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Cognitive Impairment Among Elderly Patients With Chronic Heart Failure and Related Factors

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Abstract

Background: Patients with heart failure (HF) older than 65 years have a two-fold increased risk of cognitive impairment than elders without HF. Identifying factors affecting cognitive impairment in HF may present targets for intervention.
Objectives: The aim of the present study was to determine cognitive function and related factors among elderly patients with heart failure.
Patients and Methods: In this cross-sectional study, 184 elderly patients with heart failure were selected from four Mazandaran University of Medical Sciences teaching hospitals using convenience sampling. Data were collected from patients' medical records and by interview, using the abbreviated mental test, geriatric depression scale, and Charlson comorbidity index.
Results: There were significant relationships between cognitive status and living arrangement ($P < 0.001$), education ($P < 0.001$), hypertension ($P = 0.039$), anemia ($P = 0.046$), Charlson comorbidity index ($P < 0.001$) and geriatric depression scale ($P < 0.001$).
Conclusions: Screening of cognitive impairment in elderly patients with heart failure seems necessary.

Keywords: Cognitive Impairment, Elderly, Heart Failure

1. Background

About 17% of individuals older than 65 years have some degree of mild cognitive impairment (CI). Patients with heart failure (HF) older than 65 years have a two-fold increased risk of cognitive impairment than elders without HF (1).

The prevalence of cognitive impairment in adults with chronic heart failure is recognized as a factor contributing to the complexity of care for these patients (2). Cognitive impairment may impact the ability to perform heart failure self-care procedures and is associated with an increased risk of re-hospitalization and mortality (3).

Despite the prevalence of these two conditions, cognitive impairment in HF patients is usually underestimated by physicians (4) and currently, there is insufficient evidence to develop recommendations for strategies to improve cognitive impairment for HF patients (5). Identifying factors affecting cognitive impairment in HF may present targets for intervention.

2. Objectives

This study was designed to determine factors related to cognitive impairment among elder with HF.

3. Patients and Methods

In this descriptive, correlational, cross-sectional study, 184 patients with chronic heart failure were selected from four Mazandaran University of Medical Sciences teaching hospitals using convenience sampling: Imam Khomeini hospital in Behshahr, Fatemeh Zahra heart center in Sari, Imam Khomeini hospital in Fereydunkenar and Imam Khomeini hospital in Noor. Patients hospitalized for symptomatic heart failure between October 2013 and January 2014 were included in this study and confirmed by the cardiologists. Inclusion criteria were a history of at least six months involvement with heart failure, age $\geq$ 60, and remaining stable 1 - 2 days after admission. Exclusion criteria were communication problems such as severe hearing impairment (without hearing aids), speech problems, severe

cognitive impairment with abbreviated mental test (AMT) scores < 4 (6) and uncooperativeness.

All eligible patients were first approached by the research nurse. After providing written informed consent, each patient was interviewed by an independent data collector who was not involved in the patient's care. This study ethically complies with the declaration of Helsinki.

3.1. Study Measurements

Socio-demographic variables consisted of age, gender, location, living status, education level, and income.

Clinical variables consisted of left ventricular ejection fraction (EF), poly-pharmacy ($\geq$ 5 different drugs), comorbidities (Charlson comorbidity index), blood pressure, depressive symptoms, body mass index (BMI), number of hospitalizations during the previous six months, and some biochemical characteristics of the blood. These variables were collected from patients' medical records and by interviews.

Cognitive status was measured using the Iranian version of the abbreviated mental test. The ideal cut-off point reported 6, while sensitivity and specificity identified at 88 and 99%, respectively (6), using a 10-item scale. Each correct answer received a score of 1 and incorrect answers were scored as 0. A total score of $\leq$ 6 indicates the presence of cognitive impairment (a score of 0 - 3 indicates severe cognitive impairment and 4 - 6 indicates moderate cognitive impairment).

The severity of comorbid conditions was assessed using the Charlson comorbidity index (7), which classifies comorbidities based on the number and seriousness of one-year survival, with higher scores indicating greater risk of death. Most diseases are assigned a score of 1 on the index, but more severe conditions are given a weight score of 2, 3 or 6. All weights are summed to obtain a numeric comorbidity score for each particular patient.

Depressive symptoms were assessed using the geriatric depression scale (GDS). This is a 15-item scale and scores $\geq$ 5 indicate depressive symptoms (8).

3.2. Statistical Analysis

Descriptive statistics were used to characterize this sample. Fisher's exact test and logistic regression were used to compare cognitive status scores with demographic characteristics and disease related variables. The independent samples t-test was used to compare biochemical characteristics of the blood from the subjects both with and without cognitive impairment. The gamma test was used for ordinal variables that were not normally distributed. All analyses were performed using SPSS software version 16.0.

