

Impact of a Multidisciplinary Heart Failure Management Programme on Clinical Outcomes and Hospital Admissions

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LEUNG ET AL.: Impact of a Multidisciplinary Heart Failure Management Programme on Clinical Outcomes and Hospital Admissions. Objectives: Heart failure is associated with significant morbidity and high admission rate. We evaluated the impact of a multidisciplinary heart failure management programme in a regional hospital. **Methods:** From March 2001 to January 2003, fourteen patients with heart failure and history of ≥ 1 hospitalization for heart failure in the previous 6 months were recruited. Patients attended the programme twice per week for 3 months. Patients were cared by a multidisciplinary team including cardiologist, geriatrician, registered nurse, physiotherapist, occupational therapist and dietitian. All patients were counseled on different aspects about heart failure and received exercise training. Medications for heart failure were optimized. Knowledge of the disease, drug compliance, functional class, exercise capacity and quality of life were assessed before and after the programme. Number of heart failure hospitalization and the cost of care within the 6 months before enrolment were compared to that within the 6 months after enrolment. **Results:** The number of hospitalization for heart failure was reduced significantly from 28 to 6 (a reduction of 78.6%, $p < 0.001$). Knowledge score, drug compliance score, New York Heart Association (NYHA) class, 6-minute walk and quality of life scores all improved significantly. An estimated cost saving of HK\$11,340 per patient was achieved over a 6-month time frame (reduction of in-patient costs by HK\$35,880 per patient and an increase in outpatient costs by HK\$24,540 per patient). **Conclusions:** Multidisciplinary heart failure management programme is feasible in our locality. It can improve clinical outcomes; reduce heart failure hospitalizations and the high cost burden of this condition. (J HK Coll Cardiol 2004;12:16-22)

Cardiac rehabilitation, exercise, heart failure, multidisciplinary approach

摘要

目的：心力衰竭往往伴隨嚴重的病殘和高入院率。我們評估心力衰竭的多學科治療方案在地區醫院中的影響。**方法：**從2001年3月至2003年1月，14位心力衰竭的病人入組研究，這些病人在既往6個月中因心力衰竭至少住院1次以上。病人每周二次參加這一治療方案，時間持續3個月。這些病人有一個多學科的醫護隊伍來治療，其中包括有心臟病專科醫生、老年病專科醫生、註冊護士、心理治療師、職業治療師和營養師。所有病人接受了不同角度關於心力衰竭的忠告和運動訓練。心力衰竭的藥物治療也採用最優化。在實施治療方案的前後，評估病人對於疾病的知識、藥物的順從性、功能分級、運動能力和生活質量。在該方案實施前6個月的心力衰竭住院次數和費用與實施該方案後6個月的作對比。**結果：**心力衰竭的住院次數從28次顯著減少到6次(減少了78.6%, $p < 0.001$)。疾病知識評分、藥物順從性評分、紐約心臟協會分級、6分鐘步行評分和生活質量評分均有顯著的提高。在6個月的時間框架內，每一位病人平均節約HK\$11,340(每一位病人減少住院費用HK\$35,880，而每一位病人增加門診費用HK\$24,540)。**結論：**在我們地區心力衰竭的多學科治療方案是可行的。它能夠提高臨床療效，減少心力衰竭的住院次數和由此產生的高費用負擔。

關鍵詞：心力復蘇、運動、心力衰竭、多學科途徑

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Background

Heart failure is a growing public health problem in Hong Kong and in many other countries. Both the incidence and the prevalence of chronic heart failure are increasing. Heart failure is associated with poor

prognosis, reduced quality of life and is one the most significant causes of hospital admissions. In the United States, the incidence of heart failure approaches 10% per 1,000 population after age 65.¹ Heart failure accounts for 5 to 10% of all hospitalizations in the United States annually, and is the leading cause of hospitalization in individuals older than 65 years of age. Hospital discharges for heart failure increased for more than three times from 1979 to 1997. Readmission rate for congestive heart failure is very high, with half of the patients readmitted within 6 months.^{2,3} In Hong Kong, heart failure is also an important cause of hospital admissions.⁴ The overall incidence was 0.7 per 1,000 population, whereas in the older than 85-year age group, the incidence was 20 per 1000 women and 14 per 1,000 men.⁵ Cost of care for heart failure is very substantial because of the high hospitalization and rehospitalization rate. In the United States, heart failure costs about US\$38 billion annually, of which approximately two-thirds of this amount are spent on hospitalizations.^{6,7}

