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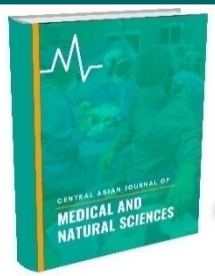

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# The Most Serious Causes That Cause Heart Failure and Their Prevention

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**Abstract:** We found that the prevalence of heart failure with preserved ejection fraction among patients with a discharge diagnosis of heart failure increased significantly from 1987 to 2001. The prevalence of hypertension, atrial fibrillation, and diabetes increased during the study period, while the prevalence of coronary disease remained stable. Patients with preserved ejection fraction fared slightly better than patients with reduced ejection fraction. However, although survival improved during the study period among patients with reduced ejection fraction, it did not improve among patients with preserved ejection fraction.

**Key words:** Heart failure , patient, systolic, dystolic.

Heart failure has been classified as “diastolic” (preserved ejection fraction) or “systolic” (reduced ejection fraction), but this nomenclature has become the subject of controversy. Because the recently revised American College of Cardiology–American Heart Association guidelines for the diagnosis and management of heart failure use the term “heart failure with preserved ejection fraction” rather than “diastolic heart failure,” this terminology has been adopted here.

The increase in the prevalence of heart failure with preserved ejection fraction over time noted in our analysis has also been suggested by previous studies. A review of 31 studies of patients with heart failure conducted from 1970 through 1995 noted that most studies (90 percent) involved patients who had been referred for treatment and that the prevalence of preserved ejection fraction among patients with heart failure ranged from 13 to 74 percent, with a median value of 40 percent.9 Subsequently, 12 community-based studies published from 1998 through 2003 found that the prevalence of preserved ejection fraction among patients with heart failure ranged from 40 to 71 percent, with a mean of 54 percent. The difference between the average prevalence rates reported in the early referral-based studies and those reported in the later community-based studies does suggest that the prevalence of preserved ejection fraction among patients with heart failure has either increased over time or differs between referral and community settings. Our findings, obtained with the use of consistent methods of

patient identification at a single center serving both referral and community patients over a 15-year period, suggest that both factors are important.

A true increase in the age-specific prevalence of heart failure with preserved ejection fraction could be related to changes in associated cardiovascular disease in the population. In our analysis, the prevalence of atrial fibrillation increased over time; this dysrhythmia is a common precipitant of acute decompensation in patients with heart failure with preserved ejection fraction.The prevalence rates of hypertension and diabetes mellitus, both of which are commonly associated with heart failure with preserved ejection fraction, also increased significantly over time among patients with heart failure.

The observed increase in heart failure with preserved ejection fraction could also be a consequence of changing physician behavior over time. The concept of "diastolic dysfunction" evolved markedly during the study period, and it is likely that the propensity to diagnose heart failure with preserved ejection fraction has evolved as well. The likelihood that this diagnosis will be made also depends to some extent on the rigor with which other diagnoses are considered. Some patients admitted during the early period of this study with symptoms of heart failure who were found to have preserved ejection fraction might have been assigned a different diagnosis at discharge and would therefore not be included in our data set. The prevalence of preserved ejection fraction among hospitalized patients with heart failure from Olmsted County in 1991 (45 percent) was similar to that found in a study conducted in Olmsted County in the same year that included both inpatients and outpatients (43 percent) however, similar reservations regarding diagnosis may apply to the outpatients in that report.

The survival rates of patients with heart failure with reduced ejection fraction and of those with preserved ejection fraction have been extensively studied and compared, with disparate conclusions. Previous reviews noted the variation in findings of studies performed before 2001. More recent studies also report variable findings.Six studies reported findings similar to ours, with time-specific hazard ratios within approximately 10 percent of those in our study. These studies had a design similar to ours — that is, they were single-center or single-region studies confined to patients hospitalized for heart failure, measurements of ejection fraction were available for most of the patients, and all consecutive patients for whom measurements of ejection fraction were available were included in the study. Eight recent studies reported greater differences in survival between patients with reduced ejection fraction and those with preserved ejection fraction than we found in our study. Most of these studies enrolled outpatients, enrolled hospitalized patients who were not admitted specifically for heart failure, did not include all consecutive patients admitted for heart failure, or included a much smaller percentage of consecutive patients with heart failure than we did, because of the lack of echocardiographic data.

The methodologic differences described above may have resulted in cohorts of patients with preserved ejection fraction who had much milder heart failure than did patients with reduced ejection fraction. In contrast, we enrolled patients with reasonably uniform symptom status (i.e., their symptoms were sufficiently severe that they were hospitalized for heart failure). The diagnosis of heart failure in patients with preserved ejection fraction and milder symptoms not requiring hospital admission raises concern about the possible misdiagnosis of heart failure and about comparisons between cohorts of patients with heart failure of different severity. On the other hand, our requirement that patients be hospitalized emphasized the prognosis of patients who had reached a somewhat advanced stage in their illness and did not permit us to incorporate the natural history of heart failure with preserved ejection fraction from the time of first diagnosis until the need for hospitalization.

Community-based studies suggest that overall survival among patients with heart failure is improving. We found a trend toward improved overall survival that did not achieve statistical significance. However, among patients with reduced ejection fraction, survival improved significantly over time, whereas there was no trend toward improvement among patients with preserved ejection fraction. These observations suggest that improvement over time in the survival of broader populations of patients with heart failure may be due primarily to improvement among those with reduced ejection fraction. Although several interventions known to improve survival among patients with reduced ejection fraction were introduced into clinical practice during the study period, no agents have been proven to improve survival among patients with preserved ejection fraction. Thus, it is not unexpected that survival among patients with preserved ejection fraction did not change significantly over the study period.

This study is subject to the limitations inherent in retrospective studies. Restriction to patients with DRG code 127 provides a potential for bias based on coding practices. The absence of ejection-fraction data from some patients could have affected the absolute prevalence of heart failure with preserved ejection fraction as well as secular trends (although the proportion of patients who underwent echocardiography was stable during the study period). Restriction of the study to hospitalized patients might have introduced bias, since the results from this population may not reflect larger trends in disease prevalence in the community. We were not able to take into account any possible evolution of the diagnostic behavior of physicians. Our data may not reflect secular trends among patients with different racial or ethnic, regional, or socioeconomic backgrounds.

The increase in the prevalence of heart failure with preserved ejection fraction over time and the stability in the rates of death from this condition underscore the importance of studies to determine the pathophysiology of this form of heart failure and develop therapeutic stategies against it. Indeed, should these trends be confirmed and should they continue, heart failure with preserved ejection fraction may become the most common form of heart failure. Because no proven therapy for heart failure with preserved ejection fraction currently exists, there is a need for coordinated efforts to address this growing problem.

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