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Original article

Presentations and outcomes of patients with acute decompensated heart failure admitted in the winter season

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ABSTRACT

Background: Seasonal variations in cardiovascular disease is well recognized. However, little is known about the presentations and outcomes of Japanese heart failure (HF) patients in the winter season.
Methods and results: We used a single hospital-based cohort from the Shinken Database 2004–2012, comprising all new patients (n = 19,994) who visited the Cardiovascular Institute Hospital. A total of 375 patients who were admitted owing to acute decompensated HF were included in the analysis. Of these patients, 136 (36%) were admitted in winter. Winter was defined as the period between December and February. The HF patients admitted in winter were older, and had a higher prevalence of hypertension and diabetes mellitus than the patients admitted in other seasons. Patients with conditions categorized as clinical scenario 1 tended to be admitted more commonly in winter. HF with preserved left ventricular ejection fraction (LVEF) was more common in HF patients admitted in winter than in those admitted in other seasons. Beta-blocker use at hospital discharge was more common in the patients admitted in other seasons. Kaplan–Meier curves and log-rank test results indicated that the incidences of all-cause death, cardiovascular death, and HF admission were comparable between the patients admitted in winter and those admitted in other seasons.
Conclusions: HF admission was frequently observed in the winter season and HF patients admitted in the winter season were older, and had higher prevalence of hypertension and diabetes mellitus, and preserved LVEF suggesting that we might need to pay more attention for elderly patients with hypertension, diabetes mellitus, and HF with preserved LVEF to decrease HF admissions in the winter season.
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Introduction

The seasonal variation in the incidence of various cardiovascular diseases is well established [1–4]. The environmental temperature is associated with this variability, as cardiovascular events peak in winter. The physiologic consequences of a cold climate are thought to result in increased coronary risk factors and might also cause clinical deterioration in patients with heart failure (HF). Skin cooling has been shown to increase systemic vascular resistance [5], heart rate [6], plasma norepinephrine concentration [7], circulating levels of vasoconstrictor peptides [8], and blood pressure (BP) [9]. In keeping with these changes, BP is higher in winter [10]. Cold can also induce myocardial ischemia [11]. All of these effects could clearly lead to worsening of HF. However, little is known about the clinical characteristics and outcomes of Japanese HF patients admitted in winter. In the present study, we aimed to elucidate the characteristics and clinical outcomes of patients with acute decompensated HF admitted in winter by examining data from our hospital-based cohort selected from the Shinken Database 2004–2012.

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Methods

Study patients

The Shinken Database includes all patients who visited the Cardiovascular Institute in Tokyo, Japan ("Shinken" is a Japanese abbreviation for the name of the hospital), and excludes patients who are foreign travelers and those with active cancer. This hospital-based database was established to investigate the prevalence and prognosis of cardiovascular diseases in the urban areas of Japan [12,13]. The registry began in June 2004, and patients have been continually registered to the database annually. The present study analyzed data from this database collected between June 2004 and March 2013 (Shinken Database 2004–2012) and included 19,994 new visiting patients. Among them, 537 patients were admitted to our institute due to acute decompensated HF. We excluded HF patients with primary valvular heart disease ($n = 138$) and acute coronary syndrome ($n = 24$). Valvular heart disease was defined as long-standing mitral or aortic valve involvement, as documented by physical examination and echocardiography, angiography, or history of surgical repair. Finally, 375 patients were examined in the present study (Fig. 1). These patients were followed up for an average period of 857 ± 846 days. Winter was defined as the period between December and February.

Ethics

The ethical committee of the Cardiovascular Institute approved this study, and all the patients provided written informed consent.