4. Results

4.1. Cognitive Status Score

The AMT mean was 6.18 $\pm$ 2.002 (minimum 4 and maximum 10), with 95% CI (5.89 to 6.48). The majority of the elders in the study (110 persons, 59.8%) had scores of 4 - 6 and the others (74 persons, 40.2%) had scores of 7 - 10.

4.2. Socio-Demographic Characteristics

Females made up 61.4% of participants (113 persons) and 38.6% (71 persons) were male. The 60 - 75 age group comprised 70% of the subjects (128 persons), 29% (54 persons) were in the 75 - 90 age group and 1% (2 persons) were in the 90 - 94 age group. The mean ages in women and men were 70.7 $\pm$ 8.35 and 70.01 $\pm$ 8.99, respectively (P = 0.595).

The CI odds ratio was higher in older patients than in the younger ones (P = 0.002). In addition, the CI odds ratio was higher in female subjects than male (P < 0.001) (Table 1). There were significant relationships between cognition status scores and living status (P < 0.001) and also between cognition status scores and education level (P < 0.001) (Table 2).

Table 1. Odds Ratio and 95% Confidence Interval of Cognitive Impairment (Scores 4 - 6) Among Elders With HF Related to Demographic and Clinical Characteristics

Variable	Odds Ratio (95%CI)	P
Age (76 – 94, y)	2.27 (1.32 - 3.92)	0.002
Gender (female)	2.25 (1.62 - 3.11)	< 0.001
Location (rural)	1.46 (0.98 - 2.17)	0.052
History of hospitalization (yes)	1.06 (0.92 - 1.23)	0.369
EF < 40%	1.57 (1.15 - 2.14)	0.002
Diabetes (no)	1.13 (0.84 - 1.52)	0.399
Hypertension (yes)	1.27 (0.98 - 1.65)	0.057
BMI > 25	1.08 (0.79 - 1.48)	0.590
Poly-pharmacy (yes)	1.07 (0.93 - 1.24)	0.306
Hyperlipidemia (no)	1.02 (0.85 - 1.21)	0.812
Hg < 12	1.27 (0.97 - 1.66)	0.067
IHD (no)	1.22 (0.84 - 1.76)	0.277

Abbreviation: BMI, body mass index.

4.3. Clinical Characteristics

The CI odds ratios were higher in subjects with an ejection fraction of < 40% compared to subjects with an ejection fraction of $\geq$ 40% (P = 0.002) (Table 1). Fisher's exact test results showed a significant relationship between cognitive status scores and hypertension (P = 0.039) and also

Table 2. Comparison of Socio-Economic Characteristics Among Elders With HF, Related to Cognitive Impairment

Variable	AMT Scores		Mean AMT	Type of Test	P Value
	4 - 6	7 - 10			
Education[a]				Gamma	< 0.001
Illiterate	101 (73.7)	36 (26.3)			
Under diploma	7 (17.9)	32 (82.1)			
Diploma or higher	2 (25)	6 (75)			
Income[a]				Gamma	0.503
Lower than enough	52 (62.7)	31 (37.3)			
Enough	56 (57.1)	42 (42.9)			
More than enough	2 (66.7)	1 (33.3)			
Living status[b]				ANOVA	0.001
Alone			5.36 ± 1.85		
With wife			6.73 ± 1.99		
With wife and child			6.44 ± 1.9		
With child			5.16 ± 1.61		
With relatives			7.33 ± 3.05		

[a]Values are expressed as No. (%) unless otherwise indicated.
[b]Values are expressed as mean ± SD.

between cognitive status scores and anemia (P = 0.046). Although the CI odds ratio was higher among subjects with hypertension and anemia, there was not a significant relationship (Table 1).

There was no significant correlation between biochemical characteristics of the blood and cognitive status scores. However, there was a near-significant level for hemoglobin, blood urea nitrogen (BUN) and systolic blood pressure (Table 3).

Table 3. Comparison of Biochemical Characteristics of the Blood Among HF Elderly With and Without Cognitive Impairment[a]

Variable	AMT (4 - 6)	AMT (7 - 10)	P
FBS	131.23 ± 61.07	146.04 ± 87.84	0.219
Sodium	139.43 ± 39.85	138.94 ± 39.15	0.431
Potassium	4.37 ± 0.65	4.43 ± 0.67	0.586
Hg	11.18 ± 1.92	11.77 ± 2.2	0.059
Cholesterol	165.4 ± 46.17	167.06 ± 45.7	0.836
Triglyceride	133.85 ± 80.26	142.19 ± 105.75	0.672
Creatinin	1.41 ± 1.05	1.29 ± 0.49	0.325
Urea	38.35 ± 16.22	37.62 ± 15.87	0.861
BUN	38.26 ± 25.59	29.55 ± 11.86	0.063

[a]Values are expressed as mean ± SD.

