Open access echocardiography in management of heart failure in the community

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Abstract

Objective—To assess the value of an open access echocardiography service.

Design—Study of new open access service for general practitioners, who were invited to refer patients taking diuretics for suspected heart failure, untreated patients with symptoms of possible heart failure, and asymptomatic patients with risk factors for left ventricular systolic dysfunction.

Setting—Regional cardiology centre.

Subjects—259 consecutive patients.

Main outcome measures—Presence or absence of left ventricular systolic dysfunction and consequent changes in clinical management.

Results—119 treated patients, 99 untreated patients, and nine asymptomatic patients were referred over five months. 32 were considered to be inappropriately referred. Among the treated patients, 31 had impaired left ventricular systolic function and five had valvular disease; angiotensin converting enzyme inhibitors were recommended for 34 of these patients. In addition, 53 were thought not to need diuretics. Eight untreated patients had impaired systolic function and six valvular disease.

Conclusions—The service was well used by general practitioners and led to advice to change management in more than two thirds of patients.

Introduction

Patients with heart failure due to left ventricular systolic dysfunction benefit from treatment with an angiotensin converting enzyme inhibitor. Symptoms are improved, the need for admission to hospital reduced, and survival increased.¹ Furthermore, progression to overt heart failure can be prevented by early treatment of asymptomatic patients with left ventricular systolic dysfunction.^{2,3} Wider but appropriate use of these inhibitors in such patients could have large public health and economic benefits.⁴

Left ventricular systolic dysfunction is difficult to identify solely on the basis of symptoms and signs. Two studies in primary care have shown that many patients with breathlessness thought to have this type of heart failure have been misdiagnosed.^{5,6} The simplest confirmation of the diagnosis is provided by echocardiography, which is as reliable as other diagnostic methods such as radionuclide angiography.⁷ Echocardiography has not previously been directly available to general practitioners. We studied the value of an open access echocardiography service in assessing patients with suspected left ventricular systolic dysfunction.

Methods

The service was launched by inviting about 550 general practitioners from Edinburgh and surrounding

areas to attend a meeting. With the invitation, each general practitioner received an information pack containing a letter outlining the reasons for initiating the service, a sample of the request form to be used, and a copy of the patient information leaflet. Ninety three general practitioners attended the meeting. Short audiovisual presentations were made describing the background to the service, the diagnostic capabilities of echocardiography, and advice on who to refer.

The request form was designed to be quick to complete with all information being entered by ticking box choices. The general practitioner identified one of three indications for an echocardiogram: an existing diagnosis of heart failure and currently treated with a diuretic (treated); symptoms and signs suggestive of heart failure (unexplained breathlessness, fatigue, or oedema) and as yet untreated (untreated); or possible asymptomatic left ventricular dysfunction (predisposing risk factors included previous myocardial infarction, coronary artery bypass grafting, or hypertension with electrocardiographic evidence of left ventricular hypertrophy) (asymptomatic). Current cardioactive drugs by class (loop diuretic, nitrate, etc) were also listed.

Before echocardiography each patient filled in a simple questionnaire relating to medical history, current symptoms, and smoking and alcohol habits.

The echocardiographic examinations were done with an Accuson XP 10 or Hewlett Packard 1500 machine by an experienced technician, and the results reported by a cardiologist. Standard imaging views were obtained with the patient lying in the left lateral decubitus position. Full two dimensional, M mode, colour flow, and Doppler studies were performed on each patient to assess left ventricular systolic function and to look for valvular disease. Wherever possible systolic function was quantified in terms of fractional shortening. Left ventricular dimensions were taken from M mode recordings made at the tips of the mitral valve leaflets. Fractional shortening was calculated as the percentage difference between the left ventricular end diastolic diameter (LVEDD) and left ventricular end systolic diameter (LVESD): $\text{LVEDD} - \text{LVESD} / \text{LVEDD} \times 100\%$. In the absence of valvular regurgitation, systolic function was considered to be significantly impaired if fractional shortening was less than 25%.⁸ In patients in whom these measurements could not be obtained left ventricular function was assessed simply as being normal or impaired.

After the examination general practitioners were sent a report summarising the findings of echocardiography and recommending changes in treatment or further investigation. Treatment with angiotensin converting enzyme inhibitors was recommended for patients with impaired left ventricular systolic dysfunction, and a diuretic or angiotensin converting enzyme inhibitor was recommended for patients with

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serious valvular disease. Withdrawal of diuretics was advised for treated patients with normal systolic function and no other indication for diuretics. Implementation of the recommendations was left to the general practitioner's discretion.

