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Screening Patients with Stroke for Rehabilitation Needs: Validation of the Post-Stroke Rehabilitation Guidelines

Dorothy F. Edwards, PhD, Michele G. Hahn, MSOT/OTR, Carolyn M. Baum, OTR/L, Monica S. Perlmutter, MA, OTR, Catherine Sheedy, RN, and Alexander W. Dromerick, MD

Background. The authors assessed patients with acute stroke to determine whether the systematic use of brief screening measures would more efficiently detect cognitive and sensory impairment than standard clinical practice. Methods. Fifty-three patients admitted to an acute stroke unit were assessed within 10 days of stroke onset. Performance on the screening measures was compared to information obtained from review of the patient’s chart at discharge. Cognition, language, visual acuity, visual-spatial neglect, hearing, and depression were evaluated. Results. Formal screening detected significantly more impairments than were noted in patient charts in every domain. Only 3 patients had no impairments identified on screening; all remaining patients had at least 1 impairment detected by screening that was not documented in the chart. Thirty-five percent had 3 or more undetected impairments. Memory impairment was most likely to be noted in the chart; for all other domains tested, undocumented impairment ranged from 61% (neglect) to 97% (anomia). Conclusion. Many acute stroke patients had cognitive and perceptual deficits that were not documented in their charts. These data support the Post-Stroke Rehabilitation Guidelines for systematic assessment even when deficits are not immediately apparent. Systematic screening may improve discharge planning, rehabilitation treatment, and long-term outcome of persons with stroke.

Key Words: Stroke guidelines—Cognitive impairment—Sensory and perceptual impairment.

Of the estimated 3 million stroke survivors in the United States, 70% experience significant functional disability in mobility, ADL, social integration, and gainful employment. Although motor impairments may be most obvious, stroke has a profound impact even in persons who appear to have recovered sensorimotor function. Higher order cognitive abilities such as short-term memory, language comprehension, orientation, safety awareness, and judgment play a major role in determining length of stay for inpatient rehabilitation and predicting functional status at discharge. Systematic screening for cognitive and sensory impairment is recommended by the Agency for Healthcare Research and Quality (AHRQ) in its Clinical Practice Guidelines for Post-Stroke Rehabilitation. However, these recommendations were largely based on consensus and expert opinion rather than empirical findings. Although most clinicians agree that standardized assessment is important, some resist screening for deficits that are not immediately apparent on brief examination. Moreover, the utility of formal screening of all patients hospitalized for stroke has not been empirically validated.

We screened persons admitted to an academic stroke service for the presence of undetected cognitive and sensory impairments and then compared the results of this testing with the patient’s...
chart. We followed the AHRQ clinical guidelines for acute stroke evaluation and assessed cognitive status, vision and hearing, unilateral visual neglect, speech and language, functional status, and depression. We chose a group of previously published and validated measures to assess each domain; we call this group of measures the “Functional Impairment Battery” or “FIB.” The purpose of this study was to determine the benefit and clinical utility of this screening battery in individuals with mild to moderate stroke.

METHODS

Clinical Setting

This study was conducted on the Stroke Management and Rehabilitation Team (SMART) service at Barnes-Jewish Hospital. This academic stroke service admits approximately 625 ischemic and 115 hemorrhagic stroke patients per year. Persons admitted to this multidisciplinary service are evaluated by neurologists, nurses, and master’s-prepared physical, occupational, and speech therapists. A standard medical and nursing evaluation, including the National Institutes of Health Stroke Scale (NIHSS), is performed on each newly admitted patient. Therapy evaluations other than the FIM were left to the discretion of individual clinicians. All patients admitted to this service were screened for study inclusion by the stroke nurse coordinator (CS). Inclusion criteria for this study were 1) primary diagnosis of ischemic stroke, 2) testing performed within 15 days of stroke onset, 3) absence of severe motor or language deficits, 4) ability to provide informed consent, and 5) English as the primary language. Exclusion criteria included 1) Glasgow Coma Scale scores of less than 15, 2) medical complexity that precluded participation (admission to intensive care unit, mechanical ventilation, etc.), 3) motor (Dominant Hand Motor Arm Score ≥ 2) or language (Best Language score ≥ 2) deficits identified by the NIHSS that prevented valid testing, 4) inability to hold and use a pencil, 5) new stroke subsequent to hospital admission, and 6) unable or unwilling to provide informed consent.

