Human & Veterinary Medicine
International Journal of the Bioflux Society HVM

OPEN ACCESS
Research Article

Is heart failure associated with cognitive impairment in elderly?

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Abstract. Aim: The aim of this study was to find an association between heart failure (HF) and cognitive impairment in geriatric patients. Also, the association of other parameters with cognitive impairment was followed.Material and methods: The study included 95 patients with the median age of 82 (78; 85) years, from which 25 (26.3%) did not have HF and 70 (73.7%) with HF. Cognitive evaluation was performed using the MMSE questionnaire. Results: Statistical analysis was conducted to assess the variables associated with the patient's cognitive impairment. Age presented a negative correlation of low power and statistical significance with the MMSE score (r=-0.249; p=0.01). The MMSE score was higher in patients without anemia (p=0.039) compared to those with anemia. The MMSE score was higher in the anticoagulant group compared to the no anticoagulant group (p=0.043). Other associations did not reach statistical significance. Conclusions: We did not find an association between HF and cognitive impairment. We demonstrated an inverse correlation between the age of the patients and MMSE values, we determined that anemia is a risk factor for presence of cognitive impairment and we demonstrated the protective effect of anticoagulant therapy on the development of cognitive impairment.

Key Words: heart failure, cognitive impairment, elderly, MMSE

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Introduction

Globally, heart failure (HF) represents a major healthcare problem, affecting more than 20 million people (Kasper et al 2015). The prevalence of this disease is positively correlated with age, geriatric patients representing over 80% of the cases from USA and Europe (Rich et al 2001, Wilkins et al 2017).

HF is associated with an increase in morbidity and mortality, frequent hospitalization, a decrease in the quality of life and of the functional status of the patients.

Considering the positive correlation of HF with age, other diseases have to be taken into consideration when evaluating the cognitive impairment in geriatric patients. Cognitive impairment is one of the most common chronic pathologies that appear in geriatric patients with HF, with an estimated prevalence between 14 and 18% in people over 70 years old (Petersen et al 2009).

Multiple cortical areas and diverse domains of cognitions can be implicated in the cognitive impairment of the geriatric patients with HF. These modifications are determined by physiopathological processes like cerebral hypoperfusion caused through a decreased cardiac output or modified cerebrovascular reactivity, arterial hypotension and the generation of proinflammatory cytokines.

The presence of cognitive impairment can interfere with the patient's capacity of self-care, causing changes in the patients' habits and the impossibility to follow the prescribed medication. These factors can lead to an increase in the number of hospitalizations and in mortality (Ekman et al 2001, McLennan et al 2006, Zavertnik et al 2014).

The aim of this study was to find an association between HF and cognitive impairment in geriatric patients. Also, the association of other parameters with cognitive impairment was followed.

Material and method

The present study is observational, prospective, transversal, analytic, case control.

The study included 95 patients with the median age of 82 (78; 85) years, from which 25 (26.3%) did not have HF and 70 (73.7%) with HF, hospitalized in the Geriatric unit of the Municipal Hospital Cluj-Napoca, between January 2015 and May 2017. The patients signed the informed consent form. The study protocol was approved by the Ethics committee of the Municipal Hospital Cluj-Napoca.

The patients were included in this study on the criteria of age (over 65 years) and the presence of HF.

Table 1. Characteristics of patients.

Variables		n=95 patients
Age (years)		82 (78; 85)
Gender	Women	70 (74%)
	Men	25 (26%)
NYHA	NYHA 1	30 (32%)
	NYHA 2	16 (17%)
	NYHA 3	48 (50%)
	NYHA 4	1 (1%)
HF	No	70 (74%)
	Yes	25 (26%)
Diastolic HF	No	77 (81%)
	Yes	25 (19%)
FEVS		50 (45; 58)
MMSE		22 (20; 23)
Cognitive impairment	No	19 (20%)
	Light	55 (58%)
	Moderate	21 (22%)
AHT	No	11 (12%)
	Grade 1	2 (2%)
	Grade 2	57 (60%)
	Grade 3	25 (26%)
Ischemic cardiopathy	No	33 (35%)
	Yes	62 (65%)
Aortic stenosis	No	79 (83%)
	Yes	16 (17%)
Obstructive apnea	No	94 (99%)
	Yes	1 (1%)
COPD	No	82 (86%)
	Yes	13 (14%)
Atrial fibrillation	No	63 (65%)
	Yes	33 (35%)
Dyslipidemia	No	52 (55%)
	Yes	43 (45%)
Carotid stenosis	No	78 (82%)
	Yes	17 (18%)
Inferior limb arteriopathy	No	89 (94%)
	Yes	6 (6%)
Type 2 diabetes	No	64 (67%)
	Yes	31 (33%)
Stroke/cerebral lacunarism history	No	50 (53%)
	Yes	45 (47%)
Anemia	No	62 (65%)
	Yes	33 (35%)
Infection	No	77 (81%)
	Yes	18 (19%)
Parkinson	No	85 (89%)
	Yes	10 (11%)

Table 2. Correlation of MMSE with patients' variables.

