

Association Between Low Serum HDL Levels and Severity of Coronary Artery Disease Among Patients with Non-ST Elevated Myocardial Infarction

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Abstract:

Introduction: Coronary artery disease is one of the leading causes of non-communicable diseases related deaths worldwide. Decreased serum high-density lipoprotein level are associated with an increased severity of coronary artery disease. Present study aims to evaluate the association between this low HDL level and the severity of coronary artery disease assessed by SYNTAX Score in patients with non-ST elevation Myocardial infarction.

Materials & Methods: This was a cross sectional study conducted in the Department of Cardiology at National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2020 to April 2021, on 170 admitted adult patients of non-ST elevated myocardial infarction undergoing coronary angiogram. Study population was divided in two groups; Group-I: Respondents with HDL level ≥ 40 mg/dl, Group-II: Respondents with HDL level < 40 mg/dl. Transthoracic echocardiography was done before coronary angiography. All coronary lesions with diameter stenosis $> 50\%$ in vessels > 1.5 mm was scored, using the SYNTAX algorithm. A low score was defined as ≤ 22 , an intermediate score as 23 to 32, and a high score as ≥ 33 . To determine statistical significance, Chi-square test and independent sample t-test were considered according to applicability. P value of < 0.05 was considered statistically significant.

Results: Highest proportion of respondents were from age group 51 – 60 years, 48.2% and 43.5% for group-I and group-II respectively. Study population was male predominant, 88.2% among patients from group-I and 83.5% among patients from group-II. Smoking was the most prevalent risk factor for group-I patients at 58.8%. Hypertension was the most prevalent risk factor for group-II patients at 45.9%. Mean total cholesterol, low-density lipoprotein and high-density lipoprotein were higher among patients from group-I than group-II and these differences were statistically significant ($p < 0.05$). Mean triglycerides was higher among patients from group-II than group-I and this difference was statistically significant ($p < 0.05$). Triple vessel was more prevalent (36.5% vs 22.4%) among patients from group-II than group-I and this difference was statistically significant ($p < 0.05$). Mean SYNTAX score (SS) was higher among patients from group-II than group-I, 17.4 ± 8.6 and 11.5 ± 8.4 respectively, and this difference was statistically significant ($p < 0.05$). There was strong negative correlation between HDL level and Syntax score ($r = -0.299$, $p < 0.05$).

Conclusion: Present study demonstrated significant negative correlation between low serum HDL levels with severity of coronary artery disease among patients with non-ST elevated myocardial infarction. Serum HDL levels can be used as a predictor for the severity of coronary artery disease among such patients.

Keywords: HDL, Coronary Artery Disease, Non-ST Elevated Myocardial Infarction

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Introduction:

Cardiovascular diseases (CVD) are considered as one of the leading causes of death worldwide, accounting for around 50% of all non-communicable diseases (NCD)

related deaths in the world each year.¹ About 17.3 million deaths globally was contributed to CVD.² In Bangladesh, the prevalence of coronary artery disease is 1.85% - 3.4%

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in rural population and 19.6% in urban population.³ The burden of non-ST elevation Myocardial infarction (NSTEMI) is increasing globally as compared to ST-elevation MI, with comparable 6 months mortality rates for both incidents.^{4–6} NSTEMI remains the leading causes of death in individuals with coronary artery disease (CAD).⁶

Although factors like age, family history, hypertension, diabetes mellitus and smoking have been shown to determine the severity and extent of coronary atherosclerosis,^{7,8} dyslipidemias, including increased low-density lipoprotein (LDL) and triglyceride (TG) concentrations and decreased high-density lipoprotein (HDL) concentration, are major risk factors for CHD.⁹ One of the major predisposing factors to atherosclerosis is an abnormal lipoprotein metabolism and it may be present in over 70% of patients with CAD.^{10,11} HDLs are a heterogeneous class of lipoproteins with the ability to drive reverse cholesterol transport.^{12,13} Studies have shown the risk for CAD to increase sharply as HDL levels fall progressively below 40 mg/dl.^{11,14,15}

Low HDL values were associated with an increased both triple vessel disease and left main coronary artery.¹⁶ Severity of CAD is inversely correlated with levels of HDL in both men and women.¹⁷ In angiographic studies the relation between HDL levels and CAD has varied widely ranging from significant inverse correlation with HDL and were the only significant predictor of the number of lesions.¹⁸

Studies related to the association between low serum HDL levels and severity of coronary artery disease among Bangladeshi population is scarce. Present study aims to evaluate the association between this low HDL level and the severity of coronary artery disease assessed by SYNTAX Score (SS) in patients with non-ST elevation Myocardial infarction (NSTEMI).

