Clinical audit

An audit of echocardiograms in acute left ventricular failure

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Summary

All patients with heart failure should have an echocardiogram to establish a diagnosis, both to aid treatment as well as for prognostic reasons. An audit of 100 case notes of patients admitted with acute left ventricular failure over a 12-month period found that 26 patients had not had an echocardiogram. Of the 74 who did have an echocardiogram 68 patients had reduced systolic function (mean ejection fraction 42%). Almost all (93%) were commenced on an angiotension-converting enzyme (ACE) inhibitor. Those who did not receive an ACE inhibitor had no contraindications to these drugs. Seventeen patients had a confirmed myocardial infarction. Of these, 11 had an echocardiogram and 10 were discharged home on an ACE inhibitor. Despite appropriate indications some patients are deprived of echocardiography as well as the benefits of ACE inhibitors.

Keywords: echocardiogram, audit, heart failure

The standard treatment of heart failure should now include an angiotensin-converting enzyme (ACE) inhibitor unless specifically contraindicated. These drugs have been shown not only to relieve symptoms but also to improve quality of life, reduce hospitalisation and increase survival rate.^{1–3} Echocardiography should be performed on patients presenting with heart failure to exclude a treatable cause, eg, aortic stenosis, which would also preclude the use of ACE inhibitors. Echocardiography can also be useful in determining prognosis as some features, eg, reduced systolic function, are associated with an increased mortality.^{4,5}

Methods

We undertook an audit of 100 case notes selected from a computerised list of 155 patients who were admitted to hospital having a diagnosis of acute left ventricular failure over a 12-month period. Patients who had died and patients in whom the diagnosis was equivocal were excluded. Collection of data included details of echocardiography, electrocardiograms, chest X-rays, biochemistry and medication on admission and discharge as well as out-

patient follow-up arrangements. Analysis was performed using the Epi info database.

Results

There were 53 females and 47 males, mean age 77.9 years (standard deviation 10.3), most of whom were admitted by general physicians (table 1). The majority (82%) had a history of ischaemic heart disease and/or hypertension. The mean ejection fraction was 42%. Seven patients were found to have aortic stenosis, three of whom were referred for aortic valve replacement due to severe disease. Of the 45 patients previously diagnosed as having heart failure, 26 had had at least one previous admission with an exacerbation of heart failure.

A total of 60 echocardiograms were requested (table 1). Of the 26 patients with a previous admission with heart failure, 17 had had an echocardiogram in the last 18 months and three had a repeat on this admission. A total of 74 patients therefore who were admitted with acute left ventricular failure had an echocardiogram either on this admission or within the last 18 months.

Almost half (12) of the 26 patients who had had a previous admission with heart failure were on an ACE inhibitor on this admission. Of the 41 patients started on an ACE inhibitor on this admission two had not had an echocardiogram. There were five patients who had not been prescribed an ACE inhibitor despite having reduced systolic function and no contraindications. Of ACE inhibitors started on this admission 17 were prescribed by geriatricians and 24, (including two without an echocardiogram) by general physicians.

Eleven of the 17 patients with a proven diagnosis of myocardial infarction had an echocardiogram on this admission. All 17 patients had normal renal function but only 10 patients were discharged on an ACE inhibitor.

Table 1 Characteristics of patient sample (n = 100). Figures in parentheses are standard deviations

	Admitted by	
	general physician	geriatrician
n	59	41
Mean age (years)	72.9 (9.7)	85.2 (5.9)
Length of stay (days)	8.8 (4)	11.2 (14)
Echocardiograms	39	21

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Table 2 Number of patients receiving anti-heart failure medication on admission and discharge

Medication	Admission (n)	Discharge (n)
Frusemide (40 mg daily)	29	45
Frusemide (80 mg daily)	18	38
Frusemide (120 mg daily)	2	5
Frusemide (> 120 mg daily)	2	7
ACE inhibitor	16	57
Thiazide	2	2
Digoxin	9	21
Aspirin	29	51

The medication profiles on admission and discharge can be seen in table 2.