Variable 1	Variable 2	r	p
FEVS	MMSE	0.093	0.441
Age	MMSE	-0.249	0.01

The exclusion criteria were the lack of MMSE (Mini Mental State Examination) measurement, the presence of anterior diagnosed dementia and of other neurodegenerative diseases.

For all included patients we observed the following data:

1.Demographic data: age, sex

2.Clinical data: NYHA class of HF, left ventricle ejection fraction, the presence of diastolic HF, MMSE values, the presence of arterial hypertension, the grade of arterial hypertension (AHT), ischemic cardiopathy, aortic stenosis, sleep obstructive apnea, COPD (Chronic Obstructive Pulmonary Disease), atrial fibrillation, dyslipidemia, carotid stenosis, inferior members arteriopathy, type 2 diabetes, stroke, anemia, major infections, Parkinson disease, anticoagulant, psychiatric medication.

Cognitive evaluation was performed using the MMSE questionnaire. MMSE is a questionnaire that includes 30 points that analyze multiple domains of cognition: temporo-spatial orientation, immediate memory, attention, mental mathematics, short term memory, language, repetition and complex commands.

Every point from the 30 present in the questionnaire are scored, the maximum score being 30. The result is interpreted as follows:

•30-24: normal cognition

•23-19: light cognitive impairment

•18-10: moderate cognitive impairment

•<10: severe cognitive impairment

The final score has to be correlated considering the age and education of the patient. A maximum score of 30 cannot exclude the presence of a cognitive impairment from the dementia spectrum, MMSE being a screening examination. Also, the presence of physical impairments like auditive impairment, inability to read, etc. can affect the result if those are not considered.

Statistical analysis was performed using MedCalc Statistical Software version 17.5.5 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2017). Qualitative data were represented as median and 25-75 percentile. Qualitative variables were characterized by number and percent. Comparations between groups were tested through the tests: Mann-Whitney, Kruskal-Wallis or Chi-square. Correlations between two variables were tested using Spearman's rho coefficient. A p value under 0.05 was considered statistically significant.

Results

The basic characteristics of the included cohort are presented in Table 1.

Statistical analysis was conducted to assess the variables associated with the patient's cognitive impairment, with the data presented in Table 2, Table 3 and Table 4. Age presented a negative correlation of low power and statistical significance with the MMSE score (r=-0.249; p=0.01). The MMSE score was higher in the no anemia group (p=0.039) compared to the anemia group. The MMSE score was higher in the anticoagulant group compared to the no anticoagulant group (p=0.043). Other associations did not reach statistical significance.

Table 3. Comparation of MMSE in different groups of patients.

Variable	Discriminative characteristic	p	Conclusion
MMSE	HF	0.963	
MMSE	Diastolic HF	0.792	
MMSE	AHT	0.594	
MMSE	Ischemic Cardiopathy	0.623	
MMSE	Aortic stenosis	0.406	
MMSE	COPD	0.559	
MMSE	Atrial fibrillation	0.747	
MMSE	Dyslipidemia	0.189	
MMSE	Carotid stenosis	0.081	
MMSE	Inferior limb arteriopathy	0.503	
MMSE	Type 2 diabetes	0.731	
MMSE	Stroke/Lacunarism history	0.366	
MMSE	Anemia	0.039	Higher MMSE in no anemia group
MMSE	Infection	0.379	
MMSE	Anticoagulant	0.043	Higher MMSE in anticoagulant group
MMSE	Antiplatelet	0.479	

The AHT grade was analyzed for grade 1, 2 and 3, not including the patients without AHT. NYHA class was analyzed for classes 2, 3 and 4, not including patients with NYHA 1.

Discussions

Cognitive impairment is an affection associated with old age that is characterized by a multitude of risk factors frequently observed in geriatric population like: HF, arteriosclerosis, AHT, diabetes mellites (Breteler et al 1994, Cuierman 2005, Ott et al 1999, Román et al 2004).

In this study we obtained an inverse correlation of low power, statistically significative, between patients age and the values of MMSE that shows that once a patient advances in age the cognitive impairment is more significant, results that correspond with the literature (Salthouse et al 2010).

This study could not demonstrate the association between HF and cognitive impairment (shown through low values of MMSE examination). In the literature the association between these two diseases is initially described in 1977 through the term cardiogenic dementia (Cardiogenic Dementia. The Lancet 1997). Also, there are a significant number of recent studies that describe the link between HF and cognitive impairment (Trojano et al 2003, Vogels et al 2007, Zuccalà et al 2003, Zuccalà et al 2005). A systematic review published in April 2017 (Cannon et al 2017), also presents the association between HF and cognitive impairment without being able to demonstrate a causality link between them. Also, the authors draw attention to the fact that further studies to determine the pathogenetic links of this association are necessary.

This study could not demonstrate the link between COPD and cognitive impairment. In the literature, a recent review published in May 2017 (Yohannes et al 2017) demonstrates the causal link between COPD and cognitive impairment. The authors speculate the importance of hypoxemia as a causative agent in the development of cognitive impairment in patients with HF and COPD.

