The Economic Burden of Heart Failure

J. B. O'CONNELL, M.D.

Department of Internal Medicine, University Health Center, Wayne State University, Detroit, Michigan, USA

Summary: Heart failure, a major cause of morbidity and mortality among the elderly, is a serious public health problem. As the population ages and the prevalence of heart failure increases, expenditures related to the care of these patients will climb dramatically. As a result, the health care industry must develop strategies to contain this staggering economic burden. Strategies may include adopting approaches for preventing heart failure and implementing new treatment modalities with proven efficacy into large-scale clinical practice. Successful implementation of these strategies will require intensive physician and patient education and development of innovative approaches to fund support services.

Key words: heart failure, economic burden, aging population, angiotensin-converting enzyme inhibitors, beta blockers, hospitalization costs

Introduction

Heart failure is a major public health issue. It is highly prevalent among the elderly population, and its prevalence is projected to rise markedly over the next decade.^{1,2} Even with the commitment to excellence in health care that exists in the United States, resources and personnel are limited; the economic burden of managing heart failure is staggering. It is, therefore, imperative that the medical profession examines the impact of developing technology and new therapeutic modalities on heart failure management. Efforts must be made to develop novel strategies to reduce the burgeoning cost of care of these patients without compromising the effectiveness of that care.^{3,4}

Prevalence and Prognosis of Heart Failure

Prevalence

Heart failure is a clinical syndrome that has become more prevalent in recent years. In 1996, almost 4.8 million Americans were afflicted with congestive heart failure (CHF), and each year approximately 400,000 new cases of CHF were diagnosed.⁵ Disease prevalence is expected to reach 10 million cases in the U.S. alone by the year 2007.⁶ Enhanced public awareness and advances in the management of acute myocardial infarction, diabetes, hypertension, and heart failure have led to decreased early mortality rates from these disorders while increasing the incidence of heart failure.² In 1979, there were 377,000 hospital discharges of patients with primary heart failure; this number increased to 870,000 in 1996, accounting for 2.8% of all hospital discharges and 22% of all discharges for cardiovascular disease in the U.S. In 1991, there were 2.3 million hospital discharges of patients with a primary or secondary diagnosis of heart failure, and examination of nonfederal hospital discharge records for that year indicated an average length of stay of 7.7 days for such patients.⁴

Prognosis

Mortality rates from CHF continue to be high, with a 6-year mortality rate secondary to heart failure of 84% in men and 77% in women.⁷ In 1996, heart failure caused 43,837 deaths; women accounted for a larger proportion (62%) than men (38%).⁵ Following the development of systolic dysfunction, heart failure usually progresses unpredictably and symptoms worsen. Once cardiac muscle loss and fibrosis become irreversible, disease advance becomes inexorable and death inevitably follows (Fig. 1).

Impact of Aging Population

As the population ages, the incidence of heart failure and its resulting mortality will continue to increase.⁷ In 1940, only 7% of Americans were expected to live to the age of 90 years; by 1980, 24% of Americans were expected to reach the age of 90; however, the long-awaited aging of the 75 million baby boomers born between 1947 and 1964 is still to come. The

Address for reprints:

J.B. O'Connell, M.D.
Department of Internal Medicine
Wayne State University
UHC 2E
1402 St. Antoine
Detroit, MI 48201, USA

FIG. 1 Once left ventricular (LV) systolic dysfunction is present, it usually progresses, albeit not predictably. As LV dysfunction progresses and symptoms increase, the mortality rate increases and the process becomes inexorable. Myocyte loss and fibrosis become irreversible. An effective preventive measure must be introduced before onset or early in the course of progressive LV dysfunction. CHF = congestive heart failure. Reprinted from Ref. No. 13 with permission from Mosby, Inc.

number of Americans over the age of 65 is expected to double in the next 30 years.⁸ The incidence of CHF approaches 1% in those over the age of 65 years,⁵ and has been reported at 4% in the 70- to 79-year age group.⁹

