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Original Article

Obesity paradox in heart failure patients – Female gender characteristics-KAMC-single center experience

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ABSTRACT

Background/Introduction: The correlation between low body mass index (BMI) and congestive heart failure (obesity paradox) has been described in the literature; However, the association between BMI and clinical outcome measures is not well characterized. Little is known about CHF in the Middle Eastern female population; most of the gender-specific information on heart failure comes from higher income "Western" countries.

Objectives: We aimed to identify the correlation between heart failure patients especially those with low BMI and clinical/safety outcome measures with focusing on female patients subgroup characteristics.

Methods: We performed group comparisons of statistically relevant variables using prospectively collected data of HFrEF patients hospitalized over a 12 month period.

Results: The 167 patients (Group I) enrolled by this study with mean age of 59.64 ± 12.9 years, an EF score of 23.96 ± 10.14, 62.9% had ischemic etiology, 12.5% were smoker, 18% had AF, 31.1% had received ICD/CRT-D and an estimated 8.85 ± 9.5 days length of stay (LOS). The low BMI group of patients (Group II) had means age of 58.7 ± 14.5 years, a significant lower EF score of 20.32 ± 8.58, significantly higher 30, 90 days readmission rates and in-house mortality (22%, 36.6% and 17.1% vs 10.2%, 20.4% and 6.6% respectively) and higher rates of CVA, TIA and unexplained syncope (19.5% vs 7.2%). Similarly, female patients with low BMI (Group IV) had lower EF score of 22.0 ± 53, higher 30,90 days readmission rates and in-house mortality (34.4%,43.8% and 25% vs 13.5%,21.6% and 5.4% respectively) and higher rates of CVA, TIA and unexplained syncope(10% vs 0%).

Conclusion: Our findings showed that heart failure patients with low BMI had poor adverse clinical outcome measures (poor EF, recurrent readmission, mortality and composite rates of CVA, TIA and unexplained syncope) which reflect the effect of obesity paradox in those patients with HFrEF. Female patient subgroup showed similar characteristic findings which also might reflect the value of gender-specific BMI related clinical outcomes.

1. Introduction

The obesity paradox is a phenomenon that describes positive association with obesity, as measured by a high body mass index (BMI) and survival observed in certain patient categories.[1] Thus, advanced heart failure (HF) patients with a higher BMI had inversely or not associated risk of mortality and morbidity outcomes.[2] The hemodynamic alterations of overweight/obesity and its pathological effects on arterial blood pressure (BP) and cardiac structure and function, thus contributing role in HF was described in a previous study.[3] Horwich et al. conducted one of the first studies that demonstrated obesity paradox in HF and concluded that HF prognosis was better among overweight patients followed closely by obese patients, and the worst prognosis occurred in underweight HF patients, followed closely by patients with "normal" BMI.[4] The correlation between low body mass index (BMI) and congestive heart failure (obesity paradox) has been described in the literature.

In the Western literature, female patients with congestive heart failure (CHF) are typically older and have a higher incidence of obesity, hypertensive etiology, urinary tract infections, and atrial fibrillation compared with male patients. They are also more likely to suffer from anemia, depression, complications, and underutiliza-

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tion of resources than their male counterparts; however, they show less incidence of ischemic etiology in comparison. Moreover, a low body mass index (BMI) of <25 kg/m^2, valvular heart disease, dementia, pulmonary hypertension, malignancy, and aortic stenosis were found to predict poor outcome and mortality of hospitalized females.[5–8] Despite most of the gender-specific information on heart failure comes from higher income "Western" countries, little is known about CHF in the Middle Eastern female population.

In this study, we aim to determine the impact of obesity paradox on clinical and safety indicators of heart failure patients with consideration of female gender subgroup characteristics description which may add benefit on clinical practice to the treating physicians and guideline makers. Male-to-female comparison was not a primary objective of this study.

2. Methods and statistical analysis

The King Abdullah Medical City-heart failure (KAMC-HF) registry is an observational single-center prospective registry of hospitalized patients with congestive heart failure (CHF), comprising patients initially hospitalized with increased BNP levels, evidence of pulmonary congestion upon chest X-ray, an ejection fraction of <40% on echocardiogram, and New York Heart Association (NYHA) class II-IV symptoms. A total of 167 patients with HFrEF (37 (22%) female patients) were enrolled in our study and followed up for one year. We retrospectively analyzed the epidemiological, clinical, and safety characteristics of each patient and calculated the American Heart Association (AHA)-advocated readmission and the Get With the Guidelines (GWTG) inhouse mortality scores of all patients enrolled.[9,10] Patients with HFpEF and those who lost during the 1 year follow-up were excluded from our study.