Materials & Methods:

This was a cross sectional study conducted in the Department of Cardiology at National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2020 to April 2021, on 170 admitted patients of non-ST elevated myocardial infarction undergoing coronary angiogram, under the strict supervision of the institute authority and only after receiving the ethical clearance from the institutional review board. Adult patients of either sex were included in this study. Severely ill patients and patients with prior history of PTCA, prior history of CABG, associated with valvular heart diseases, associated with congenital heart diseases, cardiomyopathy, prior history of taking anti-lipid drugs, LDL level more than 130 mg/dl, comorbid conditions such as severe renal impairment, hepatic failure and hypothyroidism were excluded from the study. Aims and objectives of the study along with its procedure, risks and benefits of the study were explained to the respondent in easily understandable local language.

Data were collected through face-to-face interview using a semi-structured questionnaire and data collection tools, only after Informed written consent was taken from the respondents. As per the selection criteria, 170 patients of both gender, age ≥ 18 years, were enrolled in the study through purposive sampling technique.

Study population underwent detail history taking, physical examination and relevant investigations. Risk factor profile including smoking, hypertension, diabetes, dyslipidemia, and family history of coronary artery disease was noted. Patients were treated in accordance with the current guideline. Aspirin, clopidogrel, enoxaparin, beta blockers, statins, and ACE inhibitors angiotensin receptor blocker medications were administered to every patient unless contraindicated. Twelve lead resting ECG was done at a paper speed 25mm/s and 10mm standardization at admission and as needed. Lipid profile was done within 24 hours of admission by using BECMAN COULTER AU480 analyzer at NICVD biochemistry laboratory. Two groups were defined based on HDL value. Group-I: Respondents with HDL level ≥ 40 mg/dl, Group-II: Respondents with HDL level < 40 mg/dl. Transthoracic echocardiography was done before coronary angiography. Coronary angiography was performed through trans femoral and trans radial approach. Angiographic severity assessment was done by visual estimation. The Syntax scores of all patients was calculated. All coronary lesions with diameter stenosis $>50\%$ in vessels >1.5 mm was scored, using the

Results:

Among the study population, highest proportion of respondents were from age group 51 –60 years, 48.2% and 43.5% for group-I and group-II respectively (Table I). Mean age was 54.8 ± 8.1 years for group-I and 52.7 ± 9.4 years for group-II, but the difference was not statistically significant. Study population was male predominant, 88.2% among patients from group-I and 83.5% among patients from group-II. Body mass index (BMI) was 24.5 ± 2.7 kg/m² and 24.7 ± 3.4 kg/m² for group-I and group-II respectively and there was no statistically significant difference between the two groups. Obesity was most prevalent among both groups, 50.6% and 45.9% for group-I and group-II respectively.

Table II shows cardiac risk factor profiles for both groups. Many of the respondents had more than one risk factors present. Smoking was the most prevalent risk factor for group-I patients at 58.8%. Hypertension was the most prevalent risk factor for group-II patients at 45.9%. No statistically significant differences were present between the two groups in terms of cardiac risk factors. Mean total cholesterol, low-density lipoprotein and high-density lipoprotein were higher among patients from group-I than group-II and these differences were statistically significant ($p < 0.05$). Mean triglycerides was higher among patients from group- II than group-I and this difference was statistically significant ($p < 0.05$). Triple

Table-I
Descriptive statistics of the study population (n = 170)

