Congestive Heart Failure in the Community: A Study of All Incident Cases in Olmsted County, Minnesota, in 1991

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Congestive Heart Failure in the Community
A Study of All Incident Cases in Olmsted County, Minnesota, in 1991

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Background—Data are limited regarding the classification and prognosis of patients with congestive heart failure (CHF) in the community.

Methods and Results—Using the resources of the Rochester Epidemiology Project, we evaluated all patients receiving a first diagnosis of CHF in Olmsted County, Minnesota, in 1991 (n=216). Among these patients, 88% were ≥65 years and 49% were ≥80 years of age. The prognosis of patients with a new diagnosis of CHF was poor; survival was 86±2% at 3 months, 76±3% at 1 year, and 35±3% at 5 years. Of the 216 patients, 137 (63%) had an assessment of ejection fraction. In these patients, systolic function was preserved (ejection fraction ≥50%) in 59 (43%) and reduced (ejection fraction <50%) in 78 (57%). Survival adjusted for age, sex, NYHA class, and coronary artery disease was not significantly different between patients with preserved and those with reduced systolic function (relative risk, 0.80; $P=0.369$). ACE inhibitors were used in only 44% of the total population with CHF.

Conclusions—The present study reports the clinical characteristics and natural history of CHF as it presents in the community in the vasodilator era. CHF is a disease of the "very elderly," frequently occurs in the setting of normal ejection fraction, and has a poor prognosis, regardless of the level of systolic function. Diagnostic and therapeutic methods are underused in the community. **(*Circulation*. 1998;98:2282-2289.)**

Key Words: epidemiology ■ heart failure ■ prognosis

During the past 25 years, death rates for cardiovascular disease have been decreasing in western countries.[1,2] In contrast, congestive heart failure (CHF) is the only common cardiovascular condition whose prevalence is increasing, particularly in elderly patients.[3] This condition is associated with high morbidity and mortality. Approximately 2 million persons in the United States have CHF; every year there are 400 000 new cases[4] and 274 000 deaths.[5] Furthermore, as the US population becomes older, the prevalence of CHF may continue to increase.[6,7] Most studies that have characterized patients with CHF include only patients with systolic left ventricular dysfunction and are limited by significant referral bias because they often focus on hospital-based practices or patients referred to a tertiary center and generally have excluded very elderly patients.

Limited data are available about the characterization and prognosis of CHF in the community.[8–12] There has been considerable interest in isolated diastolic dysfunction in recent years, and several studies have reported that a substantial number of patients with CHF have normal systolic function.[13] Most of the previous studies were small and subject to referral bias. In the community setting, it is unknown how many patients with CHF have normal systolic function and whether their clinical characteristics and prognosis are unique. Furthermore, few data are available regarding the use of therapeutic agents in the community. These data are essential to the understanding of potential differences between patients with CHF in the community and those commonly studied in CHF therapeutic trials and to the determination of whether recommendations from these trials have an impact on the management and outcome of CHF in the community.

Therefore, we studied patients receiving a first-time diagnosis of CHF in a well-defined community. We specifically wanted to evaluate (1) the age distribution of patients with CHF in the community; (2) the prevalence of normal systolic function in patients with CHF; (3) the prognosis of new-onset CHF in the community, including the prognosis of patients with CHF and preserved ejection fraction; and (4) the use of vasodilators and other therapies for CHF after diagnosis.

Methods

Study Setting

This study was approved by the Mayo Institutional Review Board. Olmsted County, Minnesota, is located ≈80 miles southeast of Minneapolis. Approximately 70% of the population of the county

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resides within the city limits of Rochester. Demographic information about Olmsted County is available from each published decennial census. In 1990, Olmsted County population was 106 470 (96% white); 28% of the population was >45 years of age, and 11% was ≥65 years of age. The population is primarily middle class; ≈82% of the adult population have graduated from high school. Except for a higher proportion of the working population employed in healthcare-related facilities, the characteristics of the population of Olmsted County are similar to those of other US whites.[14]