Clinical indicators of the patients were monitored and detected. Length of stay (LOS) was calculated during the initial hospitalization, and 30- and 90-day readmission rates were calculated during any one of the relevant hospitalizations. In house mortality was identified as death occurred due to any cause at home. Many safety indicators were also assessed. Device related complications (infection, thrombosis, lead dislodgment and malfunctions), serious bleeding mandated blood transfusion or evidence of orthostatic hypotension, whereas serious infections with positive blood cultures and hemodynamic instability, compared with non-serious ones all were assessed. Acute kidney injury (AKI) was defined as rapid loss of renal function, resulting in a number of complications including fluid imbalance, metabolic acidosis, and uremia and that might be related to angiotensin converting enzyme inhibitors (ACI). Evidence of thromboembolic complications (TIAs and CVAs) was also detected.

We used a standard cutoff value for BMI < 25 kg/m^2 to define the low BMI class. Also, we compared the clinical and safety indicators between low BMI's group and all patient's group (including all normal, overweight and high BMI) to demonstrate the features and specific disease's pattern in those subgroup of patients with referral to the characteristics of female gender in the same way. Low BMI-high BMI comparison was not a primary objective of our study.

The KAMC heart failure observational registry is designed to be the part of the standard of patient care, to measure and improve quality of CHF disease management program, and has received approval of the organization ethics committee/institutional review board.

The collected data were tabulated and analyzed using SPSS version 16 software (Spss Inc, Chicago, ILL Company) and Microstate W software (India, CNET Download.com). Categorical data were presented as number and percentages while quantitative data were expressed as mean ± standard deviation. "*Z*" test was used to analyze categorical variables. Quantitative data were analyzed using Student "*t*". The accepted level of significance in this work was stated at 0.05 ($P < 0.05$ was considered significant).

3. Results

We categorized our data into two categories: patient's baseline characteristics and safety and clinical indicators and compared between the all patient's group (Group I) and low BMI's group (Group II) regarding those data. Also, we discussed female gender subgroup's characteristics in the same way.

3.1. Baseline characteristics

The 167 patients (Group I) enrolled by this study were of Arab descent and had a mean age of 59.64 ± 12.9 years, an EF score of 23.96 ± 10.14, 62.9% had ischemic etiology, 12.5% were smoker, 18% had AF, 31.1% had received ICD/CRT-D and an estimated 8.85 ± 9.5 days length of stay (LOS). However, the low BMI group of patients (Group II) means age of 58.7 ± 14.5 years, a significant observed lower EF score of 20.32 ± 8.58, 63.4% had ischemic etiology, 9.7% were smoker, 26.8% had AF, 26.8% had received ICD/CRT-D during 1 year of follow up and an estimated 8.69 ± 7.83 days (LOS) Table 1.

3.2. Clinical and safety indicators

The main clinical indicators such as 30 days and 90 days readmission rates and inhouse mortality were higher among patients of group II (Low BMI group) (22%, 36.6% and 17.1% vs 10.2%, 20.4% and 6.6% respectively). The safety indicators were either direct CHF or CHF co morbidity-related events and mostly were observed to be higher in low BMI group of patients (Group II). The indication for abdominal or thoracic interventional drainage performance was higher among group II (14.6% vs 6%). CVA, TIA and unexplained syncope were occurred significantly higher among patients of group II (19.5% vs 7.2%). Also, device related complications and under-or over-anticoagulation adverse events were observed more in patients of group II (14.6 and 14.6% vs 6%

Table 1
Comparison between all patients and those with low BMI subgroup regarding clinical characteristic.

Variable	All patients, *n*: 167 (100%)	All patients low BMI, *n*: 41 (24.5%)	Test	*P*
Age (mean ± SD)	59.64 ± 12.9	58.7 ± 14.5	St. "*t*" = 0.39	0.69 (NS)
EF (mean ± SD)	23.96 ± 10.14	20.32 ± 8.58	2.12	0.035 (S)
LOS (mean ± SD)	8.85 ± 9.5	8.69 ± 7.83	0.099	0.92 (NS)
Ischemic etiology	62.9%	63.4%	*Z* = 0.06	0.95 (NS)
Smoking rate	12.5%	9.7%	0.49	0.62 (NS)
AF rate	18%	26.8%	1.27	0.2 (NS)
ICD/CRT-D rate	31.1%	26.8%	0.54	0.59 (NS)
Furosemide average dose in mg (mean ± SD)	(59.42 ± 27.02)	57.5 ± 28.6	St. "*t*" = 0.4	0.68 (NS)

AF: Atrial fibrillation, CRT-D: Cardiac Resynchronization Therapy-Device, EF: Ejection fraction, ICD: Intra Cardiac Device, LOS: length of stay.

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