

Efficacy of community-based multidisciplinary disease management of chronic heart failure

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ABSTRACT

Introduction: A multidisciplinary disease management (DM) programme in chronic heart failure (CHF) improves clinical outcome. The efficacy of such a programme in a heterogeneous Asian community is not well established. Therefore, we undertook the evaluation of the efficacy of the multidisciplinary community-based DM CHF programme.

Methods: This was a prospective study involving 154 patients (54 percent male) with a primary diagnosis of CHF, New York Heart Association functional class III/IV CHF, with left ventricular ejection fraction (LVEF) less than 40 percent. The mean age was 65 +/- 12 years and mean LVEF was 27 +/- 9 percent. We evaluated CHF hospitalisation, quality of life, activity status and quality of care (percentage of patients who received ACE inhibitors/angiotensin receptor blockers (ARB) and beta blockers after a period of six months).

Results: At six months, there was improvement in the quality of life and activity status ($p < 0.001$). ACE inhibitors/ARB were maintained in 97 percent of the patients and there was an increased usage of beta blockers (p -value equals 0.001). The rate of CHF hospitalisation was reduced by 68 percent (p -value is less than 0.001) and there was no mortality.

Conclusion: The multidisciplinary DM of CHF in a heterogeneous Asian community showed significant improvement in quality of life, quality of care and reduction in CHF hospitalisation.

Keywords: chronic heart failure, disease management, heart failure, quality of care, quality of life

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INTRODUCTION

Chronic heart failure (CHF) is associated with increasing morbidity, mortality and frequent hospitalisation. This places a significant economic burden on society. Numerous studies have identified the negative impact of behavioural and socioeconomic factors on clinical outcomes of heart failure patients.⁽¹⁻⁵⁾ In addition, physicians still underutilise CHF medication which has proven benefits.⁽⁶⁻⁸⁾ It has been shown that a multidisciplinary disease management (DM) heart failure programme, managed by a heart failure specialist, improves morbidity, mortality and rehospitalisation rates.⁽⁹⁻¹¹⁾ The Asian community has a diverse social and cultural background, and the efficacy of a multidisciplinary DM programme is not well established. We undertook a study to assess the efficacy of the multidisciplinary DM CHF programme in a heterogeneous Asian community-based setting.

METHODS

This study was performed at the National University Hospital, Singapore. Patients in this study included those with a primary diagnosis of New York Heart Association (NYHA) functional class III/IV CHF with left ventricular ejection fraction (LVEF) $< 40\%$. Patients were ineligible if they had any of the following: valvular heart disease requiring surgery, hypertrophic cardiomyopathy with left ventricular outflow tract obstruction, restrictive cardiomyopathy, constrictive pericarditis, psychiatric disease or dementia or any cognitive condition likely to impair compliance, concurrent non-cardiac comorbidity likely to cause repeat hospitalisation, untreated thyroid disease, serum creatinine ≥ 265 $\mu\text{mol/L}$, cardiac surgery or myocardial infarction during the index admission.

The members of the heart failure programme consist of the CHF cardiologist, disease managers and CHF nurses, pharmacist, physiotherapist, dietician and medical social worker. The CHF cardiologist is the physician and the overall leader piloting the programme. The disease managers and CHF nurses play a role in educating patients and their caregivers on heart failure and self-care management of their condition. In addition, they are involved in coordinating the screening, selecting and recruitment of patients into the programme. Finally,

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they are also involved in the regular tracking of clinical progress of heart failure patients and handling enquiries via telephone. The roles of the pharmacist, physiotherapist and dietician are to educate and counsel the patient, with an aim to promote compliance to medication, regular physical activity and moderate exercise regime, fluid restriction and low salt diet, respectively. The medical social worker will also assist in managing the socioeconomic issues, in particular, the medical cost associated with CHF.

Baseline clinical evaluation was performed by the CHF cardiologist. LVEF was documented from two dimensional echocardiography performed over the last six months. Patients and caregivers were educated and counselled by the multidisciplinary team, in particular, with regard to recommended medication, diet and exercise management. All patients were put on telephonic case management. Telephone calls were placed within one week after discharge and monthly thereafter, unless a problem occurred that required more frequent contact. The telephone nurse coordinator followed a set script and pursued problems as clinically indicated. Adjustment of medications was made under the direction of the CHF cardiologist. The management plan was individualised for each patient, based on current CHF guidelines and clinical experience. Patients, together with their caregivers, were reviewed in the CHF clinic, with the frequency of visits depending on the severity of the underlying clinical conditions.

