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Original Research Article

Prevalence and patterns of dyslipidaemia and glycaemic abnormalities among patients of heart failure at a tertiary care hospital in Eastern India

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ABSTRACT

Background: Dyslipidaemia and diabetes mellitus are highly prevalent in India. Both are risk factors of various cardiovascular diseases which may progress to heart failure. Heart failure is a leading cause of morbidity and mortality throughout the world. This study aimed to estimate the prevalence of different patterns of dyslipidaemia and glycaemic abnormalities among the heart failure patients of different severity.
Methods: A descriptive, cross-sectional study was done on 492 clinically diagnosed heart failure patients categorised according to severity based on NYHA classification. Serum lipid profile, fasting plasma glucose and HbA1c % were evaluated. Data were analysed using standard statistical software.
Results: The different patterns of dyslipidaemia detected were hypercholesterolaemia (32%), increased LDL cholesterol (34%), decreased HDL cholesterol (52%) and hypertriglyceridaemia (26%). Prevalences of pre-diabetes and diabetes mellitus were 33 % and 29 % respectively. No patient had NYHA class I symptoms. Prevalence of hypercholesterolaemia among NYHA class II, III and IV patients were 28 %, 33 % and 40 % respectively whereas prevalence of hypertriglyceridaemia were 21%, 28% and 30% in the respective classes. Diabetes mellitus was present in 7%, 39%, and 50% of NYHA class II, III, and IV patients, respectively.
Conclusions: The commonest form of dyslipidaemia was low HDL cholesterol, detected in almost half of the patients, followed by elevated LDL cholesterol. Hyperglycaemia was detected in almost two-thirds of the patients. Pre-diabetes was slightly more prevalent than diabetes mellitus. Prevalence of dyslipidaemia and diabetes mellitus increased with the severity of heart failure.

Keywords: Heart failure, NYHA, Hypercholesterolaemia, Hypertriglyceridaemia, Diabetes mellitus

INTRODUCTION

Heart failure is a leading cause of morbidity and mortality across the globe.[1] The current guidelines from the American College of Cardiology Foundation and the American Heart Association describe heart failure as a complex clinical syndrome arising from structural or functional abnormalities that impair ventricular filling or the ejection of blood. This impairment results in hallmark symptoms such as dyspnoea and fatigue, along with clinical signs including oedema and rales.[2] Globally, more than 64 million individuals are living with heart failure. In India, the most recent estimates indicate a prevalence of approximately 1% of the total population, corresponding to nearly 8–10 million affected individuals.[1] New York Heart Association (NYHA) functional classification categorizes heart failure patients according to the severity of their symptoms and extent of limitation of their physical activity.[2] Dyslipidaemias, particularly elevated serum LDL cholesterol levels, are major risk factors for

cardiovascular disease.[3] Dyslipidaemias are highly prevalent in India. Elevated serum total cholesterol is present in 25–30% of urban and 15–20% of rural population.[4] Diabetes mellitus is closely associated with cardiovascular disease.[5] Globally, and in India, the prevalence of type 2 diabetes mellitus is rising rapidly. The estimated number of individuals with diabetes in India was 101 million in 2025 according to the ICMR–INDIAB study.[6] The Framingham study in 1974 showed that diabetic patients have a 2–5 times higher risk of developing heart failure compared to age-matched, non-diabetic patients, independent of other comorbidities.[7]

The main purpose of this study is to investigate the prevalence of different patterns of dyslipidaemia and glycaemic abnormalities among heart failure patients of different severity at a tertiary care hospital in Eastern India.

METHODS

Study design

This was a descriptive, cross-sectional study.

Study setting

The study was done at the Department of Cardiology and the Department of Biochemistry of a tertiary care hospital in Kolkata, India

Study duration

The study was done between March 2021 and December 2022

Study population

The study was conducted on clinically diagnosed patients of heart failure who attended the cardiology outpatient department (OPD) of this hospital during the period of data collection for the study.

Inclusion criteria

Patients older than 18 years having symptoms and signs suggestive of heart failure who provided informed consent were included in the study

Exclusion criteria

Patients with coexisting acute illness known to transiently alter lipid profile or glycaemic status and patients receiving medications (other than lipid lowering and anti-diabetic drugs) known to affect lipid or glucose metabolism were excluded.

