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Research Article

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Clinical Characteristics and Segmental Qualities of Young Patients with Heart Failure in a Tertiary Care Centre

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Abstract

Background: *The prevalence and hospitalizations of patients with heart failure aged <55 years have increased. The study aims to evaluate the clinical traits and segmental qualities of young patients experiencing heart failure at a tertiary care center.*

Methods: *This cross-sectional study design enrolled 83 individuals who had recently developed heart failure at a young age. The study encompassed individuals aged 18 to 55 years, from whom clinical indicators and potential risk elements were obtained followed by 2D transthoracic echocardiography performed as part of the routine assessment.*

Results: *The study comprised of 83. The participants with a mean age of 51.5 ± 4.0 years. A significant proportion of the individuals were noted to have diabetes (65%), while 74.7% were identified with hypertension. A statistically significant association was noted between patients who had a prior history of Ischemic heart disease (IHD) and their probability of developing Heart failure (HF) (p-value = 0.02). The primary and the most prevalent cause of heart failure among these study participants was dilated cardiomyopathy. Patients with reduced Ejection fraction (EF) had a notably higher occurrence (68%) compared to mid-range EF (14%) and preserved EF (23%).*

Conclusion: *The study comprised of involved individuals those belonging to the age group between 45-55 years, exhibited higher rates of hypertension and diabetes. Heart Failure with reduced Ejection Fraction (HFrEF) was dominant, wherein dilated cardiomyopathy invariably being the most common cause of heart failure in younger patients. Notably, a significant portion of these individuals had a past history of IHD, which contributed a substantial role in the development of HF*

Keywords: Cardiac Failure, Young Adults, Coronary Artery Disease, Cardiomyopathies

Abbreviations

ACC: American College of Cardiology
AHA: American Heart Association
DM: Diabetes Mellitus
EF: Ejection Fraction
IHD: Ischemic Heart Disease
IVS: Interventricular Septum
HF: Heart Failure
HFimpEF: Heart Failure with Improved Ejection Fraction
HFmrEF: Heart Failure with Mildly Reduced Ejection Fraction
HFpEF: Heart Failure with Preserved Ejection Fraction
HFrEF: Heart Failure with Reduced Ejection Fraction
HTN: Hypertension
LV: Left Ventricle

LVEDD: Left Ventricular End Diastolic Dimension
MV: Mitral Valve
NYHA: New York Heart Association
RV: Right Ventricle
TAPSE: Tricuspid Annular Plane Systolic Excursion
TV: Tricuspid Valve

1. Introduction

Heart Failure (HF) poses a significant public health concern, and its prevalence increases as individuals age [1]. Heart Failure (HF) mortality rates have been relatively higher among young and middle-aged adults [2]. The prevalence of heart failure is on the rise in developing countries such as India, primarily due to changes in lifestyle and the presence of risk factors like smoking, hypertension, and diabetes [3]. Moreover, heart failure imposes significant symptom burden leading to impaired quality of life. The continuous increase in cardiovascular risk factors has contributed to a persistent rise in both the occurrence and frequency of heart failure. Furthermore, the numerous comorbid conditions associated with heart failure impose a significant financial burden [4].

Heart Failure is classified based on Ejection Fraction (EF) into four categories:
1. HFrEF occurs when EF is less than 40%.
2. HFmrEF is diagnosed when EF ranges from 41% to 49%.
3. HFimpEF is defined when the initial EF is lower than or equal t0 40% with an improvement in EF up to 40% and at least more than 10% increase at the month of follow-up.

2. Material and Methods

A cross-sectional study was carried out from November 2022 to November 2023. The research received approval from the Ethics board, Kasturba Medical College, ethics board on 19th of January, 2023 (Reg. No. ECR/S41/Anst/KA/2014 / RR-20) and written consent was obtained from all participants aged 18-55 displaying heart failure symptoms, regardless of the cause. Pregnant women with heart failure and patients with concurrent heart failure requiring rehospitalization were not included in the study. Baseline information was recorded, including patient age, blood tests, and blood pressure. Medical records were used to gather information on a patient's medical history, the causes of heart failure, clinical symptoms, Electrocardiogram (ECG) data, and risk factors. Following the imaging criteria established by the American Society of Echocardiography, echocardiography was performed to assess the left and right ventricular performance.

2.1. Statistical Analysis

The mean +/- SD metric will be used to express all continuous variables. The percentages for all categorical variables will be used. A p-value of 0.05 was deemed significant when using the two-sample t-test to compare the distribution of different risk variables and medical history between genders. The study was carried out using R software after all the data had been uploaded to an Excel sheet.