Population-based epidemiological research is feasible in Olmsted County because the city and county are relatively isolated from other urban centers and patient care is available from a limited number of healthcare providers: the Mayo Clinic, the Olmsted Medical Center, their hospitals, and a few private practitioners. Most care is provided through the Mayo Clinic, which has maintained a unified medical record with 2 hospitals for the past 80 years. The Mayo Clinic unit record contains a master sheet that includes all diagnoses made during outpatient office visits, clinic consultations, emergency department visits, nursing home care, hospital admission, autopsy examination, and death certification. This information has been indexed since the turn of the century.[14,15] The Rochester Epidemiology Project has developed a similar index for the records of other providers of medical care to local residents. The epidemiological potential of this index system is further enhanced because each provider uses the unified medical record system, whereby all data collected on an individual patient are assembled in 1 place. The result is the linkage of medical records from essentially all sources of medical care available to and used by the Olmsted County population.[14,15]

Identification of Cases

Potential cases of CHF were identified through the available indexes, which indicated patients who had a new diagnosis of CHF from January 1,1991, through December 31,1991. Once these patients had been identified, the complete community medical records of each candidate case were reviewed carefully. The validity of the diagnosis of CHF was ascertained by use of a slight modification of the Framingham criteria.[8] These criteria are classified as major or minor. The major criteria were paroxysmal nocturnal dyspnea, orthopnea, abnormal jugular venous distention, pulmonary rales, cardiomegaly, pulmonary edema, presence of a third heart sound, and central venous pressure of >16 cm H_2O. The minor criteria were edema, night cough, dyspnea on exertion, hepatomegaly, pleural effusion, tachycardia (>120 bpm), and weight loss of ≥4.5 kg in 5 days (considered a major criterion if it occurred during therapeutic interventions for CHF). A patient was considered to have CHF if 2 major criteria were present or if 1 major and 2 minor criteria were present concurrently. The medical record was examined to determine whether systolic function, assessed according to ejection fraction, had been evaluated within 3 weeks before or after the diagnosis. Left ventricular systolic function was classified as indeterminate (not assessed), normal (ejection fraction ≥50%), or reduced (ejection fraction <50%). Patients with an ejection fraction of ≥50% were classified as having CHF with normal systolic function. Clinical characteristics that provide information pertinent to potential cause, diagnosis, therapy, and prognosis were collected. The number of hospitalizations and days of hospitalization in which CHF was a primary or major contributing factor subsequent to the diagnosis of CHF were noted. Total mortality was determined from the clinical record and the death certificate listings.

The clinical record was reviewed to establish residency at the time of diagnosis of CHF. Residency in Olmsted County 1 year before the diagnosis of CHF was required to exclude the possibility that a patient moved to Rochester to facilitate diagnosis or treatment of the condition (residency for these reasons would introduce a form of referral bias).[16]

Coronary artery disease was defined as (1) the presence of a clinical diagnosis of coronary artery disease, (2) positive results of a stress test, (3) coronary angiography showing ≥1 vessel with stenosis of >50%, (4) a clinical diagnosis of myocardial infarction, or (5) ECG findings of Q-wave myocardial infarction. A patient was considered to have hypertension if (1) this was a clinical diagnosis indicated in the medical record, (2) arterial blood pressure was normal with ongoing antihypertensive therapy, or (3) at diagnosis there were 2 successive determinations of either a systolic arterial blood pressure of ≥160 mm Hg or a diastolic arterial blood pressure of ≥90 mm Hg. The diagnosis of severe valve disease was based on angiographic or echocardiographic data. The criterion for idiopathic dilated cardiomyopathy was global left ventricular dilatation with impaired systolic function occurring in the absence of a known cardiac or systemic cause. A patient was considered to have chronic obstructive pulmonary disease or restrictive lung disease if a clinical diagnosis was listed in the medical record or if the patient had abnormal results of pulmonary function tests.

TABLE 1. Clinical Characteristics of 216 Patients With First Diagnosis of CHF

Characteristic	n	%
Age (mean±SD), y	77.3±12.1	
Male	125	58
Age ≥65 y	189	88
Age ≥80 y	105	49
NYHA class III or IV	116	54
Inpatient at diagnosis	146	68
Clinical history		
Restrictive/COPD	51	23
Underlying CV disease		
CAD	87	40
HTN	113	52
HTN+CAD	51	24
IDC	3	1
Chest radiograph		
Cardiomegaly	152	70
Pulmonary venous hypertension	127	59
Pulmonary edema	103	48
ECG		
Atrial fibrillation/flutter	52	24
LBBB/IVCD	50	23
MI	63	29
LVH	37	17

Restrictive/COPD indicates restrictive/chronic obstructive pulmonary disease; CV, cardiovascular; CAD, coronary artery disease; HTN, hypertension; IDC, idiopathic dilated cardiomyopathy; LBBB, left bundle-branch block; IVCD, intraventricular conduction delay; MI, myocardial infarction; and LVH, left ventricular hypertrophy.

