Does Multidisciplinary Management of Chronic Heart Failure Improve Clinical Outcomes?

Case Study and Commentary, Roger Kerzner, MD, and Michael W. Rich, MD

INTRODUCTION

Heart failure is a major public health problem that has reached epidemic proportions in the United States [1]. It affects nearly 5 million Americans, or 1.9% of the population, with more than 500,000 new cases being diagnosed each year [2]. Furthermore, the population prevalence of heart failure is increasing [3], and this trend is expected to continue well into the 21st century [4].

The rise in heart failure prevalence is due in part to increased survival rates among patients with coronary artery disease and hypertension, the 2 leading causes of heart failure in industrialized societies [5,6]. Another major factor leading to the increasing prevalence of heart failure is the aging of the population. Heart failure is a disease of the elderly, with 80% of hospital admissions occurring in individuals 65 years of age and older, and 50% occurring in individuals over the age of 75 [7]. Heart failure is the leading cause for hospitalization and rehospitalization in elderly individuals [1,2,7], and it is by far the most costly diagnosis-related group in the United States [8].

Despite numerous advances in the pharmacotherapy of heart failure, morbidity and mortality rates remain high, and the expanding nature of the heart failure epidemic demands other forms of treatment. One of the most promising approaches is multidisciplinary heart failure disease management. This strategy combines the expertise of physicians and nonphysicians to address the myriad medical, psychosocial, behavioral, and economic factors that contribute to each patient’s illness. This article reviews several approaches to heart failure disease management and discusses the impact of such programs on patient outcomes.

CASE STUDY

Initial Presentation

A 72-year-old woman presents to her primary care physician’s office with a 3-week history of increasing dyspnea on exertion and orthopnea. Her symptoms became much worse after a large family reunion, and she decided to seek medical attention.

History

The patient denies chest discomfort, fever, cough, and other symptoms of a respiratory tract infection. Past medical history is notable for hypertension and type 2 diabetes mellitus, both of which are well controlled. She also has osteoarthritis, bilateral cataracts, and a remote history of peptic ulcer disease. Four months previously, the patient presented with dyspnea and orthopnea, and congestive heart failure was diagnosed. Prior to that time she was an active volunteer and lived alone without any assistance from her children. However, she has subsequently discontinued many of her activities and now requires help with her housework and shopping. Current medications include atenolol, lisinopril, enteric-coated aspirin, furosemide, and an oral hypoglycemic agent; she also takes ibuprofen “as needed” for arthritis. The patient admits that she periodically forgets to refill her medications but reports generally good compliance.

Physical Examination

On examination, the patient is noted to be in mild to moderate respiratory distress. Her blood pressure is 150/60 mm Hg, pulse is 65 bpm, and respiration rate is 24 breaths/minute. Her weight has increased 6 lb since her last office visit. Her jugular veins are distended 7 cm above the sternal notch. The carotid upstrokes are diminished in intensity without bruits. Auscultation of the chest reveals bibasilar crackles. Cardiac examination is significant for an S4 gallop and a soft crescendo-decrescendo murmur at the right upper sternal border, but there is no S3. Her apical impulse is slightly displaced laterally. Her abdomen is benign, with good bowel sounds. Her pulses are 2+ throughout, and there is 2+ pitting edema bilaterally to the mid-shins. Her neurologic examination is normal.
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Initial Management

Based on the patient’s symptoms and physical findings, recurrent heart failure is diagnosed, and the patient is admitted to the hospital. On admission, an electrocardiogram reveals normal sinus rhythm with left ventricular hypertrophy, but there are no acute ischemic changes. Chest radiography reveals mild cardiomegaly and moderate pulmonary edema. Cardiac enzymes are normal, serum creatinine is 1.1 mg/dL, and all other laboratory studies are unremarkable.

During the first 2 days of hospitalization, the patient’s symptoms improve with intravenous furosemide and an increase in lisinopril dosage. A transthoracic echocardiogram reveals moderate left ventricular hypertrophy, mild global hypokinesis, and an estimated ejection fraction of 40%. Despite symptomatic improvement, the patient and her family express concern about her declining health and loss of independence, and they request information about additional therapeutic options.

- What are the clinical challenges of caring for heart failure patients?

The demography and etiology of heart failure often lead to difficult management decisions. Multiple comorbid conditions are frequently present, including coronary artery disease, hypertension, diabetes, dyslipidemia, and renal insufficiency. Management of heart failure in this context often results in polypharmacy. Other conditions that are common in elderly patients, such as arthritis and dementia, may require multiple health care workers to optimize care, including physical therapists, social workers, and home health professionals. Psychosocial and financial constraints also contribute to difficulties in disease management. Depression occurs in 15% to 20% of patients with heart failure and may contribute to medical and dietary noncompliance [9]. The high cost of medications and relatively low cost of high-sodium foods further compounds the problem. As a result, the majority of older patients with heart failure have management issues that exceed the usual scope of the primary care physician’s tools and expertise.