Sample size

A total of 500 patients (253 males and 247 females) were selected from the male and female OPDs on two randomly selected days each week, one day from each OPD. The patients were selected using random sampling. Out of these 500 patients, 8 (7 males and 1 female) were lost to follow-up before laboratory investigations could be performed. Therefore, the final study sample comprised 492 patients (246 males and 246 females).

Data collection

The collected data included age, sex, the class of heart failure according to the NYHA functional classification, along with history of comorbidities including diabetes mellitus and dyslipidaemia. Data were collected through clinical records and a pre-designed questionnaire. The NYHA class is based on clinical manifestations and reflects the severity of heart failure. The severity increases progressively from NYHA class I to class IV.

Laboratory investigations

The selected participants were asked to come on a subsequent day in a 12-hours fasting state. Venous blood samples were collected from the study participants. HbA1c was estimated by Immunoturbidimetry using Imola Clinical Chemistry Autoanalyzer (Randox). Fasting plasma glucose (FPG) along with serum total cholesterol, LDL cholesterol, HDL Cholesterol and Triglyceride estimation was done by absorption spectrophotometry using Erba XL 1000 Clinical Chemistry Autoanalyzer (Transasia). The patients were categorized as normoglycaemic, pre-diabetic or diabetic based on their clinical history and laboratory findings. Some patients were previously diagnosed with diabetes mellitus. Patients without any previous history of diabetes mellitus having FPG < 100 mg/dl and HbA1c < 5.7 % were classified as normoglycaemic. Those with FPG = 100-125 mg/dl or/and HbA1c=5.7-6.4 % were classified as pre-diabetic, whereas those with FPG ≥126 mg/dl or HbA1c ≥6.5 % were newly diagnosed with diabetes mellitus which was confirmed by repeat testing on a separate day. Dyslipidaemia was defined as serum total cholesterol >200 mg/dl or LDL cholesterol >130 mg/dl or HDL cholesterol <40 mg/dl or triglyceride >150 mg/dl.

Statistical analysis

The data were recorded in Microsoft Excel and were analysed using Statistical Package for Social Sciences (SPSS) software version 20 (IBM, 2011). The data were analysed using descriptive statistical measures.

RESULTS

The mean age of the study participants was 54.2±13.1 years. Majority of the patients with heart failure (HF) were aged above 40 years (84%), with similar proportions in the 41-60 years and above 60 years age groups. The study was done on an equal number of male and female patients (Table 1). Based on their clinical presentation, the patients belonged to NYHA classes II, III and IV with more than half of the patients having class III symptoms (Table 2).

Table 1: Demographic characteristics of the study participants.

Characteristic	Value
Number of study participants	492
Age (in years), mean±SD	54.2±13.1
Age group (in years)	**N (%)**
18-40	81 (16)
41-60	203 (41)
>60	208 (43)
Sex	
Males	246 (50)
Females	246 (50)

Table 2: Prevalence of different severity grades of heart failure.

NYHA class*	Number of patients (%)
I	0 (0)
II	174 (35.4)
III	258 (52.4)**
IV	60 (12.2)

*NYHA class reflects the severity of heart failure based on symptoms; class IV is the most severe. **More than half of the study population belonged to NYHA class III.

The prevalence of various patterns of dyslipidaemia was as elevated total cholesterol (>200 mg/dl) in 156 (32%) patients, increased LDL cholesterol (>130 mg/dl) in 168 (34%) patients, decreased HDL cholesterol (<40 mg/dl) in 258 patients (52%), and elevated triglycerides (>150 mg/dl) in 126 (26%) patients (Figure 1).

165 (33.5 %) patients having normal lipid profile were taking lipid lowering medications daily. The prevalence of hypercholesterolaemia increased with advancing severity of HF. Hypercholesterolaemia was found in 48 patients (28 %) among NYHA class II patients, 84 (33 %) among NYHA class III patients and 24 (40 %) among NYHA class IV patients (Figure 2). The prevalence of hypertriglyceridaemia also increased with worsening severity of HF, affecting 36 patients (21 %) among NYHA class II patients, 72 (28 %) among NYHA class III patients and 18(30 %) among NYHA class IV patients (Figure 3).