Statistical Analysis

Continuous variables were expressed as mean±SD and were compared between groups with Student's *t* test. Discrete variables were summarized by frequency percents and were analyzed with the χ^2 test. Survival function estimates were derived by the Kaplan-Meier method, and differences in survival between groups were assessed by the 2-sample log-rank test. Expected survival overall or for subgroups was based on age- and sex-matched mortality data for the 1990 Minnesota white population, and comparisons of observed and expected survival were based on the 1-sample log-rank test. Univariate and multivariate Cox proportional hazards regression analyses were used to identify predictors of survival. Univariate and multivariate logistic regression analyses were used to evaluate clinical predictors of abnormal systolic function (ejection fraction <50%). The independent candidate variables corresponded to the variables listed in Table 1. A value of $P<0.05$ was considered statistically

TABLE 2. Diagnostic Criteria for Diagnosis of CHF

Criteria	n	%
Major criteria		
Paroxysmal nocturnal dyspnea	68	32
Orthopnea	66	31
Elevated JVP	119	55
Pulmonary rales	175	81
Third heart sound	40	19
Cardiomegaly on CXR	151	70
Pulmonary edema on CXR	103	48
Minor criteria		
Peripheral edema	121	56
Night cough	26	12
Dyspnea on exertion	200	93
Hepatomegaly	30	14
Pleural effusion	70	32
Heart rate >120 bmp	8	4
Weight loss ≥4.5 kg	4	2

JVP indicates jugular venous pressure (distention); CXR, chest radiograph.

significant. S-PLUS software (Statistical Sciences, Inc) was used for the survival analyses; all other computations were performed with the SAS System (SAS Institute, Inc).

Results

Total Incident Population

A total of 216 new cases of definite CHF were identified in Olmsted County in 1991. The clinical characteristics of the patients are summarized in Table 1. The distribution of the diagnostic criteria is reported in Table 2.

The age distribution of incident cases of CHF is shown in Figure 1. The number of patients with heart failure dramatically increased with advancing age.

The prognosis of patients with a new diagnosis of CHF was poor (Figure 2A). Cumulative survival was 86% ± 2% at 3 months, 76% ± 3% at 1 year, and 35% ± 3% at 5 years. Survival of the 185 patients still alive 90 days after the diagnosis of CHF was 88±2% at 1 year and 41±4% at 5 years (Figure 2B). By multivariate analysis, advanced age (P=0.0001; relative risk [RR], 1.042; 95% CI, 1.024 to 1.062) and moderate to severe NYHA functional class (P=0.027; RR, 1.47; 95% CI, 1.04 to 2.09) were negative predictors of long-term survival. After the first episode of CHF, 34% of patients were subsequently hospitalized for symptoms of heart failure. In all, only 27% of patients were never hospitalized for CHF.

Normal Versus Reduced Ejection Fraction

Of the 216 patients, 137 (63%) had an assessment of ejection fraction by echocardiography within 3 weeks before or after diagnosis. Of these patients, 59 (43%) had preserved systolic function (ejection fraction ≥50%), and 78 (57%) had predominantly systolic dysfunction. Clinical characteristics of the patients with preserved and those with reduced systolic function are outlined in Table 3. In the 59 patients with normal systolic function, only 5 (3 with severe mitral regurgitation and 2 with severe mitral stenosis) had significant valve disease at diagnosis. By logistic regression analysis, female sex was identified to be associated with preserved ejection fraction. Age ≥90 years was an independent positive predictor of normal systolic function. The presence of left bundle-branch block or a myocardial infarction pattern on ECG was independently associated with decreased ejection fraction (Table 4). Survival adjusted for age and sex was significantly reduced in both ejection fraction groups compared with expected survival (P=0.0001 for both; Figure 3). Unadjusted survival was similar in the two groups (P=0.279; Figure 4). By multivariate analysis, survival adjusted for age, sex, NYHA class, and coronary artery disease was still not significantly different between patients with ejection fractions <50% and those with ejection fractions of ≥50% (RR, 0.80; P=0.369). In patients with CHF and ejection fractions of ≥50%, survival was not different in patients with recognized coronary artery disease (RR, 1.170; 95% CI, 0.79 to 1.73; P=0.42). Survival was not different in the 18 patients treated with ACE inhibitors (RR, 0.905; 95% CI, 0.62 to 1.33; P=0.60).

