Deficits and disability in acute ischemic stroke

Karen Greenberg, DO, FACOEP
Disclosures

• This program is presented on behalf of Genentech, and the information is consistent with FDA guidelines.

• I have been compensated by Genentech to serve as a speaker for this program.

• This program is intended to provide general disease education about acute ischemic stroke and not medical advice for any particular patient.

• This program may be monitored by Genentech for adherence to program requirements.

This program is focused on diagnosis, and is not focused on any particular product.
Today’s objectives

At the end of this presentation, you will be able to:

• Explain the importance of assessing disability as part of the initial stroke assessment

• Recognize some signs and symptoms that may not be captured by the NIHSS

• Distinguish between stroke severity, stroke deficits, and disability
Brenda: 56-year-old Caucasian woman

**PHYSICAL AND HISTORICAL FINDINGS**

- Current BP = 162/91 mm Hg
- No medications
- Non-smoker

**SYMPTOMS**

- Sudden-onset headache
- Sudden-onset “dizziness” and nausea
- Trouble seeing to the right
- Unsteady balance

Would you suspect stroke?
Patients with atypical symptoms may be misdiagnosed\(^1\)

Signs and symptoms associated with missed stroke diagnosis included\(^1\):

- Headache
- Nausea or vomiting
- Dizziness
- Seizure
- Syncope
- Difficulty walking

*Based on a retrospective chart review on all patients with a discharge diagnosis of ischemic stroke between February 2013 to February 2014 at a large certified stroke center and academic teaching hospital that sees >1000 emergency department stroke codes each year (n=280) and a regional referral community hospital that sees 200 emergency department acute stroke codes each year (n=185).\(^1\)

50% of patients with AIS in the GWTG-Stroke registry had an NIHSS score ≤5

Distribution of NIHSS scores

- **Alive**
- **Dead**

Data from discharges for acute stroke using (ICD)-9 codes from 404 hospitals enrolled in the GWTG-Stroke hospitals between 2003 and 2006 with follow-up through 2007 (N=33,102).

GWTG=Get With The Guidelines

Even an isolated deficit can lead to disability, and can have a lasting impact.\(^1\)

**Stroke** is one of the leading causes of disability* in the United States.\(^2\)

*Disability defined as a “yes” response to at least one of the following limitation categories: 1) use of an assistive aid (cane, crutches, walker, or wheelchair); 2) difficulty performing activities of daily living (ADLs), instrumental activities of daily living (IADLs), or specified functional activities; 3) one or more selected impairments; or 4) limitation in the ability to work around the house or at a job or business.\(^2\)

Many patients with AIS require ongoing support

In 2 separate studies:

At 6 months

45%

of ischemic stroke patients were functionally dependent (N=7,710)\(^1\)

At 1 year

50%\(^\dagger\)

of patients with a cerebral infarct had a disability\(^\ddagger\)

(N=92)\(^\S\)

---

\(^1\) Defined as Rankin Scale score 3-5 or survey question response on requiring assistance for activities of daily living.\(^1\)

\(^\dagger\) Of 92 patients who responded to a survey of 200 patients with a confirmed cerebral infarction in the North East Melbourne Stroke Incidence Study (NEMESIS).\(^3\)

\(^\ddagger\) Defined as less than 20/20 on the Barthel Index.\(^3\)

\(^\S\) Data from North East Melbourne Stroke Incidence Study (NEMESIS). Due to different social, medical, and government support structures, there are limitations to the conclusions that can be applied for practice in the US.\(^3\)

Caregivers are impacted across multiple aspects of their lives*¹

1 in 2
moderate to extreme reduction in leisure activities

1 in 3
moderate to extreme impact on relationships

1 in 4
loss of income

Separate studies have shown:
Primary caregivers spend 17–32 hours a week performing caregiver-related tasks¹

*Data from the Australian Stroke Survivor and Carer Needs Assessment Project (N=369). Due to different social, medical, and government support structures, there are limitations to the conclusions that can be applied for practice in the US.

Brenda: Signs and symptoms

**PHYSICAL AND HISTORICAL FINDINGS**
- Current BP = 162/91 mm Hg
- No medications
- Non-smoker

**SYMPTOMS**
- Sudden-onset headache
- Sudden-onset “dizziness” and nausea
- Trouble seeing to the right
- Unsteady balance

Would you suspect stroke in this patient?

