Continued Construct Validation of the St. Marys CVA Evaluation: Brunnstrom Arm and Hand Stage Ratings

Julia Van Deusen, Diane Harlowe

Key Words: hand strength • research • sensorimotor dysfunction

The purpose of the study was to test whether evaluations of cerebral vascular accident (CVA) patients show a significant relationship between ratings of Brunnstrom's arm and hand stages and scores on Schenkenberg's Line Bisection Test of unilateral neglect. Spearman rho correlation coefficients for 20 acute care right CVA subjects showed a highly significant relationship between performances on the two measures. Results can be interpreted to further the construct validity of the St. Marys CVA evaluation.

The American Journal of Occupational Therapy

The American Occupational Therapy Foundation views the development of standardized evaluation instruments as a high research priority of the profession (The Foundation, 1983). The St. Marys cerebral vascular accident (CVA) evaluation is currently undergoing a construct validation. A factor analysis was conducted, which involved 33 variables from data on 100 acute CVA patients evaluated by occupational therapists at the St. Marys Hospital Medical Center in Madison, Wisconsin (Fox & Harlowe, 1984). Variables included the Brunnstrom arm and hand recovery stages, bilateral grasp and pinch measures, bilateral tests of coordination, a number of perceptual tests, and five measures of self-care. From interpretation of the rotated factor patterns, five factors were defined: self-care (I), left function (II), recovery stage (III), perception (IV) and strength (V).

To further verify the construct validity of the St. Marys CVA evaluation, hypotheses relevant to test performances must be examined. Harlowe and Van Deusen (1984) supported the hypothesis that scores on the perceptual tests would be related to the disposition of the patient at discharge. The present study examined the hypothesis that the Brunnstrom arm and hand recovery stage ratings in the CVA evaluation would be significantly related to scores on the Schenkenberg Line Bisection Test of unilateral neglect (Schenkenberg, Bradford, & Ajax, 1980). The rationale for this hypothesis follows.

The author's original analysis revealed a factor defined as a Brunnstrom hemiplegic recovery stage factor (Factor III). There were high loadings on both hand and arm stage ratings and on the bilateral awareness ratings. The Brunnstrom recovery scales for arm and for hand each consist of six items. Item 1, flaccidity, represents the lowest level of recovery, and Item 6, essentially normal isolated movement, represents the highest level of recovery (Brunnstrom, 1970). The St. Marys CVA evaluation rates bilateral awareness of body sides by having therapists clinically observe patients' functional performance. Specifically, the patients' functional performance is assessed while they are putting together a body scheme puzzle, doing self-care tasks, or performing a modified Southern California Sensory Integration Left-Right Discrimination test. It is of particular interest that bilateral body awareness loaded on this recovery stage rather than on Factor IV, which emerged as the perception factor.

Historically, the association of parietal lobe lesions with unilateral neglect suggested spatial perceptual deficits as a reasonable explanation for the neglect syndrome (Heilman & Watson, 1977). When further research showed neglect from lesions outside the sensory and sensory association areas, the perceptual construct could no longer be considered the essential explanation of unilateral neglect although it remained a component. A prevalent view incorpor-
ing animal and human research results considers unilateral neglect a defect in the neural attentional (orienting or arousal) mechanism with lesions possible anywhere in the cortico-limbic reticular activating loop (Heilman & Watson, 1977; Mesulam, 1981). Since bilateral awareness ratings did not load with perceptual scores in the factor analysis of the St. Marys CVA evaluation, results supported the notion that unilateral neglect is a construct differing from the construct of perceptual dysfunction.

Considering the results of the factor analysis showing the loading together of bilateral awareness and Brunnstrom ratings, it seems logical to hypothesize that Brunnstrom hand and arm stage ratings, if valid, would be significantly related to a measure of unilateral neglect more rigorous than the one used in the St. Marys CVA evaluation. If such a relationship were observed, the construct validity of the St. Marys' instrument would be further supported.

The Schenkenberg Line Bisection Test (see Figure 1) has received research attention as a measure of unilateral neglect (Schenkenberg, Bradford, & Ajax, 1980; Van Deusen, 1983). Although the bisection of lines has long been used by neurologists as a diagnostic tool, Schenkenberg and colleagues were the first to report reliability and validity data for such a test. These researchers studied 60 brain-damaged subjects, 20 each with right, left, and diffuse brain damage, and 20 normal subjects in a control group. The line test scores discriminated among these groups. When the test is turned upside down, it becomes an alternate form. Using both forms, the test reliability coefficients ranged from 84 to 93 for the four groups of subjects.