Results

In all, 259 patients (aged 17 to 91) were referred to the service in the first five months. No request for echocardiography was refused. Table I shows the characteristics of patients referred according to reason for referral. Thirty two (12%) patients had none of the three main indications specified on the request form and were considered to be inappropriately referred. Most of these patients had been sent for further assessment of murmurs.

TABLE I—Characteristics of patients referred for echocardiography. Values are numbers (percentages) unless stated otherwise

Number	Treated (n=119)	Untreated (n=99)	Asymptomatic (n=9)
Mean (range) age (years)	73 (45-91)	68 (27-88)	64 (44-83)
Male:female	53:66	39:60	4:5
Angina	40 (34)	37 (37)	3 (33)
Myocardial infarction	28 (24)	18 (18)	4 (44)
Coronary artery bypass	5 (4)	2 (2)	1 (11)
Diabetes mellitus	5 (4)	4 (4)	0 (0)
Chronic destructive pulmonary disease	40 (34)	22 (22)	0 (0)
Hypertension	28 (24)	43 (43)	4 (44)
Ever smoked	77 (65)	57 (57)	4 (44)
Current smoker	15 (13)	18 (18)	1 (11)

It was not possible to measure chamber dimensions in 108 (42%) patients because of obesity or airways disease. Table II shows the assessment of left ventricular function in the remaining 151 patients.

TABLE II—Echocardiographic findings in patients with normal and impaired left ventricular function expressed as means (SD)

	Normal (n=121)	Impaired (n=30)
Left ventricular end diastolic dimension (cm)	5.1 (0.6)	6.5 (0.8)
Left ventricular end systolic dimension (cm)	3.2 (0.5)	5.3 (0.8)
Left ventricular posterior wall diameter (cm)	1.0 (0.2)	1.0 (0.2)
Fractional shortening (%)	35.8 (5.5)	19.5 (5.9)
Left atrium (cm)	4.0 (0.7)	4.8 (0.9)

Among the patients being treated for heart failure, serious left ventricular systolic dysfunction was identified in 31 patients, 19/53 (36%) men and 12/66 (18%) women (table III). Valvular disease was observed in five (one with mitral regurgitation, two with aortic stenosis, and two with aortic regurgitation). Thirty four patients were thought suitable for treatment with an angiotensin converting enzyme inhibitor (31 with left ventricular systolic dysfunction and three with serious valvular regurgitation), but only five of these patients were already taking an angiotensin converting enzyme inhibitor. Diuretic treatment was thought unnecessary in 53 of the 83 patients with no abnormality. Some patients continued diuretics for symptomatic oedema or hypertension. Thus, overall, there were clear indications for important changes in treatment in 82 (69%) patients in this group.

Serious left ventricular systolic dysfunction was

TABLE III—Numbers (percentages) of patients in each group with normal or impaired left ventricular systolic function and valvular disease

	Treated (n=119)	Untreated (n=99)	Asymptomatic (n=9)
Impaired systolic function	31 (26)	8 (8)	2 (22)
Normal systolic function	88 (74)	9 (92)	7 (78)
Valvular disease	5 (4)	6 (6)	1 (11)

identified in eight of the patients with untreated suspected heart failure (table III). Valvular disease was seen in six patients (one with mitral stenosis, two with mitral regurgitation, and three with aortic stenosis). A large pericardial effusion was found in one patient. Treatment with an angiotensin converting enzyme inhibitor or diuretic, was recommended for 14 patients (14%).

Only nine patients with possible asymptomatic left ventricular systolic dysfunction were referred. Predisposing risk factors were, previous myocardial infarction (four patients), previous coronary bypass grafting (one patient), and hypertension with left ventricular hypertrophy on electrocardiography (four patients). Left ventricular systolic dysfunction was identified in two patients and important valvular disease was observed in one patient (with aortic regurgitation).

Discussion

Recent work has shown that patients with heart failure are not adequately investigated.⁹ All patients with suspected heart failure should have an echocardiogram as it allows rapid assessment of left ventricular systolic function and identification of potentially reversible causes of congestive heart failure.¹⁰ Most patients with suspected heart failure will be seen by general practitioners.⁶ However, echocardiography has previously been available to general practitioners only through referral to hospital specialists.

The rationale for open access diagnostic services is that they provide the opportunity for rapid diagnosis and prevent delay which may lead to inappropriate treatment. For the most part the condition being sought is treatable by the general practitioner. The service reduces the burden on hospital outpatient departments, which saves money.^{11,12} Open access echocardiography for the improved diagnosis and treatment of heart failure due to left ventricular systolic dysfunction clearly meets these aims.

