Evaluation of echocardiography in the management of elderly patients with heart failure

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Abstract

Objective: to determine the validity of a clinical diagnosis of systolic dysfunction in elderly patients with heart failure and assess the contribution of echocardiography to their management.

Subjects: 61 elderly patients with a diagnosis of heart failure in a geriatric assessment unit setting.

Methods: prospective study determining sensitivity, specificity and predictive values of a clinical and radiological diagnosis compared with echocardiographic standard. Proposed management was compared before and after echocardiography.

Results: clinical assessment was highly sensitive (93%) but lacked specificity (32%). Combining radiological and clinical diagnoses increased specificity to 58%. Echocardiography revised the lead cardiac diagnosis for 28% of patients and influenced patient management plans for 41%.

Conclusion: for elderly patients with heart failure, echocardiography improves diagnostic accuracy and identifies those patients with potential to benefit from angiotensin-converting enzyme inhibitors.

Keywords: aged, angiotensin-converting enzyme inhibitors, echocardiography, heart failure

Introduction

Echocardiography facilitates non-invasive assessment of cardiac structure and function and is a key investigation of congestive heart failure. Echocardiography helps clarify the aetiology of the heart failure syndrome. It identifies (i) patients whose symptoms and signs of heart failure may be a consequence of impaired ventricular relaxation and diastolic filling [1–5] (diastolic failure) and (ii) those with dilated and poorly contractile left ventricles and reduced ejection fraction (systolic heart failure). There is no consensus on the optimal management of patients with heart failure in the presence of normal systolic function. There is, however, compelling evidence that patients with impaired left ventricular systolic function benefit from angiotensin-converting enzyme (ACE) inhibitors, whether they are prescribed for severe heart failure [6], mild to moderate heart failure [7, 8] or asymptomatic left ventricular dysfunction [9, 10].

The incidence of heart failure rises exponentially with age [11], and decompensated heart failure is a frequent cause of hospitalization [12, 13]. With an ageing population, therefore, heart failure makes considerable demands on health care resources. ACE inhibitors improve prognosis in heart failure and their use is established in the management of elderly patients with moderate–severe heart failure. Appropriate prescribing of ACE inhibitors for elderly patients with mild heart failure may be limited by the poor sensitivity and specificity of a clinical diagnosis of heart failure in patients with relatively few symptoms and signs [14, 15]. Open access echocardiography for primary care can help identify those with impaired systolic function who are most likely to benefit from ACE inhibitors [16]. Echo assessment is not, however, an investigation to be considered in isolation: the results should be used in conjunction with clinical signs, radiological abnormalities and electrocardiographic findings. Echocardiography may be of little value in acute medical admissions with decompensated heart failure [17], but elderly patients on assessment wards represent an older population with co-morbidity in whom sub-acute presentation of nonspecific fatigue, dyspnoea and ankle swelling can make diagnosis difficult.

In this prospective study of elderly patients with a clinical syndrome of heart failure, we determined the validity of a clinical diagnosis of impaired left
ventricular systolic function and assessed the contribution of echocardiography to patient management, with particular reference to ACE inhibitor therapy.

Patients and methods

We prospectively studied patients referred to a geriatric assessment unit and identified those with a clinical syndrome of heart failure present for at least 4 weeks (heart failure defined by two major or one major and two minor Framingham criteria [18]; Table 1). We documented symptoms, drug therapy, cardiorespiratory signs and the results of a 12-lead electrocardiograph and chest radiograph. For each subject, a consultant or senior registrar indicated the principal cardiac diagnosis and proposed management and suitability for ACE inhibitor therapy, before and after echocardiography.

