A STUDY OF THE CORRELATION BETWEEN SERUM LIPID LEVELS AND ITS OUTCOME IN ACUTE HEART FAILURE - IN A TERTIARY CARE HOSPITAL

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Article History: Received: 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

Abstract

Objective: In chronic heart failure, lower cholesterol levels have been associated with increased mortality. The relationship between cholesterol levels and in-hospital mortality in patients hospitalized with acute heart failure has not been studied in detail**.**

Methods: A total of 109 (69.7% were males and 30.3% were females) patients were included in this study. The clinical diagnosis of acute heart failure by Framingham criteria with a duration of symptoms less than seven days were included in the study. The baseline blood investigations were analyzed. Statistical Package for the Social Sciences (SPSS) software V 19.0 was employed and $p < 0.05$ is considered to be statistically significant.

Results: The most commonly associated co-morbidity in our study population was ischemic heart disease followed by diabetes mellitus and hypertension. LDL value was found to be less than 100 among 18 of the 20 non-survivor (p=0. 006). HDL value was less than 50 for all the non-survivors.

Conclusion: This study provides new insights into the relationship between lipid levels and in-hospital clinical outcomes from a small subset of patients hospitalized with HF in a south Indian state of India and including patients with preserved systolic function and multiple comorbidities.

Key words: Serum lipid levels, Heart failure, LDL, HDL, Diagnosis

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DOI: 10.31838/ecb/2023.12.s2.076

1. Introduction

The pathogenesis of acute and/or chronic heart failure has been the main focus due to its wide spectrum of aetiology, high prevalence, incidence and lack of understanding of this disease (1). Heart failure (HF) is a complex clinical syndrome and life-threatening disease, and incidence, prevalence rates are rising globally (2). According to an INDUS study, in India, the prevalence rate was estimated at around 1.2/1000 individuals, and hospitalized acute heart failure was also estimated that 17.4% to 43.9% (3). Further, a very recent study from India also revealed that 67 % of acute denovo HF, among the majority of patients, are males (65.9%), and they were in warm and wet clinical phenotype (86.4%) (4). Besides gender and age, the modifiable risk factors of ADHF- diabetes mellitus (DM), hypertension (HTN), dyslipidaemia, cigarette smoking, hyperlipidaemia, and hypercholesterolemia have been considered due to disease severity and reduced mortality (1). However, acute or chronic heart failure is a significant burden to healthcare systems and damage the quality of individuals. Therefore, the researchers focus towards the understanding of pathophysiological mechanisms and identifying the biomarkers to reduce the burden and improve the quality of life (5). The pathogenesis of acute cardiac failure is multifactorial; however, several risk scores have been identified for the early prediction of cardiovascular disease. These risk scores are developed based on the observations of an individual's major risk factors (6). Hence, risk scores cannot be used for all acute cardiac failure patients as a predictive tool. Therefore, several physiological biomarkers have emerged; such as serum lipid, glucose, and serum hormone, glucose and hormone profiles were linked to increased cardiovascular risks (7). Further, the traditional biomarkers based on lipid profile and risk factors were developed. According to recent research, the standard lipid profile, such as total cholesterol, cholesterol, LDL (low-density lipoprotein), HDL (high-density lipoproteins) cholesterol, and triglycerides, was also recommended for cardiovascular risk prediction (8, 9). However, these serum, blood biomarkers have not consistent in community based populations across the globe for predicting cardiovascular disease (10). Therefore, present study aimed to find a population based serum lipid biomarkers for early prediction and intervention of cardiovascular disease.

2. Materials methods

This is an observational and single-center study that included a total of 109 (69.7% were males and 30.3% were females) patients. Patients admitted to the Department of General Medicine, Chettinad Hospital and Research Institute,Chennai between January 2022 to December 2022 were included. The present study was approved by the institutional ethical committee (IEC) of Chettinad Hospital and Research Institute, and from all the subjects proper written informed consent was collected before recruiting them into the study. The 5 ml of peripheral venous blood was collected from all study subjects and the lipid profile was analyzed as per Beckman Coulter instrument AU5800 (Beckman Coulter, Brea, California, USA) protocol. Clinical and other demographic characteristics such as age, gender, history about personal, co-morbidities with associated medicines, TC, LDL, HDL, HB, Creatinine and BUN, and Chest-X Ray (CXR) were collected. Further, Framingham criteria (6) were used to diagnose AHF and grouped into De Novo Acute Heart Failure (HF) (54.1%) and Acutely Decompensated Chronic Heart Failure (ADCHF) (45.9%).

Statistical analysis

Statistical Package for the Social Sciences (SPSS) software V 19.0 was employed for all statistical analyses. Data were expressed as mean ± SD and/or median ± SE and/or frequencies by percent. Student's t-test and Chi-square analysis were performed for continuous variables and categorical variables to evaluate the statistical significance. Further, the logistic regression analysis was employed to determine the independent association of lipid profile levels and predicts hospital mortality. $p < 0.05$ is considered to be statistically significant.

