

The Role of Diabetes Mellitus Type 2 in Heart Failure: A Cross - Sectional Study from Central India

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Abstract: Heart failure (HF) remains a critical health issue in India, with a rising burden among diabetics due to the dual prevalence of communicable and non - communicable diseases. This cross - sectional study conducted in a tertiary care hospital in central India assessed 186 patients with HF, including 104 diabetics and 82 non - diabetics. The study revealed that diabetics with HF were significantly older, predominantly male, and exhibited higher rates of hypertension, tobacco consumption, and dyslipidemia compared to non - diabetics. Heart failure with preserved ejection fraction (HFpEF) was more common among diabetics (92.31%) and statistically significant. Despite similar anthropometric and echocardiographic profiles, diabetics had a significantly higher mean ejection fraction. These findings underscore the intricate link between type 2 diabetes and heart failure, highlighting the need for targeted interventions in this high - risk group.

Keywords: Heart Failure, Diabetes Mellitus, Preserved Ejection Fraction, Dyslipidemia, Hypertension

1. Introduction

Heart failure (HF) in India is the commonest cardiac cause for hospitalization with 1% of the general population being affected annually, which adds up to between 8–10 million patients. The 1% average in the general population looks different when only the 65 - 79 age group is considered where heart failure related hospitalization is 5 - 10%. In elderly above 80 years of age such hospitalization is even higher at 10 - 20%. Patients with HF in India are younger, sicker and have a much higher morbidity and mortality. (1.) Congestive heart failure (CHF), as defined by the American College of Cardiology (ACC) and the American Heart Association (AHA), is "a complex clinical syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood." (2) Heart failure (HF) is emerging as an important heart problem in low - middle - income countries (LMIC) like India. The double burden of HF, contributed by the persistence of old - world diseases like rheumatic heart disease and the surging prevalence of non - communicable diseases like diabetes mellitus and coronary artery disease (CAD), is driving the risk burden. (3).

Type 2 diabetes mellitus (T2DM) is a global epidemic and is expected to affect over 592 million people worldwide by 2035 (4) According to the national family health survey - 5, The prevalence of diabetes in India for individuals aged 15 - 49 years was found to be 4.90%. (5) Patients with diabetes mellitus have over twice the risk of developing HF than patients without diabetes mellitus. (6, 7) The Framingham Heart Study suggests that diabetes mellitus independently increases the risk of HF up to 2 - fold in men and 5 - fold in women compared with age - matched controls. (8)

Nearly 68 % of patients with T2DM have evidence of asymptomatic LV dysfunction after 5 years of T2DM diagnosis. (9) Several studies have reported a higher prevalence of LV dysfunction among subjects with T2DM. (10, 11.)

To further explore the clinical features of heart failure in diabetics and non diabetics, this cross sectional study was conducted in a tertiary care teaching hospital in central India.

2. Methodology

A cross - sectional study was conducted from January to August 2024 in the cardiology department of a tertiary care teaching hospital of central India among 186 patients with signs and symptoms of heart failure. The cases were further classified into two groups, diabetics (104) and non - diabetics (82). All subjects were above the age of 18 and both men and women were included in the study. Patients who were non - consenting, those with type 1 DM & gestational DM were excluded from the study. Ethical clearance from the institutional ethical committee was obtained before commencing the study and ethical guidelines and standards outlined in the Declaration of Helsinki were observed.

A pre - tested structured questionnaire was used to collect details regarding socio - demographic characteristics and past medical history. All study participants underwent a thorough clinical examination during which the anthropometric measurements such as height, weight, Body Mass Index (BMI) were noted and blood pressure (BP) was measured using a sphygmomanometer. Biochemical parameters such as fasting and postprandial plasma glucose, glycosylated haemoglobin (HbA1c) levels, serum lipid profile and haemoglobin (Hb) were recorded from the medical records. Heart rate and rhythm were assessed using an electrocardiogram. Echocardiogram was done by a cardiologist to assess regional wall motion abnormalities, left ventricular ejection fraction (LVEF) and valvular heart diseases. LVEF was categorized into reduced ejection fraction (HFrEF): $EF \leq 40\%$, mid - range ejection fraction (HFmrEF): $EF = 41 - 50\%$ and preserved ejection fraction (HFpEF): $EF > 50\%$.

