Clinical Significance of the V-Shaped Space in the Subluxed Shoulder of Hemiplegics

A. Bertrand Arsenault, PhD; Martin Bilodeau, MSc; Elisabeth Dutil, MSc; and Elisabeth Riley, BSc

Recently, it has been proposed that shoulder subluxation in hemiplegia is accompanied by 1) the appearance of a V-shaped articular configuration occurring between the humeral head and glenoid fossa and 2) the presence of chronic pain. The main purpose of this study was to investigate the validity of these statements. We evaluated 40 hemiplegic subjects over 3 months. Radiographs of the affected and nonaffected shoulders were taken at both a frontal plane (0°) and a 45° incidence. From these patients, subluxed (n=19) and nonsubluxed (n=21) groups were formed. Pain was evaluated using the Present Pain Intensity index of the McGill Pain Questionnaire. On these x-ray films, measurements were taken of the V-shaped space, abduction of the arm, and rotation of the scapula. The statistical analysis (analysis of variance for repeated measures) contrasted the results obtained from the nonaffected side with those from the affected side over the 3 months studied. At the 45° angle, which better exposes the articular configuration of the shoulder, the difference in the V angle between the affected and nonaffected shoulders was significant (p<0.01), indicating that such a V-shaped space can be identified. The measures taken also indicate that a downward subluxation of the humeral head occurs relative to the scapula without any systematic abduction of the humerus or downward rotation of the scapula. None of the results obtained from the frontal plane x-ray films was significant. Finally, no significant relation was found between subluxation and shoulder pain. (Stroke 1991;22:867-871)

The literature on hemiplegia suggests that a subluxed shoulder is accompanied by an abduction of the arm and a downward rotation of the scapula.1,2 It has recently been proposed that these clinical observations are accompanied by the appearance of a V-shaped articular configuration occurring between the humeral head and the glenoid fossa.3 The suggestion was made that such a V-shaped configuration could be considered as a clinical sign indicating the development of a shoulder subluxation. Such a sign would obviously be attractive as a clinical tool if it is strongly associated with the presence or development of shoulder subluxation, an important clinical problem in hemiplegia.

Furthermore, it has been suggested that the presence of this V sign is strongly associated with the presence of chronic pain at the level of the subluxed shoulder.3 From the x² value of 8.1 obtained by Shai et al3 while contrasting these two variables, we calculated a Φ (coefficient of association) of 0.68, a value rather significant.4 Clinically, however, one can argue against this finding since it is well known that a patient can develop a subluxed shoulder without having pain. This issue of shoulder pain in hemiplegia is in itself a topic lacking clear answers based on scientific evidence.

The purpose of this study was to investigate the validity of this V sign. Furthermore, its association with pain was evaluated using one index taken from the McGill Pain Questionnaire.5

Subjects and Methods

Forty hemiplegic subjects (22 men and 18 women with a mean±SD age of 46.5±13.8 years) participated in this study. Nineteen subjects were right hemiplegics. They were evaluated before, during, and after treatment over a period of approximately 3 months.

With the subject seated, arms dependent in a neutral position, radiographs of the affected and nonaffected shoulders were taken in an anteroposterior (A–P) projection as well as with the beams at 45° (i.e., parallel to the glenoid fossa). Two anatomic
FIGURE 1. Schematic description of measurements taken to evaluate V-shaped space of glenohumeral joint (θ1 and θ4), rotation of scapula (θ2), and abduction of arm (θ3). A, superior border of glenoid fossa; B, line through A and H to horizontal; C, apex of humeral head; D, inferior portion of anatomic neck of humeral head; E, center of circle best fitting humeral head; F, line from E through center of humerus to horizontal; G, point on head of humerus containing tangent through H; H, inferior border of glenoid fossa.

reference points (i.e., the apex of the humeral head and the inferior border of the glenoid fossa) taken on each film were used to evaluate the state of the glenohumeral joint. A perpendicular line was drawn from the apex of the humeral head to a horizontal line passing through the inferior border of the glenoid fossa. A difference of 1 cm between the lines drawn (on the 45° angle films) between the affected and nonaffected shoulders was interpreted as reflecting a subluxed state. Consequently, groups of subluxed (n=19) and nonsubluxed (n=21) subjects were formed. In the subluxed group 12 subjects had their left side affected, while in the nonsubluxed group nine had their left side affected, with an average difference of about 1 cm between the lines. None of the results obtained from the A-P films was significant. Because of the superposition of bony structures of the shoulder, it was impossible in most cases to calculate θ4 on the A-P film. However, on the 45° angle films the difference in θ1 between the affected and nonaffected shoulders was significant for both groups, with an average difference of about 5°. Furthermore, θ4 showed significant differences only for the subluxed group, thus showing sensitivity to the subluxed state. Finally, the subluxed group had a significant difference in θ3, with an average differ-
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TABLE 1. Summary of Analyses of Variance Performed on φ1, φ2, φ3, and φ4 for Subluxed and Nonsubluxed Groups

<table>
<thead>
<tr>
<th>Angle</th>
<th>Frontal films</th>
<th>45° angle films</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intraclass correlation coefficient</td>
<td>Intraclass correlation coefficient</td>
</tr>
<tr>
<td>Nonsubluxed (n=21)</td>
<td>F</td>
<td>R²</td>
</tr>
<tr>
<td></td>
<td>φ2</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>φ3</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>φ4</td>
<td>...</td>
</tr>
<tr>
<td>Subluxed (n=19)</td>
<td>F</td>
<td>R²</td>
</tr>
<tr>
<td></td>
<td>φ2</td>
<td>3.28</td>
</tr>
<tr>
<td></td>
<td>φ3</td>
<td>1.35</td>
</tr>
<tr>
<td></td>
<td>φ4</td>
<td>...</td>
</tr>
</tbody>
</table>

φ1, V-shaped angle; φ2, rotation of scapula; φ3, abduction of arm.

