CLINICAL RESEARCH STUDY

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Contemporary Prevalence and Correlates of Incident Heart Failure with Preserved Ejection Fraction

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ABSTRACT

BACKGROUND: We assessed the prevalence of preserved left ventricular ejection fraction in patients with incident heart failure and differences in the demographic and clinical characteristics that may differentiate patients presenting with heart failure with preserved versus reduced left ventricular ejection fraction.

METHODS: We identified all patients with newly diagnosed heart failure between 2005 and 2008 from 4 sites in the Cardiovascular Research Network on the basis of hospital discharge and ambulatory visit diagnoses, and assigned a category of preserved, borderline, or reduced left ventricular ejection fraction using data from electronic databases and chart review.

RESULTS: We identified 11,994 patients with incident heart failure; of these, 6210 (51.8%) had preserved left ventricular ejection fraction, 1870 (15.6%) had borderline systolic dysfunction, and 3914 (32.6%) had reduced left ventricular ejection fraction. For those with heart failure with preserved left ventricular ejection fraction, the mean age was 74.7 years and 57.1% were women; for those with borderline systolic dysfunction, the mean age was 71.6 years and 38.4% were women; and for those with reduced left ventricular ejection fraction, the mean age was 69.1 years and 32.6% were women. Compared with white patients, black patients were less likely to have heart failure with preserved systolic function. Those with a history of coronary artery bypass surgery, mitral or aortic valvular disease, atrial fibrillation or flutter, or a diagnosis of hypertension were more likely to have heart failure with preserved systolic function, as were those with a diverse range of noncardiac comorbid conditions, including chronic lung disease, chronic liver disease, a history of a hospitalized bleed, a history of a mechanical fall, a diagnosis of depression, and a diagnosis of dementia. Patients with a history of acute myocardial infarction and a history of ventricular fibrillation or ventricular tachycardia were less likely to have heart failure with preserved left ventricular ejection fraction. Patients with higher systolic blood pressures at baseline and lower low-density lipoprotein levels were more likely to have heart failure with preserved left ventricular ejection fraction, as were those with lower hemoglobin levels and the lowest glomerular filtration rates.

CONCLUSIONS: Heart failure with preserved left ventricular ejection fraction is the most common form of the heart failure syndrome among patients newly presenting with this condition, and women and older adults are especially affected. Evidence-based treatment strategies apply to less than one third of patients with newly diagnosed heart failure.

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KEYWORDS: Ejection fraction; Elderly; Gender; Heart failure; Prevalence; Systolic function

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The heterogeneity of the heart failure syndrome is well appreciated, and the importance of heart failure with preserved left ventricular ejection fraction as a prominent contributor to the heart failure epidemic has been established unequivocally.[1,2] Heart failure with "normal ventricular performance" has been described in case reports and small hospital-based case series dating back to the 1970s.[3] However, there have been few large population-based studies of this condition.

In a community-wide study of residents of Olmsted County, Minnesota, among 556 individuals with incident or prevalent heart failure identified in the early to mid-2000s, more than half had heart failure with preserved left ventricular ejection fraction.[4] Another study of patients hospitalized with decompensated heart failure at Mayo Clinic Hospitals from 1987 to 2001 determined that the prevalence of heart failure with preserved left ventricular ejection fraction increased from 38% to 47% to 54% over the 3 consecutive 5-year periods encompassed in the study.[5]

CLINICAL SIGNIFICANCE

- Heart failure with preserved left ventricular ejection fraction is the most common form of the heart failure syndrome among patients newly presenting with this condition.
- Women and older adults are especially affected.
- Patients with ejection fractions less than 40% comprise less than one third of those with incident heart failure.
- Evidence-based treatment strategies apply to only a minority of patients with newly diagnosed heart failure.

We conducted a large population-based study to provide a contemporary estimate of the prevalence of heart failure with preserved left ventricular ejection fraction and heart failure with reduced left ventricular ejection fraction among patients with newly diagnosed heart failure syndrome. An additional goal was to describe the demographic and clinical characteristics that may differentiate heart failure with preserved left ventricular ejection fraction from heart failure with reduced left ventricular ejection fraction at the time of initial clinical presentation. To address these questions, we identified all patients with newly diagnosed heart failure from 4 sites participating in the Cardiovascular Research Network (CVRN) between 2005 and 2008.

MATERIALS AND METHODS

The source population included members from 4 participating health plans within the National Heart, Lung, and Blood Institute–sponsored CVRN.[6] Sites included Kaiser Permanente Northern California, Kaiser Permanente Colorado, Kaiser Permanente Northwest, and Fallon Community Health Plan. Contributing sites provide care to an ethnically and socioeconomically diverse population across varying clinical practice settings and geographically diverse areas. Each site also had a Virtual Data Warehouse,[6,7] which served as the primary data source for subject identification and characterization. The Virtual Data Warehouse is a distributed standardized data resource composed of electronic datasets at each CVRN site, populated with linked demographic, administrative, ambulatory pharmacy, outpatient laboratory test results, and health care use (ambulatory visits and network and non-network hospitalizations with diagnoses and procedures) data for members receiving care at participating sites. Institutional review boards at participating sites approved the study, and waiver of consent was obtained because of the nature of the study.

Study Sample and Characterization of Left Ventricular Systolic Function

We first identified all persons aged ≥ 21 years with diagnosed heart failure based on having been hospitalized with a primary discharge diagnosis of heart failure or having >3 ambulatory visits coded for heart failure with at least 1 visit being with a cardiologist between January 1, 2005, and December 31, 2008. We used the following International Classification of Diseases, 9th Revision (ICD-9) codes: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, and 428.9. Prior studies have shown a positive predictive value of $>95\%$ for admissions with a primary discharge diagnosis of heart failure based on these codes when compared against chart review and Framingham clinical criteria.[8-10] We defined incident heart failure as having no hospitalization or ambulatory heart failure diagnosis at any time during the 5-year period before each patient's first heart failure diagnosis.

We ascertained information on quantitative or qualitative assessments of left ventricular ejection fraction from the results of echocardiograms, radionuclide scintigraphy, other nuclear imaging modalities, and left ventriculography test results available from site-specific databases complemented by manual chart review. We classified patients into categories of preserved and reduced ejection fraction. We defined heart failure with preserved left ventricular ejection fraction as a reported left ventricular ejection fraction $\geq 50\%$ or a qualitative assessment of preserved or normal systolic function by a physician.[11] We defined heart failure with reduced left ventricular ejection fraction as a reported left ventricular ejection fraction $\leq 40\%$ or a qualitative assessment of moderate, moderate to severe, or severe systolic dysfunction by a physician. A third category termed "borderline" systolic dysfunction was defined as a left ventricular ejection fraction of 41% to 49% or a qualitative assessment of mildly reduced systolic function by a physician.