The absence of anemia, in this study, was correlated with higher values of MMSE, the differences being statistically significant. These results are the same as the literature data from a recently published study, that demonstrates the association of anemia with cognitive impairment, independent of traditional cardiovascular risk factors (Dlugaj et al 2015). The association between anemia and cognitive impairment has an important clinical significance, because a lot of anemia cases can be efficiently treated. In this study, the higher MMSE values were correlated with the absence of stroke, the obtained results not having statistical significance.

The MMSE values in this study, are higher in patients with anticoagulant therapy compared with patients without anticoagulant therapy, the results being statistically significative (p=0.043). in the category of patients with anticoagulant therapy there were included patients with classical coumarin anticoagulants (antivitamin K - eg. Acenocumarol) and patients that follow NOAC (novel oral anticoagulant) therapy (eg. Rivaroxaban, apixaban and endoxaban) or heparin derivates. The results are similar to the literature (Kalaria et al 2016).

The protective effect of anticoagulant therapy is caused, most probably, from the lowering of stroke and cerebral microembolism incidence, factors implicated in the development of cognitive impairment.

The exact determination of the pathogenetic links that associate HF and cognitive impairment are of clinical importance, the patients with cognitive impairment presenting a low treatment compliance, which determines a growth in morbidity and mortality in this group of patients.

Table 4. Comparation of cognitive impairment in multiple groups of patients.

		All patients=95		
Variables		**Cognitive impairment**		**p**
		Yes=76	No=19	
NYHA	NYHA 2	13 (24.5%)	3 (25%)	0.1
	NYHA 3	40 (70.5%)	8 (66.7%)	
	NYHA 4		1 (8.3%)	
HF	No	19 (25%)	6 (31.6%)	0.56
	Yes	57 (75%)	13 (68.4%)	
Gender	Women	54 (71.1%)	16 (84.2%)	0.244
	Male	22 (28.9%)	3 (15.8%)	
AHT grade	Grade 1	2 (2.9%)		0.407
	Grade 2	44 (64.7%)	13 (81.2%)	
	Grade 3	22 (32.4%)	3 (18.8%)	
AHT	No	8 (10.5%)	3 (15.8%)	0.521
	Yes	68 (89.5%)	16 (84.2%)	
Ischemic cardiopathy	No	25 (32.9%)	8 (42.1%)	0.451
	Yes	51 (67.1%)	11 (57.9%)	
Aortic stenosis	No	62 (81.6%)	17 (89.5%)	0.411
	Yes	14 (18.4%)	2 (10.5%)	
Sleep obstructive apnea	No	75 (98.7%)	19 (100%)	0.615
	Yes	1 (1.3%)		
COPD	No	67 (88.2%)	15 (78.9%)	0.296
	Yes	9 (11.8%)	4 (21.1%)	
Atrial fibrillation	No	52 (68.4%)	10 (52.6%)	0.196
	Yes	24 (31.6%)	9 (47.4%)	
Dyslipidemia	No	44 (57.9%)	8 (42.1%)	0.216
	Yes	32 (42.1%)	11 (57.9%)	
Carotid stenosis	No	65 (85.5%)	13 (68.4%)	0.082
	Yes	11 (14.5%)	6 (31.6%)	
Inferior limb arteriopathy	No	71 (93.4%)	18 (94.7%)	0.833
	Yes	5 (6.6%)	1 (5.3%)	
Type 2 diabetes	No	51 (67.1%)	13 (68.4%)	0.913
	Yes	25 (32.9%)	6 (31.6%)	
Stroke/lacunarism history	No	39 (51.3%)	11 (57.9%)	0.607
	Yes	37 (48.7%)	8 (42.1%)	
Anemia	No	48 (63.2%)	14 (73.7%)	0.389
	Yes	28 (36.8%)	5 (26.3%)	
Infection	No	62 (81.6%)	15 (78.9%)	0.793
	Yes	14 (18.4%)	4 (21.1%)	
Parkinson	No	66 (86.8%)	19 (100%)	0.095
	Yes	10 (13.2%)		
Anticoagulant	No	62 (81.6%)	12 (63.2%)	0.083
	Yes	14 (18.4%)	7 (36.8%)	
Antiplatelet	No	43 (56.6%)	15 (78.9%)	0.074
	Yes	33 (43.4%)	4 (21.1%)	

One of the study limitations is represented by the relatively small cohort, that didn't allow for achieving a clinical significance for some of the analyzed correlations.
Another limitation of this study is the variability of the results of MMSE examination between different doctors.

Conclusion

We did not find an association between HF and cognitive impairment. Through this study we demonstrated an inverse correlation between the age of the patients and MMSE values, we determined that anemia is a risk factor for the presence cognitive impairment and we demonstrated the protective effect of anticoagulant therapy on the development of cognitive impairment.

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Citation	Neculicioiu V, Paşca S, Azamfirei BA, Vesa SC, Sava M, Vlaicu SI, Macarie AE. Is heart failure associated with cognitive impairment in elderly?. HVM Bioflux 2018;10(3):122-127.
Editor	George Saraci
Received	19 June 2018
Accepted	1 August 2018
Published Online	17 August 2018
Funding	None reported
Conflicts/ Competing Interests	None reported