Behavioral Problems in Stroke Rehabilitation Patients: A Prospective Pilot Study

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Thirty-two patients undergoing rehabilitation after stroke were prospectively evaluated in a pilot study to determine the frequency and significance of behavioral problems interfering with rehabilitation. Based on prior experience within the rehabilitation unit, we studied depression, as well as somnolence, irritability, anxiety, confusion, delusions, denial of deficit, impulsivity, inappropriate sexual behavior, and pain. Depression was present in 31% of patients, and other behavioral problems occurred in up to 41% of patients. Although the sample size was small, significant associations were noted between somnolence and left hemisphere infarct, between the number of behavioral problems and rehabilitation outcome, and between certain behavioral problems and neurologic variables. Behavioral problems other than depression are common after stroke, and such problems correlate with specific neurologic variables. Rehabilitation outcome can be hindered by these identified behavior problems. Key Words: Stroke—Behavior—Rehabilitation—Depression.

Depression is a recognized complication of stroke and occurs in up to 50% of patients (1). Poststroke depression delays both acute (2) and long-term recovery (3). Other behavioral changes have been described after stroke, but their impact on recovery is less well understood (3–6). The study and treatment of poststroke behavioral disorders is limited by the lack of uniformity in defining behavioral changes (3). Available data suggest, however, that behavioral changes besides depression are common (2), stabilize or improve at different time intervals other than motor weakness (7), and negatively impact on long-term recovery (2,4–6).

Our experience at The Burke Rehabilitation Center indicated that several recurrent behavioral problems occur in patients undergoing stroke rehabilitation. We therefore conducted a prospective stroke rehabilitation study to better characterize these behavioral changes. We had the following objectives: (a) to identify the frequency of depression plus the observed, recurrent behavioral problems in our stroke rehabilitation patients; (b) to determine if these specific behavioral problems were associated with infarct location or lateralization; (c) to determine if these behavioral problems were associated with neurologic signs; (d) to determine if these behavioral problems influenced rehabilitation outcome as measured by Barthel score at time of discharge; and (e) to identify predictors of poor outcome as measured by Barthel score at time of discharge.

Methods

Fifty consecutive patients admitted to the inpatient stroke rehabilitation unit at The Burke Rehabilitation Center were entered into the study. Preadmission screening evaluation indicated that all patients were at least able to follow gestural cues and had no active
Table 1. Baseline neurologic variables

Neurologic examination
Sum of motor strength
  Each limb graded 0 to 5/5
  5/5 equals normal strength
Mini-mental state examination
  Maximum score: 30
  High scores correlate with normal cognition
Burke Cognitive Score
  Expanded mini-mental status
  Maximum score: 55
  High scores correlate with normal cognition
Western Aphasia Battery/Cortical Quotient
  Maximum score: 100
  High scores correlate with normal language
Hamilton Depression Score
  Maximum score: 30
  High scores correlate with depression
Admission Barthel score
  Maximum score: 100
  High scores correlate with functional independence

Table 2. Behavioral problem checklist used by physical and occupational therapy

Behavioral problems interfering with program?
Yes ________ No _________
If yes, please check the appropriate features below:
1. Sleeps during program if not stimulated
2. Withdrawal, apathy, lack of motivation, inappropriate fatigue, depressed, crying
3. Irritable, agitated, hostile, aggressive, uncooperative
4. Anxious, fixates on minor problems
5. Confusion, can’t focus attention, easily distractable
6. Delusions, hallucinations, paranoid, suspiciousness
7. Denial or neglect of deficit
8. Impulsive
9. Inappropriate sexual behavior
10. Pain interferes with program
11. Other behavior interfering with program (describe)

Cardiopulmonary, rheumatologic, orthopedic, or pre-existing comorbid medical problems that precluded participation in the rehabilitation program. Baseline admission data included evaluation of poststroke brain computed tomography (CT) and the following neurologic variables (Table 1): (a) neurologic examination, which included numeric grading of gross limb pyramidal motor strength, where 5/5 is normal strength (8); (b) mini-mental state examination with maximum score of 30, and normal being greater than or equal to 24 (9); (c) Burke Cognitive Score, which is an expanded mini-mental status with a maximum score of 55 (scores below 38 suggest cognitive impairment); (d) Western Aphasia Battery/Cortical Quotient (10), which has a maximum score of 100 (low scores indicate global cognitive impairment); (e) Hamilton Depression Score, modified and previously standardized to be more applicable to dysphasic, hemiplegic patients (11) (maximum score is 30 with significant depression associated with scores greater than 8); (f) baseline Barthel Score (12), which grades independence in activities of daily living. A maximum score of 100 indicates functional independence.