At the end of six months, the primary outcome variables were the composite of the total mortality and the total number of CHF hospitalisations. The secondary outcome variables were changes in the quality of life, measured by the Minnesota Living With Heart Failure Questionnaire (MLWHFQ) score.⁽¹²⁾ The MLWHFQ best score was 0 and the worst was 105. Improvement is indicative when there is a 10-point or 20% reduction in the MLWHFQ score from the baseline. Secondary outcomes also included quantification of activity status, by the six-minute walk test (6MWT)⁽¹³⁾, NYHA class and quality of care (percentage of patients receiving target ACE inhibitors or approved angiotensin receptor blockers (ARB) and beta blockers).

Continuous variables were expressed in the mean form and the differences were evaluated by non-parametric methods. Categorical variables were presented as counts and percentages and the differences were evaluated by using chi-square contingency table methods or Fisher's exact test. A p-value of less than 0.05 was considered to be statistically significant.

RESULTS

From November 2002 until June 2004, 154 patients were enrolled into the study. The demographical and baseline

Table I. Baseline characteristics of subjects.

Variables	Study group n = 154 (%)
Demographical data	
Age (years)	65 ± 12
Male	82 (54)
Race	
Chinese	87 (56)
Malay	40 (26)
Indian	25 (17)
Others	2 (1)
Baseline clinical data	
Hypertension	121 (79)
Diabetes mellitus	95 (62)
Ischaemic aetiology	96 (63)
NYHA functional class	
II	74 (48)
III	77 (50)
Medications	
ACE inhibitors	123 (80)
Angiotensin receptor blockers	25 (16)
Beta blockers	
Carvedilol	92 (60)
Bisoprolol	4 (3)
Atenolol	11 (7)
Diuretics	
Spironolactone	71 (46)
Frusemide	118 (77)
Digoxin	48 (31)
Hydralazine	0
Long-acting nitrate	74 (48)
Physical examination	
Pulse (beats/minute)	84 ± 14
Blood pressure (mmHg)	
Systolic	130 ± 20
Diastolic	77 ± 12
Laboratory data	
Creatinine (umol/L)	108 ± 45
Sodium (mmol/L)	136 ± 45
Six-minute walk test (metres)	273 ± 128
Minnesota Living With Heart Failure Questionnaire	
Total	43 ± 30
Physical	33 ± 20
Emotional	8.3 ± 7.3

characteristics are shown on Table I. The mean age was 65 ± 12 years and 54% were males. The patients were predominantly Chinese (56%), with the Malays (26%) and Indians (17%) contributing to the remaining study

Table II. Clinical data at baseline and six months.

	Baseline (%)	At six months (%)	p-value
NYHA functional class			< 0.001
I	0	31 (20)	
II	74 (48)	118 (77)	
III	77 (50)	4 (3)	
IV	3 (2)	1 (1)	
Medications			
ACE inhibitors	123 (80)	126 (82)	0.66
ARBs	25 (16)	24 (16)	0.87
Beta blockers	107 (69)	124 (81)	0.001
Spironolactone	71 (46)	74 (48)	0.46
Minnesota Living With Heart Failure Questionnaire			
Total	43 ± 30	24 ± 20	< 0.001
Physical	33 ± 20	19 ± 16	
Emotional	8.3 ± 7.3	5.1 ± 5.4	
Six-minute walk test (metres)	273 ± 128	316 ± 119	< 0.001

population. The aetiology for CHF was predominantly coronary heart disease (75%), non-ischaemic dilated cardiomyopathy (12%), hypertension (7%), valvular heart disease (3%) and other aetiology (3%), such as hypertrophic cardiomyopathy. Significant CHF comorbidities of hypertension and diabetes mellitus were present in 79% and 62% of the sample size, respectively. The mean LVEF of the study group was $27 \pm 9\%$. The MLWHFQ score and 6MWT results were consistent with a moderate impairment in quality of life and functional capacity, respectively. Upon recruitment, 98.1% were in NYHA functional class II/III.

At the time of recruitment, 80% were receiving ACE inhibitors, while 16% on ARB and 70% had concomitant beta blockers (86% carvedilol, 4% bisoprolol and 10% atenolol).