Data was entered in MS Excel, sorted and cleaned. Frequencies and proportions were calculated. Mean and standard deviation for continuous variables. Student t - test and one - way ANOVA for continuous variables and Chi - square test for categorical variables were used respectively. A p - value of <0.05 was considered statistically significant.

3. Results

A total of 186 subjects were included in this study, of which 55.91 % (104) were diabetic and 82 (44.08 %) were non diabetic, 113 (60.75 %) were male and 73 (39.24 %) were female. Most of the participants were above 70 years of age (39.24%). Characteristics of the study participants are detailed in table 1.

Table 1: Clinical Characteristics of Study Subjects

Variable		Frequency	Percentage
Age	<40	6	3.2
	41 - 50	40	21.5
	51 - 60	35	18.81
	61 - 70	32	17.2
	≥ 70	73	39.24
Sex	Male	113	60.75
	Female	73	39.24
BMI	Normal	26	13.97
	Overweight	108	58.06
	Obese	52	27.95
Co – morbidities*	HTN	142	76.34
	CAD	93	50
	DM	82	44.08
	CKD	25	13.44
	Others	117	62.9
Addictions	Tobacco	81	43.54
	Alcohol	56	30.1
Dyslipidemia	Yes	138	74.19
	No	48	25.8
Past H/O Heart failure	Yes	57	30.64
	No	129	69.35
Type of heart failure	HFpEF	122	35.6
	HFrEF	64	34.4

*Multiple responses.

The commonest clinical presentation among study subjects was Dyspnea (46.24%), followed by orthopnea (17.74 %),

fatigue (10.75%), chest pain (6.45%), paroxysmal nocturnal dyspnea (9.14%) and palpitations (9.68%). (Fig.1)

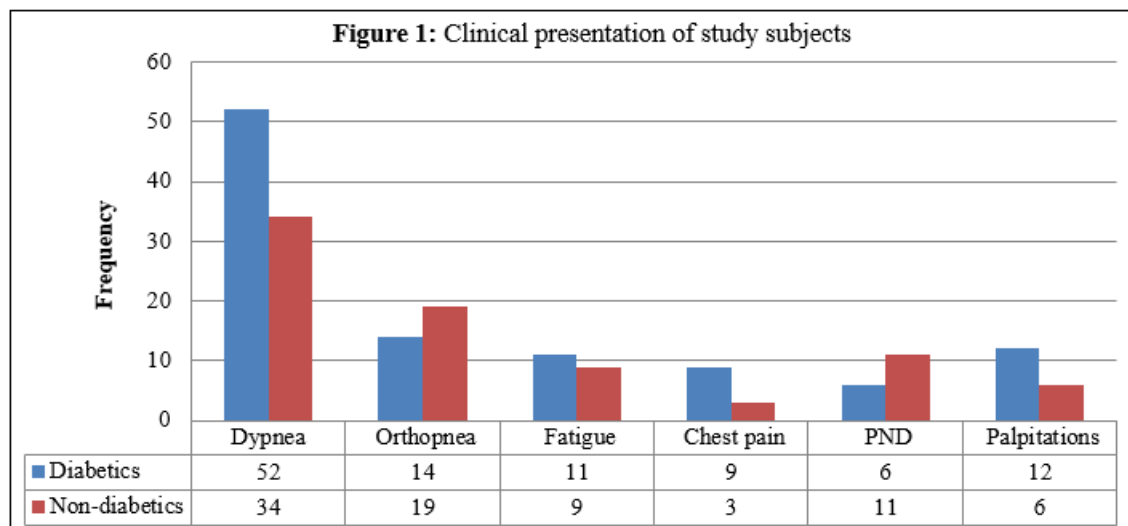


Table 2 shows the association of patient in our study we found that the mean age of diabetic patients with heart failure was significantly higher as compared to that of non - diabetics. Out 186 participants, 113 were male and rest were female, 71.15 % males were diabetic while 28.85 % females were diabetic and this difference was statistically significant (p<0.05). Most of the diabetic patients with heart failure

were hypertensive (88.46%) and consumed tobacco (59.62 %) and both these factors were found to be statistically significant. The prevalence dislipidemia was also significantly higher among diabetics as compared to non - diabetics (p<0.05). Heart failure with preserved ejection fraction was more common in diabetics (92.31%) compared to non diabetics and this difference was statistically

significant ($p < 0.05$). The mean ejection fraction was also significantly higher among diabetics vs. non diabetics ($p < 0.05$). There was no significant difference in the other Echo parameters of diabetics and non - diabetic patients.

