be valuable, especially in groups where the interpretation of ST segment responses during exercise is difficult, as in females, in patients with a previous infarction and in patients on medication such as digitalis.

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References

The author replies:

To the Editor:

Dr. Simoons' observations and comments are of interest and appreciated. We are pleased that he confirmed our findings that the R wave almost always decreases in normal patients during an exercise test and that he found the diseased patients had an increase in amplitude, however, with a lesser sensitivity than was found for ST depression.

In a subsequent study of patients coming in for consecutive angiograms and stress tests, we found that the ST segment had a sensitivity of 49% while the R wave had a sensitivity of 68% (p = 0.054).

In another group of 100 patients, 50 with angiographic disease and 50 young healthy asymptomatic subjects stressed as part of an American Heart Association study, the sensitivity for the ST was 76% and for the R wave only 60% (p > 0.05).

When either a positive ST or R wave response was taken as a positive test, sensitivity increased to 84% (p > 0.05). We agree that the sensitivity discrepancies are indeed secondary to patient population differences which we have demonstrated above.

Another consideration, however, is that we used a treadmill while Dr. Simoons' group used a bicycle ergometer. This would result in posture differences and patients usually are stressed to a greater degree on the treadmill. We calculated the control and immediate post-exercise R wave difference with the patient standing; Dr. Simoons calculated it with the patient in a sitting position. Perhaps the sitting posture after exercise reduces the venous return compared with the standing position. This could account for the increased number of false negative responses, lowering the sensitivity.

With regard to the mechanism, recent radionuclide studies\textsuperscript{4,5} with exercise have shown a decrease in the volumes with a subsequent increase in ejection fraction in normal patients, while patients with coronary disease increased their volumes. This supports the Brody effect as a probably mechanism for the R wave change with exercise.

Dr. Simoons' observations raise many interesting questions. Further studies are needed to evaluate the best position for the measurements of the R wave, to determine if the R wave trends during exercise and immediately after exercise are significant and determine how much of an increase in heart rate is necessary for the R wave changes to be of significance. We have some evidence to suggest that the R wave normally increases in normals until the patient has a heart rate of 120-130 when it begins to decrease. This would suggest that the measurements would have less significance in patients who stop very early in the protocol before their heart rates reach a significant increase.

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Long-Term ECG Monitoring to Assess Ventricular Ectopic Activity

To the Editor:

We read with interest the article by Morganroth and colleagues (Circulation 58: 408, 1978) regarding the limitations of long-term ambulatory electrocardiographic monitoring in the assessment of ventricular ectopic activity. While their overall impression of the variability of ectopic activity is undoubtedly correct, the statistical techniques they used and the conclusions drawn from their data may be unjustified.

Many different methods have been used to detect and quantitate ventricular premature depolarizations (VPDs) which use analog and/or digital electronic techniques. These methods are prone to both false-positive and false-negative errors. Therefore, system variability must be considered before defining patient variability. Morganroth et al. noted that the relative error ratio of VPD counts between their real-time control method and their analog detector method varied inversely with the degree of VPD frequency per hour, "but was on the average, 7.2%". The average value alone is not, however, adequate to describe the error distribution. A regression line between the relative error ratio and the degree of VPD frequency would have conveyed considerably more information. Even if the average value is used, a quantity that measures the variability, e.g., standard deviation, should have been reported so that the reader could realize the extent of the error ratio. Furthermore, and more important, the possible effects of the error ratio on the results of the analysis of variance were not discussed at all by the authors. They also did not comment on the extent of data loss in their recordings, since not all ambulatory recordings contain 24 hours of data.

The authors applied the analysis of variance to analyze a series of hourly frequencies of VPDs. Consideration was correctly given to the statistical assumptions of normality and variance homogeneity of the data by the use of the natural logarithmic transformation. The square root transformation, however, may have been more appropriate in this case, since the basic data relates to frequency of occurrence during certain time intervals which suggests a Poisson dis-
Long-term ECG monitoring to assess ventricular ectopic activity.
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