Imaging was performed in the left lateral and decubitus positions using the Acuson 128 system with a 2.5/3.5 MHz dual frequency cardiac transducer and a separate 3 MHz continuous wave Doppler probe. From M mode we obtained measures of left ventricular systolic and end diastolic dimensions. Where possible, an estimate of ejection fraction was calculated using the Acuson Software Cardiac Analysis Package. This method applies Simpson's formula to calculate ventricular volumes using disc summation before obtaining a mean value for ejection fraction from each of several scanning planes. While quantitative assessment using left ventricular ejection fraction or wall motion index is preferable, in practice, fractional shortening or ‘eyeball assessment’ of left ventricular contractility are commonly used. These measures correlate reasonably well with left ventricular ejection fraction [19].

We calculated the sensitivity, specificity and predictive accuracy of a clinical and radiological diagnosis of systolic dysfunction and assessed the contribution of echocardiography to management and treatment.

Results

We studied 61 patients (15 men) aged 71–96 (mean 82) years, with a clinical diagnosis of heart failure, supported by Framingham criteria (Table 1). One subject was an outpatient and the remainder were inpatients in a geriatric assessment unit. Twenty-eight patients gave a history in keeping with ischaemic heart disease and 15 were hypertensive. Sixteen had coexisting chronic obstructive pulmonary disease. Fifty-two patients took a loop diuretic [40–160 mg (mean 63.8) frusemide daily] and five were already taking an ACE inhibitor. Eight had not yet started drug treatment for heart failure. Twenty patients were prescribed digoxin. Cardiac rhythm was sinus (40), atrial fibrillation (17), paced (three) or complete heart block (one). Fifteen patients had electrocardiographic criteria for left ventricular hypertrophy.

Technical difficulties were experienced in 15 echo subjects because obesity or emphysema (in 10 subjects) or kyphoscoliosis (in two) limited access, or because severe orthopnoea (in two) or severe cognitive impairment (in one) limited patient tolerance of the procedure. Despite these difficulties, the aortic and mitral valves were visualized in all subjects and left ventricular contractility could be assessed from a two-dimensional study of wall motion in 59 out of 61 subjects. While 12 patients had only this subjective assessment of systolic function, quantitative measures were obtained in 47 patients: fractional shortening and ejection fraction (in 33), fractional shortening alone (in 10) and ejection fraction alone (in four). Mean fractional shortening was 20.9% (range 3.9–48.5). Mean ejection fraction was 38.7% (range 18–72).

Table 2 records the radiological abnormalities in the 61 subjects and the echocardiographic indices of systolic dysfunction. A radiological diagnosis of heart failure (pulmonary venous congestion or oedema) and a clinical diagnosis of systolic dysfunction are compared with echo indices of systolic dysfunction (reduced contractility, fractional shortening < 25% or ejection fraction ≤ 40%) in Table 3.

The sensitivity, specificity and predictive accuracy of a clinical and radiological diagnosis for systolic dysfunction are presented in Table 4. The principal

<table>
<thead>
<tr>
<th>Symptom/sign</th>
<th>Prevalence</th>
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<tbody>
<tr>
<td>Major Cardiomegaly (clinical)</td>
<td>51 (84%)</td>
</tr>
<tr>
<td>Crepitations</td>
<td>42 (69%)</td>
</tr>
<tr>
<td>Elevated jugular venous pressure</td>
<td>37 (61%)</td>
</tr>
<tr>
<td>Orthopnoea</td>
<td>32 (52%)</td>
</tr>
<tr>
<td>Minor Effort dyspnoea</td>
<td>54 (89%)</td>
</tr>
<tr>
<td>Dependent oedema</td>
<td>47 (77%)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>20 (33%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardio-thoracic ratio &gt; 50%</td>
<td>53/61 (87%)</td>
</tr>
<tr>
<td>Pulmonary congestion/oedema</td>
<td>43/61 (70%)</td>
</tr>
<tr>
<td>Reduced left ventricular contractility</td>
<td>37/59 (63%)</td>
</tr>
<tr>
<td>Fractional shortening &lt; 25%</td>
<td>31/43 (72%)</td>
</tr>
<tr>
<td>Ejection fraction ≤ 40%</td>
<td>21/37 (57%)</td>
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cardiac diagnosis was indicated before and after echocardiography (Table 5). The procedure revised the lead cardiac diagnosis in 28% of subjects and influenced management plans for 25 patients (41%) because of a change in cardiac diagnosis, assessment of clinically suspected valvular disease or detection of atrial thrombus. Most valvular lesions were of minor haemodynamic importance, but four subjects had previously unsuspected mitral stenosis. Fourteen of 52 patients, thought to have systolic dysfunction and potential for benefit from ACE inhibitor therapy, were subsequently found to have a contraindication to this treatment—coexisting aortic stenosis (in one), unsuspected mitral stenosis (in four) and cor pulmonale (in two)—or had normal left ventricular systolic function (seven). This group included two of the five patients who had already been prescribed ACE inhibitor therapy. Three of the nine patients initially considered inappropriate for ACE inhibitors had echocardiographic evidence of impaired systolic function which would respond to this treatment.