With permission from Schenkenberg (the first author of the article entitled "Line Bisection and Unilateral Visual Neglect in Patients with Neurologic Impairment," 1983) and the publisher (the American Academy of Neurology) to conduct research with this tool, Van Deusen obtained normative data on this test from 93 non-brain-damaged elderly subjects. The mean performance for these subjects showed but minute deviation from the true center of the line. These results with non-brain-damaged subjects are in marked contrast to the poor performances shown by right brain-damaged subjects examined by Schenkenberg and colleagues (1980) and also by three patients medically confirmed as having unilateral neglect who had been extensively tested with the line test by Van Deusen.

To administer this test it is taped to the table directly in front of the seated patient. The top and bottom lines are practice items. If the patient skips any items, they are pointed out so that all items can be completed. The following directions are given:

1. Use your right hand; keep the other off the table.
2. Do not move the paper.
3. Cut each line in half by placing a small pencil mark through each line as close to its center as possible.
4. Do not make more than one mark on any line.
5. Mark each of the lines without skipping any.

Method

The Schenkenberg Line Bisection Test was administered to CVA patients with right hemisphere lesions. Information was also obtained on the subjects' age, sex, hand dominance, and date of onset of current stroke (see Table 1). Data were collected from December 1983 through May 1985 by occupational therapists at four facilities. Acute care patients \((n = 20)\) were hospitalized at a medical center in Wisconsin. Rehabilitation patients were evaluated at two facilities in Oregon \((n = 7; n = 6)\) and at one facility located in the state of Washington \((n = 3)\).

Since analysis of variance showed a highly significant relationship between line test data and the state where data were collected \((F = 13; P < .0001)\), the relationship between the Brunnstrom stage ratings and line test scores had to be analyzed separately by state. Because of the ordinal level of measurement of the Brunnstrom evaluation, Spearman rank correlation coefficients were computed. A major limitation of the

Table 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unreported</th>
<th>(M)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>3</td>
<td>72.55</td>
<td>10.24</td>
</tr>
<tr>
<td>Sex</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand dominance</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year of onset</td>
<td>6</td>
<td>1984</td>
<td>00.81</td>
</tr>
</tbody>
</table>
Table 2
Relationship of Line Bisection Test Scores and Brunnstrom Hand and Arm Stage Ratings

<table>
<thead>
<tr>
<th>Brunnstrom Stage</th>
<th>Left-Placed Lines</th>
<th>Center-Placed Lines</th>
<th>Probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm</td>
<td>Rho = -0.67</td>
<td>Rho = -0.68</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>Hand</td>
<td>Rho = -0.70</td>
<td>Rho = -0.69</td>
<td>P &lt; 0.0006</td>
</tr>
</tbody>
</table>

The study is the practical inability to randomly select the participating institutions.

**Results**

The correlation coefficients for data collected on rehabilitation patients were not significant. Those for acute care patients did reach statistical significance. These coefficients and their probabilities are presented in Table 2. It should be noted that only the lines placed to the left and center of the test sheet are scored. No right-placed lines enter into the test results. The coefficients are negative because lower scores on the line test indicate performance within normal limits whereas the highest scores on the Brunnstrom scales indicate maximum functioning.

**Discussion**

Because the proposed hypothesis regarding test performances was supported, the results of the acute care patient data further the construct validation of the St. Marys CVA evaluation. It remains unresolved, however, whether the observed relationship holds only for acute care patients and not for rehabilitation patients or whether it is specific to the institution. It would be of value to replicate this study with acute care patients from a second institution. It should also be noted that the number of subjects in the rehabilitation settings was small, which would decrease the likelihood of finding significant relationships.

If it is assumed that the relationships for acute care patients are meaningful, then there is corroboration for the notion that the arm and hand recovery stages outlined by Brunnstrom and the phenomenon of unilateral neglect are a unitary construct. Sensory integration theory would predict an association between unilateral neglect and motor planning but not with actual motor return. Consequently, this construct may pertain to the severity of hemispheric involvement or to the speed of recovery of the stroke patient rather than to motor return per se. In future research it will be of interest to determine if the line test scores are not significantly related to perceptual test scores, that is, if there is further support for the notion that unilateral neglect is a construct differing from that of perceptual dysfunction.

**Acknowledgments**

The authors thank Kenneth Ottenbacher, PhD, OTR, for computer consultation and occupational therapy students, Dana and Sandy, for research assistance. The authors gratefully acknowledge the assistance in the data collection by the occupational therapy staffs of the following facilities: St. Marys Hospital Medical Center, Madison, Wisconsin; Sacred Heart General Hospital, Eugene, Oregon; Benedictine Nursing Center, Mt. Angel, Oregon, and Harborview Medical Center, Seattle, Washington.

The preparation of this study was supported in part by Hilldale Trust Funds, University of Wisconsin-Madison.

**References**


The American Journal of Occupational Therapy 563