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Reduced functionality in everyday activities of patients with self-reported heart failure hospitalization — Population-based study results ☆

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ABSTRACT

Aim: To assess daily functioning and geriatric conditions of older subjects suffering from heart failure (HF) as compared to the general population.
Methods and results: The data were collected as part of the nationwide PolSenior project (2007–2011). Of 4979 individuals (age range 65–104 years), data on self-reported HF hospitalization were available for 4795 subjects (96%). Geriatric assessment (GA) included functional status (ADL, *Activities of Daily Living* and IADL, *Instrumental ADL* scales), cognitive function, mood disorders, sensory organ impairment, falls and comorbidity. Mean age ± SD of the study population was 73.8 ± 6.5 years; 62% were female. The proportion of subjects with HF hospitalizations increased from 8% in subjects aged 65–69 years up to 13% in the age group of 85–89 years, and decreased in nonagenarians (11%). Subjects with the HF hospitalization were older, used more drugs, and were characterized by a higher prevalence of comorbid conditions, mood disorders, hearing impairment and functional limitations. In logistic regression, HF hospitalization increased the age–sex adjusted risk of disability by 40%, both in ADL and IADL. After adjustment to other clinical and geriatric conditions, HF hospitalization remained an independent predictor of disability in both ADL (OR = 1.36, 95%CI: 1.00–1.84) and IADL (OR = 1.40, 95%CI: 1.01–1.93).
Conclusions: Older people who reported HF admissions had a higher number of comorbidities and geriatric conditions: mood disorders, hearing impairment and functional limitations. Besides, in our study, HF hospitalization independently and significantly increased the risk of limitations in IADL and ADL. Therefore, further studies are needed to evaluate the benefits of GA in patients with HF.

1. Introduction

Heart failure (HF) is a complex clinical syndrome involving functional deterioration of the heart and other systems, such as the kidneys, liver, lungs and muscles, and significantly affecting everyday life [1]. As a chronic condition, it is associated with a high risk of mortality and hospitalization, especially among the elderly [2–4]. The majority of HF cases in adults are a consequence of preceding arterial hypertension [5,6] and coronary heart disease (CHD) [5,7,8]. Due to population aging, the age-associated increase in the occurrence of both diseases and the longer exposure to risk factors, the prevalence of HF also increases with age [2,4]. Paradoxically, advances in hypertension and CHD treatment also contribute to the epidemic of HF in the elderly [6,7]. The results of the National Health and Nutrition Examination Survey (NHANES) showed an increasing proportion of patients with HF who were over 80 years old [9]; furthermore, co-existing multimorbidity [1,10–12] and functional limitations [13–18] increased mortality

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among elderly HF patients. Therefore, assessment of functional and cognitive deficits, as well as nutritional status might complement the characteristics of older patients with HF and contribute to the optimization of diagnostic and therapeutic procedures. The available data on functional capacity and the prevalence of geriatric conditions in older patients with HF are limited.

The aim of the study was to assess the range of functional limitations and the comorbidity profile in older population according to the history of hospitalization for HF.

2. Methods

2.1. Study design and population

The study population consisted of participants in the PolSenior project, a population-based multicenter study aimed at evaluating the medical, psychological and socioeconomic aspects of aging in Poland, carried out from October 2007 to December 2011. A detailed description of the project and its methodology were reported previously [19]. Briefly, the participants were randomly recruited in bundles in a stratified, proportional draw performed in three stages: identification of local administrative units (urban, rural and urban–rural municipalities); a selection of streets in urban and villages in rural municipalities and random identification of individuals in bundles using the national PESEL database (Universal Electronic System for Registration of the Population) [19]. The study included subjects aged 65 years and more, and people at the age of 55–59 years as the comparative group. In the present analysis, only the older group was considered. The PolSenior project was approved by the Bioethics Commission of the Medical University of Silesia in Katowice and all the participants gave written informed consent separately to the interview and to the blood sampling.

2.2. Data collection

Socio-demographic data and the data concerning education, diagnosed diseases and employed medications were obtained using a structured questionnaire performed by trained nurses during a home visit. A participant or a caregiver was asked to answer the question whether *he/she had ever been diagnosed with arterial hypertension or cardiac arrhythmia and had ever been hospitalized for CHD, myocardial infarction (MI), HF, arrhythmia, or stroke*.

Hemoglobin and albumin concentrations were measured by the standard method employing an automatic analyzer. N-terminal pro B-type natriuretic peptide (NT-proBNP) was measured by the electrochemiluminescence immunoassay ECLIA (Roche Diagnostics GmbH, Mannheim, Germany) using an automatic immunodiagnostic analyzer Cobas e411 (Roche Diagnostics GmbH, Mannheim, Germany).

Body mass index (BMI) was calculated according to the formula: body weight (kg)/height (m^2). Individuals with BMI of 30 kg/m^2 and over were considered obese, BMI 25.0–29.9 kg/m^2 denoted overweight and BMI below 18.5 kg/m^2 — underweight subjects.

2.3. Geriatric assessment

Cognition was assessed using the Mini Mental State Examination (MMSE) [20]. The results were corrected for age and education according to the Mungas formula: adjusted MMSE = raw MMSE − (0.471 × [years of education − 12]) + (0.131 × [age − 70]). With the maximum score of 30 points, the score of 23 points and lower was regarded as indicative of impaired cognition [21]. Mood was assessed with the 15-item Geriatric Depression Scale (GDS), and a score of 6 points and more was regarded as suspected depression [22].