Participants

Eighty-one patients met the inclusion criteria over the 3-month study period. Of these, 60 consented and 53 completed testing. This group represented 46% of all patients admitted to the Neurology Stroke service during the study period. Mean time from stroke onset to testing was 4.3 ± 2.9 days. The demographic and clinical characteristics of the participants are presented in Table 1. The mean length of stay on the stroke service was 5.5 (SD = 4.03; range = 1-12) days.

Measures

The NIHSS is widely used to assess stroke-related cognitive and physical impairments. The NIHSS includes level of consciousness, motor weakness, presence of neglect and visual field cuts, language deficits, and sensory loss. This 13-item test has a 0 to 46 total score range, with a score of zero indicating no measured impairment.

The MIS Pocket Vision Guide is a near visual acuity chart measuring functional acuity in both eyes; the patient is tested wearing corrective lenses when available. Possible scores range from 20/20 to 20/400. Acuity was classified using 4 levels of impairment: no impairment (<20/25), mild impairment (20/25 to 20/40), moderate impairment (20/50 to 20/100), and severe impairment (20/200 to 20/400). Persons with scores in the moderate and severe ranges were classified as visually impaired.

The Behavioral Inattention Test Star Cancellation requires cancellation of 54 small stars presented on a page with distracter items. The number correctly cancelled in each of 6 columns is recorded and summed. More errors on the
contralateral side than the ipsilateral side indicate unilateral visual neglect. The test was used as published, with scores of 51 or less classified as having visual spatial neglect.

Sound repetition screens were used for hearing impairment. This brief bedside test assesses the ability to hear a combination of high- and low-pitched sounds used in everyday conversation without the benefit of lip reading. Persons are asked to repeat the sounds s, s, s, s, and s while the person vocalizing the sounds blocks the view of his or her lips. Each sound heard correctly is given a score of 1. A score of 4 or less indicates a functional impairment.

The Frenchay Aphasia Screening Test (FAST) assesses comprehension and expression using a variety of language-based tasks. Possible scores range from 0 to 20; scores of less than 13 are indicative of language impairment.

The CERAD (Consortium to Establish a Registry for Alzheimer’s Disease) version of the Boston Naming Test uses 15 items to evaluate anomia, or confrontation naming. Subjects are asked to name objects presented as line drawings. One point is given for each object named correctly; a score of 12 or less indicates anomia.

The Short Blessed Memory Orientation and Concentration Test consists of 6 items assessing memory, orientation, and concentration. Possible scores range from 0 to 28. Persons with scores of 9 or more are classified as cognitively impaired.

The Geriatric Depression Scale–Short Form is a 15-item version of the original 30-item scale. Subjects answer yes/no questions about feelings, interests, activities, and hopes. Scores of greater than 5 indicate probable depression.

Procedures

All testing was performed by occupational therapy students trained and supervised by clinical faculty (MH and MP). Interrater reliability (k, of 0.90) for all scales was established with a separate sample of 15 acute stroke patients prior to initiating this study. Consecutive acute care admissions to the stroke service were reviewed by the stroke nurse specialist (CS) to determine eligibility for the project. Patients meeting the inclusion criteria were asked to participate. Informed consent was obtained from all subjects. The majority of patients were tested during a single session; the average time required to complete the battery was 45 min (range = 25-65 min). All testing took place at the bedside; voice amplifiers were used with hearing-impaired patients who did not have hearing aids available at the time of testing. Subjects’ eyeglasses were used when available; reading glasses were provided.

