

Original Research Article

Association of high-density lipoprotein and myocardial infarction: a cross sectional study

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ABSTRACT

Background: There is substantial evidence illustrating a negative relationship between High Density Lipoprotein Cholesterol (HDL-C) to Coronary Artery Disease (CAD) progression. HDL concept can be put forward as a new concept in the field of cardiovascular research. The objective of this study was to carry out to observe the status of serum HDL-C level in Coronary Artery Disease patients and the impact of the level in them.

Methods: It was a hospital based cross sectional observational study among 60 patients of acute myocardial infarction (MI) who were admitted in Medical intensive care unit. High density lipoprotein cholesterol (HDL-C) was determined using standard methods.

Results: The study showed that 52 (86.7%) of study subjects had abnormal HDL-C level and 39 (65%) of subjects had abnormal CRP level. There is a negative correlation between HDL and other biochemical variables like LDL, LDL/HDL and CRP, i.e. as HDL decreases all the variables increase which is statistically significant. Majority of patients 52 (86.7%) with MI had abnormal HDL-C level which was not statistically significant.

Conclusions: Numerous studies showing evidence that high levels of HDL-Cholesterol associated with a lower risk of Coronary heart disease. This study showed that there is a low HDL-C level among coronary artery disease patient. The relationship between HDL and CAD proved to be an inverse one which caters the need to concentrate further on HDL.

Keywords: Coronary artery diseases, Cross sectional study, HDL

INTRODUCTION

Coronary artery disease (CAD), also known as ischemic heart disease (IHD) involves the reduction of blood flow to the heart muscle due to build-up of plaque in the arteries of the heart. It is the most common of the cardiovascular diseases. Types include stable angina, unstable angina, myocardial infarction, and sudden cardiac death.^{1,2} World Health Organization (WHO) reported the age standardized CAD mortality rates among males and females in India (per 100,000) at 363-443 and

181-281, respectively in 2011.³ The conventionally divided the risk factors of coronary heart disease into non modifiable and modifiable. Those include age, sex, ethnicity and family history, while the latter include dyslipidemia, diabetes mellitus (DM), obesity, smoking, and hypertension.

Recently, identified number of newer cardiovascular risk factors like higher levels of plasminogen activator inhibitor, C-reactive protein, and homocysteine levels.^{4,5}

HDL particles were highly heterogeneous with a very complex metabolic profile. The variable HDL subclasses varies in quantitative and qualitative content of apolipoproteins, lipids, enzymes, and lipid transfer proteins, resulting in differences in size, shape, density, charge, and antigenicity.

Dyslipidemia is caused for most coronary artery disease with high concentration of Low Density Lipoprotein Cholesterol (LDL -C) and low level of High Density Lipoprotein Cholesterol (HDL-C) promoting atheroma formation for atherosclerosis and CAD. The function of plasma HDL-C is the transport of the cholesterol from periphery to the liver, for further catabolism and excretion. About one fourth of coronary heart disease patients have low level of high density lipoprotein cholesterol with there is no of elevation of LDL-cholesterol.⁶

Recent studies showed other functions of HDL-C like antioxidant, anticoagulant, antiplatelet, endothelial protection and anti-inflammatory properties of HDL-C helps prevent atherogenesis.⁷ Each 1mg/dl increase in HDL-C, CAD risk event is reduced by 2% in men and 3% in women was estimated.⁸ The four large analysis data studies concluded that increase HDL-C about 1 mg/dl is associated with a decreases 2 to 3% the risk of CHD.⁹

HDL also has antiapoptotic, anti-inflammatory and antithrombotic property in the endothelial cells of healthy individuals. HDL is an index of health status because it reduces blood clotting by stimulating the secretion of nitric oxide (NO) inside endothelial cells and prevents the inflammation by inhibiting the inflammatory factors expression in the endothelial cells. Additionally, HDL prevents the low-density lipoprotein-cholesterol (LDL) to limit the interactions and adsorption of monocytes and endothelial cells, while releasing cholesterol from endothelial cells via the reverse transport of cholesterol.¹⁰⁻¹²

LDL: HDL ratios greater than 5 were associated with a fivefold increase in the risk for cardiovascular events.¹³ CRP strongly and independently predicts adverse cardiovascular events, including myocardial infarction, ischemic stroke, and sudden cardiac death in individuals both with and without overt CHD.^{14, 15}

This study was carried out to observe the status of serum HDL-C level in Coronary Artery Disease patients and the impact of the level in them.

METHODS

Study population

Patients with acute myocardial infarction who fulfill inclusion and exclusion criteria, getting admitted in

medical intensive care unit. This study was conducted from Sep-2016 to Dec-2018.

Inclusion criteria

- Age >40 years,
- Acute myocardial infarction evidenced by ECG, Elevated CK-MB,
- 2D Echocardiography.

Exclusion criteria

- Patients below 40years of age,
- Individuals with heart diseases, chronic liver diseases, diabetes mellitus,
- Patient on statin therapy.