Fasting plasma glucose and HbA1c % along with past clinical records of the study population revealed 187 (38 %) cases had normal glycaemic status, 162 (33 %) were pre-diabetic and 143 (29 %) cases had diabetes mellitus (DM) (Figure 4). The prevalence of DM was observed to rise with increasing severity of HF, occurring in 12 (7 %) NYHA class II patients, 102 (39 %) NYHA class III patients, and 30 (50 %) NYHA class IV patients. The prevalence of pre-diabetes was similar among the different severity grades of heart failure. 60 (34 %) NYHA II cases, 84 (33 %) NYHA III cases and 18 (30 %) NYHA IV cases had pre-diabetes (Figure 5).

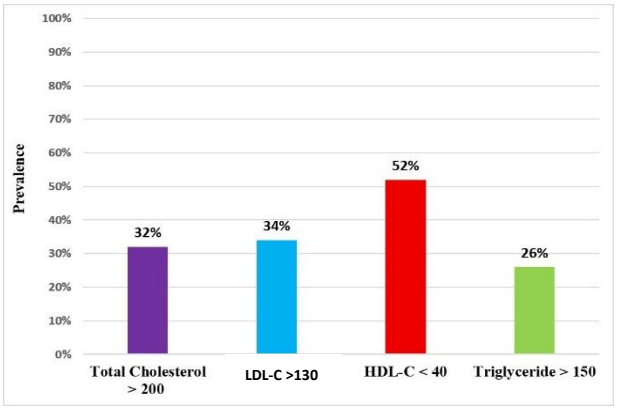

Figure 1: The prevalence of different patterns of dyslipidaemia among the heart failure patients. Low HDL-cholesterol was the most common dyslipidaemia, followed by elevated LDL-cholesterol and hypercholesterolaemia.

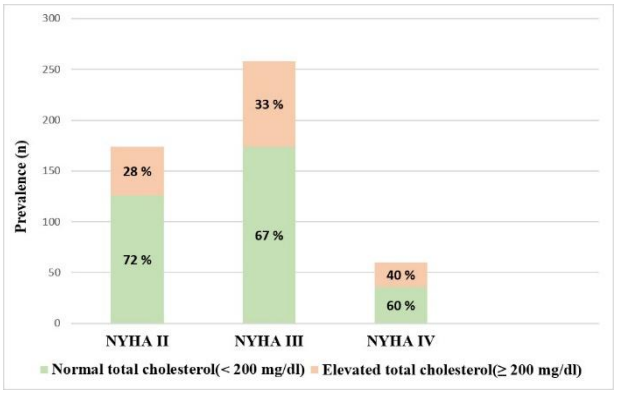

Figure 2: The prevalence of normal and elevated serum total cholesterol levels among the various severity grades of heart failure. Prevalence of hypercholesterolaemia increased with advancing severity of heart failure.

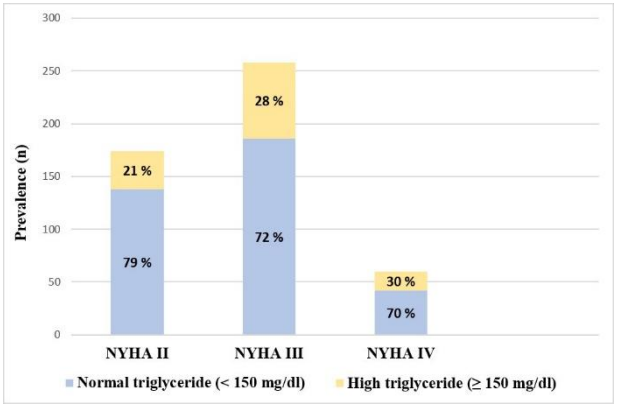

Figure 3: The prevalence of normal and elevated serum triglyceride levels among the various severity grades of heart failure. Prevalence of hypertriglyceridaemia increased with worsening severity of heart failure.

