Echocardiography, congestive heart failure and integrated care

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ABSTRACT

Background

Congestive heart failure (CHF) is a common chronic disorder that carries a poor prognosis. Echocardiography is the diagnostic investigation of choice in patients with CHF.

Objectives

To assess changes in echocardiographic status as a result of providing free direct access to general practitioners as part of an integrated care programme. To examine the use of echocardiography in the diagnosis of CHF in primary care and secondary care. To do a cost analysis of the use of echocardiography in the diagnosis of congestive heart failure.

Methods

Data on echocardiography status (*Yes*, *No* or *Unknown*) in CHF patients was collected from general practitioners at the time patients with CHF enrolled in an Integrated Care project. They were then offered free direct access echocardiography and status data was recollected after six months. Echocardiography results were collected in order to calculate the percentage of clinically diagnosed CHF patients who had systolic dysfunction on echocardiogram.

Results

The number of patients that had echocardiograms performed increased from 25% (37/150) at the start of the project to 79% (119/150) by the end of the project. A formal report was available for analysis in 107 patients. In this group, only 32% had evidence of left ventricular systolic function by echocardiography. A further 14% had evidence of another possible reason for heart failure reported (nine diastolic dysfunction, two left ventricular hypertrophy and four valve disease). General practitioners were often not aware of the results of the echocardiograms that had been performed. There is a cost benefit in the accurate diagnosis of the syndrome of CHF and the underlying cause.

Conclusion

Echocardiography is an important and under-utilised investigation in patients being treated for CHF. The majority of patients treated for CHF in the community do not have systolic dysfunction. Integrated care projects can increase the utilisation of this procedure.

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Introduction

Congestive heart failure (CHF) is a major public health problem in the western world. In NZ the management of CHF has been estimated to consume 1.5% of the total health care budget.[1] The diagnosis may be problematic due to the non-specific nature of the characteristic signs and symptoms and the fact that CHF may arise from any cardiac disorder that impairs ventricular filling or ejection.[2] Generally, however, the diagnosis is made on the basis of a patient's clinical history and examination, combined with evidence of cardiac dysfunction, and where possible a response to treatment.[3] Echocardiography is currently the investigational tool of choice to show the presence of left ventricular impairment[4] or other possible cardiac causes of the syndrome.

In response to these problems, Counties Manukau District Health in association with local South Auckland Independent Practitioners Associations produced an integrated care CHF intervention programme. This paper discusses the outcomes of this

programme that are specific to echocardiographic status of patients enrolled in the project.

Objectives

1. To assess changes in echocardiogram status as a result of providing free direct access to general practitioners as part of an integrated care programme.
2. To examine the use of echocardiography in the diagnosis of CHF in primary care and secondary care.
3. To do a cost analysis of the use of echocardiography in the diagnosis of congestive heart failure.

Methodology

Data was collected from GPs regarding the echo status of all patients enrolled in the Counties Manukau CHF Integrated Care project. The CHF project is a programme that was developed between Counties Manukau District Health and two local South Auckland IPAs (South-Med and Procare). The programme included: updating general practitioners (GPs) and practice nurses (PNs) with accurate information regarding the latest evidence based management of congestive heart failure, and a series of free patient assessments by health providers (one by the GP and two by practice nurses) to patients with CHF. A follow-up visit with the GP was planned at three to six months as part of usual care, however this visit was not subsidised. Information on the patient's CHF status was electronically collected during each health care visit. Free educational material was available to patients and included a CHF educational booklet; a personalised patient-held care plan containing details of all their health problems, medications, an action plan for CHF, and a summary of their lifestyle goals.

Free direct access echocardiography at Middlemore Hospital was also offered to patients enrolled in the programme. Standard two-dimensional and Doppler echocardiographic studies were performed using a Ving-Med System 5 scanner (GE Ving-Med Ultrasound, Horten, Norway). Left ventricular ejection fraction was calculated by the D2 method.[5] Left ventricular dysfunction was defined as an ejection fraction less than 50%.

The project enrolled 150 patients from 18 general practitioners in the South Auckland area, commencing January 2001. Patients were followed up for approximately three to six months. Patient selection was based on the following criteria:

- patients with CHF and left ventricular systolic dysfunction confirmed by cardiac imaging (usually echocardiography), *OR*
- where the diagnosis was not confirmed, those patients with a clinical diagnosis of CHF who their GPs thought would benefit from such a programme.