The clinical treatment team was unaware of study measurements. Study clinicians administering the FIB battery were not provided access to patient charts. After discharge, the entire medical chart, including physician, nursing, and therapy notes, was independently reviewed by 2 trained study reviewers for any mention of impairment measured by the FIB. The reviewers followed a structured guide to complete the review. The reviewers’ notes were compared, and the final chart assessment included all terms noted by either reviewer. Any mention of a deficit by any clinician was acceptable; for example, a neglect was scored as present in the chart if any mention of hemi-inattention, visual field cut, or other lateralized visual disturbance was documented. Thus, the clinician did not have to specify or use a specific term such as aphasia or neglect for the deficit to be recorded as present.

Analysis

Descriptive statistics were computed for each variable. Student t tests were computed to determine differences by side of lesion and prior stroke. The proportion of patients impaired on each scale (domain) was determined by applying the published criteria for each scale. χ² analyses were used to compare frequency of impairment on each scale to the frequency of the same impairment noted in each patient’s chart.

RESULTS

Performance on the Screening Tests

Admission NIHSS scores ranged from 2 to 21 (9.37 ± 7.48), indicating mild to moderate stroke severity at the time of admission to the stroke service.

The scores on each of the screening measures are presented in Table 2. The number of impairments noted on the battery was summed for each patient. Only 3 (6%) of the 53 study participants had no measurable impairment. Thirty-three percent of the patients had 4 or more sensory or cognitive problems, whereas 13% had more than 6. The mean number of impairments was signifi-
Significantly higher for patients with right hemisphere lesions ($t = 2.27, P < 0.03$) than patients with left hemisphere lesions. Prior stroke was not associated with greater numbers of impairments ($t = 0.008, P < 0.99$).

The highest level of impairment was observed on the visual acuity measure. Scores on the vision screening ranged from 20/25 to 20/400; 70% of the patients had moderately to severely impaired visual acuity. Although many of these patients wore glasses prior to their stroke, 20 of the 37 patients with impaired acuity did not have their glasses with them in the hospital, so their performance on the vision screening is not surprising. However, 17 of the visually impaired patients were tested with their glasses on and still met the criteria for impaired visual acuity.

Impaired hearing was noted in 41% of the patients. Scores on the hearing screening ranged from 0 to 5; the mean score was 4.4 ($SD = 1.1$).

Scores on the BIT Star Cancellation scale ranged from 3 to 54. Visuospatial neglect was noted in 52% of the patients. The mean score on the Star Cancellation test was 44.4 ($SD = 14.3$), significantly below the cutoff of 51 for this scale.

The battery included 2 measures of language function. Scores on the Boston Naming Test, a measure of anoma or confrontation naming, ranged from 2 to 15, with a mean of 11.2 ($SD = 3.2$). Sixty-five percent of the participants met the criteria for impairment on this scale. The FAST is used to assess receptive and productive aphasia; 36% of the patients in this sample were aphasic. The mean score was 14.3 ($SD = 4.2$), with a range of 3 to 20. It should be noted that persons with severe aphasia on their admission NIH Stroke Scale were excluded from the study.

The Short Blessed scale measures memory, orientation, and concentration. The mean was 10 ($SD = 6.7$), with scores ranging from 0 to 25. Based on a cut score of 9, 61% of the patients were cognitively impaired.

Thirty-one percent of the patients met the screening criteria for depression on the GDS. The mean GDS score was 3.6 ($SD = 3.2$), with a range of 0 to 12.

**Tested versus Charted Impairments**

Each subject’s test performance was compared to data obtained from a structured chart review. $\chi^2$ analyses were computed to compare the number of impaired persons identified by chart review to the number of persons with impairments noted by each scale. The screening measures detected all impairments noted in the charts, but every impaired patient had at least 1 undocumented cognitive or sensory deficit. In each domain, the screening measures identified significantly more impairments than were noted in the charts. Memory ($\chi^2 = 21.9, P < 0.0001$), visuospatial neglect ($\chi^2 = 10.1, P < 0.001$), and depression ($\chi^2 = 6.7, P < 0.01$) were most likely to be undocumented in the patient’s chart. Eighteen (35%) of the patients had 3 or more undocumented impairments. These results suggest that in the absence of formal testing with standardized assessments, much impairment goes unrecognized and perhaps untreated (see Table 3).