Statistical analysis

Statistical analysis of the data is carried out using the statistical package for social sciences (SPSS 23.0 version). Quantitative data will be expressed as mean±standard deviation while categorical data will be expressed using descriptive statistics (frequency and percentage). chi square test will be used to study the association of c reactive protein and LDL: HDL ratio with patients of acute myocardial infarction at significance level of 0.05 (p value).

It was a hospital based cross sectional observational study among 60 patients of acute myocardial infarction (MI) who were admitted in Medical intensive care unit. The patients comprised age more than 40 years were diagnosed as acute myocardial infarction (ST-segment elevation myocardial infarction and unstable angina/non-ST-segment elevation myocardial infarction) by the proper history, clinical examination, electrocardiogram, laboratory investigations and 2D echo.

Patients were excluded, who had a past history of heart disease, diabetes mellitus and chronic liver diseases and on statin therapy. All the patients were interviewed, and phlebotomy was done. Informed consent was obtained from all the participants or 1st degree relatives prior to start the study. The blood sample was collected immediately after admission. Lipid profile was done with the ERBA XL300 autoanalyzer.

High density lipoprotein cholesterol (HDL-C), Low-density lipoprotein cholesterol (LDL-C), C-reactive protein (CRP) was determined in the hospital laboratory using standard methods. HDL-C (Normal >40 mg/dL for men, >45 mg/dL), LDL-C (Normal <130 mg/dl) and C-RP (>10-Elevated) and LDL/HDL ratio >5-abnormal.^{16,17} The data of 60 patients was collected and entered into Microsoft Excel and analyzed using SPSS version 16.

Demographic data was summarized descriptively. Continuous variables were expressed as mean±standard

deviation. Categorical variables were presented as percentages.

RESULTS

The mean age of study population was 56.57 years with a standard deviation of 11.28.

Table 1: Descriptive statistics

Variable	Category	Frequency (%)
Age (years)	40-49	20(33.3%)
	50-59	19(31.7%)
	>60	21(35%)
Gender	Male	37(61.7%)
	Female	23(38.3%)
HDL-C	Normal	8(13.3%)
	Abnormal	52(86.7%)
LDL/HDL ratio	Normal	32(53.3%)
	Abnormal	28(46.7%)

The minimum age was 41 years and maximum 83 years. About 67% of study population belonged >50 years. Majority (61.7%) was males (Table 1).

The mean HDL-C was 34.47±5.66 mg/dl with a minimum of 24 and maximum of 52 mg/dl. The mean LDL-C was 152.85 mg/dl with a standard deviation of 31.23. The minimum and maximum values were 90 mg/dl and 212 mg/dl respectively. The median CRP level was 11 with an interquartile range 0.8-21. The mean LDL/HDL ratio was 4.58 with a standard deviation of 1.16 ranging from 1.89 to 6.09 (Table 2).

Table 2: Distribution of study subjects by biochemical levels

Biochemical variables	Mean	Standard deviation	Median	Range
HDL-C	34.47	5.66	34	24-52
LDL-C	152.85	31.23	152	90-212
LDL/HDL	4.58	1.162	4.91	1.89-6.09
CRP	12.38	11.25	11	0.3-38

The study showed that 52 (86.7%) of study subjects had low HDL-C levels and 46 (76.7%) of study subjects had elevated LDL-C level and 39 (65%) of subjects had abnormal CRP level (Figure 1).

Among 60 patients 28.3% had anterior wall MI and 15% had inferior wall MI and anteroseptal MI. 10% of study subjects had unstable angina. Ninety percentage of study subjects had stable angina (Table 3).

Table 4 shows that there is a negative correlation between HDL and other biochemical variables like LDL, LDL/HDL and CRP, i.e. as HDL decreases all the variables increase which is statistically significant.

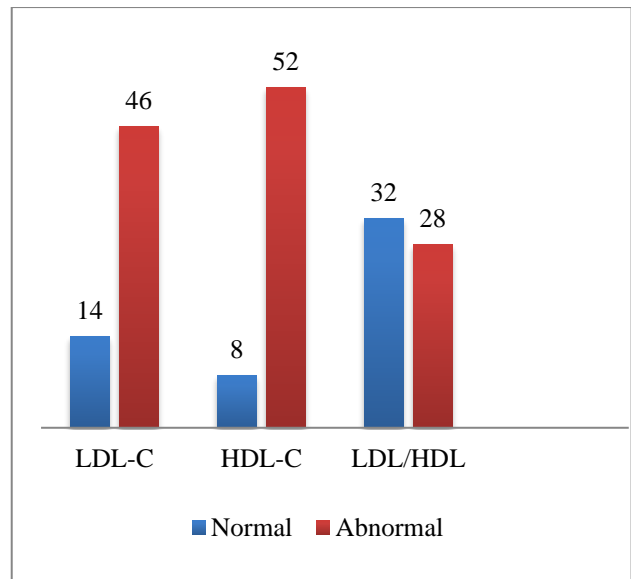


Figure 1: Distribution of study subjects based on cholesterol levels

Table 3: Distribution of study subjects by clinical diagnosis

Diagnosis	Frequency	Percentage
Anterior wall MI	17	28.3%
Inferior wall MI	9	15%
Anteriolateral MI	7	11.7%
Anterioseptal MI	9	15%
Inferiolateral MI	1	1.7%
Inferioposterior MI	2	3.3%
Posteriolateral MI	1	1.7%
Posterior wall MI	6	10%
Septal MI	2	3.3%
Unstable angina	6	10%

