

Cognitive Function and Self-care in Patients with Heart Failure: A Pilot Study from Korean Patients

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Purpose: Despite poor cognitive function in heart failure (HF), few studies have examined cognition and its probable implication in self-care among Korean HF patients. The purposes of this study were (1) to describe cognition in the domains of global, memory, and executive functions, (2) to explore the relationship between cognition and self-care, and (3) to determine the amount of dietary sodium intake among Korean HF patients. **Methods:** A pilot study was conducted: 7 HF patients (3 men, mean age 68 years) completed face-to-face interviews for neuropsychological tests of cognition and self-care including dietary sodium intake. **Results:** More than half of the patients had impaired global cognition, memory, or executive function; patients with more severe HF were at higher risk of poor cognitive function. Korean HF patients exhibited poor self-care, with a high dietary sodium intake (5.6 g/day), approximately twice more than the suggested guideline of 2~3 g/day for patients with stable HF. **Conclusion:** Cognitive dysfunction and inadequate self-care with noncompliance with dietary sodium restriction were evident in Korean HF patients. More studies are warranted that examine the prevalence of cognitive impairment and areas of deficit using neuropsychological tests in a larger sample and that examine how cognition affects self-care and compliance in salt-intake.

Key Words: Cognition, Self-care, Sodium, Dietary

INTRODUCTION

Approximately 7 million people in South Korea live with chronic illnesses, of which cardiovascular diseases are among the leading diagnoses at discharge and rank third in length of admission (Health Insurance Review & Assessment Service, 2010). In Korea, hypertension and ischemic heart disease - the major etiologies of heart failure (HF) - have increased by 40% and 55% in prevalence, respectively, over the last 5 years (Health Insurance Review & Assessment Service, 2010). With advanced medical treatment increasing longevity, Koreans will experience prolonged exposure to the threat of cardiovascular disease, which will increase the risk of developing HF in older people.

Multidisciplinary efforts have yielded substantial pro-

gress in management of a complex HF syndrome, in which self-care has been documented as a critical behavioral strategy (Hummel, DeFranco, Skorcz, Montoye, & Koelling, 2009; Riegel, 2008). However, an intricate cognitive decisional process that is involved in self-care prevents more than half of HF patients in engaging in various self-care activities (Bennett et al., 1998; Riegel, Vaughan Dickson, Goldberg, & Deatrck, 2007). Approximately 25% to 50% of HF patients have cognitive dysfunction due to structural and functional brain changes (Pressler, 2008). Such dysfunction may interfere with compliance with complex self-care regimens, in particular, dietary sodium restriction. Noncompliance with dietary sodium restriction has been reported as a major problem, leading to frequent hospitalization due to fluid volume overload associated with excessive sodium re-

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tention (Bennett et al., 1998; Hummel et al., 2009; Jurgens, Hoke, Byrnes, & Riegel, 2009). Sodium restriction may present a further challenge to Korean patients because of their traditional dietary pattern. South Koreans consume 8.8 g of sodium per day, approximately 4 times more than the suggested World Health Organization limit (<2 g/day of sodium) for general populations (Elliott, & Brown, 2006; World Health Organization, 2007).

Despite poor cognitive function in HF and high salt intake among Korean HF patients, few studies have examined cognitive dysfunction among these patients and its probable implication in overall self-care and compliance with dietary sodium restriction. Therefore, this study presents preliminary data from Korean HF patients who participated in face-to-face interviews for cognitive function and self-care, which also involved recording a 3-day food diary for identification of the amount of dietary sodium intake. The specific objectives were to (1) describe cognitive function in domains of global cognition, memory, and executive function; and (2) explore the relationship between cognitive function and self-care. An additional research question is (3) how much dietary sodium do Korean HF patients consume per day?