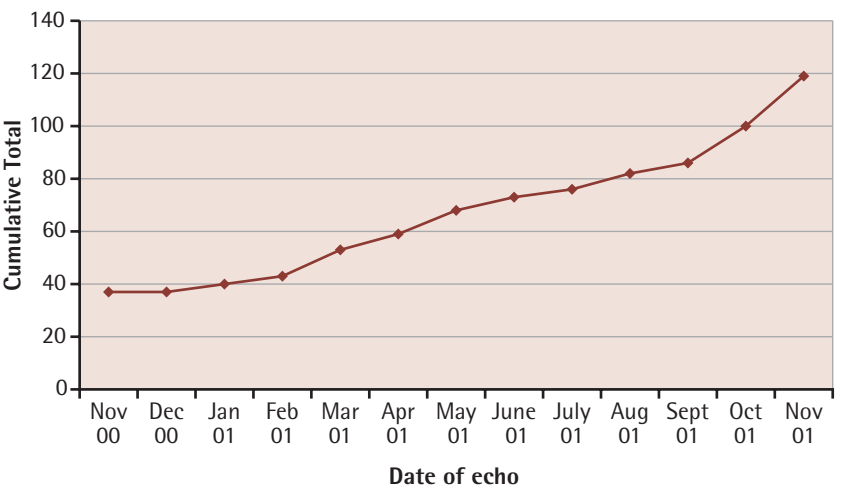
As part of this project information was also collected on the echocardiographic status of patients. When patients were reviewed by their GPs, information was electronically entered onto a CHF template that was sent through to an evaluator for analysis. The information requested on this template included whether the patient had had an echocardiogram at any stage in the past. Possible responses included *Yes* (the patient had had a previous echo), *No* (no previous echo) or *Unknown* (echo status was unknown to the GPs).

Concurrently echocardiographic status information was collected on these same patients from the Middlemore Hospital (the local hospital) cardiac database. Information collected included the date of the echocardiogram, the presence of systolic or diastolic dysfunction and the severity of any dysfunction. This information was updated each week until the project ended in December 2001.

If GPs had provided information that was either *No* or *Unknown* regarding a patient's echo status and this information did not match that held by the hospital, then the relevant reports were sent out to those GPs. When echocardiograms had been performed at an institution other than Middlemore Hospital, a copy of the report was requested from the GP to complete the hospital database.

Patients enrolled in the project gave informed consent for information to be collected and shared between project health professionals. This information was also to be used for evaluation purposes. Consent was recorded by participating GPs and entered into the CHF electronic template at the time of the CHF consultation. Ethics committee advice was sought, and as this project was not researching any new intervention and the information to be gained was to be used for audit and evaluation

Figure 1. Echocardiographic status during the CHF project period



purposes, full ethics committee approval was not deemed necessary.

Results

Echocardiography status changes during the study period

Figure 1 shows how, over time, echocardiographic status changed during the project period. At the start of the project, 37 patients had had an echo (25% of total patients enrolled in the project); 17 (49%) of these studies were more than a year old. During the study period a further 70 (47% of all patients) had an echo completed at the Middlemore Hospital site and a further 12 (8%) were completed at other sites, so that by the end of the study 119 patients had had an echocardiogram performed.

Health provider knowledge of echo status

Of total patients enrolled in the study (Table 1), GPs provided echo status information on 148 (99% of all participants). From this data, 73 patients had had a previous echo, 56 had not and 19 patients had an echo status that was unknown.

However, when the Middlemore Hospital databases were searched with regard to the echo status of the patients enrolled in the project, the non-matched results in Table 2 were found. Data was available on the same 148 patients.

It appears that GPs were aware of only 51% of the reports that were available on their patients (Table 3). Middlemore Hospital had also not received reports on 12/19 (63%) of patients that GPs had arranged an echo for at another site (Table 3).

Table 1. GP Echo Status

Echo Status	Number	Percentage
Yes	73	49
No	56	38
Unknown	19	13
Total	**148**	**100**

The combined number of patients that had had an echo report either confirmed by Middlemore or by the GP was 119 (79% of all patients).