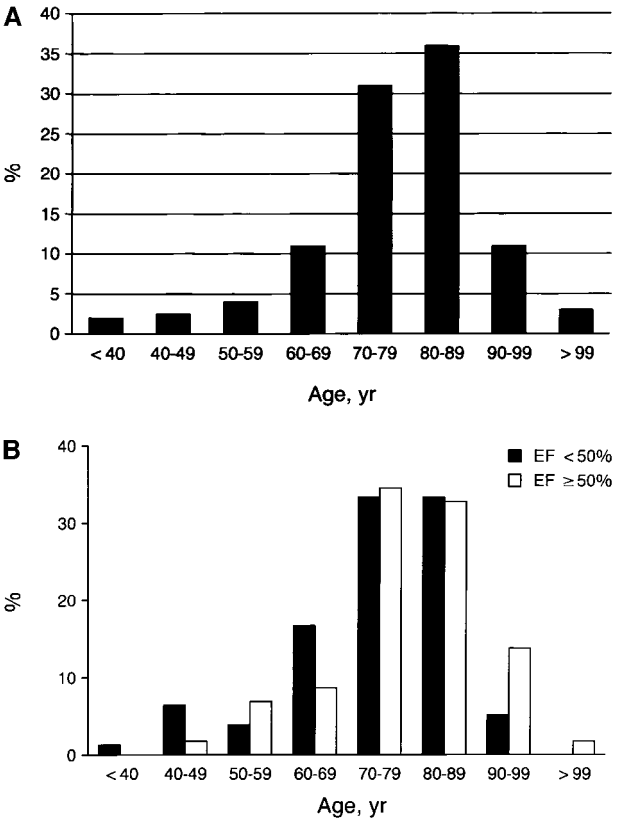

Figure 1. A, Age distribution in 216 incident cases of CHF. B, Age distribution in patients with CHF and ejection fraction (EF) <50% or ≥50%.

Medical and Surgical Treatments

Medical and surgical treatments prescribed after the diagnosis of CHF are outlined in Table 5. Treatment for all patients and for those who had assessment of ejection fraction (preserved or reduced systolic function) is presented. Patients with heart failure and systolic dysfunction

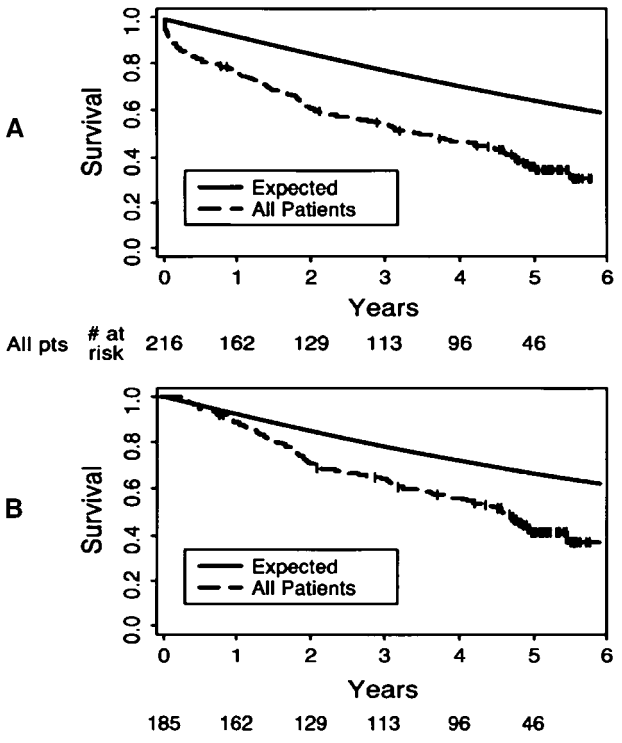

Figure 2. Survival of all patients with new diagnosis of CHF (A) and those alive at 3 months after diagnosis (B).