The importance of these issues has been highlighted in several studies. It has long been recognized that heart failure is the leading cause of repetitive hospitalizations in adults, and in 1997, Krumholz et al [10] reported that 44% of older heart failure patients were rehospitalized at least once within 6 months of an initial heart failure admission, a finding consistent with results from other studies [11–14]. In 1988, Ghali et al [15] reported that 64% of heart failure exacerbations were attributable to noncompliance with diet, medications, or both, and that 26% were related in part to environmental or social factors. Similarly, in 1990, Vinson et al [13] found that over half of all readmissions were directly attributable to problems with compliance, lack of social support, or process-of-care issues and concluded that up to 50% of all readmissions were potentially preventable. More recently, Michalsen et al [16] reported similar findings. These studies confirm the complexity of heart failure management and suggest that a multidisciplinary approach to care could potentially be beneficial.

- What multidisciplinary approaches have been studied?

Four basic models of intervention have been studied to date: (1) a short-term, limited approach utilizing a nurse or clinical pharmacist; (2) a more extended series of contacts with a single health care professional, usually a nurse; (3) an integrated multidisciplinary approach incorporating physicians, nurses, dietitians, and social workers; and (4) comprehensive management by a specialized heart failure/transplant team.

Short-term Intervention

Stewart et al [17–19] and Cline et al [20] utilized a short-term limited intervention involving 1 pre-discharge and 1 post-discharge visit by a nurse and/or pharmacist in patients hospitalized with heart failure. Prior to discharge, patients were educated about their disease and its symptoms, the importance of recording daily weights, and issues of compliance with their diet and medication regimen. One to 2 weeks later the nurse or pharmacist visited patients at home to assess their clinical status and reinforce the issues discussed during the initial visit. If problems in management were discovered, a more directed intervention was implemented at the second visit. This included education, medication compliance aids, caregiver education, and, in some cases, a flexible diuretic schedule. Patients were also encouraged to contact the nurse if additional problems arose. In all cases, the patient’s primary care physician and cardiologist were informed of the patient’s progress.

Serial Contacts

Several approaches involving serial contacts with a health care worker have been investigated. Most of these studies have been conducted in an outpatient setting, and the unifying concept has been that multiple visits by a health care worker could promote optimization of management and coordination of care. In the late 1970s, Cintron et al designed a nurse practitioner clinic [21]. Later, West et al [22] utilized a nurse manager that met with patients during an initial visit and then contacted them by telephone at regular intervals based on the patient’s clinical status. The main goals of the
intervention were patient education about heart failure, dietary compliance, and monitoring of symptoms, and, specifically, optimization of angiotensin-converting enzyme (ACE) inhibitor or nitrates and hydralazine dosing in concert with the patient’s primary care physician. Similar protocols relying on pharmacists [23] or physicians [24] to provide follow-up contacts have also been studied. Heidenreich et al [25,26] evaluated a novel approach that incorporated weekly educational mailings, weekly phone calls from a nurse, and daily recordings of blood pressure and weight that were transmitted to the nurse using a paging system. The nurse then notified the physician if the patient’s clinical status deteriorated. As with most of these studies, patients were provided ready access to the nurse if questions or problems arose.

Integrated Approach

An integrated multidisciplinary approach, involving health care workers from a variety of disciplines, was first investigated by Rich et al [27–29]. The intervention included intensive patient education about heart failure and its treatment, dietary and social service consultation, detailed medication analysis by a geriatric cardiologist to improve compliance and reduce adverse effects by simplifying the treatment regimen, and close follow-up after hospital discharge by a home health nurse and through telephone contacts. Patients were initially enrolled during hospitalization for heart failure, and they were subsequently seen by a member of the management team on multiple occasions both during admission and for a 3-month follow-up period. After discharge, a home health nurse reinforced the patient’s education, assessed medical and dietary compliance, and performed a clinical assessment. Rauh et al [30] employed a similar model but utilized protocols that were implemented by the medical staff in conjunction with the multidisciplinary team. This intervention also focused on the pharmacologic management of heart failure, and a subset of patients received outpatient intravenous inotropic therapy as needed to avoid hospital admission. Another team of investigators studied an intensive lifestyle modification program in nonhospitalized patients [31]. This included a structured exercise program, dietary modification, and group-based cognitive-behavioral therapy to address the psychological aspects of heart failure. Like the other multidisciplinary studies, many types of health care workers were involved.

