

## DIAGNOSIS

# Electrocardiography was highly sensitive but only moderately specific in detecting chronic heart failure

Davie AP, Francis CM, Love MP, et al. Value of the electrocardiogram in identifying heart failure due to left ventricular systolic dysfunction. *BMJ*. 1996 Jan 27;312:222.

### Objective

To assess the value of electrocardiography (ECG) in identifying patients with possible chronic heart failure caused by left ventricular systolic dysfunction.

### Design

Blinded comparison of ECG results with the results of an echocardiogram, the diagnostic standard.

### Setting

An echocardiography service for general practitioners established in a hospital in Edinburgh, Scotland.

### Patients

534 patients aged 17 to 94 years were assessed.

### Description of test and diagnostic standard

Each ECG was reported as normal or abnormal independently by 2 investi-

gators blinded to the echocardiographic results. Echocardiograms were recorded by a technician and described by a cardiologist. Two-dimensional, M-mode, and Doppler ultrasound studies were done to assess left ventricular systolic function and possible valve disease. Left ventricular systolic function was quantified in terms of fractional shortening derived from M-mode studies or simply as preserved or impaired.

### Main outcome measures

Sensitivity, specificity, and positive and negative predictive values.

### Main results

96 patients had impaired left ventricular systolic function. Of these, 90 patients had major ECG abnormalities (atrial fibrillation, previous myocardial infarction, left ventricular hypertrophy, bundle-branch block, or left-axis deviation); none had a normal ECG. Of the 438 patients with normal left ventricular systolic function, 169 had major ECG abnormalities. The sensitivity of detecting impaired left ventricular systolic function with ECG

was 94% [95% CI 87% to 98%]\*; the specificity was 61% [CI 57% to 66%]\*; the positive predictive value was 35%; and the negative predictive value was 98%. (The likelihood ratio of a positive test result was 2.41, and the likelihood ratio of a negative test result was 0.10.)\*

### Conclusion

Electrocardiography was sensitive but only moderately specific in detecting heart failure caused by left ventricular systolic dysfunction.

Source of funding: In part, Merck Sharp and Dohme.

For article reprint: Dr. J.J. McMurray, West Glasgow Hospitals University NHS Trust, Western Infirmary, Dumbarton Road, Glasgow G17 6NT, Scotland, UK. FAX 44-141-211-2000.

\*Numbers calculated from data in article.

### Commentary

It is not surprising that patients with ventricular abnormalities on an ECG would frequently have ventricular abnormalities on an echocardiogram. Yet the exclusion of atrial enlargement and broadening of QRS as minor abnormalities in this study is surprising because left atrial enlargement on the ECG is one of the most sensitive signs of left ventricular hypertrophy, and intraventricular block usually indicates an abnormal ventricle. Of course, the authors of this study were not concerned with diastolic dysfunction, an increasingly recognized source of congestive failure.

The echocardiographic service in this study was aimed at evaluating patients with suspected chronic heart failure caused by left ventricular systolic dysfunction. Was this the sole aim of the service or of this study? Were the minor abnormalities identified before or after completion of data gathering? There was no description of how the 534 patients were

selected, so the question of bias from the beginning arises. Moreover, with an age range of patients from 17 to 94 years, a breakdown by age of the 90 patients with impaired systolic function might be of interest. The above-mentioned points bear on the generalizability of the results, even if selection bias can be excluded. Within that constraint, the authors' conclusions that a major ECG abnormality was usual with systolic dysfunction and that an abnormal ECG had a reasonable chance of indicating substantial systolic dysfunction were unexceptionable; yet the numbers reported remain in question.

The suggestion that ECG as the initial investigative procedure was more cost-effective only bears out current practice; one would not begin with an echocardiogram. The suggestion that ECG raises diagnostic possibilities other than chronic heart failure is feasible, although the authors of this study ignore acute

heart failure and diastolic dysfunction. Similarly, the suggestion that echocardiography was indicated if the ECG was abnormal with suspected heart failure also mirrors current practice. The authors' observations that including only patients already treated with diuretics would have increased the yield of positive scans to 47% and that patients with a murmur should have an echocardiogram as the ECG may be normal in valvular heart disease, while distinctly plausible, lack a basis in the results of the study.

Despite multiple shortcomings, this study calls for a more comprehensive and tightly organized diagnostic investigation in patients with suspected chronic heart failure caused by left ventricular systolic dysfunction.

David H. Spodick, MD  
Saint Vincent Hospital  
Worcester, Massachusetts, USA