Hypothetical case.
NIHSS measures stroke-related neurological deficits

1. Level of consciousness
2. Best gaze
3. Visual fields
4. Facial palsy
5. Motor: arms
6. Motor: legs
7. Limb ataxia
8. Sensory
9. Best language
10. Dysarthria
11. Extinction or inattention

Brenda: NIHSS score

**SYMPTOMS**

- Sudden-onset headache
- Sudden-onset “dizziness” and nausea
- Trouble seeing to the right
- Unsteady balance

**NIHSS: Overall score:** 3

- 3. Visual – Complete hemianopia, right side: 2
- 8. Sensory – Mild-to-moderate sensory loss, right side: 1

*Hypothetical case.*
NIHSS was not designed to predict disability

Consider scenarios with an NIHSS score of 3:

- Moderately severe language impairment
  
  “…”

- Mild facial weakness or asymmetry, mild dysarthria, and mild upper extremity drift

Even an NIHSS score of zero can result in disability at discharge

In an analysis using data from the GWTG–Stroke program:\(^1\):

<table>
<thead>
<tr>
<th></th>
<th>NIHSS = 0(^\d)</th>
<th>NIHSS = 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of patients</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unable to be discharged home</td>
<td>15.5% (n=500/3,229)</td>
<td>35.4% (n=596/1,682)</td>
</tr>
<tr>
<td>Non-ambulatory at discharge</td>
<td>16.1% (n=488/3,025)</td>
<td>33.9% (n=528/1,557)</td>
</tr>
</tbody>
</table>

\(^1\)Example: Truncal ataxia, agitated confusion\(^2\)

Overall, 28.3\% (n=8272/29,200) of patients with “mild/improving” symptoms could not be discharged home\(^\d\)

\(^1\)Data from the GWTG-Stroke program; N=29,200 acute ischemic stroke patients from 1092 hospitals between 2003 and 2009 arriving within 2 hours after symptom onset.

\(^\d\)Untreated patients arriving within 2 hours of symptom onset who were documented as “mild or rapidly improving stroke” and had a final discharge diagnosis of ischemic stroke.

Clot location impacts symptoms based on associated neuroanatomy¹

Brenda: Stroke location

**SYMPTOMS**

- Sudden-onset headache
- Sudden-onset “dizziness” and nausea
- Trouble seeing to the right
- Unsteady balance

**NHISS: Overall score: 3**

3. Visual – Complete hemianopia, right side: 2
8. Sensory – Mild-to-moderate sensory loss, right side: 1

*Hypothetical case.*
Not all stroke deficits are captured by the NIHSS\textsuperscript{1}

The scoring system is heavily biased toward anterior circulation and left hemisphere strokes\textsuperscript{1}

Cranial nerve signs and ataxia receive fewer points or are excluded entirely\textsuperscript{2}

Only 2 points are directed toward neglect, whereas 7 points are directed toward language\textsuperscript{3}

NIHSS lacks sensitivity in posterior stroke

Posterior circulation strokes account for 20%–25% of all ischemic strokes

Some common posterior stroke symptoms are:

- Dizziness
- Diplopia
- Dysarthria
- Dysphagia
- Ataxia

Ataxia is frequently excluded from scoring due to the coexistence of motor deficits.

*Range 17-40%; estimated based on ischemic strokes in the UK affecting posterior circulation brain structures.

NIHSS quantifies deficits, not the potential impacts

Even a single residual deficit can have a lasting effect

<table>
<thead>
<tr>
<th>NIHSS item*</th>
<th>Score</th>
<th>Deficit</th>
<th>Potential patient impact†</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Visual</td>
<td>2</td>
<td>Complete hemianopia</td>
<td>• No commercial driving</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Impaired peripheral vision and depth perception</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Difficulty navigating crowded spaces (e.g., grocery stores, shopping centers, train stations)</td>
</tr>
<tr>
<td>9. Best language</td>
<td>2</td>
<td>Aphasia</td>
<td>• Communication through fragmentary expression</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Range of information that can be exchanged is limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Listener carries burden of communication</td>
</tr>
<tr>
<td>10. Dysarthria</td>
<td>2</td>
<td>Severe dysarthria</td>
<td>• Speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or patient is mute/anarthric</td>
</tr>
</tbody>
</table>

*To review the entire NIH Stroke Scale, visit http://www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf.

