Characteristics of Hospitalized Heart Failure Patients of Eastern Taiwan: A Single Center Registry

Yuan-Chieh Chang, Ying-Chi Tsai, Huai-Ren Chang, Yu-Chih Chen, Wei-Shin Liu

Division of cardiology, Hualien Tzu-Chi Hospital, Buddhist Tzu-Chi Medical Foundation, Hualien, Taiwan

Abstract

Background: The prevalence and treatment of heart failure (HF) have been extensively studied in Western countries, but data from Asian regions like Hualien, Taiwan, where a significant Austronesian aboriginal population resides, are scarce. This gap highlights the importance of localized studies in Hualien to understand the unique etiology and treatment approaches for HF in this demographic, which could differ markedly from Western data.

Methods: This study, part of the TSOC HF 2020 registry and focused on a single center in eastern Taiwan, analyzes heart failure patients categorized by their left ventricular ejection fractions into three groups: reduced, mildly reduced, and preserved. It includes patients either recently hospitalized for HF or with a history of HF-related hospitalization. This substudy reported echocardiographic measurements, treatments the patients received, and various patient characteristics. The results are presented in two groups: ischemic cardiomyopathy (ICM) group and non-ischemic cardiomyopathy (NICM) group.

Result: In this Taiwanese study of 58 heart failure (HF) patients, 16% had ischemic cardiomyopathy (ICM) and 84% non-ischemic cardiomyopathy (NICM). ICM patients were generally older and had more comorbidities like COPD/Asthma, hypertension, diabetes, stroke/TIA, and renal insufficiency. NICM patients more often had cardiac implantable electronic device (CIED) implantations and a slightly higher body mass index. The majority of both groups had reduced ejection fraction (HFrEF). Echocardiographic analysis showed significantly higher Tissue Doppler E velocity (Lateral) in the NICM group, but other cardiac measurements were similar between groups. Laboratory tests, including NT-proBNP, creatinine, and lipid profiles, showed no significant differences. Most patients in both groups were treated with neurohormonal blocking agents (ACE inhibitors/ARB/ARNI), with beta-blockers also commonly prescribed. Fewer patients in the ICM group received mineralocorticoid receptor antagonists, and only a small number were on Ivabradine, SGLT2 inhibitors, and Digoxin. No new CIED implantations were reported during the study period.

Conclusion: In our single center experience, ischemic cardiomyopathy patients often have more comorbidities than those with non-ischemic cardiomyopathy, with dilated cardiomyopathy being prevalent in NICM, and most patients receive standard medical therapy.

Keywords: heart failure, ischemic cardiomyopathy, non-ischemic cardiomyopathy, registry

Received: Nov. 15, 2023; Accepted: Nov. 30, 2023

Address for correspondence: Dr. Wei-Shin Liu, MD
Division of Cardiology, Hualien Tzu-Chi Hospital, Buddhist Tzu-Chi Medical Foundation, Hualien, Taiwan
E-mail: wsliu@tzuchi.com.tw

Introduction

The prevalence of heart failure (HF) has been increasing until recently as the population ages, survival after cardiovascular care improves, and the prevalence of HF risk factors increases.[1] At the same time, mortality from HF has decreased due to advances in treatments.

In terms of causes of HF, ischemic cardiomyopathy (ICM) accounts for two-thirds of patients with HF and is the most common cause of HF. Non-ICM (NICM) still accounts for one-third of patients with HF.[2]

Published epidemiological data mainly come from Western countries, with a relatively small proportion of the Asian population. Hualien is located in the eastern half of the small island of Taiwan. Nearly one-third of the population is Austronesian aboriginal. The causes of HF and the treatments received may be even more different. Therefore, our study aimed to describe the etiology, characteristics, and treatment of patients with HF at our single center in the hope that this will inform future treatment strategies.