### Table 2. Performance on Functional Impairment Battery Subtests

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Mean + SD</th>
<th>Cutoff</th>
<th>% Impaired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anomia</td>
<td>BNT</td>
<td>11.2 ± 3.2</td>
<td>≤12</td>
<td>65</td>
</tr>
<tr>
<td>Memory</td>
<td>Short Blessed Test</td>
<td>10.0 ± 6.7</td>
<td>≥9</td>
<td>61</td>
</tr>
<tr>
<td>Neglect</td>
<td>BIT Star Cancellation</td>
<td>44.4 ± 14.3</td>
<td>≤51</td>
<td>52</td>
</tr>
<tr>
<td>Hearing</td>
<td>Sound Repetition</td>
<td>4.4 ± 1.1</td>
<td>≤4</td>
<td>41</td>
</tr>
<tr>
<td>Aphasia</td>
<td>FAST</td>
<td>14.3 ± 6.7</td>
<td>≤13</td>
<td>36</td>
</tr>
<tr>
<td>Depression</td>
<td>GDS</td>
<td>3.6 ± 3.2</td>
<td>≥5</td>
<td>31</td>
</tr>
<tr>
<td>Visual Acuity</td>
<td>% impaired</td>
<td>Mild (30%) Moderate (34%) Severe (36%)</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20/25-20/50</td>
<td>20/70-20/100</td>
<td>20/200-20/400</td>
</tr>
</tbody>
</table>

BNT = Boston Naming Test; BIT = Behavioral Innatention Test; FAST = Frenchay Aphasia Screening Test; GDS = Geriatric Depression Scale.
DISCUSSION

We hypothesized that patients in the acute stage of stroke recovery could be tested with the FIB screening battery and that the battery would detect sensory and cognitive impairments not noted by the treatment team. Both hypotheses were confirmed. We note that this took place despite the presence of a multidisciplinary team of experienced rehabilitation professionals working in an academic tertiary specialty service that provided a level of assessment not typically found in community hospitals.

Many clinically important cognitive and perceptual deficits were not documented in the hospital charts of this sample of mildly to moderately affected stroke patients. Thus, stroke patients who appear normal may nonetheless have cognitive and perceptual deficits that may prevent them from taking medication properly, driving, and other cognitively demanding tasks necessary for return to community and family life. These findings support the recommendations of the expert panel that developed the Post-Stroke Rehabilitation Clinical Practice Guidelines. Newer efforts by voluntary groups to establish stroke centers of excellence may accelerate the use of standardized screening protocols such as described in this study.

Our findings are clinically significant because the domains assessed in this study are essential for independence in community settings. Each of the noted impairments inhibits successful functional recovery.25-29 These impairments are also associated with caregiver burden30 and increased costs of care. Functional and emotional problems become more salient when patients leave the highly structured hospital environment. When patients exhibit behaviors not present in the hospital setting, family members and primary care physicians may attribute these behaviors to psychosocial factors rather than cognitive impairments. Many patients are discharged directly to home from the acute care setting, and the opportunity for cognitive screening and treatment may be limited to the acute hospitalization. Failure to address these issues may lead to premature nursing home placement when the untrained family cannot provide the supervision, cognitive support, or environmental modifications needed for independent living.31-33

Our findings support systematic screening for cognitive and perceptual domains known to influence functional performance, even when such deficits are not immediately apparent.34 Previous studies have noted the reluctance of clinicians to use standardized testing protocols.9,10 The literature suggests that many therapists believe that standardized assessments are only warranted if the patient shows clear signs of impairment.35 In the past, longer lengths of stay allowed acute care clinicians to spend more time with patients and their families, thus increasing the detection of subtle cognitive and perceptual impairments during the course

