volving the anterior wall of the left ventricle and one who had an inferior aneurysmal bulge confirmed by ventriculography. As Weyman et al. correctly have noted, the M-mode scan frequently failed to show the tapering that normally occurs as the beam traverses the peri-apical region. However, in addition to that finding (which we could not consistently obtain) we noted that in the eight patients with anterior aneurysm there was a convex systolic anterior motion of the mitral valve which resembled, yet was distinctly different from, the so called SAM usually seen in IHSS. This finding was absent in the patient who had the inferior wall aneurysm. Although SAM is nonspecific, it does provide a definite clue, when correctly correlated with the clinical findings, toward the diagnosis of ventricular aneurysm. For those echocardiographers who have yet to acquire cross-sectional capability this information should prove useful.

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Reference


Effect of Electrode Area on V ECG

To the Editor:

It was with some concern that I read the article by Hughes et al. “Failure of Demand Pacing with Small Surface Area Electrodes” (Circulation 54: 128, 1976). The authors correctly point out that decreasing surface area of electrodes is associated with decreasing energy requirements for cardiac stimulation but add, incorrectly, that “small” area electrodes are associated with poor detection of the ventricular electrogram and that failure of QRS sensing by a pulse generator will occur. They make the statement “Recent reports indicate a failure rate (sic. sensing) as high as 15%.” Two publications were cited. One, from 1968 (authors’ ref. 9) addressed itself solely to the problem of poor development of the intracardiac potential in the specific instance of and as a complication of acute myocardial infarction and pointed out that with clinical improvement the amplitude of the intracardiac potential increased and sensing was restored, without electrode change. No information aside from the unipolar nature of the electrode was given and no inference concerning the electrode size is possible. It was in this publication that the failure of sensing of 15% (6 of 40 patients with acute myocardial infarct) was given. The second reference, from 1970, (authors’ ref. 11) concerns itself with the operation of a pacemaker clinic, in which no electrode is listed by model number or size and in which, on two occasions the reversion of a pacemaker to a fixed rate, insensitive mode of operation was used as an indication of “... the first sign of battery failure,” and not of a problem with the electrode or its size. Again no evidence is given in that paper to indicate the incidence of sensing failure or that such failures were other than indicators of a depleted and thus failing pulse generator. Neither reference supports the contention in the Hughes paper and thus neither reference was correctly used.

The evaluation of sensing failure in a specific clinical situation can involve a complex analysis, only one factor of which may be the pacer and/or electrode. The title suggests a clinical experience or one with immediate clinical relevance but except for the literature review, no illustrative clinical situation was addressed. The differences between the clinical and animal laboratory circumstances were not adequately addressed.

The conclusions of the study are faulty because of an error signalled in the first sentence of the “Discussion.” “This study shows that the ability to detect R-wave potentials in low impedance systems ...” (The authors used 1000 ohm load). They correctly state “... with small surface area electrodes, pacemaker circuit impedance becomes a major determinant of the amplitude of the R-wave signal recorded.” Then the study proceeds with a pulse generator input impedance appropriate to low impedance, large surface area electrodes discontinued by the manufacturer (Medtronic, Inc., Brennan, T. — Personal Communication — August 30th, 1976) and disregards the input impedance appropriate for the presently available small electrodes. The pacemaker industry has not used sensing input impedances less than 4000 ohms for the past five years or more. The authors state that “... the current trend is toward high pacemaker circuit impedance (20,000 ohms or greater).” That is now and has been the design practice for the past five years. They quote one manufacturer who suggested that the Cordis ball tip electrode not be used with his unit but not the change in recommendation. Once the design characteristic of low input impedance was recognized, it was altered by an increase in input impedance and elimination of that recommendation. (Cardiac Pacemakers Inc. — Maki, K. — Personal Communication — August 26th, 1976).

In effect, the problem of poor sensing of the QRS complex was one of mismatch between the high impedance of a smaller electrode with the lower pacer sensing impedance, suitable for a larger, lower impedance electrode (from an earlier era) but not suitable for the smaller. That problem was addressed and has been corrected, but not by the flat statement that the signal from the small electrode is poor. The signal is not poor, but its sensing is affected by proper (or improper) match of the input amplifier impedance of the pacer and the impedance of the electrode.

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The authors reply:

In response to Dr. Furman’s questions regarding “Failure of Demand Pacing with Small Surface Area Electrodes,” Circulation 54: 128, 1976:

1) Small surface area electrodes very definitely decrease the size of the R-wave detected by a pacemaker sensing circuit — regardless of the sensing circuit impedance. Even at infinite impedance, small surface area electrodes reduce the cardiac electrogram a minimum of 25%. Dr. Furman presents no data to support his contrary opinion.

2) The references quoted in the introduction and objected to by Dr. Furman verify that sensing problems were not infrequent even with large surface area electrodes. No attempt was made by us to link all past sensing failures to small surface area electrodes.

3) We were, however, led to perform our study by the increased incidence of sensing failures in our own clinical practice, of from approximately 1% prior to the introduction of the small surface area electrode to in the range of from 3 to 5% following their introduction (see page 131). Others have noted a similar association.

4) Dr. Furman’s comments regarding what he calls matching of circuit and electrode impedances are oversimplified. High impedance (low load) circuits result in less attenuation of the R-wave signal regardless of electrode size. But the high impedance sensing circuits become critical and essential with small surface area electrodes and as the discussion section of our paper points out, this high impedance cannot be assured in a potentially wet and shorted system. Recent problems with the Xytron® offer ample evidence of the development of low impedance pathways within implanted pacemakers. Dr. Furman is incorrectly assuming that the circuit impedances measured on the bench prior to pacemaker implantation will be the same as the impedances present following implantation into the hostile biological environment. Even hermetic sealing does not totally eliminate this problem as connector leaks may, under certain circumstances, severely load the R-wave transmission-sensing circuit system. As far as the earlier and now cor-
Effect of electrode area on V ECG.
S Furman

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