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"Non-HDL Cholesterol and Coronary Angiography Findings": A Retrospective Study in Patients Undergoing Cardiac Evaluation

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Abstract

Background: Non-HDL cholesterol (Non-HDL-C) has emerged as an important predictor of cardiovascular events. This study aims to evaluate the association between Non-HDL-C levels with coronary artery disease (CAD), complexity and severity using Syntax and Gensini scores, in patients undergoing coronary angiogram.

Methods: A retrospective analysis was conducted on 1358 patients who underwent coronary angiography for cardiac evaluation. Of these, lipid profiles were available for 352 patients. After excluding 111 patients already on lipid-lowering therapy, 240 patients were included in the final analysis. Coronary artery lesion complexity was evaluated using the Syntax score and CAD severity was assessed using the Gensini score.

Results: The mean age of the study group was 56.86 years. One hundred and sixty seven of patients were male (69.58%). There was no association of SYNTAX score and Gensini score with respect to gender, age, hypertension, diabetes and smoking status. The mean non-HDL-C was found to be higher in hypertensive (158.16 mg/dl) and Diabetics (165 mg/dl). Among the 240 patients, 86 (35.8%) had normal coronary arteries, and 154 (64.2%) had coronary lesions. It was found that patients with normal coronary angiogram had a mean non-HDL-C level of 118.78 mg/dl, whereas those with coronary lesions had elevated mean non-HDL-C levels of 171.68 mg/dl, (p < 0.001). The correlation between non-HDL-C levels and Syntax score was weak (r = 0.122), with mean non-HDL-C levels slightly increasing from low to high Syntax scores. The correlation

with Gensini score was also weak (r = 0.069), though non-HDL-C levels were higher in patients with more Severe Gensini score.

Conclusion: Patients with normal coronary angiogram were found to have normal non-HDL-C levels and those with coronary lesions had elevated non-HDL-C. The mean non-HDL-C levels was found to be progressively elevated from low to high syntax scores and from mild to severe Gensini score. However, its correlation with lesion complexity and severity as assessed by the Syntax and Gensini scores was weak. The study infers that elevated non-HDL-C may serve as a potential predictor of underlying coronary artery disease but may show weak positive correlation with the complexity or severity of underlying coronary artery disease.

Keywords

Non-HDL cholesterol, Coronary artery disease, Syntax score, Gensini score, Coronary angiography, Lipid profile

Introduction

Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide, particularly in India.

Atherosclerosis is one of the main causes of CAD characterized by a cascade of chronic inflammation, pathological remodelling of vascular walls and atherosclerotic plaque formation in the coronary arteries resulting in impaired tissue perfusion and ischemia. Dyslipidemia, characterized by abnormal

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levels of lipids in the blood, is a well-known risk factor for the development and progression of CAD. Low-density lipoprotein cholesterol (LDL-C) has been the primary target for lipid-lowering therapy. However, recent studies have highlighted the importance of Non-HDL cholesterol (Non-HDL-C), which encompasses all atherogenic lipoproteins including LDL-C, very low-density lipoprotein (VLDL), intermediate-density lipoprotein (IDL), and lipoprotein (a) [Lp(a)]. Non-HDL-C predicts cardiovascular events better than LDL-C, particularly in patients with elevated triglycerides [1,2]. An increase in non-HDL-C levels by one milligram per decilitre accelerates disease mortality by 5%. Given its comprehensive nature, Non-HDL-C may provide a more accurate assessment of atherogenic risk [3,4].

However, its role in predicting the complexity and severity of CAD as assessed by coronary angiography findings remains unclear.

This study aimed to evaluate the association between Non-HDL-C levels and coronary angiography findings, specifically looking at the complexity of coronary lesions using the Syntax score [5] and the severity of CAD using the Gensini score [6] in patients undergoing cardiac evaluation.