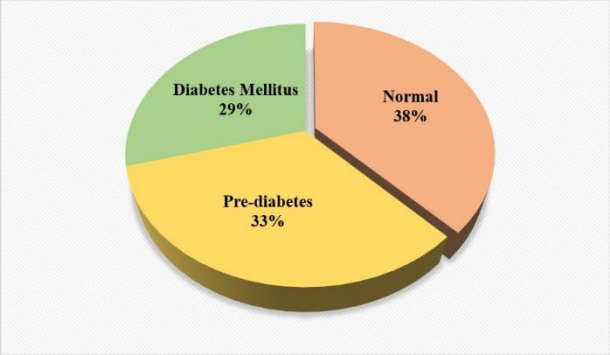

Figure 4: The prevalence of different glycaemic status among the heart failure patients. Pre-diabetes and diabetes mellitus collectively affected nearly two-thirds of the heart failure patients.

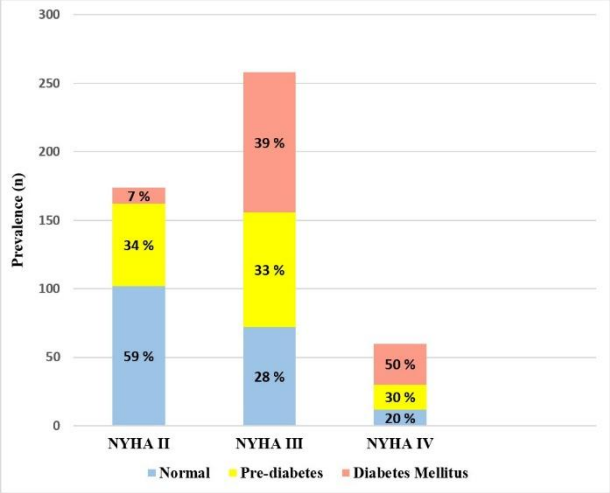

Figure 5: The prevalence of different glycaemic status among the various severity grades of heart failure. Prevalence of diabetes mellitus increased with advancing severity of heart failure. In contrast, prevalence of pre-diabetes was relatively similar across the different severity grades.

DISCUSSION

HF has a high morbidity and mortality rate throughout the world.[1] Both dyslipidaemia and DM are common in the Indian population.[9] Dyslipidaemia and DM are prominent risk factors of heart failure.[10,11] The present study was undertaken with an objective to determine the burden of various patterns of dyslipidaemia and glycaemic abnormalities among heart failure patients of different severity in a tertiary care hospital of Kolkata.

Serum lipid profile of this study population revealed that total cholesterol level was elevated (>200 mg/dl) in 32% cases. HDL cholesterol level was low (<40 mg/dl) in 52% cases. LDL cholesterol level was elevated (>130 mg/dl) in 34% cases. Triglyceride concentration was high (>150 mg/dl) in 26% cases. 33.5 % patients having normal lipid profile results were on lipid lowering medications daily. The India heart watch study conducted among urban middle class people in 11 cities of India, showed following prevalence in men and women: elevated total cholesterol ≥200 mg/dl in 25.1 % and 24.9 %; raised LDL cholesterol ≥130 mg/dl in 16.3 % and 15.1 %, HDL cholesterol <40 mg/dl (men) and <50 mg/dl (women) in 33.6% and 52.8%, and triglycerides ≥150 mg/dl in 42.1% and 32.9%.[12] In a study on HF patients in USA, the prevalence of dyslipidaemia was 49%.[13]

Elevated total cholesterol leads to increased blood pressure and decreased vascular compliance along with increased left ventricular mass. Hypercholesterolaemia, elevated LDL cholesterol and decreased HDL cholesterol are each associated with reduced systolic and diastolic left ventricular function. The Framingham heart study detected direct association between ratio of total cholesterol to HDL cholesterol and risk of HF.[11] Decreased HDL cholesterol concentrations are associated with increased left ventricular mass. Triglycerides and triglyceride-rich lipoproteins have causal role in Atherosclerotic cardiovascular disease.[14,15] Elevated triglyceride level leads to increased risk of HF in elderly. Both decreased HDL cholesterol and elevated triglycerides can predispose to dilated cardiomyopathy. Lipid abnormalities affect myocardium independent of MI.[11]

In the study, prevalence of hypercholesterolaemia increased with severity of HF-28% among NYHA II cases, 33% among NYHA III cases and 40% among NYHA IV cases. Hypertriglyceridaemia was also more prevalent in more severe cases of HF. Its prevalence was 21%, 28% and 30% among the NYHA classes II, III and IV respectively.

