absence of movement in the upper and lower face)
5. Motor arm	0 = no drift; limb holds 90 (or 45) degrees for full 10 seconds 1 = drift; limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support 2 = some effort against gravity; limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity 3 = no effort against gravity; limb falls 4 = no movement UN = amputation or joint fusion, explain: _____ 5a. Left arm 5b. Right arm

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National Institutes of Health Stroke Scale

6. Motor leg	0 = no drift; leg holds 30-degree position for full 5 seconds 1 = drift; leg falls by the end of the 5-second period but does not hit bed 2 = some effort against gravity; leg falls to bed by 5 seconds but has some effort against gravity 3 = no effort against gravity; leg falls to bed immediately 4 = no movement UN = amputation or joint fusion, explain: _____ 6a. Left leg 6b. Right leg
7. Limb ataxia	0 = absent 1 = present in 1 limb 2 = present in 2 limbs UN = amputation or joint fusion, explain: _____
8. Sensory	0 = normal; no sensory loss 1 = mild-to-moderate sensory loss; patient feels pinprick is less sharp or dull on affected side, or loss of superficial pain with pinprick, but patient aware of being touched 2 = severe to total sensory loss; patient not aware of being touched on the face, arm, and leg

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National Institutes of Health Stroke Scale

9. Best language	0 = no aphasia, normal 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. Range of information that can be exchanged is limited; listener carries the burden of communication. Examiner cannot identify materials provided from patient response. 3 = mute, global aphasia; no usable speech or auditory comprehension
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National Institutes of Health Stroke Scale

10. Dysarthria	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 so slurred as to be unintelligible in the absence of or out of proportion to any dysphagia, or patient is mute/anarthric UN = intubated or other physical barrier, explain: _____
11. Extinction and inattention (formerly neglect)	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 extinction to more than 1 modality; patient does not recognize own hand or is oriented to only 1 side of space

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NIHSS: Clinical Use

- In the NINDS tPA study and other clinical trials, the median NIHSS for treated patients was 10-15
- This is a stroke of moderate severity that might benefit most from thrombolytic therapies.

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NIHSS Estimation

- Perform a systematic neurological exam

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NIHSS Estimation

- Perform a systematic neurological exam
- Focus on four areas of deficit:
 - Unilateral motor deficit
 - Speech and language deficit
 - CN and visual field deficit / neglect
 - Depressed level of consciousness

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NIHSS Estimation

- Perform a systematic neurological exam
- Focus on four areas of deficit:
 - Unilateral motor deficit
 - Speech and language deficit
 - CN, neglect and visual field deficit
 - Depressed level of consciousness
- Grade/add: mild (2), mod (4), severe (8)

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NIHSS ED Estimate

- CN/Vision/Neglect: 8
- Unilateral motor: 8
- LOC: 8
- Language: 8

- Mild: 2, Moderate: 4, Severe: 8

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NIHSS: Driving Principles

- NIHSS: anatomic neurologic examination
- Quantification directs therapies
- Estimation helps to categorize patients
 - Low NIHSS, thrombolysis less indicated
 - Mid-range NIHSS, thrombolysis indicated
 - High NIHSS, thrombolysis less indicated
- NIHSS 10-20 optimal for thrombolysis?

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NIHSS: Technology

- The NIHSS can be calculated using Internet-based scoring tools
- Hand-held softwares such as the one available on the ferne.org website.

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Modified Rankin Scale (MRS)

- The Modified Rankin Scale (MRS) is a stroke outcome measure that examines daily living skills
- Range of zero to five (six is sometimes used in patients who have expired)
- Patients with no symptoms or deficit as a result of the stroke have a score of zero
- Those who have symptoms but no impaired daily living skills have a score of one.

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Modified Rankin Scale

Score	Description
6	Dead
5	Severe disability: bedridden, incontinent, and requiring constant nursing care and attention
4	Moderately severe disability: unable to walk without assistance and unable to attend to own bodily needs without assistance
3	Moderate disability: requiring some help, but able to walk without assistance
2	Slight disability: unable to carry out all previous activities, but able to look after own affairs without assistance
1	No significant disability: despite symptoms, able to carry out all usual duties and activities
0	No symptoms at all

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Structured Interview for the Modified Rankin Scale

5 = severe disability: someone needs to be available at all times; care may be provided by either a trained or untrained caregiver. Question: Does the person require constant care?
4 = moderately severe disability: need for assistance with some basic ADLs, but not requiring constant care. Question: Is assistance essential for eating, using the toilet, daily hygiene, or walking?
3 = moderate disability: need for assistance with some instrumental ADL but not basic ADLs. Question: Is assistance essential for preparing a simple meal, doing household chores, looking after money, shopping, or traveling locally?
2 = slight disability: limitations in participation in usual social roles, but independent for ADLs. Questions: Has there been a change in the person's ability to work or look after others if these were roles before stroke? Has there been a change in the person's ability to participate in previous social and leisure activities? Has the person had problems with relationships or become isolated?
1 = no significant disability: symptoms present but not other limitations. Question: Does the person have difficulty reading or writing, difficulty speaking or finding the right word, problems with balance or coordination, visual problems, numbness (face, arms, legs, hands, feet), loss of movement (face, arms, legs, hands, feet), difficulty with swallowing, or other symptom resulting from stroke?
0 = no symptoms at all; no limitations and no symptoms

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Predicting major neurological improvement with intravenous recombinant tissue plasminogen activator treatment of stroke.