Geriatricians were more likely to give follow-up appointments than were general physicians (44/59 *vs* 21/41, Chi-square = 0.9, *p* = 0.3).

Discussion

Management of heart failure should include an echocardiogram for both diagnostic and prognostic reasons (box 1). Echocardiography is a non-invasive and inexpensive technique which often gives an instant diagnosis (figures 1 and 2).

Until recently it was thought that the main mechanism for all cases of congestive heart failure was impaired left ventricular contractility (systolic dysfunction). However, recent studies,⁶⁻⁸ suggest that as many as 30–40% of all patients with congestive heart failure have evidence of diastolic dysfunction. The treatment of heart failure due to systolic and diastolic dysfunction may differ. Although diuretics are the first-line drugs in the treatment of heart-failure, patients with systolic dysfunction can tolerate higher doses of diuretics than patients with diastolic dysfunction. The use of ACE inhibitors has been shown to improve symptoms, quality of life, and exercise tolerance in patients with heart failure due to both systolic and diastolic dysfunction.^{2,9} Isosorbide dinitrate and hydralazine decrease mortality in patients with systolic and diastolic dysfunction and evidence of heart failure.^{3,5} Although digoxin may be useful in treating heart failure associated with sinus rhythm and systolic dysfunction,⁹ it should be used with caution in the presence of diastolic dysfunction. Echocardiography can easily distinguish between systolic and diastolic dysfunction. Studies have validated left ventricular diastolic filling parameters obtained with echocardiography against those obtained by contrast,¹⁰ and radionuclide ventriculography.^{11,12}

Of the 74 patients who had an echocardiogram in the present study, only six had a normal ejection fraction, implying normal left ventricular systolic function and consequently heart failure secondary to diastolic dysfunction. This is a lower prevalence than in other studies,^{13,14} in which 30–41% of elderly patients with congestive heart failure have been found to have diastolic dysfunction associated with a normal ejection fraction. It is impossible from

Echocardiography in heart failure can determine:

- systolic and diastolic dysfunction
- significant valvular heart disease, eg, aortic stenosis
- myocardial disease (cardiomyopathy)
- pericardial disease (pericardial effusion)
- complications of ischaemia, eg, cardiac thrombus, left ventricular aneurysm
- unsuspected congenital heart disease
- prosthetic valve function
- vegetations in endocarditis
- prognosis

Box 1

Figure 1 A technician performing an echocardiogram on a patient

Figure 2 A parasternal long axis view showing a left atrial myxoma (arrowed). AO = aortic valve, LV = left ventricle, MV = mitral valve

clinical examination alone to distinguish diastolic from systolic dysfunction in patients with heart failure. Since the mechanism influences therapeutic decisions, an echocardiogram is required to ensure optimal treatment.

The finding that seven patients admitted with acute left ventricular failure and a myocardial infarction were discharged without an ACE inhibitor is disappointing, especially in view of recent studies showing a reduced mortality in these patients.¹⁴⁻¹⁶

Echocardiography is useful in diagnosing the presence and severity of valvular heart disease which may be the cause of congestive heart failure. Severe aortic stenosis causing heart failure may be clinically undetectable with no audible heart murmur because of a low cardiac output. Unless referred for an aortic valve replacement the prognosis is poor.¹⁷ The use of

Investigations in heart failure
<ul style="list-style-type: none">• baseline blood tests (full blood count, random blood sugar, thyroid function tests, etc)• chest X-ray• electrocardiogram• echocardiogram

Box 2

ACE inhibitors in patients with aortic stenosis may be deleterious and this diagnosis should be excluded by echocardiography before these drugs are prescribed.

