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Geriatric conditions in heart failure

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Abstract

As the U.S. population ages, the prevalence of geriatric conditions in patients with heart failure is increasing, although they currently fall outside the traditional heart failure disease model. In this review, we describe the co-occurrence of four common geriatric conditions (cognitive impairment, frailty, falls, and incontinence) in older adults with heart failure, their mechanisms of interaction, and their association with outcomes. We propose a new paradigm to meet the needs of the aging heart failure population that includes comprehensive assessment of geriatric conditions and tailoring of therapy and surveillance accordingly. Coordination among relevant disciplines such as cardiology and geriatrics may facilitate this transition. Further research is needed in order to understand how to optimize care for patients with specific impairments in order to improve outcomes.

Introduction

The vast majority of patients with heart failure are older adults; in the United States, approximately 80 % are ≥65 years of age [1, 2], and the number of patients aged 80 or older has nearly doubled over the last two decades [3]. Despite the aging of the heart failure population, geriatric conditions, defined as multifactorial non-disease specific conditions such as frailty, cognitive impairment, incontinence, dizziness, and falls [4], have historically received relatively little attention as they fall outside the traditional heart failure disease model that dominates research and clinical care [5–8].

However, there is emerging evidence demonstrating that geriatric conditions are common in older adults with heart failure and influence the heart failure disease process in multiple ways, including clinical presentation, disease progression, and outcomes including hospitalization and mortality [8, 9] (Fig. 1). The purpose of this review is to summarize the available literature on the prevalence of four common geriatric conditions (cognitive impairment, frailty, falls, incontinence) in heart failure, their relationship with the disease process, and directions for future research.

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Cognitive Impairment

Epidemiology

Cognitive impairment is relatively common in older adults with heart failure; most studies report a prevalence of at least 25 % [9–13], although some estimates are much higher. For example, a study by Cameron et al. of 93 consecutive patients (mean age 70 years, without known neurocognitive problems) hospitalized for heart failure in Australia found that mild cognitive impairment (identified by either the MMSE or MOCA) was present in 73 % of study participants [14] (Table 1). Most studies assessing prevalence of cognitive impairment in heart failure populations are small, and the variability in estimates is likely secondary to heterogeneous patient populations and differing definitions of cognitive impairment. For example, there is evidence that the prevalence of cognitive impairment is greater in heart failure patients who have recently been hospitalized [15], and in patients with advanced left ventricular systolic dysfunction [16].

Numerous studies have shown that patients with heart failure are more likely to be cognitively impaired compared with patients without heart failure [10, 16, 17]. A pooled meta-analysis of 22 studies including 2,937 heart failure patients and 14,848 controls found that the odds ratio for cognitive impairment among patients with heart failure (relative to controls) was 1.62 [95 % confidence interval (CI): 1.48–1.79] [10]. Compared with other cardiovascular conditions, heart failure appears to confer a higher risk of cognitive impairment; for example, a study by Vogels et al. found that patients with heart failure were more likely to be cognitively impaired than age-matched patients with ischemic heart disease and preserved ejection fraction [17].

Assessment

The most widely utilized instrument to assess cognitive status in older adults with heart failure is the Folstein Mini Mental Status Examination (MMSE) [10, 18]. The MMSE consists of 11 items that assess domains of orientation, short-term memory, attention, and visual spatial skills, and is scored on a 30-point scale. A score of <25 is generally considered abnormal [19, 20], although there are a variety of cutpoints that adjust for age [21, 22] and education [21, 23]. More recently, the Montreal Cognitive Assessment (MOCA) has been developed as a brief screening tool to detect mild cognitive impairment [14, 24]. The MOCA contains cognitive domains including attention, memory, language, and conceptual thinking [24], with a total possible score of 30 and a score of <26 considered abnormal. Several studies have demonstrated that the MOCA has a higher sensitivity than the MMSE in detecting mild cognitive impairment [24–26]. A shorter alternative to the MMSE and MOCA is the Mini-Cog [27], which involves a composite of three-item recall and clock drawing, and can be administered in 3 min.