were hospitalized more frequently for heart failure ($P<0.05$). In patients with ejection fractions <50%, 8 (10%) were never hospitalized for heart failure, 32 (41%) were hospitalized 1 time, and 38 (49%) were hospitalized ≥2 times for heart failure. In patients with ejection fractions of ≥50%, 14 (24%) were never hospitalized for heart failure, 30 (51%) were hospitalized 1 time, and 15 (25%) were hospitalized ≥2 times for heart failure.

Discussion

This study was performed in a well-defined community-based population and examined all patients receiving a first diagnosis of CHF in 1991 who fulfilled the Framingham criteria for CHF.[8] We found that 49% of patients with a first-time diagnosis of CHF in the community are ≥80 years of age. Prognosis for CHF in the community is extremely poor, even when patients with early mortality are excluded. For the first time in a large community-based study, we confirmed that among patients with clinical CHF who undergo assessment of ventricular function, nearly as many have preserved systolic function (43%) as have reduced ejection fraction. At the time of diagnosis, patients with preserved function were as symptomatic as patients with reduced ejection fraction and had a similar poor prognosis.

Age of Patients With New Diagnosis of CHF

The changing age demographics of the population have recognized implications for health care. The "very elderly," those ≥80 years, is the fastest growing segment of our population. The Framingham study, a community-based volunteer study, reported that the incidence of CHF increases exponentially with advancing age.[7] However, analysis of the Framingham study population regarding the incidence of CHF in very elderly patients (>84 years of age) must be interpreted cautiously because relatively few patients were ≥84 years of age. A previous study of CHF in Olmsted County[16] and the NHANES-I study[11] excluded patients >74 years of age. The present study confirms that CHF is a disease of the elderly in that the age of patients was ≥65 years in 88% of incident cases. However, the finding that ≈50% of patients with a new diagnosis of CHF in the community are among the very elderly (≥80 years old) is striking.

TABLE 3. Clinical Characteristics of 137 Patients With CHF and Preserved or Reduced Ejection Fraction

	Ejection Fraction				
	<50% (n=78)		≥50% (n=59)		
Characteristic	n	%	n	%	*P*
Female	32	41	41	69	0.001
Age (mean±SD), y	74.2±13.3		77.8±11.6		0.106
Age ≥80 y	30	38	29	49	0.211
NYHA class III or IV	58	75	40	69	0.539
Inpatients at diagnosis	67	86	42	71	0.034
Clinical history					
Creatinine ≥1.3 mg/dL	40	51	22	37	0.103
Restrictive/COPD	11	14	9	15	0.850
Underlying CV disease					
CAD	41	53	18	31	0.010
HTN	39	50	34	58	0.376
HTN+CAD	20	26	13	22	0.625
IDC	2	3	0		0.322
Chest radiograph					
Cardiomegaly	60	77	38	64	0.108
Pulmonary venous hypertension	51	65	36	61	0.599
Alveolar pulmonary edema	4	5	2	3	0.480
Interstitial	47	60	26	44	0.060
ECG					
Atrial fibrillation/flutter	19	24	17	29	0.557
LBBB/IVCD	9	12	0		0.007
MI	33	42	9	15	0.001
LVH	15	19	10	17	0.732

Abbreviations as in Table 1.

TABLE 4. Multivariate Analysis for Predictive Factors for Abnormal Left Ventricular Systolic Function (Ejection Fraction <50%)

Factor	Odds Ratio	95% CI	*P*
Female sex	0.288	0.10–0.56	0.002
Age ≥90 y	0.240	0.06–1.03	0.045
MI	4.603	1.16–9.74	0.0025
LBBB	*	*	0.0001

MI indicates myocardial infarction; LBBB, left bundle-branch block.

*Could not be reported because all patients with LBBB had an ejection fraction <50%.