METHODS

1. Design and Procedures

This study was a pilot test, using a descriptive study design, in which cognitive function and self-care including dietary sodium intake were evaluated with HF patients recruited from a university-affiliated outpatient clinic. This study was approved by the institutional review board of the university. After obtaining written informed consent from participants, the investigator conducted face-to-face interviews for neuropsychological tests of cognition and self-care. After the interview, all participants were informed of how to record a 3-day food diary for the assessment of dietary sodium intake.

2. Sample

The participants were (a) ≥ 18 years of age, and had (b) current medical diagnosis of systolic HF (ejection fraction $\leq 40\%$) ≥ 6 months before entry. Patients were excluded if they (a) were scheduled to receive cardiac surgery or had documented cardiac events 3 months prior to enrollment (hospitalization or emergency visits for HF exacerbation); (b) had severe visual or hearing

impairments; (c) had documented cognitive impairment, such as dementia and/or stroke or a psychiatric diagnosis that precludes providing informed consent or the ability to follow instructions.

3. Measurements

1) Self-care

The Self-Care of Heart Failure Index v.6 (SCHFI) is a measure of self-care (Riegel, Lee, Dickson, & Carlson, 2009). The SCHFI consists of 22 items in 3 subscales: self-care maintenance (10 items), self-care management (6 items), and self-care confidence (6 items). The scores in each subscale are transformed to 100 points with weighted values, in which higher scores indicate greater self-care (Riegel et al., 2009). The cut-off score less than 70 was used to determine poor self-care adequacy in maintenance, management, and confidence (Riegel et al., 2009).

2) Dietary sodium intake

The diet record from the 3-day food diary was analyzed using the computer software, Computer Aided Nutritional Analysis program version 3.0 (CAN-Pro 3.0) for the amount of dietary sodium intake (The Korean Nutrition Society, 2010). The accuracy and feasibility of the program has been established using nutrient intakes of 4,091 participants of 2007 Korean National Health and Nutrition Examination Survey (Shim & Paik, 2009).

3) Cognitive function

The Seoul Neuropsychological Screening Battery (SNSB) was administered to measure cognitive function in domains of global cognition (Korean-Mini-Mental State Examination, K-MMSE), memory (Seoul Verbal Learning Test, SVLT), and executive function (Controlled Oral Word Association, COWA) (Kang & Na, 2003). Neuropsychological test variables were scored according to authors' instructions and manual guidelines. The SNSB has documented validity and reliability for altered cognitive function that is associated with cognitive disorders, such as vascular dementia or Alzheimer's disease (Kang & Na, 2003).

The K-MMSE consists of 30 items with possible scores ranging from 0 to 30, in which higher scores indicate greater general cognition. In the SVLT, a list of 12 words were orally presented to the patients over 3 trials, who were asked to repeat the words, irrespective of order, after each trial (total list learning, range 0~36). The patients were then asked to recall the 12 words again, 20

min after completing the third trial (delayed recall, range 0~12). In the COWA test, 3 letters are presented to the patients who are then asked to generate as many words as they can, beginning with each letter, over a 60-s period. The score is determined by the number of words generated for the 3 letters (higher scores indicate better executive function).

4) Heart failure severity

The New York Heart Association (NYHA) classification is a measure of functional limitation imposed by HF severity in clinical practice and research. The NYHA classes range from asymptomatic class I to symptomatic classes II, III, and IV, with no (I), slight (II), or marked (III) limitations of physical activity, and unable to continue physical activity without symptoms (IV) (Hunt et al., 2005).

4. Statistical Analyses

Descriptive statistics were completed for all study variables, including frequency, means and standard deviations, and ranges, appropriate to the level of measurement.

RESULTS

Seven HF patients (3 men) participated in this study. Their ages ranged 54~80 years (mean age 68.0 ± 8.0 years). Two men and 2 women were married, and others were widowed or divorced. The mean years of education were 8.6 ± 4.8 years. The length of time since HF diagnosis ranged from 0.6 to 15.7 years. Four patients had HF with unknown etiology, 2 had HF associated with hypertension, and 1 had ischemic HF. The mean left ventricular ejection fraction was $28.6 \pm 7.8\%$ (range 20~39). All participants were on optimal medication, including angiotensin II receptor blockers (57%), beta-blockers (71%), angiotensin-converting-enzyme in-

hibitor (43%), digoxin (86%), or diuretics (57%). One patient had the NYHA class I, 4 had class II, and 2 had class III.

