Interrater Reliability of a Modified Ashworth Scale of Muscle Spasticity

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We undertook this investigation to determine the interrater reliability of manual tests of elbow flexor muscle spasticity graded on a modified Ashworth scale. We each independently graded the elbow flexor muscle spasticity of 30 patients with intracranial lesions. We agreed on 86.7% of our ratings. The Kendall's tau correlation between our grades was .847 (p < .001). Thus, the relationship between the raters' judgments was significant and the reliability was good. Although the results were limited to the elbow flexor muscle group, we believe them to be positive enough to encourage further trials of the modified Ashworth scale for grading spasticity.

Key Words: Elbow, Muscle spasticity, Physical therapy.

Spasticity, defined herein as a velocity-dependent response of muscle to passive stretching,1,2 may be among the most commonly acknowledged sequelae of central nervous system lesions.3 Although the role actually played by spasticity in motor dysfunction4 may be less than that suggested by some authors,5,6 antagonistic muscle spasticity can limit the force demonstrated by an agonist muscle during voluntary movement.7,8 One of the methods that has been proposed for measuring muscle spasticity involves manually moving a limb through the range of motion to passively stretch specific muscle groups. Ashworth has described a five-point ordinal scale for grading the resistance encountered during such passive muscle stretching.9 Ashworth's scale grades spasticity as follows: 0 = normal muscle tone; 1 = slight increase in muscle tone, "catch" when limb moved; 2 = more marked increase in muscle tone, but limb easily flexed; 3 = considerable increase in muscle tone; and 4 = limb rigid in flexion or extension. As Ashworth's scale assigns grades to a manually determined resistance of muscle to passive stretching, it measures spasticity as defined herein. The scale, therefore, has face validity, in addition to some of the other characteristics recommended for ordinal scales by MacKenzie and Charlson.10 Our previous experience with the scale revealed that many of our patients with hemiplegia demonstrated levels of spasticity defined by the grades at the lower end of the Ashworth scale and that the Ashworth grade of “1” was indiscrete. To render the scale more discrete, we added the grade “1+” and slightly modified the definitions (Tab. 1). These modifications resulted in a scale that conforms even more precisely than the Ashworth scale to the guidelines of MacKenzie and Charlson.16

Although Ashworth's subjective scale has been used clinically to examine the efficacy of Lioresal® and of electrical stimulation11 in the treatment of spasticity, we were unaware of any studies that verify the reliability of manual tests of spasticity graded with the Ashworth scale. Lacking such verification and wishing to test the reliability of our own modification of the scale, we undertook this study. The purpose of this study was to determine the interrater reliability of a manual test of elbow flexor muscle group spasticity using the modified Ashworth scale. Our expectation was that two clinicians, who regularly use the test, could measure spasticity reliably using the modified scale.

METHOD

Patients

Thirty patients (17 men and 13 women) participated in this study. Their mean age was 59.3 ± 17.6 years (range, 19–81 years). All of the patients had lesions involving the central nervous system. One patient had multiple sclerosis, 5 had closed head injuries, and 24 had cerebrovascular accidents. The paretic or weaker side of each patient (as determined by hand-held dynamometry) was tested. Consequently, the left side was tested in half of the patients, and the right side was tested in the other half. All rehabilitation patients were tested routinely during their initial assessment; the patients who participated in this study were the first 30 patients who could follow instructions adequately. All of the patients granted informed consent before testing.

Procedure

Each patient was tested first by his or her therapist (one of the authors) and then by the other author. Testing was conducted with each patient positioned supine on a padded mat table. We extended the patient’s elbow from a position of maximal possible flexion to maximal possible extension over a duration of about one second (by counting “one thousand
RESULTS

Table 2 illustrates the agreement between the raters (R.W.B. and M.B.S.). We agreed on 26 (86.7%) of the 30 ratings, and we never disagreed by more than a single grade. The Kendall’s tau correlation between our grades was .847 ($p < .001$). The mean rank of the ratings was 2.47 for each rater. These ratings did not differ significantly (as determined by the Wilcoxon matched-pairs signed-rank test).

DISCUSSION

This simple study seems to support the interrater reliability of a manual test of elbow flexor muscle spasticity graded using a modified Ashworth scale. This finding contrasts with the unsubstantiated comment by Jones and Mulley that “subjective methods of assessing a phenomenon as variable as spasticity are of necessity crude and unreliable, making evaluation of therapy difficult and open to error and bias.” We believe that the reliability we obtained can be attributed, in part, to our experience and extensive mutual testing and discussion before this investigation. Without such collaboration, different results might have been obtained.

Different results also might be obtained if different muscle groups are tested by two raters. Some muscle groups (eg, ankle plantar flexors) seem to be more difficult to test than others. If patients are tested with a greater latency between tests, ratings of spasticity might differ more than in this study. Such differences, however, might be a manifestation of variations in muscle spasticity. Variability and test reliability are different factors, and further studies of both are needed.

The positive results of our study encourage our continued use of manual tests of muscle spasticity, graded using a modified Ashworth scale. Because such tests require no equipment, they can be performed quickly and without material expense. Given these advantages, other researchers may wish to determine in their own clinical settings the efficacy of such tests for patients with neurological disorders.

CONCLUSION

Two raters, who performed manual tests of elbow flexor muscle spasticity, agreed on 86.7% of their ratings of the level of spasticity. Their ratings, which were based on a modified Ashworth scale, were significantly correlated ($p < .001$). The reliability and usefulness of a modified Ashworth scale merit further clinical investigations.

REFERENCES


TABLE 1
Modified Ashworth Scale for Grading Spasticity

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no increase in muscle tone</td>
</tr>
<tr>
<td>1</td>
<td>slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension</td>
</tr>
<tr>
<td>1+</td>
<td>slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM</td>
</tr>
<tr>
<td>2</td>
<td>more marked increase in muscle tone through most of the ROM, but affected part(s) easily moved</td>
</tr>
<tr>
<td>3</td>
<td>considerable increase in muscle tone, passive movement difficult</td>
</tr>
<tr>
<td>4</td>
<td>affected part(s) rigid in flexion or extension</td>
</tr>
</tbody>
</table>

TABLE 2
Agreement Between Two Raters Using a Modified Ashworth Scale for Grading Spasticity

<table>
<thead>
<tr>
<th>Rater M.B.S.</th>
<th>Rater R.W.B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1+</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
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</table>

one”) while the forearm was grasped distally (just proximal to the wrist). While the elbow was extended, the arm also was stabilized proximal to the elbow. The forearm was in neutral supination. We each independently performed five to eight such sequential extensions. A period of several minutes separated each rater’s “blind” rating. Each rater graded each patient’s spasticity using the modified Ashworth scale (Tab. 1).

Data Analysis

The ratings were compared descriptively and by a Kendall’s coefficient of rank (tau) correlation and a Wilcoxon matched-pairs signed-rank test.

REFERENCES


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