Heart & Lung 49 (2020) 495–500

Contents lists available at ScienceDirect

Heart & Lung

journal homepage: www.heartandlung.com

Epidemiology and clinical characteristics of hospitalized elderly patients for heart failure with reduced, mid-range and preserved ejection fraction

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ARTICLE INFO

Article History:
Received 12 December 2019
Revised 24 March 2020
Accepted 26 March 2020
Available online 18 May 2020

Keywords:
Heart Failure
Elder Patients
Epidemiology

ABSTRACT

Introduction: : Elderly patients hospitalized with heart failure (HF) have high mortality rates and requires specific evidence based theraphy, however there are few studies which have focused on patients older than 80 years hospitalized with HF. The aim of the present study is to evaluate the overall clinical characteristics, management, and in-hospital outcomes of elderly patients hospitalized with HF.

Methods: : Journey-HF study was conducted in 37 different centers in Turkey and recruited 1606 patients who were hospitalized with HF between September 2015 and September 2016. In this study, clinical profile of patients ≥ 80 years old and 65-79 years old hospitalized with HF were described and compared based on EF-related classification: HFrEF (HF with reduced ejection fraction), HFmrEF (HF with mid-range ejection fraction) and HFpEF (HF with preserved ejection fraction).

Results: : A total of 1034 elder patients (71.6% 65–79 years old and 28.4% ≥80 years old) were recruited. Of the 65–79 years old patients 67.4% had HFrEF, 16.2% had HFmrEF and 16.3% had HFpEF. Among patients ≥80 years old 61.6% had HFrEF, 15.6% had HmrEF and 22.8% had HFpEF.

When compared with patients with HFrEF and HFmrEF, patients ≥80 years old with HFpEF were more likely to be older, have atrial fibrilation (AF), and less likely to have diabetes mellitus (DM), coronary artery disease (CAD) or to be recieving an angiotensin-converting enzyme inhibitor (ACEi) or beta blocker theraphy. When compared to patients 65–79 years old with HFpEF, patients ≥80 years with HFpEF had a higher rate of AF and less likely DM. Acute coronary syndrome was the most common precipitant factor for hospitalization in both age groups with HFrEF group. Arrhythmia was a major precipitant factor for hospitalization of patients ≥80 years old with HFpEF. Non-compliance with theraphy was a major problem of patients ≥80 years old with HFrEF.

Conclusion: : Elderly patients with HFrEF, HFmrEF and HFpEF each had characterized unique patient profiles and the guideline recommended medications were less likely to be used in these patient populations. In hospital mortality rate is worrisome and reflects a need for more specific tretment strategy.

Introduction

Heart failure (HF) is a major cause of cardiovascular morbidity and mortality. The incidence and prevelance of HF progressively increases in parallel with the population's age.[1] The incidence of HF reaches 10 per 1000 population after age of 65.[2] Besides the higher incidence, elderly patients also have lower survival rates.[3] In addition to this, HF is the leading cause of frequent hospitalizations among the elderly.[4] Nearly 80% of patients hospitalized with HF are more than 65 years old.[5] Despite the higher incidence, mortality and hospitalization rates, a large knowledge gap exists regarding epidemiology, clinical characteristics and treatment strategy of this special group.

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https://doi.org/10.1016/j.hrtlng.2020.03.023
0147-9563/

HF is a complex clinical syndrome and the elder patients may have nonspecific clinical signs and sypmtoms that may cause difficulties in diagnosing. The diagnosis, management and classification of HF are based on mainly left ventricular ejection fraction (LVEF). In previous guidelines on the diagnosis and management of HF, LVEF ≥ 50% has been considered as HFpEF (heart failure with preserved ejection fraction) whereas, LVEF <40% has been considered as HFrEF (heart failure with reduced ejection fraction). Patients in the range of LVEF 40–49% have often been considered as a grey area or intermediate group and less thoroughly studied. In 2013 AHA guidelines have defined this group as borderline HFpEF for the first time.[6] Latest and updated 2016 ESC Guidelines for the diagnosis and treatment of HF clearly classified HF in 3 distinct groups: HFpEF (LVEF ≥50%), HFmrEF (heart failure with mid range ejection fraction) (LVEF 40–49%) and HFrEF (LVEF <40%); where each have different clinical characteristics, prognostic factors and response to theraphy.[7] This distinction is important in the management strategy of hospitalized elderly patients with HF. Despite the higher incidence and poor survival rates of this group, there are limited data describing the distinguishing clinical characteristics of hospitalized elderly patients for HFpEF, HFmrEF and HFrEF aged ≥80 years old and 65–79 years old. The presence of multiple co-morbidities and higher cardiovascular risk factors complicate the treatment strategy of elder patients. Morever, evidence-based treatment strategies are less frequently used in these patients.[8] Acknowledging clinical characteristics, demographics, comorbidities and cardiovascular risk factors of patient ≥80 years old and comparison between 65–79 years old are important to report evidence based and updated treatment strategies in HF for this special group.[9] This study assessed and compared comorbidities, cardiovascular risk factors, medication usages, in hospital outcomes and precipitating clinical factors for hospitalization in hospitalized HF patients 65–79 years old and ≥80 years old with reduced, mid range and preserved ejection fraction.