Methodology

This retrospective study was done in the Department of Cardiology, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru. The study included patients who underwent coronary angiography for cardiac evaluation between July 2022 and July 2024. Out of the total 1358 patients who underwent coronary angiogram, 352 patients had complete lipid profiles available. Patients on lipid-lowering therapy (n = 111) were excluded, resulting in a final cohort of 240 patients. These patients were further grouped as those with Normal epicardial coronaries (n = 86) and those with Coronary artery disease group (n = 154).

Data Collection

Patient data, including demographics, clinical history, lipid profiles, and coronary angiography findings, were extracted from medical records. Non-HDL-C was calculated as the difference between total cholesterol and HDL cholesterol. Coronary artery lesions complexity

was evaluated using the Syntax score and the severity of CAD was assessed using the Gensini score.

Inclusion criteria

i. Patients age > 18 years of either sex who underwent Coronary angiogram for evaluation of CAD.

ii. Patients with Lipid profile sent within 24 hours of Coronary angiogram and prior starting statin or other lipid lowering therapy.

Exclusion criteria

i. Already on therapy with statins & other lipid lowering agents

ii. Chronic kidney disease

iii. Chronic liver disease

Statistical Analysis

Statistical analysis was performed using SPSS 14 version. Categorical variables were expressed as frequencies and percentages, and continuous variables were presented as mean ± standard deviation (SD). The association between Non-HDL-C levels and coronary angiography findings was assessed using chi-square tests for categorical variables and independent t-tests for continuous variables. Correlation analysis was performed using Pearson's correlation coefficient to evaluate the relationship between Non-HDL-C levels and Syntax and Gensini scores.

Results

Patient characteristics

Of the 1358 patients undergoing angiogram, 240 patients were included in the study, 167 (69.58%) were male, and 73 (35.8%) were female, with a mean age of 56.86 ± 10.3 years. The baseline characteristics of patients with normal and abnormal coronary angiography findings are presented in Table 1 and those with coronary artery disease are described in Table 2.

Among the patients, 86 (35.8%) had normal epicardial coronary arteries, while 154 (64.2%) had coronary lesions. The mean Non-HDL-C level was significantly higher in patients with coronary artery disease compared

Table 1: The baseline characteristics of patients with normal and abnormal coronary angiography findings.

Parameter	Normal Coronary (n = 86)	Coronary Lesions (n = 154)
Age (years)	56.19 ± 9.8	57.53 ± 10.6
Male, n (%)	54 (62.8%)	113 (73.37%)
Non-HDL-C (mg/dL)	118.77	171.21
LDL (mg/dl)	91.63	130.45
Hypertension, n (%)	38 (44.18%)	82 (53.25%)
Diabetes mellitus n (%)	26 (29.07%)	76 (49.35%)
Smokers	19 (22.09%)	64 (41.56%)

Table 2: The baseline characteristics of patients with coronary artery disease.

Parameter	n	Mean Non-HDL-C (mg/dl)	p value
Normal epicardial coronaries	86	118.77	< 0.001
Coronary artery disease	154	171.21	< 0.001
Hypertension	122	158.16	-
Diabetes	101	164.98	-
Smoking	83	153.17	
SVD	59	163.41	< 0.001
DVD	50	170.16	< 0.001
TVD	44	182.86	< 0.001
LM	7	173.14	< 0.001
Syntax Low	118	170.27	< 0.001
Syntax Intermediate	18	173.33	< 0.001
Syntax High	10	178.7	< 0.001
Gensini Mild	66	162.36	< 0.001
Gensini Moderate	28	176.54	< 0.001
Gensini Severe	60	179.68	< 0.001