Heart Failure Team

Comprehensive management by a dedicated heart failure/transplant team is the most specialized approach to multidisciplinary management. Such teams are available only at a limited number of centers with active heart transplantation programs, and are usually directed by physicians with special expertise in heart failure [32–34]. Patients in these programs are generally referred for management of advanced heart failure, and thus tend to have more symptoms than patients enrolled in some of the other multidisciplinary programs. Interventions incorporate comprehensive education and symptom monitoring, psychosocial assessment, and an aggressive attempt to optimize heart failure medications.

CASE-BASED REVIEW

- Does multidisciplinary management reduce heart failure morbidity and mortality?

Published reports using each of the 4 multidisciplinary models have documented favorable effects, particularly with respect to reducing the number of hospital admissions, both overall and for heart failure specifically. Other benefits include a reduced number of hospital days, fewer emergency room visits, improved compliance, and improved exercise tolerance.

In 1995, Rich et al described the results of a prospective randomized clinical trial involving 282 elderly patients hospitalized with heart failure [28]. Subjects were randomized to receive standard physician-directed care or integrated multidisciplinary care provided by a team of health care workers and coordinated by a nurse. The intervention continued for 90 days after discharge and the primary outcome measure was readmission-free survival. This goal was achieved by 91 patients (64.1%) in the treatment group compared with 75 patients (53.6%) in the control group ($P = 0.09$). Intervention-group patients demonstrated fewer readmissions for any reason (44% reduction; $P = 0.02$), fewer readmissions for heart failure (56% reduction; $P = 0.04$), and fewer hospital days during follow-up (mean days, 3.9 versus 6.2; $P = 0.04$). These benefits persisted for an additional 9 months after the study intervention was terminated. Similar results have been achieved with each of the other models described above (Table).

Although multidisciplinary heart failure management has been associated with improved outcomes in virtually all studies, there are some limitations to the existing data. First, the majority of the studies have been observational in nature (ie, nonrandomized), comparing clinical outcomes before and after applying the study intervention. Fortunately, the results of observational studies have now been confirmed in randomized trials for each of the first 3 models of multidisciplinary care described above [13,18–20,23,27–29,31].

Another concern is that the impact of multidisciplinary care on mortality is unknown, in part because none of the studies have been of sufficient size to adequately assess survival. Although improved patient compliance with ACE inhibitors and β blockers would be expected to improve survival, this has not yet been convincingly documented in the
context of multidisciplinary heart failure programs. On the other hand, Stewart et al reported a beneficial effect of a home-based intervention on mortality after 18 months follow-up in a small number of patients (n = 97), and other studies have reported nonsignificantly lower mortality rates in intervention-group patients. In any case, the lack of compelling mortality data should not diminish the other benefits of nonpharmacologic interventions, the magnitude of which is similar to those observed in clinical trials of ACE inhibitors, β blockers, and digoxin [35–46].

### Table. Studies of Multidisciplinary Heart Failure Disease Management

<table>
<thead>
<tr>
<th>Author/Year</th>
<th>Type of Study</th>
<th>No. of Patients</th>
<th>Principal Findings</th>
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<tbody>
<tr>
<td><strong>Trials using a limited intervention</strong></td>
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<tr>
<td>Cline et al 1998 [20]</td>
<td>Randomized clinical trial</td>
<td>190</td>
<td>36% reduction in hospitalizations; 49% reduction in hospital days; Cost reduction of $1300/patient/year</td>
</tr>
<tr>
<td>Stewart et al 1998 [17]</td>
<td>Randomized clinical trial</td>
<td>97</td>
<td>43% reduction in unplanned readmissions; 42% reduction in hospital days</td>
</tr>
<tr>
<td>Stewart et al 1999 [18] (18-month follow-up of cohort studied in above trial)</td>
<td>Randomized clinical trial</td>
<td>97</td>
<td>49% reduction in unplanned readmissions; 44% reduction in hospital days; Hospital-based cost reduction of $5500 (Australian)/patient/duration of study</td>
</tr>
<tr>
<td>Stewart et al 1999 [19]</td>
<td>Randomized clinical trial</td>
<td>200</td>
<td>40% reduction in combined endpoint of unplanned readmissions and out-of-hospital deaths; 61% reduction in hospital days; Hospital-based cost reduction of $2600 (Australian)/patient/year; Improved quality of life</td>
</tr>
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| **Trials involving an extended series of health care worker visits** | | | |
| Cintron et al 1983 [21] | Observational pre/post-intervention | 15 | 60% reduction in hospitalizations; 85% reduction in hospital days |
| Kornowski et al 1995 [24] | Observational pre/post-intervention | 42 | 62% reduction in hospitalizations; 77% reduction in hospital days; 72% reduction in CV admissions; Improved ability to perform ADLs |
| West et al 1997 [22] | Observational pre/post-intervention | 51 | 74% reduction in hospitalizations; 87% reduction in HF admissions; Fewer office and ER visits; Improved symptoms, quality of life, exercise tolerance; Improved ACE-inhibitor dosing and salt restriction |
| Shah et al 1998 [25] | Observational pre/post-intervention | 27 | 50% reduction in hospitalizations; 91% reduction in hospital days; 66% reduction in CV admissions |
| Heidenreich et al 1999 [26] | Observational pre/post-intervention | 154 | 44% reduction in hospitalizations; 71% reduction in hospital days; Cost reduction of $9000/patient/year; No change in quality of life |
| Gattis et al 1999 [23] | Randomized clinical trial | 181 | 75% reduction in combined endpoint of all-cause mortality and heart failure events; Improved ACE-inhibitor dosing |

