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Memory loss and decreased executive function are associated with limited functional capacity in patients with heart failure compared to patients with other medical conditions

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ABSTRACT

Background: There is limited evidence on the degree of cognitive impairment and its association with physical functional capacity among patients with heart failure (HF) in Korea.

Objectives: In this study, we compared cognitive impairment between patients with HF and community-dwelling participants with non-HF medical conditions (medical participants) and its association with physical functional capacity.

Methods: We conducted a cross-sectional comparative study and assessed the neuropsychological cognitive status (Seoul Neuropsychological Screening Battery) and physical functional capacity (Duke Activity Status Index) of patients with HF and medical participants using face-to-face interviews.

Results: One hundred and eighteen patients with HF (age, 65.45 ± 9.38 years; men, 57.6%; left ventricular ejection fraction, 34.93 ± 8.72%) and 83 medical participants (age, 66.02 ± 8.28 years; men, 47.0%) were included. Using seventh-percentile medical participant Z-scores as cutoffs, memory and executive function were worse in patients with HF than in medical participants: immediate (35.0% vs. 6.0%) and delayed recall memory (34.5% vs. 8.4%), and executive function (28.6% vs. 6.0%). Independent of age, sex, education, comorbidity, and HF status, executive function was a significant predictor of physical functional capacity ($b = 1.82, p = .021$).

Conclusions: More patients with HF had impaired memory and executive function, which were associated with their physical functional capacities.

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Introduction

Heart failure (HF), the most advanced form of cardiovascular disease, is a global epidemic.¹ Approximately 5.7 million American adults have HF, with 915,000 new cases occurring annually, with a stable prevalence over the past decade (2000–2010).² According to a recent analysis of national data, approximately 750,000 Koreans suffered from HF in 2013, corresponding to a prevalence of 1.5% of the population, which is projected to increase to 3.35% by 2040.³ The development of HF increases with age and high blood

pressure, with the HF incidence approaching 10 in 1000 persons at age 65 years or above; this incidence increases twofold for blood pressures >160/90 mm Hg.² This debilitating progressive disease is also a leading cause of death and costly hospitalizations in the United States and Korea,^{2,4,5} mostly associated with decompensated HF, overwhelming noncardiac comorbidities, and psychosocial factors. These factors often complicate HF management.^{6–10}

Mild-to-moderate cognitive impairment (CI) is a common comorbidity in patients with HF and is associated with structural and functional alterations in the brain, particularly hippocampal damage, largely due to prolonged circulatory insufficiency to the brain resulting from HF.^{11–14} Advanced age and concomitant cardiovascular comorbidities such as atherosclerosis, uncontrolled hypertension, or midlife onset of diabetes mellitus may worsen cognitive impairment.^{15–18} Cognitive impairment involves multiple domains, including memory, attention, psychomotor speed, and executive function, and affects approximately one in four patients with HF.^{16,19} This impaired cognition and its association with adverse outcomes have emerged recently from samples largely consisting of patients of non-Hispanic White, European, or Black races/ethnicities,^{20–23} while more data-based research studies of patients of other races/ethnicities, particularly Asian ethnicities, should be conducted. The mechanism of CI may interfere with an individual's capacity to make complex decisions relating to the therapeutic recommendations for HF management.^{11,24,25} Poor cognitive function is also likely to be a barrier to effective disease management, prompting the need for the incorporation of routine cognitive assessment for the early detection of patients at risk of CI into models of HF care.^{16,26,27}

Evidence regarding the types and extent of CI is limited for patients with HF in Korea who possibly demonstrate ethnic or sociocultural cognitive presentations^{28,29} associated with their differences in the etiology and therapeutic responses to HF.^{30–32} In particular, it is not clear how CI differs among patients with HF from CI in other patients who have comorbidities. These contexts affect the therapeutic strategies for HF management, with poor adherence being a determinant of patient outcomes.^{28,33–36} The functional implications of HF are particularly substantial, where the essential component of HF management is the preservation or improvement of physical functional capacity,^{37,38} while limited, but available, data indicate that CI has important implications for diminished functional capacity.^{21,28,39,40} Such information may serve as the basis for the development of cognitively tailored strategies that consider ethnic and cultural factors in order to improve patient physical functional capacity.

Therefore, the purpose of this study was to address the gaps in the knowledge of cognitive function in Korean patients with HF and to develop an understanding of each domain of CI associated with HF and its relevance to physical functional capacity. This was achieved by comparing patients with HF to age-sex matched persons living in the community who had medical conditions other than HF (medical participants). The specific aims were (1) to compare the prevalence of CIs between patients with HF and medical participants and (2) to examine how personal factors (age, sex, education, comorbidity, and the presence of HF) and each cognitive function domain are associated with physical functional capacity.

Methods

Study design and procedure

This study used a comparative study design. Patients with HF were recruited from three tertiary hospitals. Medical participants were recruited from the community health center. The institutional

review boards of the university-affiliated hospitals for the patients with HF and the university with which the investigator was affiliated for the medical participants approved the study protocol.

All participants signed written informed consent statements prior to data collection. Three graduate nursing students and a research coordinator conducted face-to-face interviews to evaluate neuropsychological functioning, physical functional capacity, and comorbidity for both groups of participants. The three students and the research coordinator had significant experience in cardiovascular care or research in HF and received training on the neuropsychological test guidelines by the principal investigator prior to the interviews.⁴¹ For patients with HF, interviews were conducted in the outpatient area of the hospitals after follow-up for routine care. The graduate nursing students then conducted a review of the medical records for HF-related information about the HF etiology, medication, or past and current medical history. The same data were collected from all medical participants, except for HF-related information. The face-to-face interviews were 60 min in duration for patients with HF and 30 min for medical participants. The time for data collection took longer for the patients with HF than the medical participants due to the additional data obtained from those with HF.

Subjects

Eligibility criteria for the study participants were: (1) age 45 years and older, (2) a diagnosis of HF with abnormal left ventricular systolic function (ejection fraction [EF] < 52% for men and < 54% for women)⁴² (patients with HF) or other comorbidities, excluding HF (for the medical participants), and (3) capacity to understand and follow the instructions of the study protocol, which was determined by the referring physicians.

Exclusion criteria for both patients with HF and medical participants were: (1) history of or current medical condition which is recognized as being associated with or inducing CI, such as stroke, renal failure, dementia or Alzheimer's disease, psychiatric disorders, or alcohol/substance abuse, (2) life-limiting condition, such as terminal cancer, or (3) inability to read, see, or hear the study materials.

Measures

Cognitive function

The Seoul Neuropsychological Screening Battery II is a measure of cognitive function in the domains of memory, attention, and executive function.^{41,43,44} It is widely used to assess cognitive function in Korea and its validity and reliability for the identification of mild to moderate levels of cognitive impairment have been previously documented in a range of cognitive disorders. Administration of the screening test adhered to the relevant guidelines.⁴¹ Raw scores were estimated following the scoring guidelines⁴¹; age-, sex-, and education-adjusted Z-scores estimated in persons 45 years of age or above were constructed using computer software⁴⁵ for comparisons in cognitive function between the patients with HF and the medical participants group.

Memory

The Seoul Verbal Learning Test (SVLT) is a measure of memory function. In this test, patients are asked to recall, in any order, as many items as possible out of a list of 12 words. This procedure is repeated consecutively three times for immediate recall memory. Patients are then asked to repeat the list one more time 20 min later from recall only, for delayed recall memory; each test generates scores ranging from 0 to 36 and 0–12, with the higher scores indicating better memory function.

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