SVD: Single Vessel Disease; DVD: Double Vessel Disease; TVD: Triple Vessel Disease; LM: Left Main

to patients with normal coronary arteries (171.21 mg/dl vs. 118.8 mg/dl, p < 0.001). The mean LDL levels in Normal epicardial coronaries were 91.63 mg/dl and in patients with coronary artery disease was 130.45 mg/dl. Hypertension was observed in 122 patients in the study and had mean non-HDL-C levels of 158.16 mg/dl, whereas out of 122 patients with hypertension, 38 patients had mean non-HDL-C of 126.82 mg/dl and Hypertensive patients with Coronary artery disease (n = 82) had a mean non-HDL-C of 172.98 mg/dl. Diabetes mellitus was observed in 102 patients and had higher levels of mean non-HDL-C of 164.98, Diabetic patients with normal coronary angiogram (n = 26) had mean non HDL-C of 115.96 mg/dl, where as Diabetic patients with CAD (n = 75) had higher level of mean non-HDL-C of 179.63 mg/dl. Patients with single vessel disease (n = 59) had a mean non-HDL-C levels of 163.41 mg/dl, double vessel disease (n = 50) had a higher non-HDL-C of 170.27 mg/dl and Triple vessel disease were observed to have higher mean non-HDL-C of 182.86 mg/dl (Figure 1). To assess the complexity of CAD, Syntax score was calculated for all the patients with CAD. Patients were classified as low (n = 118) when score was < 22, were observed to have a mean non-HDL-C of 170.27 mg/dl, intermediate score of 23-32 (n = 18) had mean non-HDL-C of 173.33 mg/dl and as high score > 33, (n = 10) had a mean non-HDL-C of 178.7 mg/dl. It was observed that there was increase in the mean non-HDL-C with increasing complexity assessed by Syntax scores (p < 0.001). But there was a weak positive correlation between complexity of lesion assessed by syntax score and the non-HDL-C levels, (r = 0.113, p = 0.12). The severity of CAD was assessed using Gensisni Score and categorized into Mild (0-20), Moderate (21-39) and Severe (> 40). Those with Mild scores (n = 66) had a mean non-HDL-C of 162.36 mg/dl, Moderate (n = 28) were observed to have mean non-HDL-C of 176.54 and those with Severe (n = 60) had higher mean non-HDL-C of 179.68 mg/dl, suggestive of increment in the mean non-HDL-C levels with severity of CADs (p < 0.001). However, on evaluation of correlation between non-HDL-C levels and Severity of CAD assessed using Gensini score showed a weak positive correlation (r = 0.07, p = 0.23).

Discussion

The present study aimed to evaluate the association between Non-HDL-C levels and coronary artery disease in patients undergoing coronary angiogram. Our study shows mean non-HDL-C of 118.77 mg/dl , (Normal non-HDL-C: < 130 mg/dl) in patients with normal epicardial coronaries (n = 86) and in patients with coronary artery disease, mean-non-HDL-C was elevated at 171.21 mg/dl, which is consistent with the literature [3-5] and suggests that Non-HDL-C is a strong predictor of atherosclerotic cardiovascular disease (ASCVD) events [7-12] and provides a better reflection of the total atherogenic particle burden than LDL-C alone [13-15].

The number of vessels involved in CAD was categorized as Single vessel disease, double vessel disease and Triple vessel disease and its mean non-HDL-C was assessed. Patients with single-vessel disease (n = 59) had a mean non-HDL-C of 163.41 mg/dl, whereas those with double-vessel disease (n = 50) exhibited higher levels (170.27 mg/dl). The highest levels were seen in patients with triple-vessel disease (182.86 mg/dl). It can be inferred that patients with multi vessel involvement had higher levels of mean Non-HDL-C (p value < 0.001) (Figure 1). These results align with findings that non-HDL-C cholesterol is a significant predictor of CAD severity, as evidenced in prior studies where elevated non-HDL cholesterol levels were associated with worse coronary outcomes [16,17].
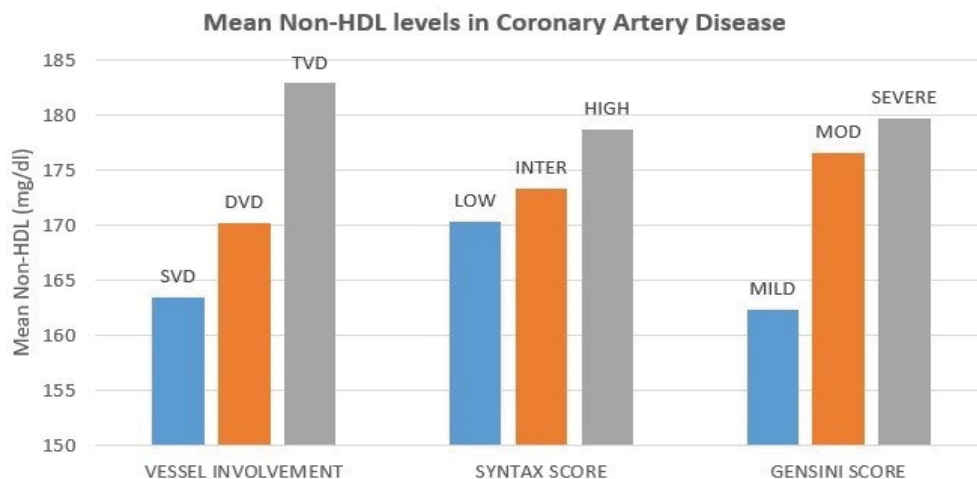
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Figure 1: Mean Non-HDL-C levels in coronary artery disease.
SVD: Single vessel disease; DVD: Double vessel disease; TVD: Triple vessel disease; LM: Left Main