Non-compliance to optimal pharmacological, dietary or physical activity regimens is a major cause for heart failure decompensation.⁸ It has been shown that early re-hospitalization in patients with heart failure may be preventable in up to 50% of cases.^{2,9,10} These preventable negative factors include noncompliance with medications or diet, inadequate discharge planning or follow-up, and failure to seek medical attention promptly when symptoms recur. Recent studies have shown that multidisciplinary heart failure disease management programme can improve the clinical outcomes and quality of life of patients with heart failure, and reduce hospital admissions and resources utilization.¹¹⁻¹⁸

We designed and implemented a multidisciplinary management programme for heart failure patients in our hospital to determine whether this kind of programme is feasible and beneficial in our locality. The objectives of the programme were to optimize the medications; to improve the quality of life, compliance, symptoms, and functional status of patients with heart failure; to decrease the hospital admissions and cost of care for heart failure through multidisciplinary management approach.

Methods

Patient Selection

From March 2001 to January 2003, patients admitted to Pamela Youde Nethersole Eastern Hospital with a primary diagnosis of congestive heart failure were screened for enrolment. The inclusion criteria were: age >18; moderate to severe symptomatic heart failure (NYHA Class II to IV); history of 1 or more than 1 hospitalization for heart failure in the previous 6 months.

The criteria for exclusion from the study included: acute myocardial infarction within 4 weeks of entry; unstable coronary artery disease, acute myocarditis, constrictive pericarditis and other significant co-morbid conditions such as dementia or malignancy that likely to limit compliance or survival.

Baseline Evaluation and Outcome Measurement

Baseline evaluation included a history and physical examination performed by a cardiologist. Echocardiography was performed to assess the left ventricular function if it had not been performed in the previous six months.

Each patient was his/her own control and a comparison was made before and after the intervention. Data were obtained at entry to the study and at the end of the programme. Assessments included knowledge of the disease; drug compliance; sodium intake; New York Heart Association Class; exercise capacity measured by 6-minute walk test; quality of life using the Minnesota Living with Heart Failure Questionnaire.¹⁹ Sodium intake was assessed using a food frequency questionnaire. Each participant was interviewed by a dietitian with respect to food portion size, intake of food containing sodium, frequency of intake per week and month. Hospital diet was used as a reference to sodium level of seasoning. Average daily sodium intake was calculated based on the nutrient database of Nutritional Five (First DataBank Inc., 1998) and commercial food labeling. Knowledge of the disease was assessed by a set of 21 questions designed by our team, regarding the symptoms and worsening symptoms of heart failure;

the proper diet and physical activities. Drug compliance was assessed by asking the patients 6 questions regarding the name, dosage, frequency, route of administration and side effects of the medications for heart failure.

Number of heart failure hospitalization within the 6 months before enrolment was compared to that within the 6 months after enrolment. Death and other significant morbidity were also recorded.

Medications usage and dose were recorded at baseline and at end of the programme. Angiotensin converting enzyme inhibitors (ACE-I) were grouped and ranked according to dose: 'low dose' ≤ 10 mg/day of lisinopril or equivalent, 'medium dose' 10 to < 20 mg/day lisinopril or equivalent; and 'high dose' ≥ 20 mg/day lisinopril or equivalent. Similarly, beta-blockers were also ranked according to dose: 'low dose' ≤ 12.5 mg/day carvedilol or equivalent; 'medium dose' 12.5 to < 50 mg/day carvedilol or equivalent; 'high dose' ≥ 50 mg/day carvedilol or equivalent.