(continued on page 45)
Does multidisciplinary management improve quality of life?

While objective outcomes, such as readmission rates and mortality, are crucial for validating the effectiveness of an intervention, the day-to-day impact of heart failure on individual patients is much more complex than hospitalizations or even death. The case illustrates the marked impact of chronic heart failure on quality of life: the case patient reduced her level of activity and became dependent on assistance from her family. Similar effects have been observed in studies of patients with heart failure, who experience high rates of depression, anxiety, and social isolation [9,47]. Of note, Candlish et al [48] showed a correlation between readmission rates and patient-perceived quality of life, demonstrating the inter-related nature of these issues.

To date, only 7 studies of multidisciplinary heart failure management have formally investigated the impact on patients’ quality of life. Kornowski et al [24], in their study of weekly home visits by a physician, noted an improvement in activities of daily living, while Kostis et al [31] reported positive effects on indices of depression and anxiety. Rich et al [28] found a 52% to 195% increase in scores on the Chronic Heart Failure Questionnaire, which assesses dyspnea, fatigue, emotional function, and environmental mastery, before and after an integrated multidisciplinary intervention. A similar result was demonstrated by Smith et al [33] using the Minnesota Living with Heart Failure Questionnaire in patients treated by a specialized heart failure team. In contrast, Heidenreich et al [26] reported no change in scores on the SF-36 survey, a nonspecific health status questionnaire, in a nurse-mediated heart failure program.

In summary, the preponderance of evidence suggests that patients’ quality of life is improved with a multidisciplinary...
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approach to care. While not definitive, the available quality of life data provide further support for a beneficial effect of multidisciplinary heart failure management on a broad range of clinical outcomes.

• Is multidisciplinary care cost-effective?

Numerous investigators have included a cost analysis within their evaluation of multidisciplinary interventions, and again the results have been positive. This has been most consistently demonstrated by reductions in total hospital costs, which declined by approximately 50% in most studies [18–20,26]. When total health care costs have been studied, including outpatient visits, nursing expenditures, and intervention costs, a net decrease in costs has been reported [19,20,26,28]. This is not surprising, considering that the estimated cost of the intervention ranges from $200 to $350 per patient over a 1- to 3-month period [19,20,28], whereas a single hospital admission costs thousands of dollars. Thus, the modest cost of the intervention is more than compensated by the reduction in admissions, and multidisciplinary management is highly cost-effective.

Outpatient Management

Prior to discharge from the hospital, the patient was seen by a heart failure nurse, dietitian, and clinical social worker. She received comprehensive education about heart failure, including information about symptoms and management. Detailed instructions were provided about medications, diet, monitoring daily weights, and the importance of adhering to the prescribed treatment regimen. She was also advised to gradually increase her activity level as tolerated, with the goal of walking 20 to 30 minutes daily at least 5 days per week. Following hospital discharge, the patient was seen once by a home health nurse to address any concerns she had and to reinforce the information provided by the hospital team.

• What is the role of exercise in heart failure management?

Exercise training for patients with heart failure has received considerable attention in the last decade, and numerous randomized controlled trials have demonstrated increased exercise tolerance, as assessed by peak oxygen consumption (Vo2), exercise time, or peak power output [49–59]. These studies have been small and have predominantly involved individuals younger than 65 years of age who participated in intense 1- to 3-month exercise programs. All of the programs were determined to be safe, without major complications, and the benefits have extended for up to 1 year [49].