3. Results

Clinical characteristics between the studied groups

A total of 109 patients with HF (54.1%) and ADCHF (45.9%) were included in this study. The clinical characteristics of the studied groups were documented in Table 1. The mean age of the HF patients was 61 .97 ± 10.71 and the ADCHF was 65.62 ± 10. 25. Among all patients, the majority of de novo heart failure patients aged between 61 - 70 years and >70 years of ADCHF patients were found to be a statistically significant difference (p=0. 047) (Data not shown). However, the other studied characteristics presented in table 1 were not a significant difference between the studied groups (Table 1).

Table 1: Association analysis of clinical characteristics between studied groups

	Type of heart failure	

Parameter			
	De Novo Acute HeartFailure (N=59) (%) Mean ±SD	**AcutelyDecompensated CHF (N=50) (%) Mean ±SD**	**P value**
Age (Yrs)	61.97 ± 10 .71	65.62 ± 10.25	0.073
Male	18 (30.5)	15 (30)	Reference
Female	41 (69.5)	35 (70)	0.954
Sodium	133. 22 ± 4 .84	133. 0 ± 3.97	0.850
HB	12.40 ± 2. 54	11.79 ± 1. 93	0.161
Creatinine	1.39 ± 1.02	1.43 ± 0.78	0.833
TC(mg/dL)	156. 03 ± 48.41	148. 30 ± 48.94	0.411
LDL(mg/dL)	98.80 ± 38 .43	95.20 ± 40.44	0.637
HDL(mg/dL)	36.97 ± 9. 20	38.14 ± 12.15	0.577
TGL	113. 27 ± 57.91	105. 22 ± 61.30	0.485
Alive	48 (81 .4)	41 (82)	Reference
Death	11 (18 .6)	9 (18)	0.931

Comparison analysis between the alive and Dead group

A comparison of clinical profiles between alive and Dead individuals of De Novo Acute Heart Failure and Acutely Decompensated Chronic Heart Failure were presented in Table 2. During this study, all the patients were followed up and categorized into two groups alive and Dead. Among the HF group (alive:48 (81.4%) & Dead 11 (18.6%)) and the ADCHF group (alive:41 (82 %) & Dead 9 (18 %)). The < 100 mg/dL LDL was found to be a significant association with 18 of the 20 non-survivors (p=0.006). The HDL value was less than 50 mg/dL for all the non-survivors were also observed (p=0.040). The number of survivors was higher in the group with total cholesterol >125mg/ dl (p=0.018). But, the triglyceride was not found to have a significant association between the survivor and non-survivors (p=0.513) (Table 2).

Table 2: Comparison of clinical profile between alive and dead individuals of De Novo Acute Heart Failure and Acutely Decompensated Chronic Heart Failure

Characteristics		**Outcome**		**p-value**
		Alive	**Dead**	
LDL	Low (< 100)	51 (57 .3%)	18 (90%)	**0.006**
	High (>100)	38 (42 .7%)	2 (10%)	
HDL	Low (< 50)	73 (82%)	20 (100%)	**0.040**
	High (>50)	16 (18%)	0 (0%)	
TC	Low (< 125)	21 (23 .6%)	10 (50%)	**0.018**

	High (>125)	68 (76 .4%)	10 (50%)	
TGL	Low (< 150)	75 (84 .3%)	18 (90%)	0.513
	High (>150)	14 (15 .7%)	2 (10%)	

Risk factors with heart failure and consumption of drugs

A comparison of heart failure risk factors with the type of heart failure was documented in table 3.

Table 3: Comparison of heart failure risk factors with type of heart failure

Heart failure riskfactors	**Type of heart failure**		**P- value**
	De Novo Acute Heart Failure	**Acutely Decompensated CHF**	
Diabetes	36 (61%)	36 (72%)	0.228
Dyslipidaemia	10 (16 .9%)	8 (16%)	0.894
History of Smoking	22 (37 .3%)	16 (32%)	0.564
Alcohol consumption	11(18 .6%)	12 (24%)	0.495
Ischemic heart disease	41 (69 .5%)	40 (80%)	0.211
Dilated cardiomyopathy	2 (3.4%)	8 (16%)	0.023
Post cardiac interventions	18 (30 .5%)	23 (46%)	0.096
Obese	2 (3.4%)	3 (6%)	0.516
Family history of heart failure	2 (3.4%)	1 (2%)	0.659
Systemic hypertension	36 (61%)	26 (52%)	0.344
Anaemia	10 (16 .9%)	9 (18%)	0.885
Thyroid disease	5 (8.5%)	6 (12%)	0.543
COPD	13 (22%)	8 (16%)	0.426

The commonly associated co-morbidities among the study population included ischemic heart disease (74.3%), followed by Diabetes mellitus (66.1 %), hypertension (65.9%), history of smoking (34.9%), post-cardiac interventions like percutaneous coronary intervention, coronary artery bypass surgery (37.6%) and dilated cardiomyopathy (9. 2 %), thyroid disease(10.1%) were observed between the HF and ADCHF. The dilated cardiomyopathy was found to be a significant difference between the groups ($p=0.023$). However, there was no significant difference found for the other studied co-

morbidities (Table 3). The drugs used by the study participants were shown in table 4. Among our study population, statin use was found in 72.9% of De novo HF and 86 % of ADCHF. The usage of Beta-blocker was in 50 .5 % of De novo HF and 47.5% of ADCHF among the study population. Similarly, ACE I and ARB were also no significant difference between the groups. However, the Diuretic and Digoxin use was significantly higher among the group with ADCHF ($p<0.001$) (Table 4).