Multidisciplinary Management Programme

Patients attended the programme twice per week for about 3 months which took place at the Day Hospital of the Pamela Youde Nethersole Eastern Hospital. Patients were cared by a multidisciplinary team. The team included a cardiologist, a geriatrician, a registered nurse, a physiotherapist, an occupational therapist and a dietitian.

Each patient received an initial consultation with the cardiologist or the geriatrician. This was a comprehensive assessment of the patient's heart failure status. A monthly conference was held to discuss the progress of the patients. Followed-up review by physician would be arranged if required.

Medications for heart failure, especially angiotensin converting enzyme inhibitors and beta-blockers were optimized according to the ACC/AHA heart failure management guideline.²⁰ The side effect and the importance of drug treatment were emphasized. Instructions on the use of a flexible diuretic regimen and dosage adjustment in response to worsening symptoms and weight change were given.

All patients were counseled by the registered

nurse on different aspects of heart failure with emphasis on warning symptoms and signs of deterioration; and the importance of daily weighing. Each patient also received an educational booklet on heart failure. Patients and their caretaker received advice from the dietitian regarding diet, fluid and sodium management. Energy conservation technique, work simplification advice and relaxation practice were given by the occupational therapist.

All patients were assessed individually by the physiotherapist and received exercise training designed for heart failure patients. The exercise programme lasted for 3 months, two times per week. It included a combined programme of treadmill exercise, static bike riding and upper limb ergometer training. Patients were exercised to a heart rate of 50-60% of maximum predicted for age and a Borg rating of 9-12 for perceived exertion. Patients were encouraged to maintain a home programme of daily walking for a total period of exercise 30-minute per day, 5-7 days per week.

Statistical Method

The baseline demographic data were expressed as mean and standard deviation. The changes between the data obtained before and after the programme were analyzed using paired t-test. A p-value less than 0.05 was considered to be statistically significant. Analyses were performed using SPSS (version 10.0).

Results

Patient Population

From March 2001 to January 2003, fourteen patients with heart failure and history of ≥ 1 hospitalization for heart failure in the previous 6 months were recruited. The mean age was 71.9 ± 5.9 (range 61-84). The male to female ratio was 1:1. The mean ejection fraction was $38.5 \pm 15.0\%$. Most patients were in NYHA Class III (71.4%), 21.4% of patients in Class II and 7.1% in Class IV. The etiology of heart failure were: ischemic cardiomyopathy (50%), dilated cardiomyopathy (14.2%), hypertensive heart disease (21.4%) and valvular heart disease (14.2%). All

patients completed the programme. No patient died during follow-up up to 6 months.

Hospitalizations (Figure 1)

Hospitalizations were significantly reduced. In the 6 months prior to the start of the programme, the total number of hospitalizations for heart failure was 28. The mean number of hospitalizations for heart failure per patient was 2.0. In the 6 months after enrollment to the programme, the total number of hospitalizations for heart failure was 6. The mean number of hospitalizations per patient was 0.43. Hospitalization for heart failure was reduced by 78.5% ($p<0.001$). Bed days were significantly reduced from a total of 362 days (of which 177 were acute bed days, 185 were convalescent bed days) to 165 days following the programme (of which 15 were acute bed days and 150 were convalescent bed days) ($p<0.001$). Outpatient clinic attendance also reduced from 34 to 24 following the programme.

Drug Therapies

At baseline, 71.4% of patients were receiving ACE-I or angiotensin receptor blocker (ARB), 70% of them were receiving high dose. At the end of the programme, 78.8% were receiving ACE-I or ARB and

21.4% of patients had a dose increment from their baseline dose. Regarding beta-blockers, 35.7% of patients were taking them at baseline: 60% were on low dose; 40% on medium dose; and none on high dose. At follow-up, 50% of patients were on beta-blockers of whom 14.3% were on low dose; 57.1% were on medium dose and 28.6% were on high dose and 35.7% of study patients had a dose increment.