Despite these encouraging findings, the beneficial effects of exercise from a clinical perspective are less clear. Three of the randomized trials investigated patients’ symptomatology after completing an exercise program. Two studies noted symptomatic improvement based on questionnaires [53,57], and 1 noted an improvement in New York Heart Association functional class [56]. The latter trial involved a 6-month home-based program of daily stationary cycling for 20 minutes at 70% of symptom-limited maximum oxygen uptake. The estimated compliance was only 60%, highlighting the practical difficulty of getting patients to exercise regularly at levels shown to produce positive outcomes. On the other hand, Belardinelli et al studied 27 patients in an 8-week program of stationary cycling at only 40% of peak oxygen uptake [60]. These authors found increases in peak oxygen uptake and peak workload that were similar to those reported in studies using a more intensive exercise protocol. The clinical utility of this tempered regimen warrants further investigation.

Based on these studies, it seems reasonable to conclude that exercise can be beneficial in heart failure management. However, only 1 trial of a multidisciplinary heart failure management program included an exercise component [31]. Furthermore, all of the exercise trials have studied younger patients with stable heart failure, whereas most trials of multidisciplinary management have enrolled older patients discharged after an acute heart failure exacerbation. The generalizability of the exercise studies to the patient population typically enrolled in disease management programs is thus unclear. A safe compromise is to recommend regular low-intensity exercise as part of an overall heart failure management program in stable patients without contraindications to exercise.

• Should all patients with heart failure be enrolled in a multidisciplinary program?

Currently available evidence supports offering multidisciplinary management to patients who are at increased risk for recurrent hospitalizations. Suitable candidates include individuals with a recent hospital admission for heart failure (ie, within 1 month), 2 or more heart failure admissions within 12 months, advanced symptoms (New York Heart Association class III or IV), multiple comorbid conditions, history of poor compliance, or other factors which may confound treatment (eg, depression, social isolation).

Conversely, the benefits of multidisciplinary programs have not been established in stable outpatients with very mild...
symptoms (New York Heart Association class I) or in patients with a good compliance record, few comorbidities, and adequate social support. Such patients are at low risk for hospitalization during short-term follow-up, thus limiting the potential benefits and cost-effectiveness of resource-intensive disease management programs. Nonetheless, simple, low-cost interventions, such as patient education about heart failure and its treatment, including diet, medications, self-monitoring of daily weights, and regular physical activity, are likely to be of benefit in virtually all patients. In addition, maintaining close follow-up is essential for reinforcing the importance of compliance with the treatment regimen and for assessing disease progression.

- How can individual physicians implement a multidisciplinary approach to heart failure management?

Many options exist for developing a multidisciplinary heart failure program. These range from limited interventions, such as a single posthospitalization home visit, to programs involving multiple health care workers. Since each of these models has been associated with improved outcomes, it is appropriate for the physician or other health care provider to select the model that is most feasible and appropriate in a given practice environment. Thus, physicians with fewer heart failure patients and limited resources may, of necessity, adopt a minimalist approach, whereas health systems treating large numbers of patients may be best served by a more comprehensive disease management program. Finally, patients with advanced symptoms might benefit most from being referred to a heart failure clinic with special expertise in heart failure management and an expanded armamentarium of therapeutic options.

With regard to the case patient, her initial outpatient care may have been improved by single or multiple home visits by a nurse or pharmacist. Increased interaction with her health care provider through telephone contacts may have led to earlier identification and treatment of her heart failure exacerbation. Once in the hospital, consultation with a dietitian, social worker, and pharmacist could address the patient’s concerns and expand treatment beyond the scope of her primary physician’s time and expertise. Ultimately, each of these interventions could be expected to lead to fewer admissions and an improved quality of life for the patient.

Clinical Course

Nine months later, the patient remains clinically stable and free of recurrent hospital admissions. Her exercise tolerance gradually improved and she has resumed most of her usual activities, including occasional volunteer work.

SUMMARY

Heart failure is a major public health problem that is expected to increase in the decades ahead as the population ages. Although significant strides in pharmacotherapy have occurred and will continue to occur, drugs alone cannot solve the many dilemmas of heart failure management. Optimal cost-effective management of chronic heart failure thus involves harnessing the expertise of physicians and nonphysicians alike to provide a comprehensive and coordinated approach to care that is individualized yet flexible enough to meet each patient’s unique set of needs and circumstances. Although additional research is needed, current evidence provides strong support for broader implementation of multidisciplinary disease management programs to improve care and outcomes in the growing population of patients with chronic heart failure.

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References