Characteristics	Group-I(n=85)	Group-II(n=85)	Significance(p value)
Age (in years)	54.8 ± 8.1	52.7 ± 9.4	0.13b
Age group (in years)			
<40	6 (7.1%)		
41-50	21 (24.7%)	25 (29.4%)	
51-60	41 (48.2%)	37 (43.5%)	-
61-70	17 (20.0%)	10 (11.8%)	
>70	2 (2.4%)		
Sex			
Male	75 (88.2%)	71 (83.5%)	0.38a
Female	10 (11.8%)	14 (16.5%)	
BMI Classification (kg/m ²)			
Underweight (< 18.5 kg/m ²)	3 (3.5%)	2 (2.4%)	
Normal (18.5 - 22.9 kg/m ²)	21 (24.7%)	21 (24.7%)	-
Overweight (23 - 24.9 kg/m ²)	18 (21.2%)	22 (25.9%)	
Obese (≥25 kg/m ²)	43 (50.6%)	40 (45.9%)	
BMI (kg/m ²)	24.5 ± 2.7	24.7 ± 3.4	0.597b

Data presented as n (%) or mean ± SD. Group-I: Respondents with HDL level ≥40 mg/dl, Group-II: Respondents with HDL considered statistically significant. b - Independent sample t test was done, p < 0.05 was considered statistically significant.

Table-II
Clinical characteristics of the study population (n = 170)

Characteristics	Group-I(n=85)	Group-II(n=85)	Significance(p value)
Cardiac risk factor profiles			
Hypertension	33 (38.8%)	39 (45.9%)	0.352 ^b
Diabetes mellitus	30 (35.3%)	29 (34.1%)	0.872 ^b
Dyslipidemia	26 (30.6%)	19 (22.4%)	0.224 ^b
Smoking	50 (58.8%)	37 (43.5%)	0.065 ^b
Family history of CAD	21 (24.7%)	20 (23.5%)	0.858 ^b
Lipid profile			
TC (mg/dl)	187.3 ± 39.6	150.8 ± 39.0	< 0.05 ^b
LDL (mg/dl)	97.1 ± 21.9	86.9 ± 28.5	< 0.05 ^b
TG (mg/dl)	168 ± 7.9	188 ± 61.9	< 0.05 ^b
HDL (mg/dl)	43.2 ± 3.7	31.8 ± 4.5	< 0.05 ^b
Vessel score			
None	19 (22.4%)	10 (11.8%)	< 0.05a
Single vessel	27 (31.8%)	13 (15.3%)	
Double vessel	14 (16.5%)	22 (25.9%)	
Triple vessel	19 (22.4%)	31 (36.5%)	
Left main disease	6 (7.1%)	9 (10.6%)	
SYNTAX Score (SS) classification			
Low SS (≤22)	70 (82.4%)	50 (58.8%)	
High SS (≥23)	15 (17.7%)	35 (41.2%)	
SYNTAX Score (SS)	11.5 ± 8.4	17.4 ± 8.6	< 0.05 ^b SYNTAX

Data presented as n (%) or mean ± SD. Group-I: Respondents with HDL level ≥40 mg/dl, Group-II: Respondents with HDL

level < 40 mg/dl. TC: Total cholesterol, LDL: Low-density lipoprotein, TG: Triglycerides, HDL: High-density lipoprotein.

a - Chi-square test was done. b

- Independent sample t test was done.

vessel was more prevalent (36.5% vs 22.4%) among patients from group-II than group-I and this difference was statistically significant ($p < 0.05$). Table II also shows statistically significant ($p < 0.05$) differences between the two groups in terms of SYNTAX score (SS) classification. Mean SYNTAX score (SS) was higher among patients from group-II than group-I, 17.4 ± 8.6 and 11.5 ± 8.4 respectively, and this difference was statistically significant ($p < 0.05$).

Figure 1 shows strong negative correlation between HDL level and Syntax score ($r = -0.299$, $p < 0.05$).

