First Report of the Committee on Ballistocardiographic Terminology

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Part I. Definitions and Nomenclature Applicable to Records from Ballistocardiographs Recording Displacement

The Base Line. The base line is the neutral line of the record, the horizontal line the record takes late in diastole if the pulse rate is slow enough. In faster hearts, the base line can be approximated by placing a horizontal line such that the areas of the late diastolic deflections above and below it are equal. In records secured by electrical amplification the base line can be obtained by rapidly turning down the sensitivity until the amplitudes become negligible, provided this has had no effect on centering.

The ballistic waves diverge from the base line in opposite directions.

Nomenclature for Waves

(a) Systolic Waves
1. The H wave is a headward deflection which begins its ascent at or near the peak of the electrocardiographic R wave. Its peak is at or near the beginning of ejection.
2. The I wave is the footward deflection following the H wave in normal records; it occurs early in systole.
3. The J wave is the largest headward wave on the normal record; it immediately follows the I wave, and occurs later in systole.
4. The K wave is the footward wave following J; it occurs at or near the end of systole, and may extend into early diastole.

The systolic waves recorded by low frequency instruments occur somewhat later in time and have broader bases than those of high frequency instruments, but they are in the same direction and are to be designated by the same letters.

(b) Diastolic Waves. The two smaller headward waves which usually follow the K wave in normal records are to be called L and N, the footward wave between them is to be called M. The small waves, occurring later in some normal records may be given the letters in sequence.

However, the large diastolic waves occurring in certain abnormal records are not to be given these letters as they are believed to be due to forces quite different from those which produce the smaller normal waves. Those abnormal waves should not be given a letter, but should be described by their direction and position, for example, “A large headward wave occurring in late diastole.”

(c) Presystolic Waves. The “G” wave is the small footward wave which at times precedes the H wave.

A headward wave preceding G, not described by most authors, should be called F if it is encountered, but any wave thus lettered should be clearly derived from presystolic forces such as auricular contraction and not be an after-vibration from forces liberated in the preceding systole.

Nomenclature for Parts of Waves

The point of a wave, directed upward or downward, may be called the tip, for example, “the K-wave tip.”

The part of the record joining the tip of one wave with the tip of the next wave is to be called a segment, for example, “the I-J segment.”

Measurement of Waves

The duration of waves should be measured along the base line in units of time.

The amplitude of waves should be measured from the base line vertically to the tip. This measurement may be recorded in terms of force such as grams or dynes, but for the sake of simplicity may also be given in millimeters provided the calibration of the instrument in terms of force is also stated. If the instrument
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has not been or cannot be calibrated for sensitivity, absolute figures for wave amplitudes are meaningless and should not be given, but data indicating the relation of the amplitude of one wave to other waves in the same record is permissible.

Descriptions of Instruments

The committee believes that no attempt should be made at this time to define exact specifications for the manufacture of ballistocardiographs and standards for their performance. But they advocate that no paper be accepted for publication in Circulation or Circulation Research which reports results secured by an instrument whose physical properties have not been described in detail. When by the nature of the instrument, data on frequency and sensitivity and damping cannot be given, this should be stated.

The weight of the table or platform should always be given for instruments of these types.

The results secured by static methods of calibration must be given whenever the design of the instrument permits a calibration of this type. Results secured by dynamic methods of calibration are not required, because these methods are still too complex to be generally useful in the clinic.

PART II. CONVENTION FOR THE PUBLICATION OF DATA IN A UNIFORM MANNER

1. In all records reproduced time should move from left to right.

2. For ballistocardiographs recording movement or forces in the longitudinal direction of the body, the reproductions should be oriented as follows:
   A. Headward movements or forces should be reproduced upward on the page.
   B. Footward movements or forces should be reproduced downward on the page.

3. For ballistocardiographs recording in other dimensions of the body (vector ballistocardiographs) the reproductions on the paper should be oriented as follows:
   A. Side to side (transverse) movements or forces:
      (a) towards the left, upward on the page.
      (b) towards the right, downward on the page.

4. For ballistocardiographs recording rotation
   A. About the longitudinal axis:
      (a) clockwise (as observed from the subject’s foot), upward on the page.
      (b) counterclockwise (as observed from the subject’s foot), downward on the page.
   B. About a transverse axis:
      (a) clockwise (as observed from the subject’s right), upward on the page.
      (b) counterclockwise (as observed from the subject’s right), downward on the page.
   C. About a saggital axis:
      (a) clockwise (as observed from in front of the subject), upward on the page.
      (b) counterclockwise (as observed from in front of the subject), downward on the page.

5. For turntable ballistocardiographs

   When the long axis of the turntable, and of the subject on it, lies in the direction in which movement or forces are being recorded, this is known as the longitudinal zero position.

   When the turntable is rotated clockwise (as viewed from above) so that its left side (the left side of a subject lying on his back upon it) is moved towards the position formerly occupied by the feet, the amount of rotation should be specified by degrees left; if the rotation is counterclockwise, by degrees right, thus defining the angle with the zero position in which the record is taken. For example, “The record was secured with a rotation of 30 degrees left.”

   Anteroposterior (ventrodorsal) records are taken on turntables after placing the patient on his right side, and the turntable at 90 degrees from the longitudinal zero position. When the subject and turntables are in this position it is called the saggital zero position.
and rotation from this position is defined in degrees as above.

Turntable records should be reproduced in publications in accord with the conventions for longitudinal, transverse, and sagittal records as stated previously.

PART III. THE COMMITTEE FURTHER RECOMMENDS:
1. That this report be published in CIRCULATION.
2. That reprints be sent to the editors of all journals likely to publish articles in this field, to enlist their support for a uniform terminology.
3. That other reprints be kept available for authors who may desire or need information on the matter.
4. That the recommendations submitted herein be adopted as the official policy of the editors of CIRCULATION and CIRCULATION RESEARCH.
5. That Dr. Braunstein’s article be published in CIRCULATION with a note indicating that it has the approval of this committee to appear in the same number as this report.
6. That the committee be continued in being to complete its work on the nomenclature of vertical, acceleration and other new forms of ballistocardiograms.
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