3. Results

3.1 Baseline Parameters

The study comprised 83 patients who exhibited symptoms of heart failure, regardless of the underlying cause, during the period from November 2022 to November 2023. Among these patients, 43 (52%) were male, and 40 (48%) were female. The average age of the study population was 51.5 ± 4.0 years. The mean arterial pressures were documented as having an SBP of 114.6 ± 31.95 and a DBP of 86.6 ± 17.5 (Table 1).

Characteristics	Mean (SD)
Height (cm)	163.04 ±7.72
Weight (kg)	63.5 ±10.09
HR (bpm)	108.9±24.9
SPO2 (%)	87.6±13.2

Table 1: Baseline Characteristics of the Study Participants

3.2. Medical History Profile

The patient's medical history was documented, revealing a statistically significant relationship between patients who had a history of IHD and their likelihood of developing HF. This association was found to affect both males and females equally (Table 2).

	Gender		
	Male(n=43)	Female (n=40)	
Past history	Frequency	Frequency	*p value
CABG	2.3	0	1.0
CRT	2.3	2.5	1.0
ICD	2.3	2.5	1.0
IHD	69.8	45	0.02

PCI	32.6	15	0.07
Valve Procedures	0	2.5	0.48
CABG: Coronary Artery Bypass Graft, **CRT**: Cardiac Resynchronization Therapy, **ICD**: Implantable Cardioverter Defibrillator, **IHD**: Ischemic Heart Disease, **PCI**: Percutaneous Coronary Intervention. Chi-Square Test was used for estimating difference among categorical variables			

Table 2: Association of Medical History with Development of HF

3.3. Risk Factors

Among the 83 patients, hypertension and diabetes mellitus were the most prevalent conditions, and they were nearly equally distributed between both genders (Table 3).

	Gender	
	Male (n=43)	**Female (n=40)**
Risk Factors	Percentage (%)	Percentage (%)
Hypertension	79.1	70
Diabetes	65.1	65
Obesity	20.9	5
Smoking	18.6	2.5
Alcohol	25.6	2.5
CKD	11.6	25
COPD	7	5
Abdominal pain	90.36	9.64
Chest pain	65	35
Dyspnea	1.2	98.8
Fatigue	65.06	34.94
CKD, Chronic Kidney Disease; COPD, Chronic Obstructive Pulmonary Disease		

Table 3: Profile of Risk Factors and Symptoms among the Study Participants

Clinical Profile	**Mean ± SD**
Systolic BP (mmHg)	51.5±4.0
Diastolic BP (mmHg)	86.6±17.5
Heart rate (beats/min)	108.9±24.9
Respiratory rate (per/min)	25.7±6.6
SpO2	87.6±13.2
Troponin I	75.9±1.84
Biochemical Profile	
Serum Sodium (mEq/L)	135.1±4.5
Serum potassium (mEq/L)	4.0±0.6
Serum creatine (mg/dL)	2.9±1.2
Troponin I (ng/ml)	75.9±1.8
Troponin T (ng/ml)	87.1±8.49
Blood Urea (mmol/dL)	47.9±20.5
Echocardiographic Parameters	
LVEDD (mm)	5.0±0.8
LVESD (mm)	3.5±1.01

LVEF (%)	39.2±10.1
LVFS (%)	19.9±5.1
RAP (mmHg)	7.4±4.0
PASP (mmHg)	42.2±12.4
TAPSE (mm)	16.7±3.8

Table 4: Clinical, Echocardiographic and Biochemical Profile of the Study Participants (n=83)

3.4. Etiology Contributing towards Heart Failure

The present study observed that out of the 83 participants, 11 individuals (13.2%) had Dilated cardiomyopathy as their primary cause of HF. On the other hand, a smaller number of participants presented with different heart conditions: 1 (1.2%) had Rheumatic Heart Disease (RHD), 1 (1.2%) had Ischemic Cardiomyopathy, and 1 (1.2%) had Restrictive Cardiomyopathy (RCM).

3.4.1. Profile of Signs and Symptoms

Upon initial presentation, the study found that pulmonary edema was highly prevalent in 79 individuals (95%), while tachycardia was observed in 47 individuals (57%), and pedal edema was present in 53 individuals (64%). In contrast, a smaller proportion of individuals had Jugular Venous Distension (JVD) in 8 cases (9.6%), and the third heart sound was heard in 19 cases (23%).
Regarding the primary symptoms reported by the patients, the majority presented with dyspnea, which was observed in 82 individuals (99%). Other common symptoms included paroxysmal nocturnal dyspnea in 18 cases (22%), chest pain in 29 cases (35%), and fatigue in 29 cases (35%). Additionally, abdominal pain was less frequently reported symptom, noted in 8 cases (9.6%) among the study participants.