1. Cognitive Function

Heart failure patients had poor cognitive function in global cognition (25.3 ± 2.8), list learning (17.2 ± 5.9), delayed recall memory (5.3 ± 2.4), and executive function (16.8 ± 11.9) (Table 1). Compared to the published Korean norms, 57%, 50%, and 83% exhibited lower scores on global cognition, memory, and executive function, respectively. Using a cut-off point of 23/24 (Kang, Na, & Hahn, 1997), 2 patients indicated mild cognitive impairment on the K-MMSE. The patients with NYHA Class I or II had higher scores than those with the NYHA class III on the K-MMSE (26.8 vs. 21.5), SVLT total list learning (17.8 vs. 14.0) and delayed recall (5.4 vs. 5.0), and COWA (17.0 vs. 16.0), indicating those with NYHA Class I or II having better cognitive function.

2. Self-care, Dietary Sodium Intake, and Cognitive Function

All patients had poor self-care maintenance (51.4 ± 15.4) and very poor self-care management (38.3 ± 20.9), compared to the cut-off score of less than 70 (Table 2). Poor self-care adequacy may also lead to the HF patients failing to adhere to dietary sodium restriction, while consuming approximately 3 times more dietary sodium than the suggested guideline (5.6 ± 2.5 g/day).

Cognitive dysfunction was found in Korean HF patients who had poor self-care adequacy (Table 3). Compared with patients who had poor self-care confidence (score < 70), those with adequate self-care confidence had greater cognitive function in all 3 domains of global cognition (25.8 vs. 24.7), list learning (18.8 vs. 14.0), delayed recall (5.8 vs. 4.5), and executive function (21.3 vs. 8.0).

Table 1. Descriptive Statistics for Neuropsychological Test Scores

(N=7)

Measure	Raw score M \pm SD	Actual range	Norm M \pm SD	% < Norm
General (K-MMSE)	25.3 \pm 2.8	21~28	26.8 \pm 3.3	57
Memory (SVLT)				
List learning	17.2 \pm 5.9	9~25	17.6 \pm 4.5	50
Delayed Recall	5.3 \pm 2.4	2~8	5.7 \pm 2.4	50
Executive function (COWA)	16.8 \pm 11.9	8~40	22.9 \pm 9.3	83

K-MMSE=Korean-mini-mental state examination; SVLT=Seoul verbal learning test; COWA=controlled oral word association.

Table 2. Descriptive Statistics for Self-care and Dietary Sodium Intake

(N=7)

Measure	M±SD	Actual range	Comment
Self-care			
Maintenance	51.4 (15.4)	23.3~69.9	Moderately poor maintenance
Management	38.3 (20.9)	15.0~60.0	Very poor self-care management
Confidence	71.5 (16.8)	44.5~88.9	Adequate self-care confidence
Dietary Na+ intake (g)	5.6 (2.5)	3.1~9.8	Exceed suggested amount

Table 3. Cognitive Function by Self-care Adequacy

(N=7)

Variables	Categories		Global cognition	Memory		Executive function
			M±SD	List learning M±SD	Delayed recall M±SD	M±SD
Self-care	Maintenance	≥ 70 (n=0)	-	-	-	-
		< 70 (n=7)	25.3 (3.1)	16.8 (6.5)	6.0 (2.0)	18.6 (12.4)
	Management	≥ 70 (n=0)	-	-	-	-
		< 70 (n=6)	25.2 (3.1)	17.8 (6.4)	5.8 (2.4)	17.4 (13.2)
	Confidence	≥ 70 (n=4)	25.8 (3.3)	18.8 (5.6)	5.8 (2.2)	21.3 (12.5)
		< 70 (n=3)	24.7 (2.5)	14.0 (7.1)	4.5 (3.5)	8.0 (0.0)
Dietary Na+ (g)	< 2 (n=0)	-	-	-	-	
	≥ 2 (n=6)	25.8 (2.6)	17.1 (5.9)	5.3 (2.4)	16.8 (11.8)	