Methods

Study decision and Enrollment status

This investigation forms a specialized segment of the TSOC HF 2020 registry, which itself is a multicenter, prospective, observational analysis centered on the HF patient demographic in Taiwan. This extensive study includes participation from 27 health facilities and adheres to ethical clearance provided by the ethics boards of all hospitals involved, in line with the moral standards outlined in the Declaration of Helsinki. This particular investigation narrows its scope to participants from a single center situated in eastern Taiwan.

According to current guidelines,[3] HF patients were divided into three groups according to their left ventricular ejection fraction (LVEF), which was measured via echocardiography within a period of three months: those with HF with reduced ejection fraction (HFrEF) exhibited LVEFs under 40%, while those with HF with mildly reduced ejection fraction (HFmrEF) had LVEF ranging from 40% to 49%, and those with HF with preserved ejection fraction (HFpEF) showed LVEF of 50% or more. Candidates for the study were those who had been hospitalized for an acute worsening of HF or outpatients who had a prior HF-related hospitalization within six months. By the conclusion of 2022, our center enrolled 58 patients to participate the registry study. We are here analysis and described characteristic of this these 58 patients.

Ischemic cardiomyopathy (ICM) or Non-ischemic cardiomyopathy (NICM)

In the data collection form, the causes of heart failure are classified as ischemic or non-ischemic. Following current medical practice, patients with a history of coronary artery disease, myocardial infarction, or coronary revascularization, along with a reasonable explanation for cardiac failure, are classified as having ischemic cardiomyopathy (ICM), which is cardiomyopathy caused by ischemic heart disease. In cases where depressed myocardial performance is not due to ischemic heart disease, patients are classified as having non-ischemic cardiomyopathy (NICM). Dilated cardiomyopathy (DCM) is often used interchangeably with NICM because both present with ventricular dilation and depressed myocardial performance. However, the diagnosis of DCM requires the absence of hypertension, valvular, congenital, or ischemic heart disease.[5]

Echocardiography

Certified echocardiographers at each center performed initial transthoracic echocardiograms in line with both international standards and regional protocols. From the parasternal perspective, dimensions of the left atrial anteroposterior diameter and the left ventricular internal diameter were recorded. Left ventricular end-diastolic and end-systolic volume indexes, along with left atrial volume index and LVEF, were calculated using

the biplane Simpson's method from the apical four- and two-chamber angles.

During the heart's relaxation phase, the echocardiograms were utilized to measure peak early (E) and late (A) mitral inflow velocities, as well as the peak early diastolic velocities at the lateral and medial mitral annulus (e'). The mean E/e' ratio was determined by dividing the E velocity by the average of the e' velocities. For the highest tricuspid regurgitation (TR) velocity assessment, apical four-chamber views complemented by color flow mapping were utilized, with alignment via continuous-wave Doppler.

The intensity of mitral regurgitation, tricuspid regurgitation, aortic regurgitation, and aortic stenosis was categorized into none/mild, moderate, or severe based on current established criteria.[14]

Statistical Analysis

Continuous variables were represented by their number of observations, median, and interquartile ranges, while categorical variables were detailed through counts and respective percentages. Assessments compared patients divided based on the cause of cardiomyopathy—specifically, ischemic versus non-ischemic origins. For categorical variables, chi-square tests were employed, while the Kruskal-Wallis test was used to evaluate continuous variables. All statistical tests will be performed using two-tailed tests at the 5% level of significance. Statistical analyses were performed using IBM SPSS Statistics 27.0 software (IBM SPSS, IBM Corp., Armonk, NY, USA).

Funding

The Taiwan Society of Cardiology managed the TSOC HF Registry 2020, with financial support from Novartis for the coordination among hospitals. It is important to note that the sponsor did not play any role in the gathering or analysis of data, the decision to publish, or the preparation of the manuscript.

Results

Among the 58 enrolled HF patients at our center, the distribution of phenotypes was as follows: 16% ICM and 84% NICM, corresponding to 9 and 49 patients, respectively. Table 1 shows the characteristics of the registry population.