Functional Status and Quality of Life (Table 1)

A significant improvement in symptoms and functional status was found. The NYHA Class improved from 2.9 ± 0.6 at baseline to 1.7 ± 0.4 at follow-up ($p<0.001$). Exercise capacity as measured by 6-min walk test also improved from a mean of 289.3 ± 67.5 meters to 339.1 ± 67.8 meters ($p=0.005$). Quality of life improved significantly after the programme. The Minnesota Living with Heart Failure Questionnaires improved from a score of 39.4 ± 7.6 to 16.4 ± 10.4 following the programme ($p=0.001$).

Knowledge, Drug Compliance and Sodium Intake (Table 1)

Both the knowledge of the disease and drug compliance improved after the programme. The knowledge score improved from 19.9 ± 1.5 at baseline

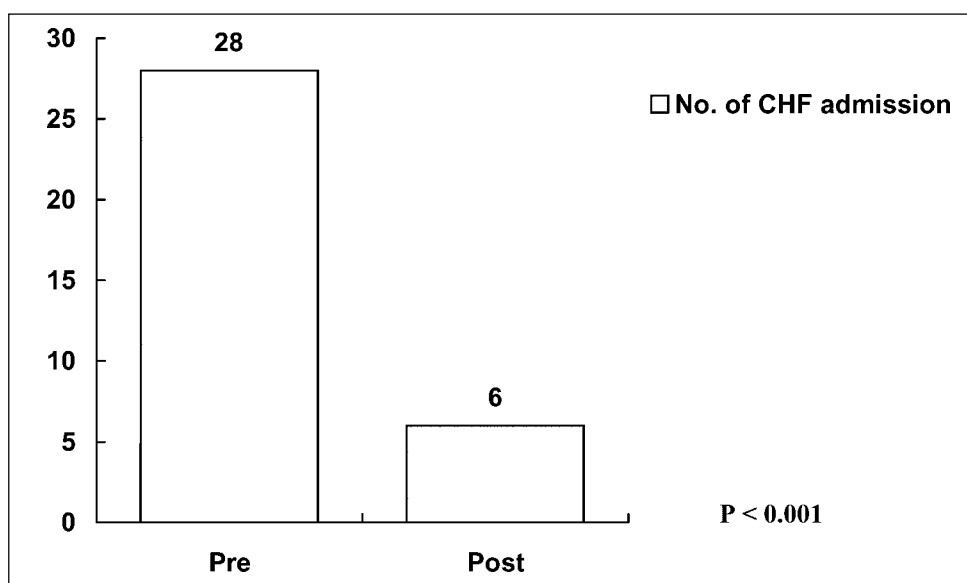


Figure 1. Total number of hospital admissions for heart failure in the 6 months before and after the programme (reduction of 78.6%, $p<0.001$).

to 22.8 ± 1.6 ($p < 0.001$) at follow-up. The drug compliance score improved from 3.9 ± 0.2 to 5.7 ± 0.5 ($p = 0.001$). The estimated daily sodium intake was 3.4 g and 3.3 g before and after the programme respectively (p : n.s.).

Discussion

There is growing evidence in supporting a multidisciplinary management approach to patients with chronic heart failure.¹¹⁻¹⁸ Increasing input into outpatient care can reduce expensive hospital readmissions. Based on available evidence, it is appropriate to recommend widespread development and application of multidisciplinary heart failure disease management. Our study, although involved only a small number of patients, demonstrated that multidisciplinary heart failure disease program is effective in reducing hospital admissions, hospital days and cost of care; enhancing patient knowledge and compliance with medications; improving functional capacity and quality of life. The only non-significant finding in our study was the estimated daily salt intake before and after the intervention.