Long-term hyperlipidaemia leads to lipid accumulation in the heart. Hypercholesterolaemia may affect calcium ion concentration and gene expression of myosin heavy chain, SERCA, ryanodine receptors and Na+/Ca2+ exchangers in cardiomyocytes. Hypercholesterolaemia leads to systemic oxidative stress, proinflammatory state and release of pro-fibrotic mediators. Hypercholesterolaemia may cause death of cardiac cells through mTOR and ATP4/CHOP pathway.[16]

In our study population, 38% cases had normal glycaemic status, 33% were pre-diabetic and 29% had diabetes mellitus. Similar prevalence of DM in heart failure patients of USA was reported.[12] Dunlay et al reported that prevalence of DM among HF cases varies from 10-47%.[17] In the general Indian population, the reported prevalence of pre-diabetes and DM were 15.3% and 11.4%.[18] Cardiac structural and functional abnormalities caused by chronic hyperglycaemia (Diabetic cardiomyopathy) could predispose to HF. Normally, the heart exhibits metabolic substrate flexibility and uses various substrates to produce ATP. Free fatty acids (FFAs) are preferred, although glucose and ketone bodies can also be utilised. Insulin resistance and hyperglycaemia lead to loss of this flexibility.[7] Decrease in glucose transporter type 1 and 4 recruitment to sarcolemma reduces glucose transport into

myocardium and hence ability to use glucose. Increased FFAs are transported into cardiomyocytes where their accumulation causes damage. The switch to FFA oxidation adversely affects cardiac contractility.[19] Hyperglycaemia activates renin–angiotensin–aldosterone system resulting in increased angiotensin II which stimulates proliferation of cardiac fibroblasts and cardiomyocyte hypertrophy.[7]

In the study, the prevalence of DM increased with severity of HF (7% among NYHA II cases, 39% among NYHA III and 50% among NYHA IV). The prevalence of pre-diabetes was similar (34% among NYHA II, 33% among NYHA III and 30% among NYHA IV). Chronic hyperglycaemia increases formation of advanced glycation end products and their receptors; their binding on cardiac cell membranes promotes pro-fibrotic and pro-inflammatory pathways and increases expression of oxidative stress mediators which cause necrosis of cardiomyocytes.[19]

There are few limitations in the study. It was a cross-sectional study. So, the risk posed by various dyslipidaemia and hyperglycaemia towards development of heart failure could not be assessed. The study subjects were recruited from patients who attended this hospital; hence the results might not be generalised. Since study design was descriptive, the aim was to find prevalence of various dyslipidaemia and hyperglycaemia but their association with the severity of heart failure were not evaluated.

CONCLUSION

Biochemical abnormalities in the form of dyslipidaemia (hypercholesterolaemia, elevated LDL cholesterol, low HDL cholesterol, hypertriglyceridemia) and deranged glycaemic status (pre-diabetes or diabetes mellitus) were very common among the heart failure patients. The most common form of dyslipidaemia was low HDL cholesterol, being detected in approximately half of the patients, followed by elevated LDL cholesterol and hypercholesterolaemia, found in one-third of the patients. Prevalence of hypertriglyceridaemia was comparatively less, evident in one-fourth of the patients. Again, almost one-third of the patients having normal lipid profile results were taking lipid lowering medications daily. The prevalence of hypercholesterolaemia and hypertriglyceridemia increased with the severity of heart failure.