Materiel and method

Journey HF study was a cross-sectional, multicenter and observational study. It was conducted between September 2015 and September 2016 and included a total of 1606 patients from 37 centers. Patients in cardiac care units, intensive care units as well as cardiology wards were recruited. The methodology and primary results of the Journey HF study have been previously described (10). To be eligible for the study, patients had to be hospitalized with new-onset or worsening HF, >18 years old, and provide an informed consent to participate in the study. Patients without documented EF or informed consent were excluded. In this study 1034 patients who were >65 years old (elderly) were analysed. The data was divided into 3 groups: elderly patients with reduced LVEF (<40%), elderly patients with mid range LVEF (40% -50%) and those with preserved LVEF (≥50%). Also patients ≥80 years old were seperately evaluated and the demographics, clinical profiles, clinical histories, symptoms, precipitant factors of patients were compared with patients 65–79 years old. The clinical characteristics, medical histories, NYHA functional class symptoms, individual precipitating factors according to local clinical judgement of local providers, medication usage, echocardiographic data, laboratory test results were recorded. Length of stay in intensive care unit (number of days from admission to discharge) and in hospital death were also assesed. Past medical history including hypertension (HT), diabetes mellitus (DM), coronary artery diseae (CAD), cerebrovascular disease (CVD), chronic renal failure (CRF) (patient's serum creatinine recurrently 2.0 mg/dL at present or in the past or patient on dialysis or with a renal transplant), anemia (Hb < 13 g/dL in men and <12 g/dL in women), atrial fibrillation (AF) were recorded. Smoking status was recorded as a smoker if the patient was an active smoker or had quit smoking within the last one year. Precipitant factors such as cardiorenal syndrome is described as disorders of the heart and kidneys whereby acute or chronic dysfunction in one organ may induce acute or chronic dysfunction of the other.[11] We accepted infection as cause of worsening of HF if there were signs of infection such as fever, elevated C-reactive protein, leukocytosis, and infectious focus.[10]

The study was approved by the ethics comitee of the Istanbul Haydarpasa Numune Training and Research Hospital.

Statical analysis

Statistical analysis Continuous variables were presented as mean ± standard deviation (mean±SD) and the categorical variables were expressed as number and percentage (%). The continuous variables were compared across the groups using the Student's t-test or the Mann–Whitney U test.

Normality of the data distribution was verified by the Kolmogorov–Smirnov test. Homogeneity of variance was assessed by the Levene's test. The categorical variables were compared using the chi-square or Fisher's exact test. P value <0.05 was considered to be statistically significant. All data were analyzed with SPSS (SPSS Inc., Chicago, IL,USA) software for Windows Version 20.0.

Results

Baseline clinical characteristics

A total of 1034 elder patients hospitalized with a diagnosis of HF were recruited. Of all, 740 (71.6%) were 65–79 years old and 294 (28.4%) were ≥80 years old. Of those 740 patients 65–79 years old 499 (67.4%) had HFrEF, 120 (16.2%) had HFmrEF and 121 (16.3%) had HFpEF. Among the 294 patients ≥80 years old 181 (61.6%) had HFrEF, 46 (15.6%) had HFmrEF and 67 (22.8%) had HFpEF. The baseline clinical characteristics, comorbidities and laboratory values of the overall elderly patients are presented in Table 1. Among the patients

Table 1
Baseline demographics of all patient groups.