Generally, patients in the ICM group are older. The percentages of women and smokers are not significantly different between groups. Patients in the ICM group seem to be more likely to have comorbidities, including chronic obstructive pulmonary disease (COPD)/asthma, hypertension, diabetes, stroke/transient ischemic attack (TIA), and renal insufficiency. A higher proportion of patients in the NICM group have already received CIED implantation. There was no difference in heart rate and systolic blood pressure (SBP) between the ICM and NICM groups. Patients in the NICM group appear to have a slightly higher body mass index (BMI). HFrEF accounts for the majority of patients in both groups.

For the echocardiography measurements, we found that the e' (Lateral) was significantly higher in the NICM group. Other parameters, including LVEF, interventricular septum (IVS), left ventricular posterior wall (LVPW), left ventricular end-diastolic dimension (LVEDD), left ventricular end-diastolic volume (LVEDV), left ventricular end-systolic volume (LVESV), TR Velocity, e' (Septal), E, A, aortic stenosis (AS), aortic regurgitation (AR), mitral regurgitation (MR), and TR, showed no significant differences.

Regarding laboratory examinations during admission, measurements of NT-proBNP, creatinine, hemoglobin (Hb), hematocrit (Hct), platelet count, aspartate aminotransferase (AST), alanine aminotransferase (ALT), HDL, and C-reactive protein (CRP) were not different between the ICM group and the NICM group. Hemoglobin A1c (HbA1c) was insignificantly higher in the ICM group, while triglycerides (TG), total cholesterol, and LDL were insignificantly higher in the NICM group.

Table 1. Characteristics of the registry population

	Ischemic cardiomyopathy (N=9)	Non ischemic cardiomyopathy (N = 49)	P value
Age, yrs	66 (53-73)	55 (44-66)	0.233
Woman %(n)	33 (3)	29 (17)	0.937
Smoker %(n)	67 (6)	59 (29)	0.637
Medical history			
COPD/Asthma %(n)	33 (1)	4 (2)	0.381
Atrial fibrillation %(n)	22 (2)	34 (17)	0.464
Diabetes %(n)	56 (5)	14 (7)	0.005*
Hypertension %(n)	67 (6)	29(14)	0.027*
Hypercholesterolemia %(n)	0 (0)	2 (1)	0.666
Hypertriglyceridemia			
%(n)	0 (0)	2 (1)	0.666
Stroke/TIA %(n)	33 (1)	6 (3)	0.587
Renal insufficiency (eGFR<60) %(n)	33 (1)	10 (5)	0.935
CIED implantation %(n)	0 (0)	6 (3)	0.446
Admission measurement			
SBP mmHg	118 (118-146)	120 (110-130)	0.186
Heart rate bpm	81 (70-84)	80 (70-86)	0.090
BMI kg/m2	23 (22-26)	26 (23-28)	0.675
HFrEF % (n)	78 (7)	86 (42)	0.441
HFmrEF % (n)	11 (1)	8 (4)	0.802
HFpEF % (n)	11 (1)	6 (3)	0.392
Echocardiography examination			
Ejection fraction %	32 (23-34)	33 (25-33)	0.547
IVS (M mode)	9.9 (8.4-12.4)	11.2 (9.9-12.4)	0.414
LVPW (M mode)	11.6 (8.6-12.2)	9.9 (8.3-12.6)	0.584
LVEDD (M mode)	59 (53-71.6)	58.2 (54.0-65.1)	0.855
LVEDV (Biplane Simpsons method)	152 (81.2-269)	127 (107.6-169)	0.668
LVESV (Biplane Simpsons method)	99 (42.4-135.4)	88 (61.0-127.7)	0.889
TR Velocity (Doppler)	223 (215-274)	270.8 (234.3-310.0)	0.147
Tissue Doppler E (Septal)	3.8 (3.4-7.6)	5.6 (4.15-7.17)	0.405
Tissue Doppler E (Lateral)	3.9 (3.5-4.6)	6.1 (4.5-7.8)	0.017*
Mitral inflow E wave velocity	90.5 (86.8-114.5)	98.4 (75.8-118.4)	0.631

(Continued)

