

## Likelihood ratios should have been given

EDITOR,—A P Davie and colleagues examine the role of electrocardiography in identifying left ventricular systolic dysfunction.<sup>1</sup> While electrocardiography is a useful first line investigation in patients deemed suitable for open access echocardiography, it would be a mistake to recommend it as a useful investigation for all patients with suspected chronic heart failure in, for example, general practice. The problem is not with the validity of Davie and colleagues' results but with their applicability, because of the problems of diagnostic data.<sup>2</sup>

The key findings relate to the predictive values of electrocardiography in diagnosing left ventricular dysfunction when compared with a chosen reference standard. Predictive values, however, are not constant, changing with the prevalence (or pre-test probability) of the target disorder in patients undergoing investigations. The prevalence of left ventricular systolic dysfunction in Davie and colleagues' study was 17%, which is much higher than the 1-3% quoted for the general population.<sup>3</sup> If Davie and colleagues' results are recalculated on the basis of a prevalence of 1% the positive predictive value of electrocardiography plummets to 2.4% and the negative predictive value rises to 99.9% (table 1), suggesting that when the prevalence of an abnormality is low electrocardiography is not useful.

**Table 1—Electrocardiographic findings with population prevalence of left ventricular systolic dysfunction of 1%**

Electrocardiographic findings	Impaired left ventricle	Preserved left ventricle	Total
Abnormal	94	3762	3 856
Normal	6	6138	6 144
Total	100	9900	10 000

Sensitivity=94%, specificity=62%.<sup>1</sup>  
Positive predictive value=2.4%, negative predictive value=99.9%.  
Likelihood ratio for abnormal electrocardiogram=2.42 and for normal electrocardiogram=0.09.

If predictive values are so variable, how can the results of studies investigating diagnostic tests be better presented? One solution is to use likelihood ratios, stratified by levels of test results when possible.<sup>4,5</sup> Because likelihood ratios do not change with the underlying prevalence of the target disorder they give a much more stable assessment of an investigation's usefulness in all situations. A simple nomogram that uses pretest probabilities, post-test probabilities, and likelihood ratios is available to help doctors decide whether an investigation is worth while in any patient and can be easily slipped into the doctor's pocket.<sup>5</sup> Finally, while likelihood ratios can be relatively easily calculated from 2x2 tables, medical journals ought to present them routinely to help doctors decide whether a particular diagnostic test will be useful.

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## Courses on interpreting ECGs would improve general practitioners' skills

EDITOR,—A P Davie and colleagues recommend that general practitioners should use electrocardiography as a screening investigation for patients with suspected chronic heart failure; if the result is abnormal the patient should be referred for echocardiography, but if it is normal other diagnoses should be considered.<sup>1</sup> We are not convinced that common abnormalities in electrocardiograms are reliably recognised by general practitioners. The main abnormalities detected in the authors' study included atrial fibrillation, previous myocardial infarction, left ventricular hypertrophy, bundle branch block, and left axis deviation. Studies have shown, however, that many general practitioners and hospital doctors lack the skills to interpret electrocardiograms.<sup>2,3</sup> In one study in general practice atrial fibrillation was diagnosed by only 65% of respondents, left ventricular hypertrophy by 76%, and left bundle branch block by 66%.<sup>2</sup> Furthermore, unequivocal acute myocardial infarction was misdiagnosed by 20% of respondents.

If general practitioners miss major electrocardiographic abnormalities they will not refer the patients for echocardiography and may start or continue inappropriate treatment. Correct reporting of electrocardiograms could be achieved if a service for interpreting electrocardiograms existed in local hospitals or if interpretive electrocardiogram recorders were used. Courses on interpreting electrocardiograms might also improve the interpreting skills of general practitioners.

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## ECGs are valuable in hospital as well as general practice

EDITOR,—A P Davie and colleagues' study suggests that a normal electrocardiogram virtually excludes chronic heart failure due to left ventricular systolic dysfunction.<sup>1</sup> The study was performed in a general practice setting in patients with chronic, stable heart failure who were referred to an open access echocardiography service. We suggest that the study may simply confirm a long-standing clinical impression and that the authors' finding may also apply to patients admitted to hospital with acute heart failure.

Over the six months March to August 1994 there were 7451 emergency medical admissions to our inner city district general hospital; 348 of the patients (170 male, 178 female; mean age 73.2 (SD 11.2) years) were diagnosed as having acute heart failure. A study of a random sample of 252 admission electrocardiograms showed that 177 patients were in sinus rhythm while 75 were in atrial fibrillation or flutter. Electrocardiographic abnormalities included abnormalities indicating cardiac ischaemia (not including signs of myocardial infarction) in 75 patients, previous or new myocardial infarction in 40, left ventricular hypertrophy in 24, and left bundle branch block (or other conduction abnormalities) in 62.

We did not classify any of the admission electrocardiograms as normal, although the admit-

ting junior medical staff had initially reported the electrocardiogram as normal in eight cases. In these eight patients the electrocardiographic abnormalities were subsequently found to have been misinterpreted or the clinical features were found to be inconsistent with heart failure due to systolic dysfunction (table 1).

**Table 1—Electrocardiograms initially reported as normal in patients admitted with heart failure**

Case No	Clinical features and other investigations	Comment
1	Atrial fibrillation, chronic renal failure, inferolateral ST/T wave changes	ECG abnormal
2	Chronic renal failure due to severe bilateral hydronephrosis; no evidence of heart failure; normal ECG and chest x ray film	Diagnosis of heart failure doubtful
3	Fatal pulmonary thromboembolism; normal ECG; no evidence of heart failure on postmortem examination	Diagnosis of heart failure doubtful
4	ECG showed left ventricular hypertrophy; echocardiogram showed normal systolic function	ECG abnormal; in view of echocardiographic findings, dysfunction was possible
5	Normal ECG, echocardiogram, and chest x ray film	Diagnosis of heart failure doubtful
6	Normal echocardiogram; peripheral oedema secondary to amlodipine treatment	Diagnosis of heart failure doubtful
7	ECG showed old anterior Q wave myocardial infarction	ECG abnormal
8	ECG showed atrial fibrillation with old inferior myocardial infarction	ECG abnormal

ECG=Electrocardiogram.

We suggest that, as well as general practitioners,<sup>1</sup> admitting junior medical staff should be advised that an electrocardiogram should be recorded in all patients in whom heart failure is suspected, since cardiac impairment is highly unlikely in patients with a normal electrocardiogram. The possibility still remains that some patients with heart failure have normal systolic contraction, the heart failure being due to diastolic dysfunction<sup>2</sup>; in such cases drugs such as  $\beta$  blockers and calcium antagonists are useful but angiotensin converting enzyme inhibitors are of less established benefit. Echocardiography may be valuable in these instances.

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## Learning from primary care in developing countries

EDITOR,—We agree with Paul Johnstone and Isabel McConnan and the subsequent correspondents that Western countries have much to learn from the primary health care systems of the developing countries.<sup>1,2</sup> Sri Lanka stands out as an example. It has been the policy of successive Sri Lankan governments to provide free health services to all citizens. However, it is estimated that the private sector, which includes Western and indigenous medicine, accounts for 55% of