At 2-week intervals, the physical and occupational therapists assessed patients for any evidence that the specific behavioral problems to be studied might be interfering with rehabilitation (Table 2). A behavioral problem was considered present if it was scored by both the physical and occupational therapist over the same 2-week period, or if it was recorded by one or both observers over at least two separate reporting periods. Of the 50 patients, 32 had complete evaluations for a minimum of 6 weeks by both types of therapists. Data from these 32 patients were analyzed.

A two-tailed Fisher exact test was used to determine the association between side of infarct and behavioral problems. Due to the small sample size, the two patients with bilateral infarcts were not included in this particular analysis, and only right/left hemispheric differences were measured. The Mann-Whitney test was used to determine the association between behavioral problems and neurologic variables and to test the association between behavioral problems and rehabilitation outcome as measured by final Barthel score. The Kruskal-Wallis test was used to measure an association between the sum of the total number of separate behavioral problems and rehabilitation outcome as measured by final Barthel score. Correlations between baseline neurologic variables and rehabilitation outcome as measured by final Barthel score were examined using the Spearman correlation coefficient.

Results

Patients ranged in age from 22 to 87 years old (mean, 66; median, 68). There were 17 men and 15 women. Right hemisphere strokes occurred in 20 patients, left hemisphere strokes in 10 patients, and 2 patients suffered bilateral infarcts.
Table 3. Frequency of behavioral problems

<table>
<thead>
<tr>
<th>Behavioral Problem</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>41%</td>
</tr>
<tr>
<td>Denial of deficit</td>
<td>33%</td>
</tr>
<tr>
<td>Depression</td>
<td>31%</td>
</tr>
<tr>
<td>Impulsivity</td>
<td>28%</td>
</tr>
<tr>
<td>Pain</td>
<td>27%</td>
</tr>
<tr>
<td>Somnolence</td>
<td>14%</td>
</tr>
<tr>
<td>Irritability</td>
<td>11%</td>
</tr>
<tr>
<td>Anxiety</td>
<td>08%</td>
</tr>
<tr>
<td>Delusions</td>
<td>03%</td>
</tr>
<tr>
<td>Inappropriate sexual behavior</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
</tr>
</tbody>
</table>

The frequency of different behavioral problems observed by the therapists is shown in Table 3. Some patients had more than one behavioral problem. Of all behavioral problems, only somnolence was significantly associated with laterality of infarct. Somnolent patients more frequently had left hemisphere than right hemisphere infarcts (p < 0.05).

The association between neurologic variables (Table 1) and behavioral problems revealed several significant correlations (p < 0.05), which are outlined in Table 4. Somnolence was significantly associated with degree of right hemiparesis, low Cortical Quotient, and both a low baseline and low final Barthel score. Depression was significantly associated with a high Hamilton depression score, as well as both a low baseline and low final Barthel score. Pain correlated with a low final Barthel score. Irritability was significantly associated with a low Burke Cognitive score and degree of right hemiparesis. Denial of deficit correlated with a low baseline Barthel score and low Cortical Quotient. Anxious patients had both a low baseline and low final Barthel score. Confusion correlated with severity of left hemiparesis.

A significant association (p < 0.05) was noted between a low final Barthel score and the total number of different behavioral problems observed. Two neurologic variables also correlated with a low final Barthel score: severity of hemiparesis (0.410, 95% confidence interval, 0.080-0.740) and Burke cognitive score (0.412, 95% confidence interval, 0.108-0.716).

Discussion

Cerebrovascular disease remains a major cause of mortality and morbidity among Americans, killing over 175,000 and disabling over 200,000 Americans per year (13). Up to 10% of stroke victims require long-term institutional care (13). Spontaneous recovery may be the most important determinant of long-term recovery and independence after stroke. Rapid initial recovery predicts more complete recovery (14). However, Toole (13) notes that even after motor power begins to reappear, improvement can cease at

Table 4. Association between neurologic variables and behavioral problems (p < 0.05)

<table>
<thead>
<tr>
<th>Behavioral problem</th>
<th>Neurologic variable</th>
<th>Median score when problem never occurred</th>
<th>Median score when problem occurred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somnolence</td>
<td>Cortical quotient</td>
<td>73</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Mini-mental status score</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Burke Cognitive Score</td>
<td>42</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Baseline Barthel score</td>
<td>41</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Discharge Barthel score</td>
<td>65</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Right hemiparesis</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Depression</td>
<td>Hamilton Depression Score</td>
<td>4.5</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Baseline Barthel score</td>
<td>41</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Final Barthel score</td>
<td>70</td>
<td>43</td>
</tr>
<tr>
<td>Pain</td>
<td>Final Barthel score</td>
<td>65.5</td>
<td>38</td>
</tr>
<tr>
<td>Irritability</td>
<td>Burke Cognitive Score</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Right hemiparesis</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Denial</td>
<td>Cortical Quotient</td>
<td>86.5</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Baseline Barthel score</td>
<td>44.5</td>
<td>33</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Baseline Barthel score</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Discharge Barthel score</td>
<td>65</td>
<td>18</td>
</tr>
<tr>
<td>Confusion</td>
<td>Left hemiparesis</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

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any stage, especially if motivation is poor, or if other behavioral problems exist. Parikh et al. (3) demonstrated the importance of early treatment of poststroke behavioral problems. Both major and minor depression in poststroke patients negatively impacted on long-term recovery in activities of daily living, even if the depression eventually improved. They speculate that depression prevented an early impetus for proper physical therapy, thereby hindering maximal levels of long-term recovery. This study has important implications for the early recognition and management of behavioral problems in stroke victims.