Economic Impact of Heart Failure

The costs related to heart failure management are difficult to assess. Hospital charges for heart failure management were approximately \$10,000 per discharge, based on a mean length of stay of 6.3 to 7.7 days.⁴ According to the Medicare program, Health Care Financing Administration (HCFA) expenditures for heart failure in 1991 were higher than those for cancer [based on the five most common diagnosis-related groups

(DRGs) for cancer combined] and higher than those for myocardial infarction (based on two DRGs for myocardial infarction combined) (Fig. 2).⁴ Almost 75% of costs associated with a typical heart failure-related hospitalization (excluding hotel charges) accumulate within the first 48 h. It is interesting that payer mix does not have a major impact on charges or length of stay, even when HMOs, indemnity insurance, and government programs were considered.

Heart failure-related readmission rates range from 15 to 30% at 90 days; data suggest that half of these readmissions could be prevented.^{10, 11} Although approximately 70% of patients with heart failure are classified as New York Heart Association (NYHA) class I or II and do not experience recurrent hospitalizations, the total expenditure in 1991 for heart failure hospitalizations alone (federal hospitals excluded) was \$23 billion.⁴ However, in addition to hospitalization charges, outpatient expenses exceeded \$4,000 per patient per year. With an average of 3.4 outpatient visits per patient per year, total ambulatory costs exceeded \$13 billion.⁴ Transplantation costs (\$250 million) are a relatively small proportion of the total expenditure; a limited number of heart transplant procedures are performed each year.¹²

In summary, the annual expenditure on heart failure management, encompassing hospitalization costs (including inpatient care and pharmacy costs) and outpatient visits, for the 4.8 million patients in the U.S. approached \$38 billion in 1991.⁴ A more recent study of 29,000 patients with heart failure reported an average cost of almost \$11,000 per patient per hospitalization (Heart Failure BOI Analysis 1997, Merck & Co., data on file). Thus, costs have not been reduced despite advances in medical treatment. Based on an increase in the number of patients with heart failure since 1990, the total cost for heart failure management in 1999 is estimated to approach \$56 billion. As the population ages and the number of patients with heart failure increases, the economic burden of managing these patients may become unmanageable.

Strategies for Managing the Burden of Heart Failure

Economic-Based Targets

Since hospitalization costs account for a major portion of expenses related to heart failure management, decreasing hospital length of stay may be desirable. However, economic gains realized by shortening hospital length of stay may potentially be compromised by increases in hospital readmission rates or emergency room visits. Efforts directed at decreasing hospital length of stay do not affect the majority of hospitalization costs (75% of non-hotel costs occur within the first 48 h). Thus, it may be more cost effective to stabilize patients in the hospital, allowing for short increases in hospital length of stay, but reducing overall hospital readmission rates and number of emergency room visits. In Michigan, health care systems are encouraged to prevent frequent hospitalizations; Medicare DRG reimbursements for a rehospitalization with 15 days of discharge are not granted.

FIG. 2 Comparison of Health Care Financing Administration expenditures on heart failure compared with cancer and myocardial infarction according to the Medicare program. Reprinted from Ref. No. 4 with permission from Elsevier Science.

TABLE I Strategies to prevent heart failure and its progression

Primary prevention ^a
1. Treat hypertension (especially systolic hypertension)
2. Treat hyperlipidemia
Secondary prevention ^b
1. ACE inhibitors
2. Beta blockers
3. Secondary prevention after myocardial infarction
(a) Aspirin
(b) Beta blockers
(c) Antihyperlipidemic therapy
(d) Anticoagulation therapy
(e) Coronary revascularization (in appropriate patients)
Tertiary prevention ^c
1. ACE inhibitors
2. Beta blockers
3. Digoxin
4. Secondary prevention after myocardial infarction
5. Intensive home monitoring and intervention

^a Before onset of left ventricular dysfunction or cardiac disease.

^b After onset of left ventricular dysfunction or coronary artery disease, but before CHF.

^c After onset of heart failure to delay progression and prevent clinical events.

