

Value of the electrocardiogram in identifying heart failure due to left ventricular systolic dysfunction

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Chronic heart failure due to left ventricular systolic dysfunction has a high morbidity and mortality. Angiotensin converting enzyme inhibitors reduce symptomatic deterioration, hospitalisation, and death. Most patients with suspected heart failure present first to general practitioners. Recent studies have emphasised the difficulty of diagnosing heart failure in the community. Fewer than half of patients treated for heart failure by general practitioners have objective evidence of cardiac disease.^{1,2}

To improve diagnosis and treatment Dargie and McMurray suggested that echocardiography should be performed in all patients suspected of having chronic heart failure.³ Screening patients before referral for diagnostic investigation may lessen the considerable resource implications of this approach. We assessed the value of the electrocardiogram in identifying patients with possible chronic heart failure.

Subjects, methods, and results

An open access echocardiography service for general practitioners was established in our hospital as described.⁴ The service aims at evaluating patients with suspected chronic heart failure due to left ventricular systolic dysfunction. In addition to having echocardiography, an electrocardiogram was recorded for each patient.

Echocardiograms were recorded by an experienced technician and reported on by a cardiologist. Comprehensive 2D, M mode, and Doppler ultrasound studies were performed to assess left ventricular systolic function and any valve disease. Whenever possible, left ventricular systolic function was quantified in terms of fractional shortening derived from M mode; otherwise it was assessed simply as preserved or impaired. Each electrocardiogram was reported as normal or abnormal independently by two of us (CMF and APD) blind to the results of echocardiography. A few cases of disagreement were settled by JMcM.

A total of 534 patients aged 17-94 were assessed. Ninety six had impaired left ventricular systolic function. Of these, 90 had major electrocardiographic abnormalities (atrial fibrillation, previous myocardial infarction, left ventricular hypertrophy, bundle branch block, or left axis deviation); none had a normal electrocardiogram. Of 438 patients with normal left ventricular systolic function, 169 had major electrocardiographic abnormalities (table 1).

Comment

This study shows that left ventricular systolic dysfunction is unlikely to be present if the electrocardiogram is normal (or shows only minor abnormalities). Conversely, there is usually a major electrocardiographic abnormality in the presence of left ventricular systolic dysfunction. The electrocardiogram is not a substitute for echocardiography, as

an abnormal electrocardiogram does not accurately predict the presence of left ventricular systolic dysfunction. A patient with an abnormal electrocardiogram has about a one in three chance of significant left ventricular systolic dysfunction.

Table 1—Electrocardiographic findings related to left ventricular systolic function. Figures are numbers of patients

Electrocardiographic findings	Impaired left ventricular systolic function	Preserved left ventricular systolic function	Total
Abnormal	90	169	259
Normal†	6	269	275
Total	96	438	534

Sensitivity 90/96=94%; specificity 269/438=61%; positive predictive value 90/259=35%; negative predictive value 269/275=98%.
†Normal or minor abnormality (atrial enlargement, bradycardia, tachycardia, broadening of QRS complex, poor R wave progression, right axis deviation, myocardial ischaemia, first degree atrioventricular block, nonspecific ST-T wave changes).

A more cost effective approach to the diagnosis of suspected chronic heart failure is to use the electrocardiogram as the initial investigation. If the tracing is normal other diagnoses should be considered. Only if these have been excluded should an echocardiogram be performed. If the electrocardiogram is abnormal echocardiography is indicated. Common abnormalities in the electrocardiogram are readily recognised.⁵ With this approach the number of echocardiograms could be reduced by 51%—that is, required in only the 259 patients in this series with a major electrocardiographic abnormality. The yield of positive (that is, abnormal) scans would increase from 18% to 37% by using major electrocardiographic abnormalities to select patients for echocardiography. Including only patients already treated with diuretics would have increased the yield to 47%.⁴

In summary, the electrocardiogram is a valuable first line investigation for suspected chronic heart failure. A normal electrocardiogram virtually excludes chronic heart failure due to left ventricular systolic dysfunction. An abnormal electrocardiogram does not mean that the patient has chronic heart failure but is an indication for an echocardiogram. Similarly, patients with a murmur should also have an echocardiogram, as the electrocardiogram may be normal in valvular heart disease.

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