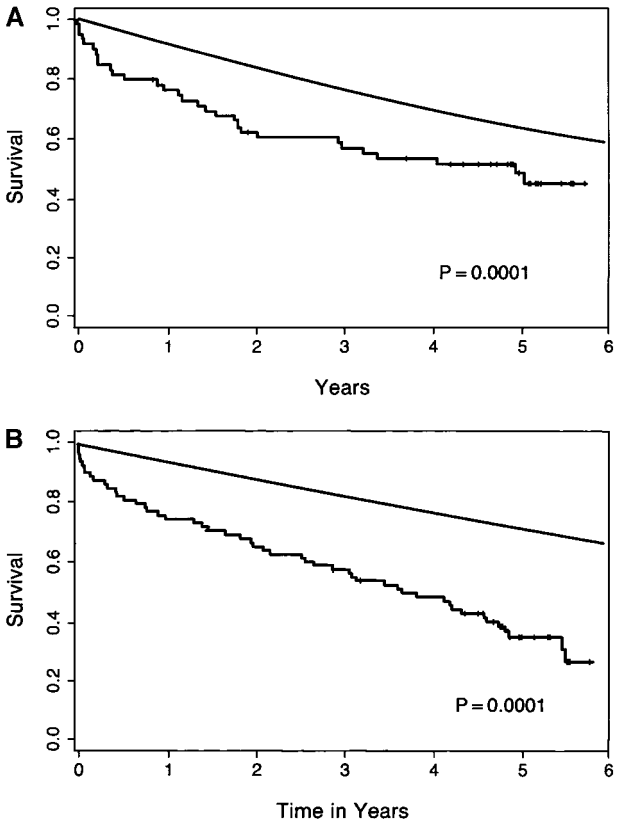

Figure 3. Survival of patients with ejection fraction of ≥50% (A) and <50% (B) compared with that for age- and sex-matched population.

As pointed out recently, the age of patients usually seen by a cardiologist is 65 to 75 years.[17] In the community, the age of most patients with CHF is much higher. These patients are routinely followed by primary-care physicians, geriatricians, or internal medicine specialists. If cardiologists are to offer meaningful consultation to their general medicine colleagues regarding the management of CHF, more data are needed for very elderly patients with CHF. These patients are characterized by a host of age-related comorbid conditions that may alter their clinical presentation and response to therapy.[17] Except for the CONSENSUS I and ELITE trials,[18,19] in which the mean ages were 71 and 74 years, respectively, these patients were not represented in major CHF treatment trials, in which the mean age ranges from 59 to 65 years.[20–25]

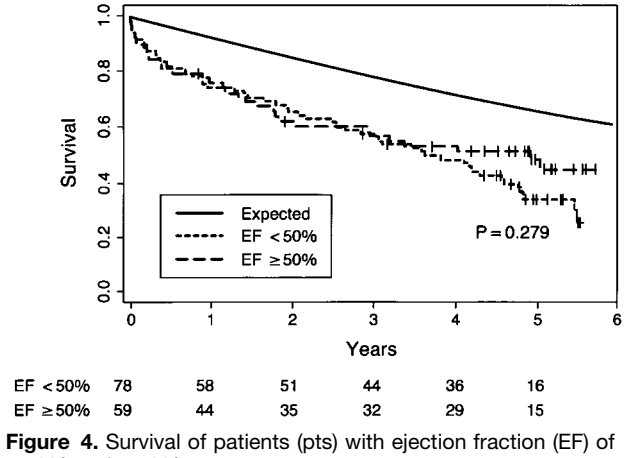

Figure 4. Survival of patients (pts) with ejection fraction (EF) of ≥50% and <50%.

TABLE 5. Therapy Prescribed After Diagnosis of CHF in All Patients and in Patients With Ejection Fraction ≥50% and <50%

	All patients (n=216)		Ejection Fraction <50% (n=78)		Ejection Fraction ≥50% (n=59)		
Therapy	n	%	n	%	n	%	P*
Diuretic	176	82	61	78	46	78	0.973
ACE inhibitors	94	44	54	69	18	31	0.001
Digoxin	83	38	43	55	16	27	0.001
β-Adrenergic blocker	24	11	8	10	11	19	0.160
Calcium antagonists	44	20	12	15	14	24	0.217
Other vasodilators	4	2	2	3	2	3	0.776
Warfarin	26	12	14	18	9	15	0.676
CABG or PTCA	10	5	6	8	3	5	0.622
Valve surgery	3	1	1	1	2	3	0.404
Heart transplantation	2	1	2	3	0		0.215

*For χ^2 test, ejection fraction ≥50% vs <50%.