**Discussion**

The introduction of ACE inhibitor therapy has been a major advance in the treatment of patients with heart failure due to impaired systolic function.

The CONSENSUS study group reported a 31% reduction in mortality at 1 year, a decrease in requirements for additional heart failure therapy and improvement in New York Heart Association classification associated with the use of enalapril for severe heart failure [6]. The SOLVD investigators [7, 20] and the second vasodilator heart failure trial [8] also demonstrated these benefits in patients with mild–moderate heart failure. In a large-scale trial of captopril in primary care, improvements in signs and symptoms of heart failure were independent of age [21]. In the SOLVD prevention study of patients with asymptomatic systolic dysfunction, enalapril delayed the onset of symptomatic heart failure and reduced the frequency of hospital admissions [9] and the number of patients developing myocardial infarction [10].

The overwhelming message from the trials is that, unless contraindicated by specific co-morbidity, ACE inhibitors should be prescribed for all patients with congestive heart failure due to impaired left ventricular systolic dysfunction [22, 23]. It may be difficult to diagnose heart failure in the early stages of the disease and the validity of a clinical diagnosis of heart failure has been questioned [14, 15]. Most individuals with heart failure are elderly and will be managed solely by general practitioners or referred to general physicians or geriatricians outwith specialist cardiac units. Such patients may also have impairment of renal function and postural instability influencing the risk/benefit ratio for ACE inhibitor therapy. Therefore, appropriate management depends on accurate diagnosis to identify correctly those patients most likely to benefit from ACE inhibitors. Despite this, patients with heart failure are often inadequately investigated and consequently treatment may be suboptimal [24].

Gillespie and colleagues found echocardiography to be of little value in medical admissions with acutely decompensated heart failure [17]: clinical assessment was highly sensitive and chest x-ray improved specificity to 91%. In contrast to their study population, those admitted to geriatric medical wards are an older group with a range of cardiac diagnoses, co-morbidity and sub-acute presentation which can all contribute to diagnostic difficulties. In this prospective study of elderly patients with heart failure, a clinical diagnosis of systolic dysfunction was highly sensitive (93%) but
lacked specificity (32%). Although chest x-ray improved diagnostic accuracy, echocardiography resulted in revised lead cardiac diagnosis for 28% of subjects. In addition, the investigation influenced proposed management for 41% of patients, identifying patients most likely to benefit from ACE inhibitor therapy and those for whom it would be of little value or be potentially risky.

A policy of echocardiography for all elderly patients with heart failure has considerable resource implications but these must surely be offset by the improved survival with ACE inhibitor therapy and, in cost/benefit terms, by the reduction in frequency and length of hospital admissions [25]. Echocardiography is a non-invasive, informative procedure which is well tolerated and influences management: it should be readily accessible to facilitate informed management of elderly patients with heart failure.

Key points

• The incidence of heart failure increases with age.
• Additional cardiac diagnoses and co-morbidity, which are common with ageing, increase diagnostic uncertainty.
• A clinical diagnosis of systolic dysfunction is highly sensitive but lacks specificity.
• Echocardiography improves diagnostic accuracy and influences patient management by targeting the use of angiotensin-converting enzyme inhibitors.

References


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