Abbreviations: ACE = angiotensin-converting enzyme, CHF = congestive heart failure.

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Medical-Based Targets

Health care professionals need to improve implementation of primary, secondary, and tertiary strategies (Table I) for preventing the onset and progression of heart failure.¹³ Nearly 75% of patients with heart failure have antecedent hypertension.⁵ The incidence of heart failure is higher than average in survivors of myocardial infarction; about 20% of these patients become disabled with heart failure within 6 years.⁵ The primary prevention strategy, introduced before the onset of left ventricular (LV) dysfunction, involves treatment of diabetes, hypertension, and hyperlipidemia; discontinuation of smoking; and prompt management of underlying cardiac disorders including coronary artery disease or valvular heart disease. Initiated after the onset of LV dysfunction but before clinical heart failure, secondary prevention involves treatment with angiotensin-converting enzyme (ACE) inhibitors, beta blockers, aspirin, antihyperlipidemic agents, anticoagulation therapy, and coronary revascularization, if appropriate. After the onset of clinical heart failure, tertiary prevention/treatment involves pharmacologic therapy with ACE inhibitors, beta blockers, digoxin, and diuretics; prevention of recurrent myocardial infarction; and intensive home monitoring to delay disease progression and prevent clinical events.¹³

Use of ACE inhibitors: Results of the Studies of Left Ventricular Dysfunction (SOLVD),¹⁴ Veterans Administration Cooperative Vasodilator-Heart Failure Trial (V-HeFT II),¹⁵ and Cooperative North Scandinavian Enalapril Survival Study

(CONSENSUS)¹⁶ trials demonstrated that ACE inhibitors reduce disability, improve functional capacity, and prolong life among patients with heart failure. Furthermore, this drug class was well tolerated in more than 80% of study patients.^{14, 15} Angiotensin-converting enzyme inhibitor treatment reduced hospital readmission rates; ACE-inhibitor therapy decreased the risk of 90- and 180-day rehospitalizations in patients with heart failure.¹⁷ However, reductions in morbidity and mortality associated with ACE-inhibitor and beta-blocker treatment have not yet translated into reduced mortality in national heart failure statistics.^{18, 19}

Underutilization of ACE inhibitors may contribute to the absence of the reduction in national heart failure morbidity and mortality. The overall use of ACE inhibitors in Medicare patients admitted to acute care hospitals with a principal diagnosis of heart failure ranges from 48 to 57%.²⁰ Ideal candidates for ACE inhibitor therapy include patients with low ejection fraction (EF) (<40%), normal renal function, and normal serum potassium. However, only 73% of patients most likely to benefit from and tolerate such therapy are prescribed ACE inhibitors at hospital discharge.²⁰ Advanced age was associated with decreased prescription rates among ideal candidates; 78% of patients 65 to 74 years and 67% of those ≥85 years were prescribed ACE inhibitors at hospital discharge.²⁰ Physician specialty also affects prescribing practices. Cardiologists prescribe ACE inhibitors to their patients with CHF more often (46%) compared with all other physicians (22%);²¹ cardiologists also tend to prescribe these agents earlier in the course of CHF treatment than do internists and family or general practitioners.²²

Obtaining an objective assessment of LV systolic function is associated with ACE inhibitor use. Of hospitalized Medicare patients with CHF, 48% lacked documentation of LV function in the medical record.²³ Patients with an objective assessment of LV function were prescribed ACE inhibitors more often at hospital discharge than patients without an LV assessment (56 vs. 48%, $p = 0.006$). In addition, when LV function was assessed at hospital admission, significantly more patients were prescribed ACE inhibitors at hospital discharge than patients without an assessment of LV function, even if EF was low (36 vs. 26%, $p = 0.004$).