Table 4: Correlation between HDL and other biochemical variables

Variable	Correlation coefficient	p value
LDL-C	-.323	0.012*
LDL/HDL	-.767	<0.001*
CRP	-.520	<0.001*

*-Pearson’s correlation, p value<0.05 was significant, p value<0.001 highly significant

Cross tabulations was done with HDL level and other variables. As age increases, no: of study subjects with abnormal HDL increases, but not statistically significant. All the study subjects with abnormal HDL-C level have abnormal LDL-C level, abnormal CRP level, and abnormal LDL/HDL ratio.

This was statistically significant. Majority of patients 52 (86.67%) with MI had abnormal HDL-C level which was not statistically significant. (Table 5).

Table 5: Association of HDL and other variables

Variable	Category	Normal HDL level	Abnormal HDL level	Chi square value	p value
Age(years)	40-49	4(50%)	16(30.8%)	1.13	0.64#
	50-59	2(25%)	17(32.7%)		
	>60	2(25%)	19(36.5%)		
Gender	Male	6(75%)	31(59.6%)	0.69	0.47#
	Female	2(25%)	21(40.4%)		
Clinical Diagnosis	Anterior MI	5(62.5%)	30(57.7%)	0.78	0.94#
	Inferior MI	1(12.5%)	11(21.2%)		
	Posterior MI	1(12.5%)	6(11.5%)		
	Unstable angina	1(12.5%)	5(9.6%)		
LDL-C	Normal	8(100%)	6(11.5%)	30.3	<0.001#
	Abnormal	0	46(88.5%)		
CRP	Normal	8(100%)	13(25%)	19.21	<0.001#
	Abnormal	0	39(75%)		
LDL/HDL ratio	Normal	8(100%)	24(46.2%)	8.01	0.005#
	Abnormal	0	28(53.8%)		

#-Fischer's exact test, p value<0.05 was significant, p value<0.001 highly significant

DISCUSSION

The purpose of the study was to find out the status of serum HDL-C level in coronary artery disease patients and the impact of the level in them.

The study showed that 86.7% had low HDL-C levels which were similar to a study done in Bangladesh.¹⁸ Several studies have reported varying prevalence and type of dyslipidemia from different regions of India. The prevalence of low HDL (27-72.2%) and high LDL cholesterol (23.3-44.5%), was observed from different regions. These variations can be explained by differences in the study population with respect to age and sex distribution, inclusion of patients with CVD and population or hospital-based study.¹⁹⁻²²

Among 60 patients 28.3% had anterior wall MI and 15% had inferior wall MI and anteroseptal MI. 10% of study subjects had unstable angina which showed a similar distribution like a study done in Bangladesh.²³

The study showed that all the study subjects with abnormal HDL-C level have abnormal LDL-C level, abnormal CRP level, and abnormal LDL/HDL ratio. Inverse relationship between HDL and other lipids like LDL was evident in the study which was similar to other studies.^{24-26,17} This study also demonstrate a combination of high LDL-C levels and low HDL levels. This combined with high triglyceride levels form a triad which was not evaluated in this study. This triad combined with high levels of lipoprotein-A constitutes the deadly lipid quartet. This lipid quartet is an emerging risk factor for atherosclerosis leading to coronary artery diseases. The study showed that all the study subjects with abnormal

HDL-C level have abnormal LDL-C level, abnormal CRP level, and abnormal LDL/HDL ratio.

The study showed that 65% of subjects had abnormal CRP level which is an emerging risk factor. This undoubtedly shows that a prediction model that incorporates high-sensitivity CRP improves global cardiovascular risk prediction. The reduction of CHD events in patients with moderately elevated CRP levels should be the aim of using statins which has an unknown anti-inflammatory property.^{27, 28}

Limitations

This study had several limitations. The selection of study subjects based on mutual exclusiveness may have failed to lead to misclassification bias. The small sample size attributed to fewer resources may prevent the results from extrapolating to the population.

Recommendations

This study tried to analyse the status of serum HDL-C level in coronary artery disease patients and the impact of the level in them. The research holds significance in the field of non-communicable disease as to emphasize the importance of emerging risk factors and their major role. Also, study proves the importance of tackling issues of early detection of dyslipidaemia and abnormality in inflammatory markers. Action should be taken to include these in the investigation and treatment protocol.

CONCLUSION

Our study showed that there is low HDL-C level among patients with coronary artery disease. This study also cemented the known inverse relationship between HDL-

C and other cholesterol in predicting coronary risk. There no specific drug to increase the HDL-C level because of complexity of HDL-C functions. Newer drugs like cholesteryl ester transport inhibitors and modulators, apolipoprotein mimetics and apolipoprotein up regulators hold much promise.

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