Mechanisms and Association with Outcomes

Two main pathophysiologial mechanisms for the association between heart failure and cognitive impairment have been postulated: intermittent cerebral hypoperfusion [28] and cerebral microemboli due to left ventricular thrombus formation [29]. As most studies have not utilized neuroimaging, the degree to which each mechanism contributes to cognitive impairment remains unclear.

Cognitive impairment may affect outcomes by impeding heart failure self-care, which is defined as an active process in which patients maintain health through adherence with medications, symptom monitoring, dietary compliance, and daily self-weighing [12, 14]. Cognitive impairment may interfere with any one of these necessary tasks; for example, doses of diuretics may be missed, or changes in symptoms (dyspnea, weight gain) may not be recognized until they are severe. The hospital to home transition may be especially difficult as therapeutic regimens and care plans are often changed [30]. Also, outpatients with heart failure and cognitive impairment may not remember to report ongoing problems at routine medical encounters [9].

Several studies have found that cognitive impairment is independently associated with mortality in patients with heart failure [8, 31]. In the largest study to date, Chaudhry et al. analyzed a sample of 62,330 Medicare beneficiaries ≥65 years of age with heart failure and found that the adjusted odds ratios (95 % CI) for death at 30 days and 5 years were 1.86 (1.73–2.01) and 2.01 (1.84–2.19), respectively [8]. The evidence base for cognitive impairment and hospital utilization in heart failure is limited. In a small study by McLennan et al. [31] of 200 inpatients admitted with heart failure, patients with cognitive impairment ($n = 27$, based on MMSE) were more likely than those without impairment ($n = 173$) to experience an unplanned rehospitalization or death at 5 years, although rates were very high in both groups (100 vs. 94 %, relative risk 1.44, 95% CI 1.06–1.95). To our knowledge, definitive large-scale epidemiologic studies evaluating the relationship between cognitive impairment and hospital utilization are currently lacking.

Frailty

Epidemiology

Frailty is defined as an increased physiologic vulnerability to stressors [32]. Frailty becomes more common with advancing age, but even in the oldest old it is not ubiquitous; in the Cardiovascular Health Study, frailty was is present in 7 % of participants ≥65 years of age, and increased in prevalence to one-quarter of those ≥80 years of age [32]. Among patients with existing heart failure, estimates of the prevalence frailty are limited. A study by Boxer et al. of 60 heart failure patients (mean age 78 years) with ejection fraction <40 % found that frailty was present in 25 % of individuals [33]. Other studies focusing exclusively on frail patients have found that frailty and heart failure frequently co-occur [34, 35]. In the Cardiovascular Health Study, 14 % of patients identified as frail also had congestive heart failure, compared with 1.8 % among individuals who were not frail (odds ratio = 7.51, 95 % CI 4.7–12.1) [34]. A similar pattern was seen in women aged 65–79 enrolled in the Women's Health Initiative (WHI); frailty was present in 16 % of participants, and women with frailty were nearly six times as likely to have heart failure compared with women without frailty [35].

Assessment

The most widely used criteria to describe the frailty phenotype were defined by Fried et al. in 2001, using data from the Cardiovascular Health Study. In this framework, frailty is a condition in which three or more of the following are present: (1) unintentional weight loss (≥10 pounds within the past year), (2) self-reported exhaustion, (3) weakness (grip strength), (4) slow walking speed, and (5) low physical activity [32]. In the same study, the frailty phenotype was independently predictive of incident falls, worsening ADL disability, hospitalization, and death.

Gait speed is an easily reproducible singular measure that correlates well with the frailty phenotype [36] and has strong associations with survival [37, 38] as well as other patient-centered outcomes, including loss of independence [39], hospital readmission [40], and nursing home placement [41, 42]. Gait speed is typically measured as one's usual pace over a pre-specified distance (such as 5 m) [43]. While the relationship between gait speed and survival is continuous [37], several cutoffs for “slow gait” have been used to ease categorization of patients, ranging from 0.65 m/s (36) to 0.8 m/s [37].