Success of service

The open access echocardiography service dealt with over 250 patients in the first five months. In a comparable study of open access exercise testing only 140 patients were seen in two years.¹³ The demand for our service has been stable and the projected yearly total of patients is about 600. Thus, the service seems popular with local general practitioners.

Another measure of the value of a service is the proportion of positive findings. Among the treated patients, 26% were found to have serious left ventricular systolic dysfunction. This is in keeping with the findings of previous smaller studies which showed the difficulty of identifying left ventricular systolic dysfunction clinically.^{5,6} The rate of positive findings compares favourably with other reported direct access cardiac investigations such as exercise testing.¹³ A negative finding is also important, however, since it allows inappropriate treatment to be withdrawn. Withdrawal of diuretics was recommended for 45% of treated patients. A recent study has shown that diuretics can be safely withdrawn in patients with a low risk of underlying cardiac disease,¹⁴ but the decision to stop diuretics was left to the patient's general practitioner. Changes in treatment were thus recommended in nearly 70% of treated patients.

The prevalence of impaired left ventricular systolic function was considerably lower (8%) in patients referred with untreated symptoms of possible heart failure. This probably reflects a low index of suspicion by general practitioners since no treatment had been started. It is more debatable whether echocardi-

graphy is useful in this group since recommendations to start treatment were relatively few (14%). A negative finding did discount heart failure from the differential diagnosis of breathlessness and allowed further investigation or treatment to be planned. However, a chest radiograph may be as, or more, useful than an echocardiogram in such patients since it allows other causes of breathlessness such as chest disease to be assessed. A further benefit of echocardiography in all three groups was the identification of important valvular disease that was contributing to symptoms.

The benefit of treating patients with asymptomatic left ventricular dysfunction has been recently established.²³ Risk factors have been identified and were highlighted on our request form. However, very few patients in this category were referred. This may reflect either the reluctance of general practitioners to screen this type of patient or a lack of awareness of the potential benefit.

Workability

Recently concerns have been expressed about open access services in cardiology. It is feared that general practitioners might be indiscriminate in their referrals and cause an unmanageable increase in workload.¹⁵ Experience with open access endoscopy services does not bear this out.¹² Indeed, it has been suggested that hospital doctors are less discriminating in their use of these investigations.¹⁶ In our study only 12% of referrals were considered inappropriate. It has also been argued that a specialist opinion is preferable to an open access investigation.¹⁵ However, we found that a clear report with simple advice allowed the referring general practitioner to use the information provided by an echocardiogram.

The cost of this service must also be considered. The service described here requires the lease of an ultrasound machine, three technician sessions, and one consultant reporting session. On this basis, we estimate the cost of each echocardiogram at about £55. Set against this must be potential cost savings related to reduction in morbidity (including hospital admission) and mortality from treatment with angiotensin converting enzyme inhibitors. There should also be savings from discontinuing unnecessary treatment and avoiding unnecessary clinic referrals. Substitution of an echocardiogram for a chest radiograph would give more useful clinical information for no extra cost.

Some limitations to this study can be identified. Precise measurement of left ventricular function was possible in only 58% of patients because of obesity or airways disease. This is in keeping with the experience of other studies.¹⁷ In addition, it has been argued that detailed measurement of left ventricular function is not necessary since the experienced observer can assess whether it is seriously impaired by inspection alone.¹⁸ The symptoms and signs of congestive heart failure can arise in the presence of normal resting left ventricular systolic function possibly as a result of primary left ventricular diastolic dysfunction.¹⁹ We did not look at diastolic dysfunction because there remains considerable debate as to how left ventricular diastolic dysfunction should best be assessed by echocardiography.²⁰

Conclusion

This study shows that open access echocardiography is a popular and cost effective service for general practitioners. It allows rapid access to the quickest and easiest investigation for confirming the presence of left ventricular systolic dysfunction. It was most valuable

Key messages

- Heart failure due to left ventricular systolic dysfunction is difficult to diagnose accurately in the community
- Without accurate diagnosis many patients will be treated inappropriately
- Echocardiography allows rapid confirmation of the diagnosis
- Providing general practitioners with open access to echocardiography led to a change in treatment being recommended for 70% of patients taking diuretics for suspected heart failure
- The open access service was popular with general practitioners and did not lead to an unmanageable increase in workload

in assessing those patients in whom a presumptive clinical diagnosis of heart failure has been made and treatment begun. In this group, echocardiography led to an important change in clinical management in nearly 70% of cases.

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