Functional status was measured using Katz's Index of Activities of Daily Living (ADL, maximal score: 6 points) [23] and Lawton's Instrumental Activities of Daily Living Scale (IADL, maximal score: 24 points) [24]. For ADL, functional impairment was recognized at ≤5 points, for IADL at ≤23 points, and disability was diagnosed for an ADL score ≤ 2 points, for IADL: ≤18 points.

The respondents were asked about the occurrence of falls during the 12 months preceding the interview. The number of comorbid conditions was summated solely on the basis of available data for the surveyed diseases: CHD, HF, hypertension, arrhythmias, transient ischemic attack/stroke, neurologic diseases (Parkinson's disease, epilepsy), diabetes, thyroid disorders, pulmonary diseases, kidney and liver diseases, peptic ulcer disease, ophthalmologic disorders, anemia, osteoporosis, neoplastic disease and psychiatric disorders. A lack of a single datum resulted in exclusion from the analysis of comorbidity.

Binocular visual acuity at a distance of 30–40 cm was tested with correction (glasses, if worn) using the Snellen arrays for near vision, consisting of eight sections of a text of a gradually increasing font size marked from 1 (the smallest print) to 8 (the largest font). Visual impairment was defined as more serious difficulties, including reading verses 5 to 8 and/or incorrect distance, through significantly impaired vision (ability to count fingers, light perception) to complete blindness.

Hearing impairment was determined when the subjects were able to hear only loud speech or only single words spoken very loudly or could not hear anything from a distance of 3 m without or with a hearing aid.

The trend in HF hospitalization frequency was analyzed in five-year age groups.

2.4. Statistical analysis

The data were summarized as mean ± standard deviation (SD) for variables normally distributed and as median with interquartile percentiles (25th;75th) for skewed distributed or ordinal variables. Normality of distribution was checked by the Shapiro–Wilk test. Categorical data were presented as percentages. Data on prevalence were weighted to age, gender and a place of residence of the Polish older population structure. This procedure allows for correcting the overabundance of the oldest respondents in the PolSenior study, making the results more representative for the population of the elderly in Poland.

Independent groups were compared using Student's t-test with independent estimation of variances (Levene's test) or the Wilcoxon rank-sum test. To compare proportions, the Chi-square test or Fisher exact test was applied. The occurrence of HF hospitalization in the age-defined groups was analyzed using the Cochrane–Armitage trend test.

Using the standard regression models, the unadjusted and age–sex adjusted effects of HF on ADL and IADL scoring were estimated. The HF-associated risk of disability was estimated using the logistic regression. In these analyses, disability was defined as either any impairment on the ADL scale (≤5 points) or an IADL score ≤ 18 points. In the separate age–sex adjusted models, the effects of HF and other clinically relevant variables were estimated. All covariates significantly related to disability, that is history of hypertension, stroke, chronic renal failure, diabetes, chronic pulmonary obstructive disease/asthma, obesity, anemia, number of medications, falls, dementia, mood disorders, and vision and hearing impairments were included in the multivariable model of logistic regression. Collinearity diagnostics was performed using PROC GENMOD to assess the correlation between parameters. Next, to assess the condition of the logistic models, a weighted regression was done in PROC REG using HESSWGT values as weights, and including the collinearity options COLLIN and COLLINOINT. Using that procedure, the condition index (CI) and the regression coefficient variance–decomposition matrix were calculated. It is assumed, that CI equals 30 and more usually indicates that collinearity exists among the weighted predictors, the variation proportions >0.90 associated with a large CI suggest that a parameter is collinear with the intercept. The calculations were performed using SAS software v.9.3 (SAS Institute, Cary, NC, USA, licensed for the Jagiellonian University). For all the analyses, the two-sided *P*-value < 0.05 was assumed significant.

3. Results

3.1. Baseline and clinical characteristics

Of the 4979 individuals aged 65 years and older (65 to 104 years) recruited to the study, data on hospitalization for HF were available for 4795 subjects (96.3%). The mean age (±SD) of the group was 73.8 ± 6.5 years, and 62.1% were female. Hospitalization for HF was reported by 531 subjects (11.1%). The individuals hospitalized due to HF were older than those who reported no such events (Table 1). The percentage of respondents reporting hospitalization for HF increased with age from 7.9% in the youngest age subgroup up to 13.2% in the study participants in the age range of 85–89 years and slightly decreased in nonagenarians (to 11.1%) (Fig. 1).

The subjects with the history of HF hospitalization had significantly higher serum concentration levels of NT-proBNP (Table 1) and higher BMI. In the raw data, the percentage of obese subjects was higher in the HF group, but after weighting, the proportion of obese subjects did not differ from those free of HF hospitalization. Additionally, there was no difference between the two groups with respect to the presence of underweight, but significantly lower albumin concentration values were observed in the HF subjects, regardless of the weighting procedure employed (Table 1). In general, the use of weights corrected the proportion of subjects, adjusting them to the general population, but did not change the trends in the majority of the differences between the groups and in their significance.

Older subjects with the history of HF were more often diagnosed with or hospitalized for CHD or MI, hypertension, stroke and arrhythmia (Table 1).

3.2. Geriatric conditions

The HF patients presented with more comorbid conditions and a higher number of used medications (Table 2). Assessment of cognitive function showed no difference in the MMSE score between the patients with and without HF, whereas mood disorders, expressed by the GDS score ≥ 6 points, were significantly more prevalent in the elderly with