Mechanisms and Association with Outcomes

The causal relationship between frailty and heart failure is complex, and each condition can exacerbate the other. In the Cardiovascular Health Study, patients who were frail were found to have reduced global left ventricular function and increased left ventricular mass compared with non-frail individuals [34]. The muscle weakness that is characteristic of frailty may impair adherence to daily self-care activities such as measurement of body weight, and may also worsen symptoms of dyspnea secondary to respiratory muscle weakness. In turn, worsening heart failure may lead to decreased activity and low nutritional intake, which can result in cardiac cachexia and worsened frailty [44]. Frail patients also appear more prone to developing iatrogenic heart failure due to excessive fluid administration compared with patients who are not frail [45].

Several investigations have demonstrated that frailty is independently associated with adverse outcomes in heart failure patients including hospitalization and mortality [9, 46, 47], although to date studies have been small. Cacciatore et al. studied 120 patients with heart failure and 1,139 controls (all ≥65 years of age) over a 12-year time period, and found that, while frailty was independently predictive of mortality in all subjects, the independent effect of frailty was greater in those with heart failure than without [46]: among the 18 heart failure patients with advanced frailty [defined according to the Frailty Staging System (FSS)], survival declined markedly after 5 years, and none were alive after 9 years of follow-up. A separate study of 59 outpatients with heart failure ≥60 years of age also found that baseline frailty status was independently associated with mortality at 4-year follow-up (hazard ratio 1.57, 95 % CI 1.05–2.33) [48].

Falls

Epidemiology and Assessment

Most literature on the epidemiology falls has assessed fall risk in the broader population of older adults, although more recent studies have focused on patients with heart failure [49, 50]. In general, more than one-third of patients ≥65 years of age experience a fall each year, and approximately 1 in 10 falls results in serious injury such as hip fracture or subdural hematoma [51, 52]. Among older adults, falls are independently associated with restricted mobility, a decline in the ability to perform independent activities such as dressing or bathing, and nursing home placement [51]. Clinicians are advised to screen for falls in older adults at annual follow-up, as information may not always be volunteered [53], and a multidisciplinary intervention may help to prevent future falls in patients at risk [54]

Heart failure has been associated with incident fall-related fracture in several studies [49, 50, 55]. Van Diepen et al. studied 2,041 consecutive patients who presented to emergency departments in Alberta, Canada with a new-onset diagnosis of heart failure, and found that within the first year after diagnosis the risk for any fracture or hip fracture (which is overwhelmingly due to falls) were elevated compared with a control population [adjusted odds ratios (95 % CI): all fracture 4.0 (2.9–5.3); hip fracture 6.3 (3.4–11.8)] [49].

Mechanisms and Association with outcomes

The relationship between heart failure and fracture has been postulated to be due to a mechanistic link between heart failure and osteoporosis shown in animal studies, specifically due to hyperaldosteronism and calcium wasting [56, 57]. The importance of aldosterone in the pathogenesis of fractures was further supported by evidence that use of the aldosteone antagonist spirnonolactone may have benefit in the prevention of fractures; in a case control study of Veterans, use of spironolactone was inversely associated with total fracture [odds ratio (95% CI) for fracture with spironolactone: 0.575 (0.346–0.955)] [55].

After hospitalization for fracture, older adults with heart failure have worse outcomes than those without heart failure [50, 58]. A study of 1,116 patients in Olmsted County, MN, who underwent operative repair for hip fracture found that preoperative heart failure was associated with increased length of stay, more frequent discharge to a skilled nursing facility, and higher postoperative mortality (1 year mortality rate: heart failure 37.2 %, no heart failure 19.8 %, $p < 0.001$) [50]. A registry of patients in Denmark with fall-related fracture also demonstrated that the presence of heart failure was independently associated with long-term mortality [hazard ratio (95% CI) for men: 1.2 (1.1–1.3); for women: 1.3 (1.3–1.4)] [58]. These studies imply that heart failure alone may classify patients as "high-risk", with increased need for postoperative surveillance to avoid complications such as iatrogenic heart failure exacerbations (i.e. secondary to postoperative blood transfusions).