Drug therapies, especially ACE-I and beta-blockers, have been shown to improve survival and reduce hospitalizations in patients with heart failure. Optimization of drug therapies was one of the objectives of our programme. We observed that by the end of the

Costs (Table 2)

The cost of care for different modalities were calculated by the finance department of our hospital, using the specialty costing exercise model and taking into account of the labour cost of different disciplines, cost for drugs and equipment. The average cost per bed day for acute bed was HK\$2,662 and for convalescent bed was HK\$2,031. The average cost per out-patient clinic attendance was HK\$1,024 and per visit to the programme (Day Hospital visit) was HK\$1,404. Comparing the cost of care in the 6 months prior the programme with that spent in the 6 months following enrolment, there was a reduction of inpatient costs by HK\$35,880 per patient and an increase in outpatient costs by HK\$24,540 per patient. An estimated cost saving of HK\$11,340 per patient over a 6-month time frame was achieved.

Table 1. Summary of the effects of the multidisciplinary heart failure programme

	Pre-programme	Post-programme	p-value
NYHA Class	2.9 ± 0.6	1.7 ± 0.4	< 0.001
6-minute walk (meters)	289.3 ± 67.5	339.1 ± 67.8	0.005
Quality of life (Minnesota HF questionnaire 0-105)	39.4 ± 17.6	16.4 ± 10.4	0.001
Knowledge score (0-21)	19.9 ± 1.5	22.8 ± 1.6	< 0.001
Drug compliance score (0-6)	3.9 ± 0.2	5.7 ± 0.5	0.001
Estimated daily sodium intake (gram)	3.4	3.3	n.s.

Table 2. Comparison of resource utilizations and cost of care per patient in the 6 months before and after the programme

	Pre-programme number / Cost (HK\$)	Post programme number / Cost (HK\$)	Cost savings (HK\$)
Acute bed days	177 / 33,655	15 / 2,852	30,803
Convalescent bed days	185 / 26,838	150 / 21,761	5,077
Outpatient clinic visit	34 / 2,487	24 / 1,755	732
Day hospital visit	2 / 201	254 / 25,473	-25,272
Cost savings (Total)	-----	-----	11,340 ($p < 0.001$)

study, the usage of ACE-I and beta-blockers were improved. We believed that the improvement in various parameters after intervention in our study could be partly contributed by a better medical regimen. However, the improvement was unlikely to be related entirely to the introduction and up-titration of medical treatment, because patients who could not tolerate beta-blocker still demonstrated no hospitalizations in the follow-up period.

Most published trials were done at academic centre in other countries while non-academic centres may lack the necessary facilities and personnel to assemble an effective heart failure management team. Our study demonstrated that this kind of multidisciplinary programme is feasible in our locality and could be implemented in a regional hospital. It is necessary, before implementing the programme, to consider a variety of disease management models, to select and modify the model most suited to a given practice environment because a single, unified approach is unlikely to be applicable to different practice settings.

Limitations

Several limitations of the study should be noted. First, this study was a non-randomized trial, and that the before-after comparison with respect to readmissions for heart failure may overestimate the reduction in hospital readmissions and the subsequent cost benefit. An appropriate way of evaluating heart failure admissions is to compare the observed readmission frequency with the expected readmission frequency during the 6 months of follow-up. A more appropriate method to confirm the true benefit of the programme is to incorporate a control group for comparison, e.g. patients who refuse to participate into the programme but with similar disease severity.

Second, it was a relatively small study. Although few patients were involved in the study, it demonstrated that this kind of programme is feasible in our locality and is potentially beneficial. Larger studies involving more patients are needed to confirm the efficacy and to identify which patient groups will benefit the most from multidisciplinary programme.

Lastly, the programme was multidisciplinary and the relative contributions of its various components could not be assessed. Future studies are needed to determine the relative merits of each component of the programme.

Conclusions

This is one of the first studies to assess a comprehensive multidisciplinary management programme specific to heart failure in our locality. Our study showed that a multidisciplinary approach with intensive outpatient care improves patient outcomes, reduces heart failure admissions and the high cost burden of this disease. Such management could be implemented in our locality and may become the standard care for heart failure patients, especially those with high risk of admission.

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