ASA %, (n)	67.7 (338)	60.8 (73)	39.7 (48)	<0.001*	68.5 (124)	63.0 (29)	44.8 (30)	0.002*	0.824	0.793	0.496
ACEİ %, (n)	46.9 (234)	33.3 (40)	24.8 (30)	<0.001*	42.0 (76)	26.1 (12)	17.9 (12)	0.001*	0.256	0.368	0.278
BB %, (n)	75.2 (375)	69.2 (83)	60.3 (73)	0.019*	72.9 (132)	65.2 (30)	43.3 (29)	<0.001*	0.557	0.625	0.025*
Diuretic %, (n)	74.1 (370)	73.3 (88)	59.5 (72)	0.020*	74.0 (134)	50.0 (23)	59.7 (40)	0.003*	0.976	0.004*	0.979
Spironalactone %, (n)	41.3 (206)	33.3 (40)	24.8 (30)	0.010*	33.1 (60)	19.6 (9)	20.9 (14)	0.059	0.055	0.082	0.545
Digoxin %, (n)	19.6 (98)	25.8 (31)	12.4 (15)	0.113	25.4 (46)	10.9 (5)	19.4 (13)	0.041*	0.103	0.036*	0.196
NSAID %, (n)	11.8 (59)	11.7 (14)	15.7 (19)	0.755	11.6 (21)	13.0 (6)	19.4 (13)	0.341	0.251	0.807	0.518

ACEİ: Angiotensin converting enzyme inhibitor, AF: atrial fibrillation; ASA: asetilsalisilic asit, bb: beta blocker, CVD: Cardiovascular disease, DM: Diyabetes mellitus, HFmEF:HF with mid-range ejection fraction, HFrEF::HF with reduced ejection fraction, HFpEF:HF with preserved ejection fraction; HPL: Hyperlipidemia, HT:Hypertension, LVEF: left ventricular ejection fraction,NSAID: Nonsteroid antiinflamatuar drugs, NYHA: New York Hear Assosiaction, PAD:peripheral arteriel disease, RF: renal failure, SD:standard deviation.
(*:indicates values p<0.05).
P1: P vavlue of comparison between the age groups wıth HFrEF.
P2: p value of comparison between tha age groups with HFmEF.
P3: p value of comparison between the age groups with HFpEF.

65–79 years old, male proportion was higher in HFrEF group. Relative to other groups' patients with HFrEF had a higher prevalence of CAD and smoking rate. In the same group patients with HFmrEF had more frequently history of HT compared to patients with HFrEF and HFpEF. Patients with HFpEF had more frequently comorbidities such as anemia and AF relative to other groups.

Among patients ≥80 years old, the mean age was highest in patients with HFpEF. In this group, the prevalence of DM and CAD were higher in patients with HFmrEF whereas, the prevalence of AF was higher in patients with HFpEF.

Patients 65–79 years old with HFrEF had a higher prevalence of male ratio, DM, CAD, hyperlipidemia, smoking, NYHA fuctional class I-II symptoms. Inversely, the prevalence of anemia, AF, NYHA functional class III-IV symptoms were lower when compared to patients ≥80 years old with HFrEF. In elderly patients with HFpEF the prevalence of DM was higher in patients 65–70 years old, whereas the prevalence of AF was higher in patients ≥80 years old as shown in Table 1.

Use of medication

In both age groups, the prevalence of ACEi, beta-blocker, diuretic usages were higher in HFrEF group. Diuretic use was significantly higher in patients' ≥80 years old with HFmrEF compared to patients 65–79 years old with HFmrEF (50% vs 73.3%, p=0.04, respectively) and beta blocker use was higher in patients 65–79 years old with HFpEF compared to patients ≥80 years old with HFpEF (60.3% vs 43.3% p=0.025, respectively). Digoxin use was higher in patients 65–79 years old with HFmrEF compared to patients ≥80 years old with HFmrEF.

Precipitating factors for hospitalization

The frequencies of individual factors that might have precipitated HF admission are shown in Table 2. ACS was the most common precipitant factor in patients 65–79 years old with HFmrEF compared to patients same age group with HFrEF and HFpEF (21.6% vs 19.2% and 11.6%, p=0.043, respectively). However in patients ≥80 years old, ACS was the most frequent precipitant factor for hospitalization in patients with HFrEF compared to patients with HFpEF and HFmrEF (28.9% vs 26.1% and 13.6%, p=0.049, respectively).