The presence of falls may also complicate adherence to guideline-based therapy for heart failure, especially with beta blocker therapy [59, 60]. Specifically, age-related conduction disease may make prescribing or up-titrating of beta blockers difficult, as they may exacerbate bradycardia or hypotension [59, 60] that may theoretically contribute to falls [61]. An observational study of 1,030 patients ≥70 years of age with heart failure starting the beta blocker carvedilol found that 20 % did not tolerate the drug at 6 months, with symptomatic hypotension and bradycardia cited as common reasons for discontinuation [60]. A smaller study of 51 heart failure patients aged 70–89 initiating bisoprolol found that 31 % did not tolerate the medication (most frequently due to hypotension and fatigue) [62]. However, a direct causal relationship between beta blockers and falls has not been established; two meta-analyses have failed to find a significant association between beta blocker use and falls in patients ≥60 years of age [63, 64], although most studies have been observational in design with limited ability to adjust for confounders, including poor candidacy for beta blocker therapy due to preexisting bradycardia.

Urinary Incontinence

Assessment and Prevalence

Urinary incontinence is a common problem in older adults with prevalence estimates ranging from 17 to 55% women and 11 to 34% in men [65]. Prevalence estimates in heart failure also vary: a Dutch study of 269 heart failure patients ≥65 years of age found that urinary incontinence was present in 17.5 % of subjects overall [66], and 42.9 % in patients ≥85 years of age. Another study of U.S. heart failure patients (mean age 62 years) found that urinary incontinence was present in 45 % of respondents [67].

Mechanisms and Association with Outcomes

The clearest mechanistic link between urinary incontinence and heart failure relates to diuretic therapy, and it is likely that incontinence adversely influences heart failure outcomes by diminishing adherence with these medications. Although data are limited, a small study of incontinent older adults in England found that of 21 patients prescribed diuretics, 20 did not take them as prescribed in an attempt to control their incontinence [68]. Withdrawal of diuretic therapy, even in stable heart failure patients, has been shown to lead to recurrence of heart failure symptoms [69] and may account for preventable reshospitalization. Urinary incontinence is known to also adversely influence outcomes such as quality of life [70] and the development of pressure ulcers [71], although whether these effects are more pronounced in patients with heart failure is unknown.

Conclusion

To meet the needs of the aging HF population, a new clinical paradigm is needed—one that starts with the comprehensive assessment of geriatric conditions and then tailors therapy and surveillance accordingly. The disease-oriented focus of medical care that has dominated heart failure practice does not adequately address the needs of older adults who have critical vulnerabilities in cognition and physical capacity. An acute heart failure exacerbation may be easily treated with intravenous diuretics, but 25 % of patients are readmitted to the hospital within 1 month, and 50 % within 6 months, often for non-cardiac reasons [72]. We need a new paradigm to care for this population, one that incorporates the routine assessment and management of geriatric conditions, and which considers the attainment of individually tailored patient outcomes such as functional status and symptom alleviation. These conditions should be considered together given their co-occurrence and potential for interaction; for example, cognitive impairment is included in some frailty scores and may improve the ability to risk-stratify patients for adverse outcomes [73, 74].

Although many geriatric conditions are not reversible, there are multiple potential interventions for patients with heart failure who are identified as having geriatric conditions. For example, in patients with incontinence, once daily dosing of diuretics may help to improve adherence and reduce inconvenience. In patients with cognitive impairment, medication regimens may also be simplified so that once-daily beta blockers or ACE inhibitors are prescribed, instead of shorter-acting formulations. Heart failure discharge education, which is a core quality measure [75], can be simplified, provided in written and pictorial formats, and targeted to include caregivers for patients who are cognitively impaired [76]. For patients identified with frailty, the targeting of resource-intensive disease management programs may help to prevent hospital readmission [47].

