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Risk Factors for Hospital Admission Among Older Persons With Newly Diagnosed Heart Failure

Findings From the Cardiovascular Health Study

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Objectives This study sought to identify risk factors for the occurrence of all-cause hospital admissions among older persons after heart failure diagnosis, and to determine whether geriatric conditions would emerge as independent risk factors for admission when evaluated in the context of other relevant clinical data.

Background Efforts to reduce costs in heart failure have focused on hospital utilization, yet few studies have examined how geriatric conditions affect the long-term risk for hospital admission after heart failure diagnosis. With the aging of the population with heart failure, geriatric conditions such as slow gait and muscle weakness are becoming increasingly common.

Methods The study population included participants with a new diagnosis of heart failure in the Cardiovascular Health Study, a longitudinal study of community-living older persons. Data were collected through annual examinations and medical-record reviews. Geriatric conditions assessed were slow gait, muscle weakness (defined as weak grip), cognitive impairment, and depressive symptoms. Anderson-Gill regression modeling was used to determine the predictors of hospital admission after heart failure diagnosis.

Results Of the 758 participants with a new diagnosis of heart failure, the mean rate of hospital admission was 7.9 per 10 person-years (95% CI: 7.4 to 8.4). Independent risk factors for hospital admission included diabetes mellitus (HR: 1.36; 95% CI: 1.13 to 1.64), New York Heart Association functional class III or IV (HR: 1.32; 95% CI: 1.11 to 1.57), chronic kidney disease (HR: 1.32; 95% CI: 1.14 to 1.53), slow gait (HR: 1.28; 95% CI: 1.06 to 1.55), depressed ejection fraction (HR: 1.25; 95% CI: 1.04 to 1.51), depression (HR: 1.23; 95% CI: 1.05 to 1.45), and muscle weakness (HR: 1.19; 95% CI: 1.00 to 1.42).

Conclusions Geriatric conditions are important, and potentially modifiable, risk factors for hospital admission in heart failure that should be routinely assessed at the time of heart failure diagnosis. (J Am Coll Cardiol 2013;61:635–42)

As the population has aged and survival with cardiovascular disease has increased, the number of older persons with heart failure has increased considerably over the past 20 years (1). Currently, 80% of patients with heart failure are age 65 years or older, and nearly 25% are age 80 years or

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Abbreviations and Acronyms

3MS = Modified Mini-Mental State Examination
ACE = angiotensin-converting enzyme
BMI = body mass index
CAD = coronary artery disease
CHS = Cardiovascular Health Study
DSST = Digit Symbol Substitution Test
NYHA = New York Heart Association

older (2). Costs associated with heart failure exceed $35 billion annually in the United States and are largely driven by hospital stays (3), yet relatively little is known about the long-term risk for hospital admission after heart failure diagnosis in older persons. Most studies have focused on the short-term (i.e., 30 days to 1 year) risk for hospital readmission after an initial hospital admission for heart failure. However, these short-term risk models have not fully characterized cumulative, lifetime hospital utilization after heart failure diagnosis, which is relevant from a public health perspective. Heart failure in older persons is often marked by recurrent episodes of clinical decompensation necessitating multiple hospital admissions. Furthermore, whereas geriatric conditions such as slow gait, muscle weakness, and cognitive impairment are emerging as important predictors of outcomes among older persons with cardiovascular disease (4–6), information about these conditions is not available in most heart failure registries, and their prognostic relevance for hospital admission in older patients with heart failure remains unclear.

To address these gaps in knowledge, the present study evaluated data from a population-based sample of persons age 65 years or older, with a follow-up period of up to 20 years after heart failure diagnosis. These data included a rich array of information, such as clinical heart failure assessments, laboratory evaluations, comorbid diseases, and objective assessments of several geriatric conditions. The goals were to identify risk factors for all-cause hospital admission among older persons after a new diagnosis of heart failure and to determine whether geriatric conditions would emerge as independent risk factors for admission when evaluated in the context of other relevant clinical data. This prognostic information may be used to assist in clinical decision making and to identify potential targets for intervention after heart failure diagnosis in older persons.

Methods

Study Population

The study population included Cardiovascular Health Study (CHS) participants with heart failure diagnosed after CHS enrollment. The objective of CHS was to identify factors associated with the onset of cardiovascular disease in older persons; however, potentially eligible participants with cardiovascular disease at the CHS screening visit were included. In 1989, 5,201 men and women age 65 years or older were enrolled into CHS from 4 communities across the United States, with an additional 687 African Americans recruited in 1992 to enhance minority representation. Potential CHS participants were identified from Medicare-eligibility lists. Persons who were wheelchair bound or receiving cancer or hospice treatment were excluded from CHS. Complete details on the inclusion/exclusion criteria have been previously reported (7).

Data Collection

In CHS, data about the development of heart failure and potential risk factors for hospital admission were collected every 12 months from 1989 to 1999 through in-person interviews and examinations, and hospital admissions through 2009 were ascertained. According to the CHS protocol, potential cases of incident heart failure were identified through 2 mechanisms: 1) hospital admission for heart failure, representing 85% of the new heart failure cases included in these analyses; and 2) self-report of a physician's diagnosis of heart failure (8). CHS criteria for heart failure required that a participant have a diagnosis of heart failure from a physician and be receiving medical treatment (e.g., a diuretic agent, an angiotensin-converting enzyme [ACE] inhibitor, or digitalis) for heart failure. The presence of cardiomegaly and pulmonary edema on chest x-ray, or evidence of left ventricular dysfunction by echocardiography or ventriculography, was used to support the diagnosis of heart failure. All potential cases of heart failure were adjudicated by an expert panel that reviewed all pertinent data from medical records. Participants entered the analysis at the time of the CHS study assessment (hereafter referred to as *baseline*) immediately after their heart failure diagnosis. However, because the objective of the present study was to identify risk factors for hospital admission that were present at the time of heart failure diagnosis, and because of the uncertainty about the duration of heart failure among prevalent cases in CHS, data from 275 CHS participants who had heart failure at the time of CHS enrollment were excluded from the present analysis.

Study Variables

Potential risk factors. DEMOGRAPHICS. Age was considered in 10-year categories. Sex, race (nonwhite vs. white), and highest level of education (<12th grade vs. 12th grade or higher) were also included in the analyses.

HEART FAILURE STATUS. Ejection fraction was classified as *depressed* (<45%) or *preserved* (≥45%) based on clinical studies of left ventricular function (echocardiography, nuclear, or catheterization data) performed at the time of hospital admission for heart failure diagnosis. New York Heart Association (NYHA) classification was ascertained through information obtained in participant interviews. ACE inhibitor and beta-blocker use was ascertained through participants' self-report and a medical record review.

BODY MASS INDEX. Based on previous work demonstrating associations of body mass index (BMI) with heart failure outcomes (9), BMI categories were selected to represent low