Noncompliance with theraphy was the most frequent precipitant factor in patients ≥80 years old with HFrEF compared to patients in same age group with HFmrEF and HFpEF (32.8% vs 17.4% and 19.4% p=0.029, respectively). Arrythmia was more likely to be present in patients ≥80 years old with HFpEF compared to patients 65–79 years old with HFpEF (43.3% vs 26.4% p=0.018, respectively). Uncontrolled HT and worsening renal failure were more common as precipitant factors for patients ≥80 years old with HFrEF compared to patients 65–79 years old with HFrEF (26.7% vs 17.4%, p=0.008 and 32.8% vs 22.8% p=0.009, respectively).

On admission, mean systolic blood pressure (SBP) was lower in patients with HFrEF in both age groups compared to HFmrEF and HFpEF (65–79 years old; 103 ± 36 vs 114 ± 22 and 120 ± 14 p<0.001; ≥80 years old; 92 ± 48 vs 115 ± 23 and 113 ± 19 all p<0.00,1 respectively). Also patients ≥80 years old with HFrEF and HFpEF had a lower mean SBP on admission compared to patients 65–79 years old with HFrEF (92 ± 48 mmHg vs 103 ± 36 mmHg p=0.02 and 113 ± 19 mmHg vs 120 ± 14 mmHg p=0.03, respectively). Patients ≥80 years old with HFrEF had a lower mean heart rate (HR) on admission compared to patients 65–79 years old (64 ± 31 bpm vs 69 ± 24 bpm p=0.027). In both age groups patients with HFrEF had a significantly lower HR on admission compared to patients with HFmrEF and HFpEF (69 ± 24 bpm vs 76 ± 12 bpm and 79 ± 13 bpm; 64 ± 31bpm vs 77 ± 16 bpm and 78 ± 16 bpm, all p<0.001, respectively) (Table 3).

Outcomes

Length of hospital stay was longer in patients ≥80 years old with HFmrEF compared to patients with HFrEF and HFpEF (4.8 ± 6.5 days vs 3.9 ± 3.3 days and 4.8 ± 5 days, p=0.026, respectively). The mortality rate was higher in patients ≥80 years old with HFmrEF compared to patients 65–79 years old with HFmEF (7.5% vs 1.7% p=0.009).

Discussion

This study has shown statistically significant differences in the clinical characteristics, demographics, medication usage, precipitant factors and outcomes of hospitalized elder patients with HFrEF, HFmrEF and HFpEF between different age groups and has provided new insight into elder patients hospitalized with HF. Our data also provides demographics of patients ≥80 years old and further describes the clinical characteristics, medication usage and outcomes of this special group according to LVEF classiffication.

In both age groups patients with HFrEF had a higher rate of hospitalization compared to patients with other HF groups, similar to the ADHERE (mean age 72.8±14.1 years) and GTWG-HF (mean age 72.6±14.2 years) studies.[12,13] In this study, the mean age of HFpEF group tend to be older in patients ≥80 years old. This may be related to increased intertitial deposition of collagen, amyloid and lipofuction, all of which increase myordial stiffness and reduce compliance in older ages.[14] But in younger patients the mean age were similar between the HF groups. In MAGGIC metaanalysis, the mean age progressively increased in patients with HFpEF trebled from the youngest to oldest age groups and reached a prevalence of 39% in patients

Table 2
Preciptant factors for hospitalization.

	65-79 years old				Over 80 years old						
	HFrEF (<40) (n=499)	HFmEF (40-49) (n=120)	HFpEF (≥50) (n=121)	P	HFrEF (<40) (n=181)	HFmEF (40-49) (n=46)	HFpEF (≥50) (n=67)	P	P1	P2	P3
Noncompilance with theraphy %, (n)	28.1 (140)	30.8 (37)	24.0 (29)	0.484	32.8 (59)	17.4 (8)	19.4 (13)	0.029*	0.233	0.081	0.472
Infection %, (n)	30.1 (150)	20.8 (25)	25.6 (31)	0.108	33.3 (60)	34.8 (16)	32.8 (22)	0.976	0.415	0.062	0.292
Arrythmia %, (n)	23.6 (118)	27.5 (33)	26.4 (32)	0.606	30.6 (55)	23.9 (11)	43.3 (29)	0.067	0.068	0.639	0.018*
Acute coronary syndrome %, (n)	21.6 (108)	19.2 (23)	11.6 (14)	0.043*	28.9 (52)	26.1 (12)	13.6 (9)	0.049*	0.050	0.328	0.681
Uncontrolled Hypertension %, (n)	17.4 (87)	20.0 (24)	24.8 (30)	0.174	26.7 (48)	19.6 (9)	23.9 (16)	0.595	0.008*	0.950	0.889
Renal dysfunction %, (n)	22.8 (114)	27.5 (33)	14.9 (18)	0.055	32.8 (59)	23.9 (11)	23.9 (16)	0.267	0.009*	0.639	0.124