The Syntax score, which evaluates lesion complexity based on angiographic findings, and the Gensini score, which quantifies the severity of coronary artery obstruction, may be influenced by factors beyond lipid levels, such as plaque stability, inflammatory markers, and other non-lipid cardiovascular risk factors [18-20].

To further assess CAD complexity, we utilized the SYNTAX score. Patients classified as low-risk (SYNTAX score < 22, n = 118) had a mean non-HDL-C of 170.27 mg/dl, while those with intermediate scores (23-32, n = 18) and high scores (> 33, n = 10) showed progressively higher levels of non-HDL cholesterol at 173.33 mg/dl and 178.7 mg/dl, respectively. The weak positive correlation between SYNTAX score and non-HDL-C levels (r = 0.113, p = 0.12) is consistent with existing literature which suggests that non-HDL cholesterol is an indicator of plaque burden and lesion complexity [17].

Severity of CAD, as determined by the Gensini score, was categorized into mild (0-20, n = 66), moderate (21-39, n = 28), and severe (> 40, n = 60). Mean non-HDL levels in these groups were 162.36 mg/dL, 176.54 mg/dL, and 179.68 mg/dL, respectively. Though the correlation between Gensini score and non-HDL levels was weak (r = 0.07, p = 0.23), these findings are consistent with previous studies that demonstrate a positive relationship between non-HDL cholesterol and CAD severity, especially in high-risk patients. A weak positive correlation with Syntax scores (r = 0.113, p = 0.12) and Gensini scores (r = 0.07, p = 0.23) implies that Non-HDL-C may not effectively capture the qualitative aspects of plaque that contribute to lesion complexity or severity, a hypothesis supported by studies highlighting the importance of other factors such as lipoprotein (a) and apolipoprotein B [21-23].

Conclusion

Patients with normal coronary angiogram were found to have normal non-HDL levels and those with elevated non-HDL cholesterol had associated with the presence of coronary artery disease in patients undergoing coronary angiogram. The mean Non-HDL was progressively higher with multivessel involvement, higher syntax and Gensini score. However patients had a weak positive correlation while assessing lesion complexity by the Syntax score and severity by Gensini score. It can be inferred that elevated non-HDL can be used as predictor of underlying Coronary artery disease.

Conflict of Interest Disclosure

Authors declare no conflict of interest.

Source of Financial Support

Nil.

Authors Contribution

Conceptualization: Abhishek Samdesi. Methodology: Abhishek Samdesi, Asha Latha; Data creation: Abhishek Samdesi, Asha Latha; Formal Analysis: Abhishek Samdesi, Asha Latha; Investigation: Abhishek Samdesi; Validation: all authors. Writing - original draft: Samdesi A, Navya CN; Writing - reviewing and editing: Abhishek Samdesi, Asha Latha, Prakash SS. Approval of final manuscript: all authors.

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