Appropriate ACE inhibitor dosing is also an important determinant of clinical outcome. The Assessment of Treatment with Lisinopril and Survival (ATLAS) trial compared the effects of low- and high-dose ACE inhibitors on the survival of patients with heart failure.²⁴ Compared with low-dose lisinopril, treatment with high-dose lisinopril resulted in small reductions in both total mortality (42.5 vs. 44.9%, $p = 0.128$) and cardiovascular mortality (37.2 vs. 40.2%, $p = 0.073$).²⁵ However, treatment with high doses of the ACE inhibitor reduced heart failure-related hospitalizations by 24% compared with the low-dose therapy ($p = 0.003$).²⁵

In a retrospective outpatient chart audit evaluating guideline implementation in the management of CHF, 50% of 16,603 patients with CHF were prescribed an ACE inhibitor, but overall only 26% of patients received the recommended target dose.²⁶

Improved timing and accuracy of heart failure diagnosis: It is recommended that all patients with heart failure undergo a complete diagnostic evaluation to (1) determine the type and severity of their cardiac dysfunction, (2) uncover correctable etiologic factors, (3) determine prognosis, and (4) guide treatment.²⁷ Routine diagnostic studies for adult patients with heart failure include complete medical history; physical examination; exercise stress testing to assess functional capacity and symptomatic limitations; transthoracic echocardiography for specific assessment of ventricular mass, chamber size, systolic and diastolic function, and valvular abnormalities; and other noninvasive tests to detect ischemia and assess myocardial viability.⁸ These diagnostic tests are essential to evaluate patients with heart failure and to determine an underlying cause that can be appropriately treated by specific therapies; improvements in the definition and detection of heart failure classes are also needed.^{9, 18}

Compliance-Based Targets

Patients' failure to comply with physician instructions frequently contributes to disease-related complications. Patients are often noncompliant with prescribed medication regimens; 15% of hospital readmissions are related to medication non-compliance.¹⁰ The Merck Study defined compliance as refilling 80% of prescriptions on time and continuing prescriptions for a 1-year period; only 46% of patients with heart failure were compliant. Proprietary issues that affect patient compliance include regimen complexity, prescription size, side-effect profile, patient education, medication effectiveness, cost, and physician factors. It is interesting that DiMatteo *et al.* reported that the most important physician factor was physician global job satisfaction. Physicians who were happier in their work appeared to improve patient adherence.²⁸

Only 10% of eligible patients with heart failure follow appropriate ACE inhibitor medication regimens when factors are combined for patient noncompliance and inaccurate medication dosing. Savings would be enormous if all eligible heart failure patients were prescribed the correct ACE inhibitor regimen and adhered to physicians' recommendations. Consider the following analysis: for 1,000 patients with heart failure taking enalapril at a cost of \$540 per person per year, the total 3-year cost would be \$1.6 million. Approximately 350 hospitalizations would be prevented over these years,¹⁴ and, at an average cost of \$10,770 per hospitalization, the savings would amount to \$3.7 million. The net savings (prevented hospitalization minus enalapril costs) would be \$2 million per 1,000 patients over 3 years. For the entire population of 4.78 million patients with heart failure in the U.S., the net 3-year savings would be \$10 billion.

Clinical trials, which contain the necessary infrastructure, ensure that a large percentage of patients receive medication prescriptions, maintain appropriate medication regimens, and require patient compliance. However, routine clinical practice lacks such an infrastructure. Managed care and discounted fee-for-service do not allow direct funding of support services

such as follow-up visits, home visits, or education. Fee-for-service arrangements are limited primarily to physician encounters and hospitalizations. During a patient's hospitalization, physicians receive a daily fee. It is in the interest of the hospital, however, to discharge the patient as soon as possible; thus, a divergence in economic outlook is created. Although a huge financial benefit exists for managed care providers to ensure patient compliance, patient compliance issues are not properly addressed under the current system.

Conclusion

There are 4.78 million patients with heart failure in the United States, of whom 1.4 million are in NYHA class III or IV at any given time. More than \$56 billion is spent annually on the treatment and management of heart failure, 70% of which covers the hospitalization of patients. There is a need to develop innovative solutions to keep this growing population out of the hospital and to improve the overall management of the patients. Success in this endeavor will have a beneficial impact on our entire health care system.

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