HFmEF:HF with mid-range ejection fraction, HFrEF::HF with reduced ejection fraction, HFpEF:HF with preserved ejection fraction, (*:indicates values p<0.05)
P1: P vavlue of comparison between the age groups with HFrEF
P2: p value of comparison between tha age groups with HFmEF
P3: p value of comparison between the age groups with HFpEF

Table 3
clinical characteristics, laboratuary values on admission and outcomes.

	65-79 years old				Over 80 years old						
	HFrEF (<40) (n=499)	HFmEF (40-49) (n=120)	HFpEF (≥50) (n=121)	P	HFrEF (<40) (n=181)	HFmEF (40-49) (n=46)	HFpEF (≥50) (n=67)	P	P1	P2	P3
Total cholesterol mean ± SD	157 ± 51	155 ± 63	149 ± 39	0.746	163 ± 58	149 ±56	172 ±57	0.127	0.301	0.689	0.038*
LDL-C mean ± SD	96 ± 31	85 ± 41	87 ± 31	0.162	103 ±47	92 ±41	101 ±33	0.623	0.423	0.494	0.058
HDL-C mean ± SD	43 ±16	42 ± 17	40 ±15	0.602	37 ±17	36 ±11	44 ±17	0.020*	0.002*	0.087	0.195
TG mean ± SD	120 ± 62	106 ±53	101 ±59	0.207	133 ±84	139 ±78	134 ±80	0.849	0.163	0.109	0.018*
Non-HDL-C mean ± SD	114 ±51	112 ±64	108 ± 33	0.839	125 ±55	112 ±52	126 ±51	0.264	0.058	0.996	0.069
SBP mmhg, mean ± SD	103 ± 36	114 ± 22	120 ± 14	<0.001*	92 ± 48	115 ± 23	113 ± 19	<0.001*	0.002*	0.886	0.003*
HR bpm, mean ± SD	69 ± 24	76 ± 12	79 ± 13	<0.001*	64 ± 31	77 ± 16	78 ± 16	<0.001*	0.027*	0.746	0.634
BUN g/dl, mean ± SD	48 ± 38.1	45.2 ± 35	48 ± 41	0.546	50.3 ± 32	47.7 ± 30	43.1 ± 33.9	0.352	0.419	0.668	0.415
Cr mg/dl, mean ± SD	1.43 ± 0.8	1.35 ± 0.8	1.3 ± 0.9	0.815	1.52 ± 0.9	1.31 ± 0.4	1.41 ± 0.9	0.514	0.073	0.815	0.551
GFR ml/min, mean ± SD	49 ±26	45 ± 30	49 ± 28	0.329	43.5 ± 22.9	45.6 ± 22.8	45.4 ± 23.6	0.785	0.005*	0.972	0.426
Hb g/dl, mean ± SD	12.2 ± 2.1	11.8 ± 2.1	11.6 ± 1.9	0.056	12.2 ± 1.8	11.6 ± 2.3	11.9 ± 1.9	0.287	0.956	0.713	0.448
WBC, mean ± SD	5753± 5900	6561± 5781	6178 ± 5519	0.414	4527 ± 6474	6417 ± 11260	3721 ± 4570	0.173	0.049	0.921	0.003*
BNP pg/ml, mean ± SD	7728 ± 9400	3767 ± 6311	3723 ± 5681	<0.001*	14.360 ± 1390	7659 ± 1353	6213 ± 7453	0.001	<0.001	0.109	0.059
Uric asid mg/dl, mean ± SD	7.9 ± 5.2	6.6 ± 1	6.8 ± 0.5	0.966	6.5 ± 0.5	5.9 ± 2	6.4 ± 0.9	0.201	0.540	0.129	0.037*
Fasting blood sugar mg/dl, mean ± SD	148 ± 92	151 ± 78	145 ± 75	0.854	114 ± 74	127 ± 69	125 ± 44	0.118	0.551	0.099	0.068
ALT, mean ± SD	67 ± 25	31 ± 65	34 ± 81	0.174	41 ± 63	44 ± 133	28 ± 29	0.412	0.186	0.448	0.527
AST, mean ± SD	61 ± 207	37 ± 72	34 ± 81	0.271	51.5 ± 91	59 ± 210	0.510	0.510	0.579	0.349	0.948
LDH, mean ± SD	315 ± 315	282 ± 118	295 ± 162	0.651	312 ± 136	310 ± 401	353 ± 183	0.543	0.951	0.630	0.110
ALBUMİN, mean ± SD	3.5 ± 0.6	3.7 ± 0.4	3.7 ± 0.5	0.139	3.5 ± 0.7	3.6 ± 1.0	3.8 ± 0.5	0.139	0.407	0.616	0.576
HBA1C, mean ± SD	7.0 ± 1.8	7.0 ± 2.4	7.4 ± 1.9	0.513	6.9 ± 1.4	5.9 ± 0.3	6.4 ± 1.1	0.086	0.886	0.198	0.131
Length of stay in ICC (mean ± SD)	4.3 ± 4.6	3.4 ± 2.4	4.1 ± 4.1	0.126	3.9 ± 3.3	4.8 ± 6.5	4.8 ± 5	0.0260	0.430	0.444	0.079
In hospital deaths %, (n)	6.7 (33)	1.7 (2)	5.8 (7)	0.108	10.5 (19)	10.9 (5)	7.5 (5)	0.753	0.101	0.009	0.663