Diastolic Heart Failure

Preliminary data from the Framingham study showed that 52% of 77 patients with new-onset CHF had preserved ejection fraction.[26] Data from 31 small uncontrolled studies showed a significant disagreement in regard to the frequency of diastolic heart failure and the clinical characteristics and prognosis in these patients.[13] None of these studies examined a large number of consecutive cases of CHF in the community. In this community-based population, 43% of patients with definite CHF who had echocardiography had normal ejection fractions, and even if patients found to have unexpected, significant valvular disease are excluded, the percentage of patients with preserved ejection fraction and CHF remains high (41%). Nevertheless, the true prevalence of diastolic heart failure in patients with a new diagnosis of CHF in our total population remains unknown because 37% did not have assessment of systolic function at the time of diagnosis. However, the prevalence ranges from 27% to 64% whether we assume that no patient or all patients without echocardiography had ejection fractions of ≥50%, respectively.

Our series also shows that in patients with CHF, advanced age, female sex, and a history of hypertension are associated with a high ejection fraction, whereas a history of coronary artery disease and a markedly abnormal ECG were associated with a lower ejection fraction, although no clinical characteristics reliably predicted normal systolic function in an individual patient. Diastolic dysfunction appears to be a primary cause of heart failure in elderly patients. Among patients ≥80 years of age who have heart failure, >50% have normal or nearly normal systolic function.[13] In our community-based study, 48% of

patients >80 years of age with CHF had ejection fractions of ≥50%. This increased prevalence of heart failure caused by diastolic dysfunction in elderly patients may reflect duration of hypertension and coronary artery disease and perhaps the concomitant effects of age-related changes in the cardiovascular system.[27]

Specific diagnostic criteria for diastolic heart failure are lacking, and currently one must rely on a firm clinical diagnosis of CHF in the absence of systolic dysfunction at the time of symptoms.[28]

For accurate characterization of diastolic function and detection of increased filling pressures in patients with normal ejection fractions, sophisticated combined analysis of pulmonary venous and mitral inflow flow velocity profile, Valsalva maneuver, and color M-mode analysis of the velocity of flow propagation are required,[29] and these were not routinely performed in our echocardiography laboratory in 1991.[29,30] Few patients had cardiac catheterization. Initial assessment of comorbid conditions such as renal and pulmonary disease failed to reveal a higher prevalence of these conditions in patients with diastolic heart failure. Thus, the diagnosis of diastolic heart failure remains presumptive, although highly likely.

Prognosis

Previous studies reporting mortality in a community-based population enrolled only patients <74 years of age.[8–12] Only the Framingham Heart Study, which evaluated survival in patients who developed CHF between 1948 and 1988, included patients without age limits and reported 3-month, 1-year, and 5-year survival rates of 73%, 57%, and 25%, respectively. Surprisingly, there was no significant change in overall survival after the onset of CHF during 40 years of follow-up. However, as emphasized by the authors, use of vasodilators and cardiac transplantation was not widespread during most of the follow-up period.[31]

In the present study, survival at 3 months, 1 year, and 5 years was 86%, 76%, and 35%, respectively. We have previously reported the impact of both secular trends and referral bias on survival in patients with idiopathic dilated cardiomyopathy.[32] Although a cross-study comparison must be made with caution, the improved survival in this 1991 cohort compared with the Framingham cohort suggests some impact of improved diagnosis and therapy on survival for patients with CHF in the community.

The prognosis for patients with CHF and preserved ejection fraction has not been extensively studied. The reported annual mortality rate varies from 1.3% to 17.5% in hospital-based series.[13] These differences in prognosis are likely related to differences in the study population, especially in regard to age, origin, and functional class. In the V-HeFT study,[33] the mortality rate of patients with CHF and normal ejection fractions was 23% at 5.7 years, but patients with myocardial ischemia were excluded, and the mean age was only 60 years. In a study by Setaro et al[34] of a cohort of patients referred to a nuclear cardiology laboratory with a diagnosis of CHF whose mean age was 71 years and in whom coronary artery disease was the predominant underlying disease, the mortality rate at 7 years was 46%. In the present study, prognosis was poor for patients with diastolic heart failure; the survival rate at 3 months, 1 year, and 5 years was 86%, 76%, and 48%, respectively.