Data collection

For each patient, after undergoing electrocardiography and chest radiography, cardiovascular status was evaluated by echocardiography, an exercise test, 24-h Holter recordings, and blood laboratory data, as prescribed by the attending physician, within 3 months after the first visit. As initial clinical parameters, collected data included gender, age, body mass index, drug information, and coexisting conditions, including hypertension, atrial fibrillation, diabetes mellitus, and dyslipidemia. In most patients, additional echocardiographic parameters included left ventricular diameter of the diastole (LVDd), LV diameter of the systole (LVDs), interventricular septum thickness (IVST), posterior wall thickness (PWT), and LV ejection fraction (LVEF) using M-mode echocardiography. Anemia was defined as a hemoglobin level of <11 g/dL. An estimated glomerular filtration rate (eGFR) was calculated using the eGFR equation for the Japanese population: $eGFR = 194 \times (\text{serum creatinine})^{-1.094} \times (\text{age})^{-0.287} \times (0.739$, if the patient is female) [14]. A baseline $eGFR < 60\ mL\ min^{-1}\ 1.73\ m^{-2}$ was used to define chronic kidney disease (CKD) [15]. Idiopathic dilated cardiomyopathy was diagnosed by the presence of global LV dilatation with impaired systolic function occurring in the absence of known cardiac causes. Hypertrophic cardiomyopathy was diagnosed by echocardiography when hypertrophy (IVST or PWT > 12 mm) without hypertension was present. We defined HFpEF patients as HF patients with preserved LVEF (i.e. LVEF > 50%), and HFrEF patients as HF patients with reduced LVEF (i.e. LVEF ≤ 50%), as previously described [16,17]. Patients were divided into three groups by clinical scenario (CS): CS1, systolic BP (SBP) at admission >140 mmHg; CS2, ≥100 mmHg; CS3, <100 mmHg [18]. We confirmed the deaths of study patients by the medical records of our hospital or by the information obtained during follow-up. We defined cardiovascular death as death resulting from acute myocardial infarction, sudden cardiac death, death due to heart failure, death due to stroke, or death due to other cardiovascular causes [19]. We confirmed HF events (HF requiring hospitalization or death due to HF) that were classified as per the International Classification of Diseases, 10th revision, code I50, using the medical records of our hospital or by the information obtained from follow-up.

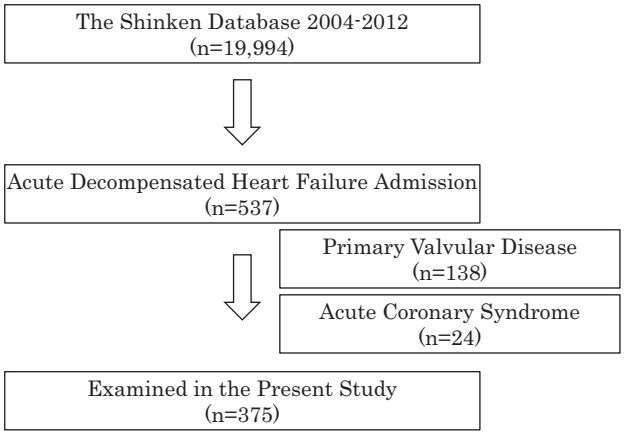

Fig. 1. Patient flow chart of the present study.

Patient follow-up

The health status, incidence of cardiovascular events and mortality of patients are maintained in the database by linking these data to the medical records of the hospital and through study documents that were sent one a year to those who stopped hospital visits or who were referred to other hospitals.

We excluded the follow-up data obtained after April 1, 2013 from data analysis. Therefore, the end of the follow-up period was defined as one of the following: (1) the date of death, if the date was before March 31, 2013; (2) the final hospital visit or the final response to our study documents involving prognosis with confirmation of being alive before March 31, 2013; (3) March 31, 2013, when the date of death, the final hospital visit, or the final response to our study documents involving prognosis was later than April 1, 2013.

Statistical analysis

Categorical and consecutive data regarding patient background are presented as numbers (%) and means ± standard deviation, respectively. The chi-square test was used for comparisons between groups, and the unpaired *t*-test was used for comparison of consecutive variables. Long-term, event-free survival was estimated using Kaplan–Meier curves and the log-rank test to assess the significance of differences between the two groups. Logistic regression analysis was used to identify the determinants of HF patients in the winter season. Univariate and age-adjusted Cox regression analysis were performed to clarify the association between HF admission in the winter season and long-term clinical outcomes. A probability value of <0.05 was considered to indicate a statistically significant difference. Statistical analyses were performed using SPSS (SPSS Inc., Chicago, IL, USA), version 19.0 software.

Results

Patient characteristics

Among the 375 patients with HF, 136 (36%) were admitted in winter, and 239 patients (64%) were admitted in the other seasons. The distribution of the admission month among

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