Echocardiography report results

Echo reports of the 100 patients who had had the test performed at Middlemore Hospital plus an additional seven echo reports that were supplied to us from GPs were reviewed. The GP-supplied echo reports were from the total of 19 reports that GPs held and that the local hospital did not have any record of. This combined data showed that only 34/107 (32%) of patients had left ventricular systolic dysfunction (seven mild, 10 moderate, 17 severe). A further 9/107 (8%) had evidence of diastolic dysfunction reported, though it should be noted that diastolic function was not commented on in the majority of reports. Another possible reason for heart failure was reported in a further six patients (two with left ventricular hypertrophy and four with valve disease).

At least 31 patients were entered into the study despite their GP having previously received an echo, which had shown no evidence of systolic dysfunction (twelve reports were unable to be obtained from the participating GPs, or were not held by the hospital).

Table 2. Middlemore Hospital Echo Status

Echo Status	Number	Percentage
Yes	100	68
No	41	28
Waiting list	1	1
DNA	3	2
Deceased	2	1
Missing data	1	1

Cost analysis results

The total estimated cost of cardiologist review and hospital investigation for chronic shortness of breath is $688 (Table 4). This includes the cost of relevant investigations, including chest x-ray, spirometry, ECG and echocardiography. The total cost of GP initiated investigations is $391 (Table 5).

This compares to the annualised cost of treatment for CHF of $617.12 (Table 6). The prognosis of heart failure remains poor, even in the current era, with annual mortality rates of up to 23% reported in recent clinical trials in significantly symptomatic patients.[6,7] The cost to patients of having been incorrectly given the diagnosis of a condition with a poor prognosis cannot be calculated.

Table 3. Matching of Middlemore and GP data

Middlemore Echo Status	GP Echo Status	Percentage
Yes = 100	Yes = 51	51
	No = 35	35
	Unknown = 14	14
No = 41	No = 19	46
	Yes = 19	46
	Unknown = 3	7

Discussion

'Heart failure' is not synonymous with cardiomyopathy or left ventricular impairment. Rather it is a syndrome that results from cardiac output being insufficient to meet the metabolic requirements of the body. The primary abnormality may be of the pericardium, valves or myocardium, or may be due to increased metabolic demand.[8] In many patients more than one abnormality is present. The single most useful test in the evaluation of patients with the clinical syndrome of CHF is echocardiography.[4] This gives comprehensive structural and

Table 4. Cost of hospital investigations to confirm CHF / Chronic shortness of breath diagnosis

Procedure	Actual Total Cost
Cardiology Outpatient New	$255*
Echocardiogram	$250*
Chest x-ray	$56*
Spirometry	$75*
ECG	$52*
TOTAL	**$688**

* *Counties Manukau District Health Data*

Table 5. Cost of GP investigations to confirm CHF / Chronic shortness of breath diagnosis

Procedure	Actual Total Cost
GP Consultation	$45*
Echocardiogram	$250†
Chest x-ray	$56†
Spirometry	$20‡
ECG	$20‡
TOTAL	**$391**

* *White Cross cost data*
† *Counties Manukau District Health data*
‡ *South-Med Independent Practitioners Association cost data.*

functional information about the heart, and allows treatment to be more specifically directed.

We have presented the results of echocardiographic data from an integrated care CHF intervention project. The project was highly successful in increasing GP access to echocardiography.

One of the most important findings of this study was that 68% of the patients who had had an echocardiogram by the end of the CHF project did not have systolic dysfunction. This figure is similar to that found in other trials of community diagnosis of CHF,[9,10] and confirms the need for objective testing. The symptoms and signs of CHF are non-specific and may be difficult to identify. Patients may incorrectly be diagnosed as having heart failure who have breathlessness or lethargy due to other causes.[2] The diagnosis has significant prognostic implications[6,7] and is now treated with an increasing armamentarium of medications. The clinical diagnosis should therefore be confirmed with objective testing.

It is recognised that up to 50% of CHF, both in the community or requiring admission to hospital, is due to impaired relaxation of the left ventricle (diastolic dysfunction).[11,12] Clinical trials of heart failure therapy have largely been performed in patients with proven systolic dysfunction. Current guidelines for CHF management therefore focus on this patient group. Heart failure due to diastolic dysfunction cannot be distinguished clinically or by chest x-ray from that due to systolic dysfunction and is associated with considerable morbidity and mortality.[13] Further progress in the treatment of this patient group will only be made if patients with diastolic heart failure are identified and entered into randomised controlled trials of therapy.

