SPECIAL ARTICLES ON BALLISTOCARDIOGRAPHIC TERMINOLOGY

When this paper was submitted to the editors of CIRCULATION it called to their attention the desirability of enlarging the work that Dr. Braunstein has begun in the following paper. Accordingly, Dr. Howard Sprague, President of the American Heart Association appointed a committee to study the field and to make recommendations leading toward both a uniform terminology and uniform methods of presenting data secured by ballistocardiographs, and Dr. Braunstein kindly consented to withhold the publication of his paper until the committee was ready to report. This committee has now approved the terminology suggested by Dr. Braunstein and, in a first report, which immediately follows Dr. Braunstein's paper, makes other recommendations pertaining to terminology and conventions for parts of the field not covered by Dr. Braunstein's paper.

A Proposed Nomenclature and Convention for Recording the Ballistocardiogram

By John R. Braunstein, M.D., Ph.D.

UNTIL recent years only the head-to-foot component of the ballistocardiogram was recorded. Whether the subject lay on his back or his belly, stood on his two feet, or was tilted, the description offered no problem even in less English words than these. Moreover, since Starr's first paper, no one has had the temerity to record a headward movement of the body as other than an upward deflection on the paper. Yet this happy state will not long continue if ballistocardiographers persist in investigating other components of the motion imparted by the heart beat. Records are now being taken at several laboratories with translation in two and three planes, and torques have been described about two axes. A third axis of considerable promise remains for some ambitious investigator and may even be under scrutiny now. Some confusion has already arisen; hence, it seems desirable before this proceeds too far to offer a nomenclature for describing the motion of the ballistic table (or body) in space, and to suggest a convention for recording it.

From a mechanical point of view a cube of iron in space is said to have six degrees of freedom which is another way of saying that six axes of reference are required to record its possible motion. The cube may be translated in any of three planes or rotated about any of three axes. A similar cube made of gelatin, however, is not a rigid structure and has an infinite number of degrees of freedom. The animal body more nearly approximates the latter, but for all practical purposes, six degrees should suffice. For these components the following is offered for the human ballistocardiogram together with a convention for the deflections produced:

<table>
<thead>
<tr>
<th>Deflections</th>
<th>Paper Convention</th>
</tr>
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<tbody>
<tr>
<td>head-to-foot</td>
<td>headward footward</td>
</tr>
<tr>
<td>side-to-side</td>
<td>leftward rightward</td>
</tr>
<tr>
<td>back-to-front</td>
<td>backward forward</td>
</tr>
<tr>
<td>clockwise or counterclockwise</td>
<td>clockwise counter-clockwise</td>
</tr>
<tr>
<td>head-foot axis as seen from the foot</td>
<td>clockwise counter-clockwise</td>
</tr>
<tr>
<td>clockwise or counterclockwise</td>
<td>clockwise counter-clockwise</td>
</tr>
<tr>
<td>side-to-side as seen from the right</td>
<td>clockwise counter-clockwise</td>
</tr>
<tr>
<td>clockwise or counterclockwise</td>
<td>clockwise counter-clockwise</td>
</tr>
<tr>
<td>front-to-back axis as seen from the front</td>
<td>clockwise counter-clockwise</td>
</tr>
</tbody>
</table>

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These are illustrated in figure 1 with the octants numbered in the usual fashion.

In constructing the scheme outlined above, I have tried to do the least violence to work already in the literature. Terminology used in human anatomy seemed undesirable since the anatomic orientation is gravitational. The terminology of comparative anatomy is theoretically more attractive since it lacks this drawback. However, some of the terms are clumsy and sound stilted. Hence they are usually avoided when possible by physicians. The nomenclature proposed here is for recording the human ballistocardiogram. Nevertheless an investigator using animals can easily make the following substitutions: headward—rostrad; footward—caudad; backward—dorsad; frontward—ventrad.

The obvious advantage which would accrue if a common frame could be used in spatial electrocardiography and spatial vectorcardiography has been pointed out. Yet, Einthoven recorded a footward flow of current as positive, and Starr, a footward movement of the body as negative. Neither could be changed today. Each is too firmly fixed.

* Talbot, S.: Personal communication.
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