Editorial

Auditory and Visual Perception of Cardiac Vibrations

SINCE the discovery by Laënnec in 1816 that the sounds produced by the heart could be well heard through a "quire of paper rolled up into a sort of cylinder," physicians have availed themselves of this aspect of physical diagnosis. All manner of stethoscopes have been devised and used from the wooden monaural type to the present binaural stethoscope but there has been little improvement in the design of the stethoscope for 60 years.

In addition to the appreciation of sound by the ear, it was early noted that these same vibrations could be recorded on photographic paper—at first by mechanical devices such as the Franck capsule and more recently by electronic means—to produce visual records of the sounds. Such recordings are called stethograms or phonocardiograms. The earlier instruments suffered from poor frequency response, did not accurately reproduce the cardiac spectrum, and at the same time introduced certain artifacts. Owing to the great advances in electronics in the last 15 years it is now possible to obtain much more fidelity in records of the vibrations initiated by the beating heart.

With the introduction of magnetic tape recording after World War II, it has become possible to record easily and with fidelity these sounds and murmurs, so that they can be reproduced as they are heard through the stethoscope. An outgrowth of the special oscilloscopes developed during the war for radar scopes now makes it possible to visualize these vibrations produced by the heart at the same time that they are heard by the ear—a true audiovisual combination.

Each of these methods has its own particular usefulness, depending upon the information desired. For routine diagnosis and the teaching of auscultation it is our belief that the simultaneous auditory perception and visualization of the cardiac sounds is of the utmost importance. It is also essential that an adequate filter system be used to emphasize limited frequency ranges, so that faint murmurs can be accentuated without interference by loud sounds and murmurs in other frequency ranges. Permanent recordings on magnetic tape for future reference add greatly to the value of the method.

For certain types of research and for special diagnostic procedures it is necessary to make photographic recordings of the heart sounds and murmurs together with some other event in the cardiac cycle such as the electrocardiogram. Records of this type can be subjected to careful analysis for the timing of the events of the cardiac cycle. Examples of these events are the delay in the onset of the first heart sound in mitral stenosis and the prolongation of right ventricular systole in pure types of pulmonic stenosis without interventricular communications. It seems quite clear that more precise diagnostic information can be obtained from these various procedures but that they each have their own advantages and limitations; the thoughtful physician will select and use the combination most likely to give valid results in a given case.

Attention may be called to some of the advantages that result from the combined use of these methods. First, the simultaneous visualization and auditory perception of the sounds of
the heart have entirely changed our concept of the teaching of cardiac auscultation. Our group believes that we can now teach with confidence, in that the student is aware of and appreciates the more difficult auscultatory phenomena. This confidence has developed from the testing of a large number of physicians at different stages of training with "unknown" recordings on tape before and after different teaching methods. It has become clear that it is now possible, in even a few hours, to develop the auditory acuity of physicians in the perception of heart sounds in a way that we did not believe possible. It should now be relatively easy to advance the auscultatory ability of the senior medical student to the point he would formerly have reached after a residency in medicine and the resident can be advanced beyond the attending physicians.

Some other points in which advantages occur are the more precise diagnosis of valvular disease by the use of these methods. We are chagrined to admit that we have discovered a number of both clinic and private patients in whom mild to gross diagnostic errors were made until one of the methods mentioned above was incorporated into the routine physical examination. It is now our custom initially to examine all patients with an audiovisual recorder of some type.

Follow-up of cases is much more precise and often a "new" sound or murmur has been shown to have been present for some time on review of the previous tape recordings on the patient. The diagnosis of various types of congenital heart disease has improved considerably by the recognition of the pulmonary and aortic components of the second pulmonic sound and the duration of murmurs in relation to these sounds. Many cases of mitral stenosis have been recognized because of the attention compelled by the recognition of the "opening snap" in mitral stenosis. Valuable information has been obtained by the correlation of preoperative and postoperative tape recordings of both congenital and rheumatic lesions. With further correlation it may be possible, in certain cases, to make accurate diagnoses without recourse to the expensive, time-consuming, and occasionally dangerous procedures of cardiac catheterization and angiocardiography.

We have been gratified at being able to correlate the auscultatory findings with the post-mortem anatomic findings, though at times this correlation or lack of correlation is disconcerting in the present state of our knowledge.

Attention should be called to the library of tape recordings of heart sounds and murmurs that has been developed by a committee of the American Heart Association for the furtherance of professional education. Information about these recordings may be obtained from the American Heart Association.*

In summary, many physicians are deficient in their ability to make accurate diagnoses of certain cardiac lesions by auscultation. The careful, thoughtful physician will probably realize this deficiency in himself and will constantly seek to improve his command of this art. It is hoped that more general use of the methods briefly mentioned in this short résumé may help him in reaching this goal.

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All the marvellous discoveries of recent times cannot remove the physician from his post of honour in detecting morbid phenomena and following the mysterious rhythm of life and death: a post, that is, at the bedside of the patient.—ARTURO CASTIGLIONI, 1874.
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