3.4.2. Cardiovascular Evaluations

ECGs were conducted as part of the evaluation, and the results indicated specific findings. Among the participants, 28 individuals (34%) were diagnosed with ST Segment Elevation MI (STEMI), while 22 individuals (26.5%) exhibited sinus tachycardia. Additionally, 22 individuals (26.5%) were identified as having Left Ventricle Hypertrophy (LVH), and 17 individuals (20.4%) were diagnosed with Non-St Segment Elevation Mi (NSTEMI). Less commonly, ECG findings included left bundle branch block (LBBB) in 9 cases (11%), Ventricle Premature Complex (VPCs) in 7 cases (8.4%), atrial fibrillation in 4 cases (4.8%), and Atrioventricular Blocks (AV) block in 3 cases (3.61%). Subsequently, echocardiograms were performed to further assess the cardiac condition, which documented that patients with reduced EF had a notably higher occurrence (68%) compared to mid-range EF (14%) and preserved EF (18%).

4. Discussion

A cross-sectional study was carried out at a tertiary care center, focusing on young patients with heart failure. The study included 83 young individuals diagnosed with heart failure, with an average age of 51.5 years and a standard deviation of 4.0 years. The research findings revealed that heart failure was most prevalent among individuals aged 45-55, affecting 96% of this age group.

Among the 83 participants diagnosed with heart failure, 43 (52%) were male, and 40 (48%) were female. The study's findings indicated that both males and females were equally affected by HF. This study demonstrated that a significant portion of the young population faced major health risks, with 65% affected by diabetes and 74% affected by hypertension. This finding aligns with a study conducted by Jasper Tromp and colleagues, which revealed that individuals aged 55 years or younger who had both hypertension and diabetes were at a significantly higher risk of developing heart failure. Hypertension in young adults was more commonly observed in those with a family history of hypertension, obesity, and certain lifestyle factors. Notably, the presence of alcohol consumption, Chronic Obstructive Pulmonary Disease (COPD), and smoking was less prevalent among the study participants. Additionally, it's worth mentioning that the prevalence of hypertension and diabetes was roughly similar in both males and females.

In the current research, it was found that 58% of the patients, which corresponds to 48 individuals, had a medical history of IHD. Additionally, 24% of the patients, or 20 individuals, had undergone Percutaneous Coronary Intervention (PCI). This data suggests a statistically significant association between a prior history of IHD and the likelihood of developing HF. Furthermore, it was observed that IHD was more prevalent in males compared to females among the study participants. Among young patients, the most prevalent condition was dilated cardiomyopathy, which also emerged as the leading cause of heart failure. This finding closely mirrors the results of a study conducted by Al Huthi and colleagues.

In this study population of young patients, the most frequently observed signs included pulmonary edema, tachycardia, and pedal edema, while Jugular Venous Distension (JVD) and the presence of a third heart sound were the least common. Additionally, the most reported symptoms by patients were dyspnea, chest pain, fatigue, and paroxysmal nocturnal dyspnea. These results align with the study findings conducted by Mohammad Ali and colleagues, as well as Dubey and colleagues [5]. In this study, it was observed that out of the 52 patients, a significant majority (63%) had HFrEF. This observation aligns with the findings of Carmen Basic and their research team, which concluded that individuals under the age of 55 were more susceptible to having reduced EF (defined as

EF<40%). Thus, the results of this study were consistent with the earlier findings from Carmen Basic's research [6].

5. Conclusion

Heart failure is a rapidly growing cardiovascular condition worldwide, posing a significant burden on healthcare systems. Although the study included a limited number of younger patients, higher rates of hypertension and diabetes were observed among the study participants. Heart Failure with Reduced Ejection Fraction was prevalent, and ischemic heart disease was the leading cause of heart failure in younger patients. A significant portion of these individuals had a medical history of IHD, which played a substantial role in the development of HF [7-9].

Limitations

This study exclusively enrolled young patients aged ≤ 55 years who were experiencing newly developed heart failure. The study had a notably small sample size and did not enroll older participants aged above 55years for comparison. Variations in the study definition of young patients differ among the study literature, hence the cutoff for young adults was considered based on the study results from Heart Failure Registry, Sweden [6].

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