Epidemiology, Pathophysiology, and Prognosis of Heart Failure in Older Adults

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KEYWORDS

• Heart failure • Elderly • Epidemiology • Pathophysiology • Prognosis • Mortality • Hospitalization • Rehospitalization

KEY POINTS

- Heart failure is a common condition in older adults that results from the complex interplay of age-related diseases and age-associated physiologic changes.
- Despite recent declines in the age-adjusted incidence of heart failure, the prevalence of heart failure continues to rise due to population aging and improved treatment of both heart failure and concomitant cardiovascular conditions.
- Outcomes for older adults with heart failure have improved over time; however, mortality, hospitalization, and rehospitalization rates remain high.

INTRODUCTION

Heart failure (HF) is the quintessential cardiovascular syndrome of aging that results from age-related cardiovascular conditions and age-associated changes in cardiovascular structure and function. The incidence and prevalence of HF increase strikingly with age and make HF the most common reason for hospitalization in older adults.[1] Although outcomes of HF have improved over time, mortality, hospitalization, and rehospitalization rates remain high. Accordingly, total costs of care for persons with HF exceed $30 billion annually and are expected to rise to more than $70 billion by 2030 due to population aging and growth.[2]

This review describes the epidemiology, pathophysiology, and prognosis of HF in older adults. We present data on the incidence and prevalence of HF, including changes over time. Where data exist, we provide estimates for HF with preserved ejection fraction (HFpEF), the most common form of HF in older adults. We then describe the pathophysiology of HF in the elderly, including the

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contributions of age-associated physiologic changes in cardiovascular and noncardiovascular systems. Finally, we describe the prognosis of HF in older adults with regard to mortality, hospitalization, and rehospitalization.

EPIDEMIOLOGY

Identification of Heart Failure

American College of Cardiology/American Heart Association guidelines define HF as a "complex clinical syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the ventricle to fill or eject blood."[3] As HF is a clinical syndrome and not a disease, many epidemiologic studies have relied on clinical diagnostic criteria for its identification.[4,5] These criteria include the Framingham criteria,[6] Boston criteria,[7] Gothenburg criteria,[8] and Cardiovascular Health Study criteria,[9] all of which have relatively similar performance characteristics for the detection of HF with high sensitivity compared with cardiologist evaluation.[10] These criteria may be less accurate for identifying acute decompensated HF[11] and do not differentiate between HF with reduced ejection fraction (HFrEF) and HFpEF. Ejection fraction criteria for distinguishing HFpEF from HFrEF have been highly variable across studies.[4]

Incidence of Heart Failure

New diagnoses of HF are common and strongly related to age. Data from the Atherosclerosis Risk in Communities Study have shown that approximately 915,000 new cases of HF occur each year in the United States.[12] Incidence rates increase with age for patients of both sexes. For example, data from the Framingham Heart Study have shown that annual rates of new HF events per 1000 person-years is 9.2 for white men 65 to 74 years of age, 22.3 for white men 75 to 84 years of age, and 43.0 for white men $\geq$85 years of age. Corresponding rates among white women are 4.7, 14.8, and 30.7 per 1000 person-years, respectively.[13] Similar findings relating HF incidence rates with age also have been noted among more ethnically and racially diverse populations.[14]

HF incidence varies by race, ethnicity, and socioeconomic factors. Data from the Multiethnic Study of Atherosclerosis have shown that HF incidence is highest among African American individuals, followed by Hispanic American, white American, and Chinese American individuals (incidence rates 4.6, 3.5, 2.4, and 1.0 per 1000 person-years, respectively).[12,15] Similar relationships were found in the Atherosclerosis Risk in Communities Study population, in which HF incidence rates were highest for black men, followed by black women, white men, and white women.[16] In both studies, the higher incidence of HF among African American individuals was largely explained by the greater prevalence of cardiovascular risk factors in this population. In addition, a systematic review of data from multiple countries, including the United States, Sweden, Denmark, and Scotland, found that income, educational attainment, and community factors suggestive of economic deprivation were all strongly associated with new-onset HF.[17]

The lifetime risk of developing HF is high. Data from the predominantly white Framingham Heart Study found that 1 in 5 men and women without HF at age 40 develop HF during their lifetimes.[18] A subsequent report from a more diverse study population derived from the Chicago Heart Association Detection Project and the Cardiovascular Health Study found that at age 45, lifetime risks for HF are 30% to 42% in white men, 20% to 29% in black men, 32% to 39% in white women, and 24% to 46% in black women, respectively.[19] The lower lifetime risks of HF in black men were largely due to higher competing risks for noncardiovascular death from renal failure, homicide, and other causes. Data from the international context confirm that elevated lifetime risk for HF is not restricted to the United States.[20]

With time, the incidence of HF may be declining in both North America and Europe. An examination of medical record data from Olmstead County, Minnesota, found that the age-adjusted and sex-adjusted incidence of HF declined from 315.8 per 100,000 persons in 2000 to 219.3 per 100,000 persons in 2010.[21] Similarly, an analysis of administrative data from a nationally representative sample of Medicare beneficiaries in the United States found that HF incidence declined from 32 per 1000 person-years in 1994 to 29 per 1000 person-years in 2003.[22] Both absolute and relative declines were greatest for Medicare beneficiaries aged 80 to 84 years (HF incidence declined from 57.5 to 48.4 per 1000 person-years). Similar declines in HF incidence also have been identified in Canada,[23] Scotland,[24] and Sweden.[25]

Prevalence of Heart Failure

The prevalence of HF is high and increasing over time. Recent data from the National Health and Nutrition Examination Survey (NHANES) demonstrated that approximately 5.7 million Americans have HF.[12] This number is expected to rise to at least 8 million by 2030. Factors driving the increase in HF include aging of the population, increased prevalence of specific risk factors for HF, including diabetes and obesity,[26,27] improvements in the treatment of concomitant cardiovascular