Table 1. *Continued*

Mitral inflow A wave velocity	75.7 (53.8-87.3)	58.8 (34.0-74.9)	0.278
Severe AS %(n)	0 (0)	0(0)	-
Severe AR %(n)	0 (0)	0 (0)	-
Severe MR %(n)	11 (1)	8 (4)	0.772
Severe TR %(n)	11 (1)	16 (8)	0.691
	Laboratory examination		
NT-proBNT (pg/ml)	2086 (1394-5771)	3155 (1545-5183)	0.836
Creatinine (mg/dL)	2 (1-1.8)	1 (0.8-1.26)	0.119
WBC (10^4/UL)	6.71 (5.8-7.9)	7.53 (5.99-8.68)	0.279
Hb (g/dL)	14.8 (10.5-15.8)	13.3 (11.6-14.7)	0.616
Hct	40.7 (34.6-45.9)	40.8 (34.8-44.4)	0.839
Platelet (10^3/UL)	222 (174-273)	214.5 (183.3-279.8)	0.641
HbA1c(%)	7.4 (6.2-8)	6.1 (5.7-7.5)	0.265
AST (IU/L)	17(16-31)	26 (19-35)	0.109
ALT (IU/L)	13 (11-21)	19 (14.5-38.5)	0.110
TG (MG/DL)	113 (88.5-139.3)	124.5 (96.5-178.8)	0.398
Total cholesterol (MG/DL)	155.5 (117-164)	165 (133-178)	0.150
HDL (MG/DL)	38 (35.5-42.8)	38 (34-43)	0.970
LDL (MG/DL)	91 (49-105)	105 (84-128)	0.101
CRP (MG/DL)*	0.22 (0.06-2.57)	0.95 (0.42-2.61)	0.229

TIA: transient ischemic attack, BMI: Body Mass Index, HFrEF: heart failure with reduced ejection fraction, HFmrEF: heart failure with mildly reduced ejection fraction, HFpEF: heart failure with preserved ejection fraction, CIED: cardiovascular implantable electronic device, IVS: interventricular septum thickness, LVPW: left ventricular posterior wall thickness, LVEDD: left ventricular end diastolic dimension, LVEDV: left ventricular end diastolic volume, LVESV: left ventricular end systolic volume, TR: tricuspid regurgitation, AS: aortic stenosis, aortic regurgitation, MR: mitral regurgitation, WBC: white blood cell, Hb: hemoglobin, Hct: hematocrit, TG: triglycerides, HDL: high-density lipoprotein, LDL: low-density lipoprotein, CRP: C-reactive protein.

Table 2. NICM etiology

Dilated (n)	43
Hypertensive (n)	1
Tachycardia related (n)	3
Chemotherapy(n)	1
Other (n)	1

Table 2 and Figure 1 summarize the etiology of NICM. Eighty-eight percent of patients were diagnosed with dilated cardiomyopathy. Hypertensive, tachycardia-related, and chemotherapy-related causes account for a minority of the patients.

A significant majority of patients were prescribed neurohormonal blocking agents ACE inhibitors / Angiotensin receptor blockers / Angiotensin Receptor-Neprilysin Inhibitor (ACEI/ARB/ARNI), with the rate nearing 85% in both groups. ARNI prescriptions were lower, at 14% and 17% for each group, respectively. A relative smaller percentage of patients in the ICM group were prescribed mineralocorticoid receptor