CR: Creatin, ICC: intensive care unit, HDL-C: High density lipoprotein. HFmEF:HF with mid-range ejection fraction, HFrEF: HF with reduced ejection fraction, HFpEF:HF with preserved ejection fraction; HR: heart Rate, LDL-C: low density lipoprotein, SBP:systolic blood pressure, TG: Trigliserid). (*:indicates values p<0.05).
P1: P vavlue of comparison between the age groups with HFrEF.
P2: p value of comparison between tha age groups with HFmEF.
P3: p value of comparison between the age groups with HFpEF.

≥80 years old.[15] Other large studies such as ADHERE, CHARM and OPTIMIZE-HF have not specifically analysed patients ≥80 years old but have found that patients with HFpEF were older.[12,16,17]

In patients 65–79 years old female ratio was higher in patients with HFpEF but in patients ≥80 years old there were no gender difference between the groups. In EPICA study female ratio of patients ≥80 years old with HFpEF was approaching 10% which was close to our finding.[18] Most registries did not specifically study patients ≥80 years old but have reported female dominance in patients with HFpEF.

In this study, patients ≥80 years with HFrEF had more frequently NYHA functional class III-IV symptoms compared to youngers. Patients with NYHA functional class I-II symptoms were predominantly younger and the proportion of NYHA functional class III-IV increased with age similar with other studies.[14,9] This finding may reflect less comorbidity such as AF or airway disease in younger patients.[15]

In most of the studies, patients with HFmrEF were more likely to have HT compared to those with HFrEF.[19] In common with our study, the prevalence of HT in patients 65–79 years old with HFmrEF was close to those patients with HFpEF and higher than the patients with HFrEF. However, no statistical significant difference was found for patients' ≥80 years old between the HF groups. HT prevalence was similar between the HF groups in patients' ≥80 years old. In addition to this, similar with ADHERE, patients 65–79 years old with HFpEF had higher levels of SBP on admission, compared to other groups.

DM was predominantly more in patients ≥80 years old with HFmrEF compared to other HF groups similar with Kapoor et al results.[13] The prevalence of DM was lower in patients' ≥80 years old with HFrEF and HFpEF compared to patients 65–79 years old with HFrEF and HFpEF. This may be related to reduced likelihood of survival of patients with DM until the age of 80.[20] However similar with CHARM study, in patients 65–79 years old DM was similarly prevalent in all HF categories (p=0.34).

As CAD is the principal primary cause of HFrEF and HFmrEF, in patients 65–79 years old CAD had a higher prevalence in HFrEF group vs HFmrEF group. Interestingly, in patients≥80 years old CAD was higher prevalent in HFmrEF group vs HFrEF group. This may be related to high-adjusted mortality rates of CAD in patients with HFrEF and portended lower survival rates of patients with CAD until the age of 80.[21] Based on TIMI-HF and our results we assume that the preponderance of CAD in HFrEF and HFmrEF sugggest a common phenotype in these patients.