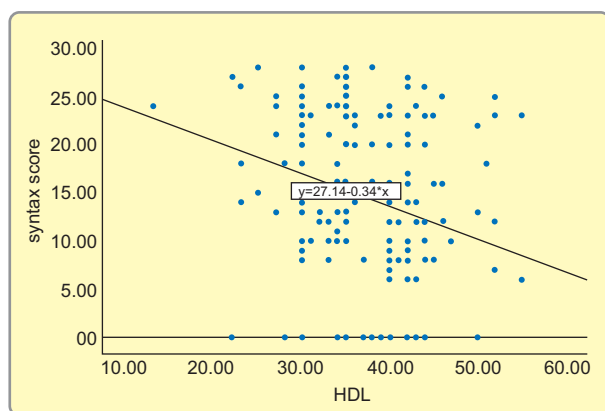


Figure 1: Correlation between HDL and SYNTAX Score (SS).

Discussion:

This cross-sectional study was carried out to find out the association between low HDL and angiographic severity of coronary artery disease among patients with NSTEMI assessed by SYNTAX score. Age distribution of study population showed 48.2% and 43.5% of the respondents from group-I and group-II respectively were from age group 51 – 60 years. This is consistent with prior Bangladeshi studies showing age group 41 – 60 years having highest frequency of respondents with coronary artery disease.^{20,21} Mean age was 54.8 ± 8.1 years for group-I and 52.7 ± 9.4 years for group-II, but the difference was not statistically significant. This is consistent with Ahmed et al., 2018 study, showing similar mean age for study population and no statistically significant difference in mean age between the two groups.²¹ In another study among Brazilian population, Luz et al., 2008 showed mean age to be 57.2 ± 11.1 years, which is higher than present study findings.²² This difference also supports the earlier incidence of coronary artery disease among Bangladeshi population.³ Study population was male predominant, 88.2% and 83.5% from group-I and group-II respectively. This indicates that males are more affected by coronary

artery disease, which is also consistent with Sabah et al., 2014 study showing similar male predominance among study population.²³

Present study showed the prevalence of hypertension, diabetes mellitus, dyslipidemia, smoking and family history of coronary artery disease to be 45.9%, 34.1%, 22.4%, 43.5% and 23.5% respectively for respondents with low HDL (< 40 mg/dl), which is consistent with Amin et al., 2016 study.²⁴ Present study found no statistically significant difference in prevalence of these risk factors among respondents with normal and low HDL levels, which is consistent with Ahmed et al., 2018 study showing similar findings.²¹ Hypertension was the most prevalent risk factor for respondents with low HDL at 45.9%, which is consistent with prior studies showing similar findings.^{25–27} In present study, respondents with normal HDL level had higher mean TC and LDL levels and lower TG levels than respondents with low HDL levels and these differences were statistically significant ($p < 0.05$). Ahmed et al., 2018 study also showed similar significant differences between study population when grouped based on serum HDL levels, which is consistent with present study findings.²¹ Triple vessel disease was more prevalent (36.5% vs 22.4%) among patients with low HDL than patients with normal HDL and this difference was statistically significant ($p < 0.05$). Higher frequency of triple vessel disease was also reported by previous study, which supports present study findings.²¹ Present study showed statistically significant ($p < 0.05$) differences between groups of respondents with normal HDL and groups of patients with low HDL, in terms of SYNTAX score (SS) classification. Presence of triple vessel disease had clear cut impact on treatment decision, only patients with low SYNTAX score (≤ 22) can be treated with PCI (Percutaneous Coronary Intervention). Patients with these conditions can undergo CABG (Coronary Artery Bypass Grafting) irrespective of SYNTAX score.²⁸ Those with low HDL level are more likely to have CABG as present study has shown that these patients had higher SYNTAX score compared with those with normal HDL level. Mean SYNTAX score (SS) was higher among patients with low HDL than patients with normal HDL, 17.4 ± 8.6 and 11.5 ± 8.4 respectively, and this difference was statistically significant ($p < 0.05$). This is consistent with prior studies showing patients with low HDL having a low SYNTAX score.^{29–32} This also supports the finding of strong negative correlation between HDL level and SYNTAX score ($r = -0.299$, $p < 0.05$) in present study.

Conclusion:

Present study demonstrated significant negative correlation between low serum HDL levels with severity of coronary artery disease among patients with non-ST elevated myocardial infarction. Patients with low HDL levels were found to have higher SYNTAX score. The value of HDL levels can be used as a predictor for the severity of coronary artery disease among patients with non-ST elevated myocardial infarction

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