The mean of Charlson comorbidity index and depression symptoms were higher among subjects with cognition impairment (P < 0.001) (Table 4).

Table 4. Comparison of Some Characteristics Among HF Elderly With and Without Cognitive Impairment[a]

Variable	AMT (4 - 6)	AMT (7 - 10)	P
Number of hospitalization	2.18 ± 2.36	1.89 ± 1.49	0.468
Number of drugs	6.7 ± 2.28	6.67 ± 2.74	0.859
Systolic blood pressure	122.94 ± 20.48	118.12 ± 15.06	0.070
Diastolic blood pressure	73.62 ± 12.99	71.6 ± 9.54	0.256
BMI	25.95 ± 4.38	26.1 ± 4.43	0.813
Charlson comorbidity index	7.26 ± 1.56	5.4 ± 1.42	< 0.001
Geriatric depression scale	7.45 ± 4.02	4.09 ± 3.61	< 0.001

[a]Values are expressed as mean ± SD.

5. Discussion

In this study, the prevalence of cognitive impairment was higher among elderly subjects with a lower level of education, patients living alone or with their children, and females. It seems that fewer years of education contribute to processing speed (2). Providing social support another

important factor that may decrease patient stress and improve cognitive status.

The results of the present study show that comorbidities contribute to cognitive impairment in HF patients. These findings are consistent with other studies (2, 9, 10), but differ from that of Pressler et al. who found no association between comorbidities and cognitive status (11).

In this study, there were significant relationships between cognitive impairment with depression, hypertension, and anemia. These findings are consistent with some studies (9, 10).

In a clinical setting, it is hard to differentiate mild stages of dementia and late life depression, because both situations may have similar presentations (12). Few studies have directly examined the association between cognitive impairment and depression in persons with heart failure, despite the likelihood of common mechanisms (13). Persons with heart failure exhibit numerous pathological changes on neuro-imaging, including greater atrophy and the presence of white matter hyper-intensities, frequently in frontal brain regions (14).

Hypertension has a significant impact on cardiovascular function, cerebral structural integrity and associated cognitive deterioration (15, 16). The most common explanation for the deleterious effect of hypertension on cognition is that hypertension increases cerebrovascular disease (17). Some longitudinal studies have shown a positive association between hypertension and cognitive impairment (15, 16). These effects were independent of clinical strokes and the association was stronger in individuals who did not use antihypertensive drugs (15). The results of some studies indicate that hypertension may be a risk factor dementia, especially Alzheimer's disease (AD) (18, 19). However, the factors that predispose individuals with hypertension to developed AD are unknown (20).

Mean blood concentration of hemoglobin progressively declines with aging (21). There have been very few studies on the association of anemia with cognitive status (22). The literature on the association between anemia and dementia is also limited and the results are inconsistent (23, 24). Anemia in heart failure may have multiple origins, which are thought to involve reduced erythrocyte production, decreased BMI, and hemodilution (25). Further contributors to the risk of anemia in HF are comorbid renal disease and increased inflammation (26). Elevated levels of pro-inflammatory cytokines may also inhibit hematopoietic proliferation (27). In addition, some medications, such as angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers, reduce erythropoietin production (25).

5.1. Limitations

A number of limitations affected the present study. First, this is a cross-sectional study and the correlations cannot imply causation relationships between parameters. Secondly, the sample size is relatively small. Moreover, the data represent only the subjects who agreed to participate in the study.

5.2. Suggestions

Identifying factors affecting cognitive impairment in HF may help clinicians in directing educational interventions on disease management to families to possibly prevent readmission of their loved ones. In addition, the multidisciplinary HF management program seems necessary. Further research to determine the feasibility and acceptability of cognitive assessment in routine clinical care is suggested.

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Footnotes

Authors' Contribution: Zohreh Taraghi designed the study, advised on the analysis, and drafted the manuscript. Ahmad-Ali Akbari Kamrani, Mahshid Foroughan, and Jamshid Yazdani advised on the study design, helped to analyze, and interpret the data. Ali Mahdavi and Seied Kazem Baghernejad helped to collect the data and revised the manuscript. All authors read and approved the version submitted.

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