Despite the importance of geriatric conditions in heart failure, screening for them remains outside routine clinical heart failure care. Underscoring the relative inattention to geriatric conditions, even guidelines developed specifically for older patients with heart failure—such as the Assessing Care of Vulnerable Elders (ACOVE) quality indicators for heart failure care [77]—do not mention geriatric conditions. There are several potential reasons for the lack of screening, including clinicians' limited time during patient encounters, unfamiliarity with the prevalence of these conditions in heart failure patients, or focusing on disease-specific outcomes rather than broader health states. Coordination among relevant disciplines such as cardiology and geriatrics may help in realigning care to improve identification and reduce fragmented management decisions. Future research is also necessary to further understand whether large-scale interventions for geriatric conditions in heart failure, such as rehabilitation for frailty, home assessment for fall risk, and individualized discharge education for cognitive impairment, may improve meaningful outcomes such as hospitalization, mortality, and quality of life.

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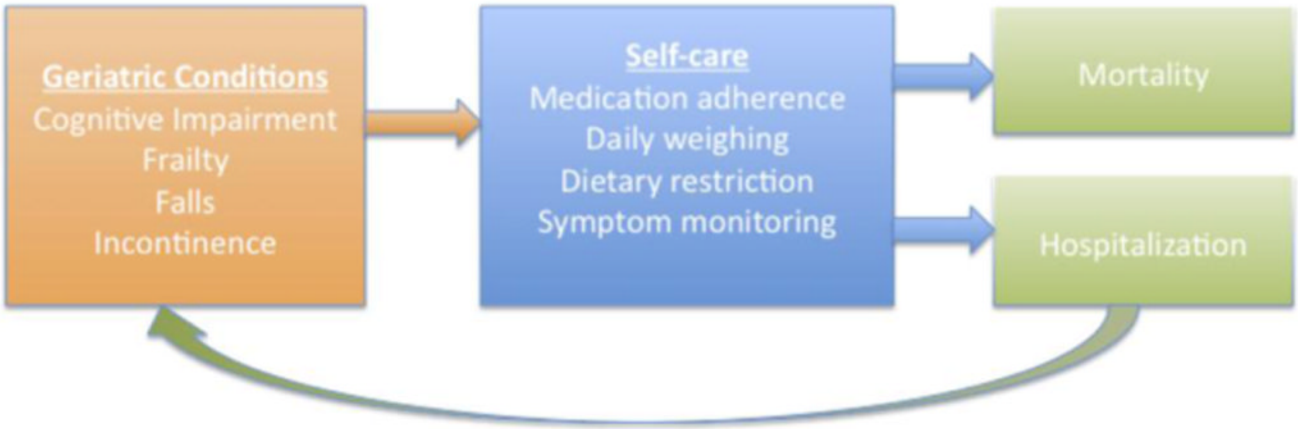

Figure 1.
Theoretical relationship between geriatric conditions and outcomes in heart failure. In this model, which is simplified for illustration, geriatric conditions impair heart failure self-care, which subsequently may result in hospitalization and mortality. Hospitalization can further worsen impairments; for example, being confined to bed can exacerbate frailty, and delirium can precipitate falls.

Table 1
Prevalence of geriatric impairments in heart failure

Condition	**Study**	***n* (mean age)**	**Prevalence**
Cognitive impairment	Cameron et al. [14]	93 (70 years)	73 %
	Zuccalá et al. [11]	1511 (82 years)	35 %
Frailty	Boxer et al. [33]	60 (78 years)	25 %
	Newman et al. [34]	299 (77 years)	14%
Falls	Tinetti et al. [52]	336 (78 years)	32 %[a]
Urinary incontinence	Van Der Wel et al. [66]	269 (79 years)	17.5 %
	Palmer et al. [67]	296 (62 years)	45 %

[a]Fall rate per year; population not exclusively limited to heart failure