The outcomes at six months are shown in Table II. There was no mortality observed at six months. There were 17 CHF hospitalisations, equivalent to a significant reduction of 68% ($p < 0.001$) at six months. 98% of the patients could be maintained on ACE inhibitors/ARB. The dose of the most commonly-used ACE inhibitors, enalapril, was 14.3 ± 9.0 mg/day and 16.8 ± 10.6 mg/day at baseline and six months, respectively. At six months, dose up-titration was performed for 26% of the study population. There was a significant increase to 81% in the usage of beta blocker ($p = 0.001$). The dose of the most commonly-used beta blocker, carvedilol, was 10.3 ± 8.0 mg/day and 13.3 ± 10.7 mg/day at baseline and six months, respectively. At six months, dose up-titration was performed for 39% of the study population. There was a reduction in the dose of diuretics (frusemide) used, with the dose of 50.8 ± 38.1 mg/day and 43.9 ± 24.9 mg/day

at baseline and six months, respectively. The quality of life and activity status showed significant improvement at six months, as reflected by a decrease in the MLFHQ total score ($p < 0.001$) and an increase in the mean distance of 6MWT ($p < 0.001$), respectively. Overall, the NYHA functional status had improved ($p < 0.001$), with an increase in numbers in the NYHA Class II/I functional status (96.8%).

DISCUSSION

The management of CHF is becoming more complex and requiring more expertise and non-CHF physician's time. Hospital admission for CHF is frequent, and readmission rates of up to 44% within six months have been reported.⁽¹⁴⁾ Behavioural factors account for a large number of CHF hospitalisations.⁽¹⁻⁴⁾ The multidisciplinary DM approach to CHF has been shown to improve clinical outcome.⁽⁹⁻¹¹⁾ It brings together a core of professionals who are champions of the concept and who will work diligently to maintain the goal of enhancing the patient's quality of life. Through this model of clinical management, it promotes an integrated, systematic assessment and management, patient counselling and education, patient compliance to medication and dietary requirement and facilitation of hospital discharge, with an emphasis towards ambulatory clinical care. Through these approaches, the programme was able to effectively correct the negative impact of behavioural and socioeconomic factors on the clinical outcomes of CHF patients. However, given the large heterogeneous Asian community, it is not clear if such approach will show similar benefits in view of the diverse cultural beliefs and practices. In our study, a multidisciplinary

DM in a heart failure programme in a large heterogeneous community was associated with a significant reduction of hospitalisation rates of 68% and no mortality was seen at six months. In addition, the quality of life and physical activity improved significantly, as assessed by MLWHFQ, 6MWT and NYHA functional status.

The ACE inhibitors and beta-blockers are important pharmacological agents which significantly influence morbidity and mortality in CHF. In our clinical practice, every effort is made to uptitrate the doses of these medications at the interval review to the dose levels used in major clinical CHF trials. However, it is obvious that the dose requirement for medications in our Asian patients is low. The mean increase in dosages at six months for enalapril and carvedilol were 2.5 ± 1.6 mg/day and 3 ± 2.7 mg/day, respectively, limited predominantly by hypotension. Despite the low doses of ACE inhibitors and beta-blockers, this study showed significant improvement in quality of life, quality of care and reduction in CHF hospitalisations. In addition, the usage of ACE inhibitors/ARB was maintained at a high level of 97%, despite prevalence of its underutilisation worldwide⁽⁶⁻⁸⁾ and the social diversity. In addition, significantly more patients (81%) were able to tolerate beta blockers. We believe this had significant contribution to the successful overall clinical outcome observed in our CHF patients. The positive clinical outcome of this study is comparable to previous studies conducted in the western hemisphere.^(9,10) The local multidisciplinary DM of CHF, utilising current evidence-based practices, frequent monitoring, intensive and continuing education to patients and caregivers, is efficacious in our heterogeneous Asian community.

There are several limitations to our study. It is not designed to analyse the relative contributions of its various components in this multidisciplinary approach. We understand that not all CHF patients require extensive intervention, and we are unable to provide data with regard to the subgroups that will benefit the most from DM. We did not perform any cost analysis; however, recent community-based studies did not show significant reductions in cost.⁽¹¹⁾ Nevertheless, the results are relevant in demonstrating the efficacy of such programmes in a multiethnic community possessing diverse behavioural factors. In summary, the multidisciplinary DM approach

to CHF in the heterogeneous Asian community is efficacious. There is a significant reduction in CHF hospitalisations, improvement in quality of life and significant increased utilisation of ACE inhibitors/ARB and beta-blockers.

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