As well as being an essential diagnostic tool, echocardiography can also provide prognostic information. The prognosis for patients with heart failure due to systolic dysfunction is worse (19% annual mortality) than for patients with diastolic dysfunction (8% annual mortality).⁴ Congestive heart failure is a major cause of morbidity and mortality, especially in patients over 65 years of age. The cause of heart failure should always be sought (box 2). Some drugs, particularly ACE inhibitors, have been shown to reduce morbidity and mortality in heart failure and, providing there are no specific contraindications, patients with heart failure should not be deprived of the benefits of these drugs.

1 The SOLVD Investigators. Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *N Engl J Med* 1991; 325: 293–302.

2 CONSENSUS Trial Study Group. Effects of enalapril on mortality in severe congestive heart failure. *N Engl J Med* 1987; 316: 1429–35.

3 Cohn JN, Johnson G, Ziesche S, *et al.* A comparison of enalapril with hydralazine and isosorbide dinitrate in the treatment of chronic congestive heart failure. *N Engl J Med* 1991; 325: 303–10.

4 Aronow WS, Ahn S, Kronzon I. Prognosis of congestive heart failure in elderly patients with normal versus abnormal left ventricular systolic function associated with coronary artery disease. *Am J Cardiol* 1990; 66: 1257–9.

5 Cohn JN, Johnson G, for the Veterans Administrative Cooperative Group. Heart failure with normal ejection fraction. The V-HeFT Study. *Circulation* 1990; 81 (suppl III): III48–53.

6 Echeverria HH, Bilsker MS, Myerburg RJ, Kessler KM. Congestive heart failure: echocardiographic insights. *Am J Med* 1983; 75: 750–5.

7 Dougherty AH, Naccarelli GV, Gray EL, Hicks CH, Goldstein RA. Congestive heart failure with normal systolic function. *Am J Cardiol* 1984; 54: 778–82.

8 Soufer R, Wohlgerlerner D, Vita NA, *et al.* Intact systolic left ventricular function in clinical congestive heart failure. *Am J Cardiol* 1985; 55: 1032–6.

9 The Captopril-Digoxin Multicentre Research Group. Comparative effects of captopril and digoxin in patients with mild to moderate heart failure. *JAMA* 1988; 259: 539–44.

10 Rokey R, Kuo LC, Zoghbi WA, Limacher MC, Quinones MA. Determination of parameters of left ventricular diastolic filling with pulsed doppler echocardiography: comparison with cineangiography. *Circulation* 1985; 71: 543–50.

11 Spirito P, Maron BJ, Bonow RO. Non-invasive assessment of left ventricular diastolic function: comparative analysis of doppler echocardiographic and radionuclide angiographic techniques. *J Am Coll Cardiol* 1986; 7: 518–26.

12 Pearson AC, Labovitz AJ, Goodgold HM, Williams GA. Comparison of radionuclide ventriculography and doppler in the evaluation of left ventricular diastolic filling. *Am J Cardiol* 1988; 61: 446–54.

13 Wong WF, Gold S, Fukuyama O, *et al.* Diastolic dysfunction in elderly patients with congestive heart failure. *Am J Cardiol* 1989; 63: 1526–8.

14 ISIS-4 Collaborative Group. Fourth International Study of Infarct Survival; protocol for a large simple study of the effects of oral mononitrate, of oral captopril and of intravenous magnesium. *Am J Cardiol* 1991; 68: 87D-100D.

15 Pfeffer MA, Braunwald E, Moye LA, *et al.* Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after myocardial infarction. Results of the survival and ventricular enlargement trial. *N Engl J Med* 1992; 327: 669–77.

16 The Acute Infarction Ramipril Efficacy (AIRE) Study Investigators. Effects of ramipril on mortality and morbidity of survivors of acute myocardial infarction with clinical evidence of heart failure. *Lancet* 1993; 342: 821–7.

17 Aronow WS, Ahn C, Kronzon I, *et al.* Prognosis of congestive heart failure in patients aged >62 years with unoperative severe aortic stenosis. *Am J Cardiol* 1993; 72: 846–8.