†Hypothetical examples of potential disabilities experienced by AIS patients.

The AHA/ASA differentiates between disabling and non-disabling deficits

The following should be considered disabling deficits:\n
- Complete hemianopia
- Severe aphasia
- Visual or sensory extinction
- Any weakness limiting sustained effort against gravity
- Any deficits that lead to a total NIHSS >5
- Any remaining deficit the patient or practitioner consider potentially disabling

The AHA/ASA state:
Many patients with low NIHSS scores are at risk for poor outcomes

Reasons for poorer outcomes include¹:

- Recurrent strokes
- Neurological deterioration of the original stroke event
- Disability from deficits not well measured by the NIHSS

Modified Rankin Scale quantifies level of disability

Modified Rankin Scale (mRS)\textsuperscript{1}

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

Brenda: Disability assessment

**SYMPTOMS**

- Sudden-onset headache
- Sudden-onset “dizziness” and nausea
- Trouble seeing to the right
- Unsteady balance

**NIHSS: Overall score:** 3

**mRS considerations**

- 3. Visual – Complete hemianopia, right side: 2
- 8. Sensory – Mild-to-moderate sensory loss, right side: 1

Would you consider any of these deficits disabling?
What about the combination of deficits?

Hypothetical case.
Consider these assessments with or in addition to the NIHSS

Assess for characteristic posterior and right-hemisphere stroke symptoms

- Eye movement abnormalities
- Acute diplopia
- Swallowing difficulties
- Gait ataxia
- Anosognosia
- Central vertigo

At 3 months, Brenda was able to live alone, but she was not cleared to drive and required her son to handle her finances due to persistent visual loss. She was able to ambulate in her home with independent use of an assistive device.
Symptom diversity and disability in acute ischemic stroke

- Disability affects stroke survivors and caregivers across multiple aspects of their lives\(^1\)
- Patients with low NIHSS scores may still have substantial deficits and potential disability\(^2\)
- Consider disability on an individualized basis\(^3\)
- The AHA/ASA recommends taking disabling deficits and potential for disability into account when assessing stroke severity\(^3\)

If a patient with atypical symptoms was to present tomorrow, how would you think about diagnosing stroke differently?

NIHSS=National Institutes of Health Stroke Scale.

NIHSS quantifies deficits, not the potential impacts

Even a single residual deficit can have a lasting effect

<table>
<thead>
<tr>
<th>NIHSS item*</th>
<th>Score</th>
<th>Deficit</th>
<th>Potential patient impact†</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Visual</td>
<td>2</td>
<td>Complete hemianopia</td>
<td>• No commercial driving</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Impaired peripheral vision and depth perception</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Difficulty navigating crowded spaces (e.g., grocery stores, shopping centers, train stations)</td>
</tr>
<tr>
<td>4. Facial palsy</td>
<td>2</td>
<td>Partial paralysis</td>
<td>• Lack of facial symmetry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Potential effect on motor skills (e.g., speech, ability to drink, drooling)</td>
</tr>
<tr>
<td>5. Motor arm</td>
<td>2</td>
<td>Some effort against gravity</td>
<td>• Limitations on activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Inability to perform some basics of self-care (e.g., brush hair, brush teeth, tie shoes)</td>
</tr>
<tr>
<td>8. Sensory</td>
<td>2</td>
<td>Severe to total sensory loss</td>
<td>• Potential loss of some fine motor skills (e.g., ability to cook safely, button shirt, shave)</td>
</tr>
<tr>
<td>9. Best language</td>
<td>2</td>
<td>Aphasia</td>
<td>• Communication through fragmentary expression</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Range of information that can be exchanged is limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Listener carries burden of communication</td>
</tr>
<tr>
<td>10. Dysarthria</td>
<td>2</td>
<td>Severe dysarthria</td>
<td>• Speech is so slurred as to be unintelligible in the absence of, or out of proportion to, any dysphasia, or patient is mute/anarthric</td>
</tr>
</tbody>
</table>

*To review the entire NIH Stroke Scale, visit http://www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf.
†Hypothetical examples of potential disabilities experienced by AIS patients.