Table 2: Association of Patient Characteristics with Diabetes Status.

Variable	Diabetic with HF (n=104)	Non - diabetic with HF (n=82)	Total	p value	
Age	62.48±3.2	58.96 ±1.4		<0.01	
Sex	Male	74 (71.15)	39 (47.56)	113	<0.01
	Female	30 (28.85)	43 (52.44)	73	
BMI	Normal	16 (15.38)	10 (12.2)	26	0.533
	Overweight/ Obese	88 (84.62)	72 (87.8)	160	
Hypertension	Yes	92 (88.46)	50 (60.98)	142	<0.01
	No	12 (11.54)	32 (39.02)	44	
Tobacco consumption	Yes	62 (59.62)	19 (23.17)	81	<0.01
	No	42 (40.38)	63 (76.83)	105	
Alcohol consumption	Yes	37 (35.58)	19 (23.17)	56	0.06
	No	67 (64.42)	63 (76.83)	130	
Dyslipidemia	Yes	83 (79.81)	55 (67.07)	138	0.04
	No	21 (20.19)	27 (32.93)	48	
Type of Heart failure	HFpEF	96 (92.31)	26 (31.71)	122	<0.01
	HFrEF	8 (7.69)	56 (68.29)	64	
Ejection fraction (%) mean ± SD	39.65±12.4	36.42± 7.2		0.03	
PASP (mmHg) mean ± SD	27.12±6.4	26.89± 5.9		0.8	
Echo LVH mean ± SD	16.1±3.2	15.8± 3.8		0.55	
Echo LAE (mm)	24.9±5.6	25.6±1.3		0.2	

4. Discussion

The current study was carried out among 186 patients of heart failure presenting to the department of cardiology of a tertiary care teaching hospital in central India. Most of the study participants were males, above 70 years of age. Only 13.97 % of the participants had a normal BMI, and more than 50 % were overweight. Out of 186, 142 (76.34 %) were hypertensive and 93 (50%) had coronary artery disease. Dyslipidemia was observed in 74.19 % of participants and 30.64 % had a previous history of heart failure.

The commonest clinical presentation among study subjects was Dyspnea (46.24%), followed by orthopnea (17.74 %), fatigue (10.75%), chest pain (6.45%), paroxysmal nocturnal dyspnea (9.14%) and palpitations (9.68%).

We observed and compared the characteristics of 104 cases with diabetes mellitus and 82 non diabetic patients with heart failure. We found that heart failure patients with diabetes were significantly older compared to those without diabetes. Another study in southern India also corroborated similar findings (12)

Diabetes with heart failure was more commonly observed in males as compared to females. However, a systematic review of 47 cohorts had concluded that excess risk of heart failure associated with diabetes is significantly greater in women with diabetes than in men with diabetes. (13)

Hypertension, tobacco consumption and dyslipidemia were also found to be significantly associated with diabetes in patients of heart failure. Similar findings were reported by a prospective study based on the data from the Jordanian Heart Failure Registry. (14)

In our study we found that heart failure with preserved ejection fraction was more common in diabetics (92.31%) compared to non-diabetics and this difference was

statistically significant ($p < 0.05$). A meta - analysis by Hoek AG. et. al similarly concluded that HFpEF was more prevalent in type 2 diabetes than the other forms of HF. (15) The mean ejection fraction was also significantly higher among diabetics vs. non diabetics ($p < 0.05$). alcohol consumption, BMI, and other parameters were not found to significantly associated with diabetes in heart failure cases in our study.

5. Conclusion

Heart failure and type 2 diabetes are two closely associated conditions and pose as an impending threat in India due to the epidemiological and demographic transition in the country. In this observational study conducted among 186 cases with heart failure we found that age, sex, hypertensive status, tobacco consumption, and dyslipidemia were significantly associated with diabetes mellitus. Heart failure with preserved ejection fraction was significantly more common in diabetics as compared to non - diabetics and the mean ejection fraction among diabetics was significantly higher.

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Conflicts of interest: None

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