The Effect of High Frequency Filter Cut-Offs on the Apexcardiogram*

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Apexcardiographic points have considerable importance in indicating the timing of systolic and diastolic cardiac events both in research and in clinical applications. The effect of filtering on validity of points measured has not been formally studied, since most investigators have been primarily concerned with curve configurations.

In recording apexcardiograms, Dimond et al. used a frequency range below 25 Hz. Their article indicated the lack of uniform agreement among researchers in setting the filter range for apexcardiography and stated that, “the ‘apexcardiogram’ is used by various workers to include vibrations of a higher spectrum.” A review of the literature reveals that many researchers do not mention the filter range used in recording apexcardiograms. Tavel et al. and Benchimol and Dimond, however, reported the use of frequency ranges from 0.1 to 20.0 Hz while Spodick and Kumar, in studying the isometric relaxation period, used a high frequency cut-off at 40 Hz. It was our purpose to demonstrate the effect of different high frequency cut-offs on the apexcardiogram with the low cut-off constant.

The Sanborn No. 62-1500-C13 attachment and crystal microphone No. 374 were used to record the apexcardiogram (ACG). Tracings were made on a Hewlett Packard Sanborn No. 568-100A photographic recorder. The frequency cut-offs on the filters were calibrated by Hewlett Packard engineers just prior to this study. A threeway signal splitting device‡ was used to obtain simultaneous recordings of the ACG through three different channels with high frequency cut-offs at 20, 40 and 80 Hz, respectively. The low frequency cut-off was set at 0.15 Hz (lowest cut-off point on Sanborn equipment) on all three channels. Five subjects each had five apexcardiograms recorded. Figure 1 shows the typical results of the ACG which had been split and filtered at three

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‡Designed and constructed by Lennart Long of NASA Electronic Research Center, Cambridge, Massachusetts.

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Figure 1. Simultaneous recordings of the apexcardiogram via a signal splitter at 20, 40 and 80 Hz cut-offs. Low frequency cut-off at 0.15 Hz.
EFFECT OF HIGH FREQUENCY FILTER CUT-OFFS ON APEXCARDIOGRAM

It is apparent that there is no difference in the timing of the ACG points or in wave configuration for any of the three tracings. High frequency cut-offs at 20, 40 and 80 Hz thus are equally adequate since they all yield comparable data. Hence, clinicians and researchers should be able to utilize any of these upper limits without sacrificing precision or validity of their ACG measurements.

SUMMARY

Twenty-five apexcardiograms were split and recorded to obtain three simultaneous tracings at three different high frequency cut-offs. Study of the simultaneously recorded tracings shows there are no observable differences in the timing of points or in wave configurations.

REFERENCES


Reprint requests: Dr. Spodick, Lemuel Shattuck Hospital, 170 Morton Street, Boston

ANNOUNCEMENTS

Postgraduate Course: Modern Concepts in Respiratory Care—Newborn to Adults

The Departments of Pediatrics and Medicine (Division of Respiratory Diseases), University of Colorado Medical Center, will present the course, Modern Concepts in Respiratory Care—Newborn to Adults, in Steamboat Springs, Colorado, February 21-25. Please contact Dr. Ernest K. Cotton, Department of Pediatrics, for information.

Teaching Seminar: Acid-base Problems in Respiratory Disease

A teaching seminar for practicing physicians will be co-sponsored by the Brooklyn Tuberculosis and Respiratory Diseases Association and the Medical Society of the County of Kings, at the State University of New York Downstate Medical Center, Brooklyn, March 16. The seminar will be devoted to acid-base problems in respiratory disease. For information, write Mr. Nelson R. Kraemer, Managing Director of the tuberculosis association, 250 Schermerhorn Street, Brooklyn 11217.

Chest Radiology Postgraduate Course

The annual Chest Radiology Postgraduate Course will be presented at the Williamsburg Conference Center, Williamsburg, Virginia, March 14-18. Registration (including luncheons and banquet) is $165. Sponsor of the course is the Department of Radiology, Medical College of Virginia. Write Dr. M. Pinson Neal, Jr., Assistant Dean and Director, Continuing Medical Education, 1200 East Broad Street, Richmond, Virginia, for details.

Seventh Annual Arizona Chest Disease Symposium

The Seventh Annual Arizona Chest Disease Symposium will be held at the Ramada Inn, Tucson, March 19-21. Information may be obtained by writing Dr. William Shepard, Coordinator, Box 6067, Tucson 85716.