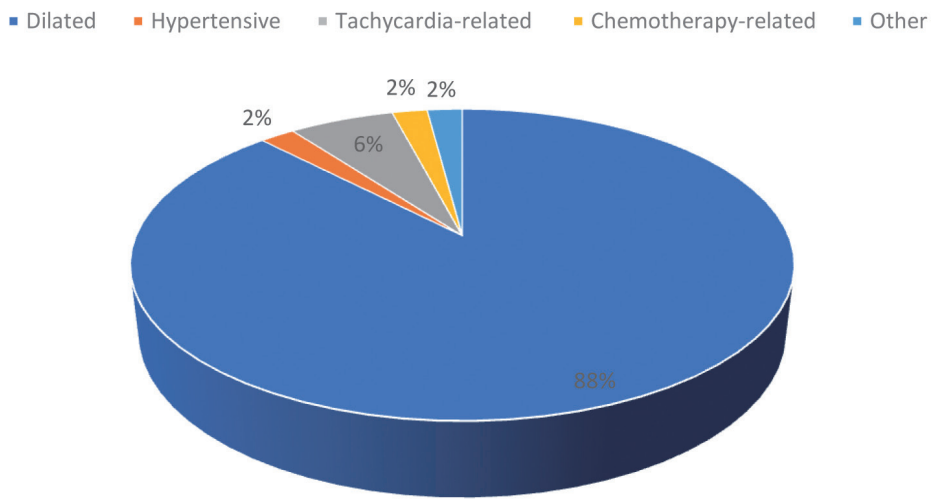

Figure 1. NICM etiology.

antagonist (MRA). The rate of beta-blocker prescriptions was comparable between the groups. Only a small fraction of patients were prescribed ivabradine, SGLT2 inhibitors, and dgoxin. None of the patients in either group received a new CIED implantation.

Discussion

This study provides valuable insights into the clinical characteristics and immediate treatment patterns of our cohort.

Our results are compatible with published data,[4] indicating that patients with ICM tend to be older and have a greater number of comorbidities. Correspondingly, laboratory results showed relatively higher HbA1c levels, which is consistent with these findings. Echocardiographic outcomes revealed no significant differences between ICM and NICM groups. A larger sample size may be required to detect nuanced changes in heart structure.

Consistent with global trends, the prescription rates for ACEI/ARB and ARNI in our cohort are remarkably high, nearing 85%. The beta-blocker prescription rate is also high, at 83% in one group and 100% in the other, respectively. This is comparable to published international data. Our aldosterone antagonist prescription rates of 42% and 88% in the two groups, respectively, are potentially better than the published international average of approximately 34%.[4]

In interpreting the findings of this study, several limitations must be taken into account. The modest sample size and the study's design as a single-center, cross-sectional observational registry may restrict the generalizability of the results. The absence of long-term outcome data precludes the ability to establish causation or predict the prognosis of the studied conditions. Furthermore, inherent to its observational nature, this registry may contain unmeasured confounders that could influence the results. The extrapolation of these findings to a broader population should be approached with caution. Future studies with larger, multi-center cohorts and longitudinal follow-up are required to confirm our observations and to explore the impact of these clinical characteristics on patient outcomes.

Conclusion

According to data from a single center in eastern Taiwan, there is a trend suggesting that patients with ICM may carry a greater burden of comorbidities than those with NICM. Dilated

cardiomyopathy (DCM) was the leading cause of NICM. Guide-direct optimal medical therapy already prescribed in high percentage even in this remote center.

References

1. Jones NR, Roalfe AK, Adoki I, Hobbs FDR, Taylor CJ. Survival of patients with chronic heart failure in the community: a systematic review and meta-analysis. *Eur J Heart Fail* 2019 Nov;21(11):1306-1325. doi: 10.1002/ejhf.1594. Epub 2019 Sep 16. PMID: 31523902; PMCID: PMC6919428.
2. Gheorghiade M, Bonow RO. Chronic heart failure in the United States: a manifestation of coronary artery disease. *Circulation* 1998;97:282-289.
3. Theresa A. McDonagh, Marco Metra, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *European Heart Journal* 2021; 42:3599-3726.
4. Shore S, Grau-Sepulveda MV, Bhatt DL, et al. Characteristics, Treatments, and Outcomes of Hospitalized Heart Failure Patients Stratified by Etiologies of Cardiomyopathy. *JACC Heart Fail* 2015 Nov;3(11):906-916. doi: 10.1016/j.jchf.2015.06.012. Epub 2015 Oct 7. PMID: 26454848.
5. Current diagnostic and treatment strategies for specific dilated cardiomyopathies: a scientific statement from the American Heart Association. *Circulation* 2016;134:e579-e646. doi: 10.1161/CIR.0000000000000455.