Smoking history was common in patients 65–79 years old with HFrEF compared to other HF groups, likewise large registries such as GTWG-HF and SwedeHF. This means younger patients with HFrEF require more attentively evaluation of smoking status and smoking cessation theraphy.

In our study, the prevalence of AF was higher in both age groups with HFpEF compared to other HF groups. The higher mean HR on admission in patients 65–79 years old with HFpEF may be due to higher prevalence of AF in those patients. Age is the strongest independent associated risk factor for AF in both HFrEF and HFpEF and in our study we found that patients ≥80 years old with HFpEF and HFrEF had higher rates of AF compared to younger patients.[22,23] The prevalence of AF was higher in patients with HFpEF and the propotion of AF was similar in patients 65–79 years old with HFpEF with other large registries such as CHARM, ADHERE and OPTIMIZE-HF. However, these registries haven't studied specifically patients ≥80 years old.

Despite the lack of evidence based directed medical theraphy for HFmrEF and HFpEF, observational studies support beneficial effects on reducing mortailty in these patients using ACEi/ARBs and beta-blockers.[12] Altough ESC guidelines recommend similar treatment with HF in these patients, in current clinical practice and in our data compared to HFrEF patients, fewer patients with HFpEF and HFmrEF appear to recieve ACEi, beta-blockers and diuretics. In our data, the higher use of ACEi, diuretics and beta-blockers across all three HF groups in patients 65–79 years old, but lower use of these medications in patients ≥80 years old compared to published data from other cohorts was notable. However, large observational studies and expert consensuses suggest similar treatment with HF benefits in older patients.[24–26]

In our data, spironalactone use was low in both age groups with HFmrEF, however in subanalysis of TOPCAT trial the potential efficacy of spironolactone was greatest at the lower end of the LVEF spectrum (EF 44% -50%, those with HFmrEF) in reduction of HF hospitalizations.[27]

The most frequent factors that might have precipitated hospitalization for elderly with HF were: Noncompliance with theraphy (21.4%), infection (22.7%), arrythmia (20.8%), ACS (16.3%), uncontrolled HT (16%) and renal dysfunction (18.8%), which were identified similar with other large registries. The precipitant factors for HFmrEF hospitalization resembled those of HFpEF in both age groups consistent with GTWG-HF study.[28] In GTWG-HF study, HFrEF patients had a higher rate of medication noncompliance compared to HFpEF and HFmrEF and consistently we found similar finding in patients ≥80 years old. However this difference did not exist in patients 65-79 years old. Of all factors ACS was detected more frequently as precipitant factor for patients with HFrEF in both age groups. This may be related to higher concomitant cardivascular risk factors and primary cause of CAD in patients with HFrEF.

Hospitalized patients with HF usually have a high mortality rate. In our database, patients ≥80 years old with HFmrEF had a higher rate of in hospital mortality compared to other HF groups, unfortunately there is no study to compare this result but in most of the studies in contast to our result, patients with HFrEF had a higher in hospital mortality rate compared to other HF groups. In addition to this, the length of hospital stay in intensive care unit was also higher in this group. These findings may point out the lack of effective management strategies for patients' ≥80 years old with HFmrEF. However, the length of hospital stay was similar in patients 65−79 years old in HF groups similar with other large registries such as OPTIMIZE-HF, GTWG −HF and ADHERE database.

Study limitations

As first, in this study follow-up data after discharge was not available to determine the long-term outcomes of the elderly patients. Second, as voluntary participation of the survey, the study population may not represent the general population. In addition, the precipitating factors for hospitalization were ascertained by the clinical judgement of the local providers. Registry of the data are based only on diagnostic coding in participating hospitals and documentation of medical history which depend on the accuracy and completeness of documentation and abstracation. Finally, diffilculties in recruiting adequate number of elderly patients decreased generalizability to the entire universe across other geographic settings.

Conclusion

Our results suggest a significant under-prescription of recommended theraphy in elderly patients for HF treatments and do raise concerns about the lack of effective treatment strategy especially in patients ≥80 years old with HFmrEF due to high mortality and in hospital stay. This registry also demonstrates an apportunity to improve care of elderly patients according to HF groups. We also increase awareness of avoidable or modifiable factors to improve optimizing HF management according to specific EF classified HF groups.

Declaration of Competing Interest

All authors declare that they do not have conflict of interest.

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