TABLE 2. Descriptive Statistics Summarizing Data for φ1, φ2, φ3, and φ4 for Subluxed and Nonsubluxed Groups

<table>
<thead>
<tr>
<th>Angle</th>
<th>Nonaffected shoulder</th>
<th>Before treatment</th>
<th>During treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>22.7</td>
<td>28.2</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>7.8</td>
<td>7.1</td>
<td>4.8</td>
</tr>
<tr>
<td>φ1</td>
<td>Mean</td>
<td>84.5</td>
<td>88.5</td>
<td>87.8</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>6.9</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>φ2</td>
<td>Mean</td>
<td>98.3</td>
<td>98.4</td>
<td>98.2</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.7</td>
<td>3.5</td>
<td>4.6</td>
</tr>
<tr>
<td>φ3</td>
<td>Mean</td>
<td>0.3</td>
<td>2.1</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>5.7</td>
<td>5.6</td>
<td>4.7</td>
</tr>
</tbody>
</table>

φ1 and φ4, V-shaped angle; φ2, rotation of scapula; φ3, abduction of arm. Values are degrees, taken from 45° films.

Discussion

Even though our results reveal that a radiograph taken at a 45° angle may be more sensitive for evaluating the state of a hemiplegic shoulder, it is clear that the magnitude of the differences found is clinically unimportant. The R² values of Table 1 and the results of Table 2 disclose this fact for φ1, φ2, and φ3. Moreover, since both the subluxed and nonsubluxed groups presented a significant difference for presence of the V sign as measured by φ1, the validity of the sign in indicating a subluxation is questionable. Either this measure is not sensitive to this particular state of the shoulder or ANOVA for repeated measures is too sensitive to small differences that clinically are within the range of human error.

However, φ4 appeared to be more sensitive to presence of the V-shaped space in subluxed shoulders. Let us consider that abduction of the arm can be appropriately measured on an A-P film. As seen in Table 1, no abduction of the arm was observed in the A-P projection. Moreover, let us consider that the possible downward rotation of the scapula that is believed to occur with shoulder subluxation can be best measured on the 45° angle film since we can clearly observe the profile of the glenoid fossa. As seen in Table 1 again, φ2 did not reach the level of

TABLE 3. Summary of Results of 2x2 Contingency Table Contrasting Presence/Absence of Pain and Presence/Absence of Shoulder Subluxation

<table>
<thead>
<tr>
<th>Subluxation</th>
<th>Chronic pain</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9</td>
<td>9</td>
<td>χ²=0.38</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>12</td>
<td>Φ=0.10</td>
</tr>
</tbody>
</table>

n=38. Φ=√χ²/n.
significance. Consequently, the downward subluxation was not accompanied by a rotation of the scapula and an abduction of the humerus. This may explain why 01 did not detect the presence of the V-shaped space since the C-D line (Figure 1) was simply shifted downward along the A-B line, keeping its angle more or less constant. However, 04 disclosed this V-shaped space, which is created by a downward movement of the head of the humerus relative to the glenoid fossa, a movement followed by the tangential line G-H (Figure 1). This phenomenon can, according to our experience, be observed only on a 45° angle film and not on an A-P film or radiograph as proposed earlier. Our previous work on this topic disclosed the fact that rotation of the scapula and abduction of the arm are not phenomena systematically related to subluxation of the shoulder in hemiplegia. Even though these are interpreted as being clinically important signs by practitioners, scientific evidence has not yet been presented to support this belief.

The fact that pain is not statistically associated with subluxation is not really surprising (Table 3). Many factors other than subluxation can cause pain.

FIGURE 2. Top: Radiograph taken in frontal (anteroposterior) plane of subluxed shoulder. Bottom: Radiograph taken at 45° angle of subluxed shoulder.
in hemiplegic shoulders. Furthermore, even patients with an impressive degree of subluxation may have no pain. Previous papers have at times been vague on how pain was quantified. It is our belief that the PPI index of the McGill Pain Questionnaire is applicable to a good proportion of the hemiplegic population, at least to that proportion that participates on a day-to-day basis in an intensive rehabilitation program. We are thus confident that our way of scoring the intensity of pain felt at the time of evaluation is more than acceptable for the present situation. The literature on shoulder pain in hemiplegia is, however, still awaiting answers and clarifications.

In conclusion, the search for a clinically valid sign and model to describe and understand the appearance and progression of shoulder subluxation is very commendable and necessary. However, any proposed sign and model need to be validated before being used in clinical practice. Our present attempt has been partially successful with regard to validating the previously proposed V sign and is complementary to our previous work on the topic.

The complexity of the hemiplegic condition and the high variability between subjects for variables such as shoulder pain and shoulder subluxation have to be recognized by the clinician and the researcher alike. Thus, standardized evaluation protocols have to be developed, validated, and used by everyone in this field. Only then will our efforts produce progress toward a better understanding of this important clinical problem.

Acknowledgments

The authors gratefully acknowledge the contribution of Mr. Réjean Prévost in the analysis of the data. The assistance of the personnel of the Radiology Department of the Institut de readaptation de Montréal and in particular that of Dr. Martine Favreau-Ethier is also acknowledged.

References


**KEY WORDS** • hemiplegia • pain
Clinical significance of the V-shaped space in the subluxed shoulder of hemiplegics.
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Stroke. 1991;22:867-871
doi: 10.1161/01.STR.22.7.867

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
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