Table 4: Comparison of drugs with the type of heart failure

Drugs	**Type of heart failure**		**P-value**
	De Novo Acute Heart Failure (n=59)	**Acutely Decompensated CHF (n=50)**	
LLD	43 (72 .9%)	43 (86%)	0.094
B blocker	28 (47 .5%)	27 (54%)	0.496
ACEI	24 (40 .7%)	19 (38%)	0.776
ARB	9 (15. 3%)	10 (20%)	0.515
Diuretics	15 (25 .4%)	34 (68%)	0.001
Digoxin	0 (0%)	6 (12%)	0.006

4. Discussion

The present study included 109 patients from a tertiary care hospital in south India with a mean age of HF (61.97 ± 10.71) and ADCHF (65.62 ± 10.25). The de novo heart failure was aged between 61 -70 years and more than 70 years for acutely decompensated chronic heart failure($p =0.047$). Our results accordance with a study conducted by Rauchhaus et al. (11) the mean age of heart failure patients was 63± 1.0 and in another study by Horwich et al. (12) the mean age of heart failure was 70 ± 14years. In contrast to this, a very recent south Indian study revealed the mean age of studied groups was similar with no statistically significant difference (3).

The burden of diabetes mellitus and hypertension were the most common risk factors in South India and a major risk factor for developing HF due to diffuse multivessel disease (13). Type 2 diabetes mellitus and systemic hypertension were observed as the most predominant comorbidity with studied groups of HF (3). Similarly, a study by Potocnjak et al. observed hypertension (89.5%), followed by type 2 diabetes mellitus (51.7%) as a predominant comorbidity for HF (14). Like previous studies, our study also found Diabetes mellitus (66.1 %) and hypertension (65.9%) but, there was no significant difference in the risk of HF. Similarly, Eythor Bjornsson et al also found a diabetes mellitus prevalence of 11.8 % and hypertension of 57.7 % and showed no significant association (15). However, the Diuretic and Digoxin use was significantly higher among the group with ADCHF ($p<0.001$) in our study.

The impact of an altered lipid profile on acute myocardial infarction was first reported by Biorck et al. in 1957. Further several studies reported the change in lipid levels, but the data is not consistent. Therefore, in the present study, we compared the lipid profiles, including low-density lipoprotein cholesterol, serum total cholesterol, high-density lipoprotein cholesterol, and triglycerides in 109 patients. A north Indian study by Laltesh Kumar in 2018, was observed that the total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides concentrations were significantly higher ($p < 0.05$) in coronary heart disease patients (16). The increased serum triglyceride, serum low-density lipid-cholesterol, and decreased serum high-density lipid-cholesterol levels were found among the HF patients of the Pakistani populations (8). In our study, the increased LDL and HDL were found to be a significant association with HF, and the number of survivors was higher in the group with total cholesterol >125mg/ dl ($p=0.018$). But, the triglyceride was not found to have a significant association between the survivor and non-survivors ($p=0.513$). Another study by Potocnjak et al. showed no significant association between large HDL particles ($p=0.353$) or HDL-cholesterol ($p=0.107$) (14). Further, a study also concluded that a reduction in serum TC does not prevent the risk of AMI, whereas a decrease in serum HDL and an increase in hs-CRP strongly predisposes the risky individuals to an AMI event (17).

5. Conclusion

Our study has some limitations such as 1) a substantial proportion of HF admissions without TC levels recorded that were excluded from this analysis, 2) the study outcome is limited to in-hospital mortality, and thus, the influence of lipid levels on post-discharge rehospitalization rates or mortality is unknown 3) sample size used for this study is very small this may be due to the Sars COV -2 pandemic the number of patients who presented to our hospital with acute heart failure may be lower than usual. Despite these limitations, the findings from this study revalidate this scientific observation that there was a significant rise in the levels of 100mg/dl LDL was found to be less than 100 for 18 of the 20 patients in the mortality group. HDL cut-off of 50 mg/dl was used and found to be less than 50mg/dl for all the non-survivors. Further, the Total cholesterol cut-off was taken as 125mg/dl for the analysis and 71.6 % had total cholesterol higher than the cut-off and 28.4% had a value of total cholesterol lesser than 125 mg/d L. However, further studies are warranted with a large sample size, multicentre and proper follow-up to validate our findings.

Acknowledgments: The authors would like to thank the management of Chettinad Hospital and Research Institute for providing the necessary facilities to complete this work.

Authours contribution: Sneha Haridas A: Conceptualization, Project administration, Supervision, Validation, Visualisation, Writing-review and editing. **Vinu Boopathy**: Data curation, Role in writing-original draft, Writing-review and editing. **VR Mohan Rao**: Conceptualization, Project administration, Supervision. The authors have read and agreed to the published version of the manuscript.

Conflict of interest: None

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