<table>
<thead>
<tr>
<th>Domain/Measure</th>
<th>Frequency Noted in Chart, N (%)</th>
<th>Frequency Noted by Testing, N (%)</th>
<th>Percent Undetected Clinically&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P &lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Blessed</td>
<td>22 (42)</td>
<td>32 (61)</td>
<td>31</td>
<td>0.001</td>
</tr>
<tr>
<td>Visual spatial neglect BIT</td>
<td>11 (21)</td>
<td>28 (52)</td>
<td>61</td>
<td>0.001</td>
</tr>
<tr>
<td>Star Cancellation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>4 (8)</td>
<td>16 (31)</td>
<td>75</td>
<td>0.002</td>
</tr>
<tr>
<td>Aphasia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAST</td>
<td>4 (8)</td>
<td>19 (36)</td>
<td>79</td>
<td>0.005</td>
</tr>
<tr>
<td>Visual acuity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIS Vision Guide</td>
<td>14 (26)</td>
<td>37 (70)</td>
<td>62</td>
<td>0.006</td>
</tr>
<tr>
<td>Anomia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boston Naming Test</td>
<td>1 (0)</td>
<td>34 (65)</td>
<td>97</td>
<td>0.01</td>
</tr>
<tr>
<td>Hearing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound Repetition</td>
<td>3 (6)</td>
<td>22 (42)</td>
<td>86</td>
<td>0.01</td>
</tr>
</tbody>
</table>

BIT = Behavioral Innatention Test; FAST = Frenchay Aphasia Screening Test.
<sup>a</sup>χ² analyses comparing impairment identified by test performance and notation of impairment in patient chart.
<sup>b</sup>Percent clinically undetected calculated by dividing the number of patients with impairment noted in charts by the number of patients with impairment detected by screening measure.

Table 3. Comparison of Impairments Noted by Testing and Chart Review
of treatment. Clinicians under pressure to discharge patients quickly may be reluctant to engage in routine cognitive screening in the absence of obvious impairments, perhaps to the detriment of many stroke patients. Pressure to discharge quickly is highest in ambulatory individuals without gross cognitive or language impairment. Most 3rd-party payers rely on the written assessment of therapy clinicians to determine who receives rehabilitation treatment, and failure to document impairments may deprive patients of treatments or in-home assistance they would otherwise receive.

In recommending assessments, the expert panel that developed the Post-Stroke Clinical Practice Guidelines sought to balance comprehensiveness, validity, and practicality. Our data demonstrate the clinical utility of these brief screening measures as part of the acute stroke care planning process. The purpose of these measures is to screen for a variety of impairments so that persons with sensory, perceptual, and cognitive impairment can be identified for further testing, diagnosis, and treatment. Like any screening tool, it will detect abnormalities from a variety of causes, and in some cases, these abnormalities may have multiple causes, including inattention, apraxia, illiteracy, and anxiety.

The battery we have chosen has several advantages. All of the measures have well-documented reliability and validity. The battery is short and does not require a high level of reading ability or education. All patients tolerated the evaluation and completed testing in less than an hour. It includes many of the domains assessed by other cognitive screening batteries but also includes measures of language, vision, hearing, depression, and visuospatial ability. We also included tests that are not influenced by motor impairment. The BIT Star Cancellation Test is intended to be a paper-and-pencil test but can be performed with the patient pointing out the stars to be canceled by the therapist. None of the study measures are timed, and all are relatively insensitive to factors that cause psychomotor slowing such as sleep deprivation or medication. Of course, later in clinical care, timed measures take on an important role in neuropsychological assessment, where response times are used to discriminate between cognitive impairments related to vascular dementia and those related to Alzheimer disease.

Our findings raise important questions about routine evaluation of people with stroke within acute care settings, but they require further studies using larger samples from a variety of acute care facilities. The study design does not allow us to determine whether the detected cognitive and sensory impairments resulted from the index stroke or from some other cause. It is reasonable to assume that some of the impairments noted predated the stroke. Regardless of etiology, these impairments are known to increase disability and decrease quality of life after hospital discharge. Our findings may also reflect the sensitivity of the screening measures and the possibility that there are false positives that may have inflated the level of impairment in the sample.

In summary, undocumented cognitive and sensory impairments are common in stroke patients admitted to an acute care hospital. These impairments can have important impacts on function in the community and may not be obvious to the clinician on superficial evaluation. The systematic use of a practical assessment tool in accordance with the AHRQ guidelines may improve discharge planning, rehabilitation treatment, and long-term outcome of persons with stroke.

ACKNOWLEDGMENTS

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