Several features of our study are noteworthy. Since physical and occupational therapists spend the most time with rehabilitation patients, we felt that their observations about behavioral problems interfering with rehabilitation would be valid. We chose the discharge Barthel score as the measure of successful rehabilitation, since this quantitative index is a reliable and valid measure of progress in self-care (12). The Barthel score, neurologic examination, and other neurologic variables were done independently of the therapists’ observations. Thus, all observations were made independently of other data used in patient analysis. Drawing conclusions about significant associations between neurologic variables and behavioral problems in a small study such as ours can be misleading, especially since so many variables were tested. We did not correct for multiple statistical tests performed (15) because of the exploratory nature of this study.

The large percentage (41%) of patients in our study with at least one behavioral problem did not surprise us, but such problems are infrequently addressed in the neurology or rehabilitation literature. Unfortunately, the behavioral problems we studied are not uniformly defined in the literature and are not coded as specific psychiatric diagnoses. For example, problems such as confusion may have a multifactorial etiology and are therefore difficult to systematically address. The high incidence of confusion as a hindrance to rehabilitation in our study, however, suggests that such a problem should be addressed more systematically. The frequency of depression in our study was similar to other reports (2,16). Depression did not occur more commonly in patients with left-hemisphere infarcts, but the small sample size did not allow us to test differences among anterior, posterior, and subcortical lesions (17). Depression was significantly correlated with a high Hamilton Depression score, lending credence to the observations of the therapists who scored depression as a symptom interfering with rehabilitation. Depression negatively impacted on rehabilitation in our patients, which is consistent with other reports and further documents the need for early treatment of depression in stroke rehabilitation patients (18–22).

Both pain and anxiety significantly interfered with rehabilitation outcome in our study. The apparent source of pain included (a) hip and knee pain associated with hemiplegic ambulation; (b) chronic back pain related to sitting in the wheelchair or lying in bed; and (c) pain affecting the hemiplegic shoulder and hand. No patient had the thalamic pain syndrome. There was no clear relationship between pain and depression. Our results suggest that an aggressive approach to diagnosing and treating the specific cause of pain is needed in stroke rehabilitation patients, especially since the pain is often musculoskeletal and amenable to physical therapy and non-narcotic analgesics. The cause of anxiety was not discerned, but if others confirm anxiety as a detriment to successful stroke rehabilitation, then studies should be done to test the usefulness of relaxation or other behavioral techniques, as well as anxiolytics such as benzodiazepines, in poststroke patients with anxiety.

Somnolent patients did poorly in rehabilitation. These patients more frequently had left-hemisphere than right-hemisphere infarcts, although the size of infarct was not studied. The Cortical Quotient and other language-dependent cognitive tests, as well as degree of right hemiparesis, were all significantly correlated with somnolence, consistent with large proximal left middle cerebral artery territory infarcts. Although size of infarct rather than hemispheric localization may be more important in blunting alertness (23), our data are consistent with other studies that demonstrate left hemisphere dominance for maintaining wakefulness (24,25). The degree to which somnolence alone interferes with rehabilitation is not clear but should be studied further, since treatment with central nervous system stimulants may be an option.

The association of irritability, denial of deficit, and confusion with various neurologic variables is noteworthy, but a detailed functional–neuroradiologic correlation was not possible because of the small number of patients. We are reluctant to comment on the significance of associations noted between neurologic variables and behavioral problems, since our data are pooled from a small number of patients, but we feel the findings should be seriously addressed in larger studies.

The association between a low final Barthel score and the total number of behavioral problems in a given patient underscores the need for further studying.
Behavioral problems in stroke rehabilitation patients. Whether one behavior problem, or a specific cluster of problems, is more important than the total number of problems is not clear. Also, the relationship between the number and type of behavioral problems and neurologic variables vis-à-vis rehabilitation outcome is not known. Neurologic variables alone can adversely affect rehabilitation outcome, as evidenced by the correlation we noted between severity of hemiparesis and severity of the Burke Cognitive Score and low final Barthel score.

Although our pilot study involved a small number of patients, the data analysis provided several important findings that should be studied in a larger number of patients in a systematic manner. Too often, behavioral problems are given less priority than motor impairment, and this approach may well hinder maximal long-term recovery from stroke.

References