Although the prognostic value of ejection fraction is well accepted, previous studies have shown that the relationship between ejection fraction and survival in CHF may not be as strong.[35,36] Indeed, Taffet et al[37] did not report differences in survival between patients ≥75 years of age with CHF and normal or reduced systolic function. Setaro et al[34] also confirmed a high risk of cardiovascular events in patients with CHF and normal systolic function. In a preliminary report from a study of 77 patients with CHF detected as part of the Framingham study, mortality adjusted for age and sex was not significantly lower in patients with normal systolic function (RR, 0.58; 95% CI, 0.30 to 1.1; $P=0.10$), although unadjusted mortality was lower in patients with preserved systolic function. The poor survival may be related to the advanced symptom level and very advanced age, as suggested by the study by Taffet et al.[37] Younger cohorts with CHF and preserved systolic function may have improved survival compared with patients who have reduced ejection fraction. This finding is consistent with our data, which reveal that the adjusted mortality, controlling for age, sex, NYHA functional class, and the presence of coronary artery disease, is similar in patients with diastolic and systolic heart failure. There was a trend toward separation of the survival curves beginning at ≈3.5 years after diagnosis. This finding may suggest that a subset of patients with preserved systolic function do well over the long term, whereas patients with systolic dysfunction have a more homogeneously poor outcome.

In the patients with CHF and ejection fractions of ≥50%, survival was not significantly lower in patients with recognized coronary artery disease. This finding may be related to sample size, with an insufficient number to demonstrate the impact of coronary artery disease, underrecognition of coronary artery disease in this elderly population as a result of less aggressive evaluation, or other factors that alter prognosis in this very elderly population and may mask the effect of coronary artery disease.

In patients with CHF and ejection fractions of ≥50%, survival was not significantly lower in patients treated with ACE inhibitors. Only 18 patients were so treated. There was no control for dose, duration of therapy, or underlying cardiovascular disease. Thus, these data do not adequately address whether ACE inhibition is useful therapy in patients with CHF and ejection fractions of ≥50%.

Evaluation and Management of CHF in the Community

In the present study, 63% of patients with a new diagnosis of CHF had an assessment of left ventricular systolic function. Such assessment is recommended in patients with suspected CHF.[38] In this population receiving a diagnosis of CHF in 1991, 44% of patients were treated with ACE inhibitors. However, among the patients in whom systolic dysfunction was confirmed, 69% were treated with ACE inhibitors. This number is higher than previously reported in patients with heart failure in the community[39] and highlights the need for studies examining practice patterns in patients with heart

failure to determine whether systolic function was assessed and whether systolic function was reduced in patients not being treated with ACE inhibitors. However, we should recognize that the SOLVD prevention[19] and SAVE trials[24] were not published at that time; thus, treatment of asymptomatic or mildly symptomatic patients with ACE inhibitors was not universally accepted.

Study Limitations

This cohort study has the typical limitations of a retrospective study. Patients with CHF were identified from medical records, and the incidence of CHF may have been underestimated, particularly among young patients, who may be less likely to seek medical attention. Moreover, Framingham criteria are relatively insensitive for the detection of early manifestations of CHF.[40] Specific symptoms or signs of CHF may not have been reported by physicians because they were considered synonymous with CHF. Therefore, some patients may have been excluded because of an inability to fulfill diagnostic criteria based on the clinical record.

Despite these limitations, this study in a nonvolunteer community and comprehensive of all ages and of institutionalized patients describes the clinical manifestations and natural history of CHF as it presents in the community. The study underscores that as it presents in the community, CHF is a disease of the very elderly and has a poor prognosis. Although CHF commonly occurs in the presence of normal systolic function, preservation of systolic function was not associated with lower mortality. Our findings underscore the differences between patients with CHF in the community and those commonly enrolled in therapeutic trials. These data are essential if we are to evaluate the impact of advances in diagnosis and therapy on the natural history of CHF in the community.

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