In this project, only 9% of subjects had isolated diastolic dysfunction reported. Diastolic function was not systematically commented on. This has important implications for the echo assessment of patients with CHF. Echocardiographic diagnosis of diastolic function may be difficult. New Doppler methods for studying diastolic function[14] such as colour M-Mode Doppler and tissue velocity imaging, which are not preload dependent, may improve the identification of patients with this disorder.

It is likely that a proportion of patients were entered into the CHF project with a clinical diagnosis based on non-specific symptoms and signs such as breathlessness, lethargy and ankle swelling in whom CHF was not present. Interestingly a high number of patients entered into the project who already had a negative echocardiogram for left ventricular dysfunction. The reason for this could not be determined from the information collected, but may be due to the echocardiograms being out of date, the results not being understood or not being believed. In addition, the data show that GPs were not always

Table 6. Cost of medical care for one year for CHF treatment

Medication	Three-monthly costs	Annual patient cost
Frusemide 40mg*	$6.75	$27.00
Metoprolol 47.5mg*	$31.44	$125.76
Inhibace 5mg*	$44.01	$176.04
Spironotone 50mg*	$17.33	$69.32
Digoxin 0.25mg*	$9.75	$39.00
GP visits†	$45.00	$180.00
TOTAL	**$154.28**	**$617.12**

* *All of the above medications carry a full government subsidy. Cost estimates are taken from Health Benefits and are calculated on the following basis: Pharmac schedule price + 3.5% margin + service of $4.9723 per item + GST of 12.5%. These are minimum prices and some pharmacy may charge a further mark-up fee. Calculations assume that patients are category A3 (non-subsided patients).*

† *GP visits are assumed to be every 3 months – average cost $45 dollars (White Cross cost data).*

aware when an echocardiogram had been performed on their patients by secondary care. This result may be due in part to a lag between an echocardiogram being performed and the collection of results from primary care. However, this may indicate the need for additional communication of results beyond sending a paper report and for GP CME on the interpretation of results of echocardiograph studies when direct access is available.

It is also apparent that hospitals do not have access to echocardiogram reports that GPs may hold. This may occur for a number of reasons, however this finding reinforces the need for improved integration of care between primary and secondary services. These findings also provide evidence that, at the present time, communication between health care providers is suboptimal.

These results also reveal that by the end of the project, 21% of enrolled patients still had not had an echo completed or requested during the study period. The reasons for this may include: patients were still on the hospital waiting list for the procedure, referrals had been lost, patients had been referred for echocardiograms to private providers or patients had not been referred at all to any providers. It is recommended that qualitative work be undertaken to further investigate this finding.

As the diagnosis of CHF is clinically difficult to make and the treatment has potential side effects, it would be important to lower this figure as much as possible. GPs, for a variety of reasons, have had difficulties accessing echocardiograms for their patients.[15] Part of the solution to this problem may be the introduction of direct speedy access for GPs to echocardiography. Direct access would help to lessen the number of patients being treated inappropriately according to the guidelines for CHF due to systolic dysfunction (although even when echo results are negative, some patients are still being treated). General practitioners usually have no training in echocardiography and in this project the reporting cardiologist often had limited information about the patient. In order for this relatively expensive test to be utilised to patients' best advantage, we believe that it is necessary that there is a forum for interactive communication between the general practitioner and the cardiologist, and that simple tests that might exclude the diagnosis be required before the echocardiogram request is made. This finding also has implications for the selection criteria of patients for future integrated care projects in that the diagnosis of CHF should be clarified before patients are enrolled.

Finally in the economic analysis, the cost of fully investigating a patient in secondary care for chronic shortness of breath is $688. The cost of GP investigations with direct access to echocardiography is $391. This compares to the annualised cost to treatment for CHF of $617.12. Therefore the additional cost of full objective work-up should not be prohibitive in this chronic disease.

Conclusion

Patients being treated for CHF in the community have generally not had an echocardiogram performed. Systolic dysfunction was present in the minority of patients in this project. Optimal diagnosis and treatment of patients can be enhanced by improved access to echocardiography and by integrated care between primary and secondary health professionals.

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