Hyperglycaemia in the form of pre-diabetes or DM was detected in almost two-thirds of the patients. The prevalence of pre-diabetes was slightly higher than that of DM. The prevalence of DM was found to increase with severity of heart failure. Half of the patients with the most severe heart failure were diabetic. Prevalence of pre-diabetes was similar among the different severity grades, being found in around one-third of the patients. Serum lipid profile and glycaemic status should always be investigated in patients with suspected heart failure. Since their abnormalities affect cardiac structure and function, their early diagnosis and management may reduce morbidity and mortality due to heart failure.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Chaturvedi V. Heart failure in India: The INDUS (India Ukieri study) study. J Pract Cardiovas Sci. 2016;2(1):28-35.
2. Jameson JL, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J, editors. Harrison's Principles of Internal Medicine.20th ed. New York, USA: McGraw-Hill Education. 2018: 1763-1769.
3. Pirillo A, Casula M, Olmastroni E, Norata GD, Catapano AL. Global epidemiology of dyslipidaemias. Nat Rev Cardiol. 2021;18(10):689-700.
4. Gupta R, Rao RS, Misra A, Sharma SK. Recent trends in epidemiology of dyslipidemias in India. Indian Heart J. 2017;69(3):382-92.
5. Leon BM, Maddox TM. Diabetes and cardiovascular disease: epidemiology, biological mechanisms, treatment recommendations and future research. World J Diabetes. 2015;6(13):1246-58.
6. Mohan V, Tiwaskar M. The unrelenting epidemic of diabetes in India: Do the numbers matter. J Assoc Physicians India. 2025;73(5):12-3.
7. Borghetti G, von Lewinski D, Eaton DM, Sourij H, Houser SR, Wallner M. Diabetic cardiomyopathy: current and future therapies. Beyond glycemic control. Front Physiol. 2018;9:1514.
8. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). JAMA. 2001;285(19):2486-97.
9. Mithal A, Majhi D, Shunmugavelu M, Talwalkar PG, Vasnawala H, Raza AS. Prevalence of dyslipidemia in adult Indian diabetic patients: a cross-sectional study (SOLID). Indian J Endocrinol Metab. 2014;18(5):642-7.
10. Dhingra R, Vasan RS. Diabetes and the risk of heart failure. Heart Fail Clin. 2012;8(1):125-33.
11. Velagaleti RS, Massaro J, Vasan RS, Robins SJ, Kannel WB, Levy D. Relations of lipid concentrations to heart failure incidence: the Framingham Heart Study. Circulation. 2009;120(23):2345-51.
12. Gupta R, Gupta P, Deedwania P, et al. Cholesterol lipoproteins, triglycerides and prevalence of dyslipidemias among urban Asian Indian subjects: a cross-sectional study. Indian Heart J. 2014;66(3):280-8.
13. Kannan L, Shaw PA, Morley MP, Brandimarto J, Fang JC, Sweitzer NK. Thyroid dysfunction in heart

failure and cardiovascular outcomes. Circ Heart Fail. 2018;11(12):5266.
14. Saadatagah S, Pasha AK, Alhalabi L, Sandhyavenu H. Coronary heart disease risk associated with primary isolated hypertriglyceridemia: a population-based study. J Am Heart Assoc. 2021;10(11):19343.
15. Toth PP, Shah PK, Lepor NE. Targeting hypertriglyceridemia to mitigate cardiovascular risk: a review. Am J Prev Cardiol. 2020;3:100086.
16. Yao YS, Li TD, Zeng ZH. Mechanisms underlying direct actions of hyperlipidemia on myocardium: an updated review. Lipids Health Dis. 2020;19(1):23.
17. Dunlay SM, Givertz MM, Aguilar D, Allen LA, Chan M, Desai AS, et al. Type 2 diabetes mellitus and heart failure: a scientific statement from the American heart association and the heart failure society of America: this statement does not represent an update of the 2017 ACC/AHA/HFSA heart failure guideline update. Circulation. 2019;140(13):294-324.
18. Anjana RM, Unnikrishnan R, Deepa M, Pradeepa R, Tandon N, Das AK et al. ICMR-INDIAB Collaborative Study Group. Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). Lancet Diab Endocrinol. 2023;11(7):474-89.
19. Rosano GM, Vitale C, Seferovic P. Heart Failure in Patients with Diabetes Mellitus. Card Fail Rev. 2017;3(1):52-5.

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