DISCUSSION

This is one of the first studies that have examined cognitive function using a neuropsychological test battery in Korean HF. These neuropsychological tests provide a more comprehensive evaluation of cognitive function and are often used to determine areas of deficits. An additional strength of the neuropsychological tests is the ability to make comparisons using the age-gender-education matched published norms. Despite a small sample, important results were obtained. Korean HF patients had poor cognitive function that might be associated with cerebral hypoperfusion (Pressler, 2008; Pressler et al., 2010). More importantly, Korean HF patients exhibited very poor self-care adequacy. In particular, their dietary sodium intake was almost twice more than the suggested daily guideline of 2~3 g for Americans with stable HF (Lindenfeld et al., 2010).

Compared to the published norms derived from 447 healthy older adults (189 men, age=67.6±5.9 years, education=7.9±5.1 years), more than half of the Korean HF patients had lower cognitive function in all domains, particularly in executive function (16.8 vs. 22.9). Further, Korean HF patients with NYHA class III had worse

cognitive function than those with NYHA class I or II, which is consistent with recent empirical evidence. One-fourth of 249 HF patients have substantial losses in memory ($p < .005$), psychomotor speed ($p < .001$), and executive function ($p = .05$); those with more advanced HF of NYHA classes II, III, or IV had significantly poorer cognitive function than those with NYHA class I, as a reference (Pressler et al., 2010). From a Korean HF literature search, a study evaluating cognitive function in 121 HF patients was obtained. Twenty-nine patients (24%) had a high risk for cognitive impairment as determined by a single screening measure of the Mini-Mental State Examination-Korean (MMSE-K)(defined as a MMSE-K score < 20)(Son, Kim, & Song, 2010).

Poor cognitive function in Korean HF patients might have an impact on very poor self-care in the current study, with all having inadequate self-care maintenance and management using a cut-off point of ≥ 70 (Riegel et al., 2009). Poor self-care adequacy may also lead to a high dietary sodium intake of 5.6 g per day, which is approximately 2 times more than the suggested 2~3-g dietary sodium restriction for HF patients (Lindenfeld et al., 2010). Koreans eat soup or stew and kimchi (a fermented Korean dish, made of vegetables with varied

seasonings) at almost every meal, which all contain high sodium. Heart failure patients may be as likely to consume high levels of dietary sodium as the general population in Korea, as Koreans have rarely changed their dietary behaviors relating to high sodium intake (Kim, Paik, Lee, Shim, & Kim, 2007). Poor self-care might be attributable to cognitive dysfunction, which prevents intricate cognitive decisional processes in self-care on many levels, such as recognizing symptoms of worsening HF or performing self-care strategies, including restriction of salt intake (Riegel & Dickson, 2008). In a study examining cognitive influence on self-care in Korean HF patients, cognitive function was a significant predictor of adherence to self-care, with a lower cognitive function being associated with poorer adherence to self-care ($\beta = .209$, $p = .03$) (Son et al., 2010).

CONCLUSION

Cognitive dysfunction and poor self-care adequacy were evident in Korean HF patients. More importantly, dietary sodium intake in HF patients is likely to be high due to the traditional dietary pattern. As this study only described several cases of cognitive function and self-care in HF, the priorities in research will be addressed instead of the study limitations.

First, prevalence of cognitive impairment and areas of deficit should be evaluated using a neuropsychological test battery in a larger sample.

Second, prospective studies that examine the dietary patterns (salt use, food preparation method, sources of high/low sodium food), are warranted to establish the dietary sodium guidelines for Korean HF patients and assist patients with the development of strategies aimed at improving compliance behaviors in salt-intake.

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