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BACKGROUND AND PURPOSE: In the National Institute of Neurological Disorders and Stroke (NINDS) rt-PA Stroke Study, major neurological improvement within 24 hours (MNI) occurred significantly more frequently with recombinant tissue plasminogen activator (rtPA) treatment than with placebo. We explored the relationship between MNI and 3-month favorable outcome and sought to predict MNI. **METHODS:** Data from 312 rtPA-treated patients from the NINDS trial were used to assess the ability of MNI to predict favorable outcome at 3 months as defined by a modified Rankin Scale score of 0 to 1. **RESULTS:** A multivariable predictive model was developed for MNI within the same data set. Clinical variables associated with MNI included age, diabetes, pretreatment glucose, baseline National Institutes of Health Stroke Scale score, pretreatment blood pressure, history of atrial fibrillation, weight >100 kg, and a dense artery sign. Finally, the model was used to forecast into the placebo group of the NINDS trial to assess the magnitude of the prediction in the rtPA-treated group. **RESULTS:** MNI had a positive predictive value and negative predictive value of 0.70 for predicting favorable 3-month outcome. Odds ratio [odds ratio (OR), 0.65, 95% confidence interval (CI), 0.47 to 0.99] and TTT (OR, 0.56, 95% CI, 0.34 to 0.91) appear to be independently associated with MNI. The model performed only moderately well (area under the receiver-operating characteristic curve, 0.66). Age (OR, 0.67, 95% CI, 0.45 to 0.99) but not TTT was associated with MNI in the placebo group. **CONCLUSIONS:** MNI may be a useful surrogate for thrombolytic activity and is predictive of favorable 3-month outcome. When rates of MNI in different populations of stroke patients treated with thrombolysis are compared, adjustments for age and TTT may be necessary.

PMID: 14657446 [PubMed - indexed for MEDLINE]

Modified Rankin Scale: Clinical Use

- In the NINDS tPA trial, there was a 13% increase in MRS 0-1 patients in the treatment group
- This demonstrates that nine patients are needed to be treated in order for one patient to have this improved MRS outcome.

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Barthel Index: Scoring

- The Barthel Index (BI) is a stroke outcome measure that examines physical capabilities in 10 areas
- Each of these physical skills is scored as 0, 5, 10, or 15 points, with a normal patient having a maximal score of 100 points
- Patients who are bedridden have a score of zero
- Those with a good or excellent outcome have a score of 95-100.

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The Barthel Index

Feeding	0 = unable 5 = needs help cutting, spreading butter, etc, or requires modified diet 10 = independent
Bathing	0 = dependent 5 = independent (or in shower)
Grooming	0 = needs help with personal care 5 = independent face/hair/teeth/shaving (implements provided)
Dressing	0 = dependent 5 = needs help but can do about half unaided 10 = independent (including buttons, zips, laces, etc)
Bowels	0 = incontinent (or needs enemas) 5 = occasional accident 10 = continent

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The Barthel Index

Bladder	0 = incontinent, or catheterized and unable to manage alone 5 = occasional accident 10 = continent
Toilet use	0 = dependent 5 = needs some help but can do something alone 10 = independent (on and off, dressing, wiping)
Transfers (bed to chair and back)	0 = unable, no sitting balance 5 = major help (1 or 2 people, physical), can sit 10 = minor help (verbal or physical) 15 = independent
Mobility (on level surfaces)	0 = immobile or <50 yards 5 = wheelchair-independent, including corners, >50 yards 10 = walks with help of 1 person (verbal or physical) >50 yards 15 = independent (but may use any aid—eg, stick) >50 yards
Stairs	0 = unable 5 = needs help (verbal, physical, carrying aid) 10 = independent

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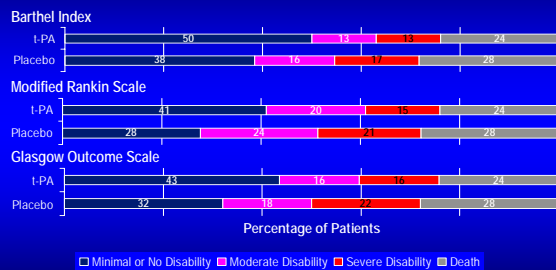
Barthel Index: Clinical Use

- In the NINDS tPA trial, there was a 12% increase in BI 95-100 patients in the treatment group
- This again demonstrates that nine patients are needed to be treated in order for one patient to have this improved BI outcome.

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NINDS One-Year Follow-Up: Favorable Outcomes at 12 Months



Barthel, Rankin, & Glasgow Outcome Scales

Comparison of Scales

- Key differences
- NIHSS is an acute score that correlates to the neurological exam
- MRS is an outcome measure that examines functional daily living skills
- BI is another outcome assessment that measures the ability to perform physical skills.

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Key Learning Points on Scales

- Know how to calculate or estimate the NIHSS based on a well-documented neurological exam.
- Have a sense of the number needed to treat from clinical trials based on good or excellent MRS or BI scores.
- In general, 10 patients are needed to be treated with IV tPA in order to have one additional patient have a good or excellent outcome.
- Examine new efficacy studies based on the baseline NIHSS scores in the two treatment groups and patient outcomes as measured by the MRS and BI.

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Questions??

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