Original Article

Relationship Between Non–High-Density Lipoprotein Cholesterol and Coronary Heart Disease

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ABSTRACT

Objective: To study the association between lipoprotein cholesterol not of high density and stenosis of the coronary artery demonstrated by the coronary angiography**.**

Study Design: Prospective and cross-sectional study

Place and Duration of Study: This study was conducted at the National Institute of Cardiovascular Diseases Karachi from December 2019 to November 2020.

Materials and Methods: In three subsets, we compared the non-high-density cholesterol level and coronary heart disease. Spearman's correlation has been applied to analyze the correlated non-high-density cholesterol lipoprotein and coronary heart disease.

Results: The cholesterol -lipoprotein-high-density rate was higher in the group of coronary artery disorders compared with the group of the non-coronary artery ($P < 0.01$). The analytical correlation of Spearman demonstrated that a strong association between non-high-density lipoprotein and SYNTAX score ($r=0.071$, $P<0.001$; $r=0.316$, $P<0.001$) was observed. In multivariate logistic regression analysis, the indigenous predictor of coronary artery condition was non–high density lipoprotein cholesterol high density lipoprotein cholesterol ratio, (Odds ratio: = 3,645; = 2.096; 95% confidence interval; = 1.438–3.054).

Conclusions: The ratio of non–high-density lipoprotein cholesterol was associated with the severity of coronary artery disease, suggesting that it might be utilized as a biomarker.

Key Words: Non–High-Density, Cholesterol, Coronary Heart Disease

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INTRODUCTION

CAD is a major disease that endangers human health, impacts the quality of life and long-term prognosis of patients. Coronary artery disease (CAD) The occurrence and progression of CAD are supported by many variables. The main cause of heart disease is atherosclerosis. The major mechanisms of atherosclerosis include inflammation, oxidative stress, and endothelial dysfunction. And in the entire atherosclerosis process, inflammation plays a significant role[1]. Non-HDL-C is the sum of all serum atherogenic cholesterol, as stated in the third national cholesterol educational report, the second objective of the antiatherosclerosis process is to reduce non-HDL-C.[2] Nonstandard cholesterol (non-HDL-C) is antiatherogenic cholesterol. Earlier investigations have demonstrated that the risk of coronary heart disease is related to non-HDL-C[3,4].

The protein compound of HDL-C is 70 percent of the anti-inflammatory and antioxidant apolipoprotein A-I (apoA-II)[5], with a protective impact on the endothermal vascular cell, nitric oxide production, inflammatory mediator expressions, and the endothelium proliferation of cells[6,7]. In the formation of atherosclerosis, monocytes and macrophages are the principal pro-inflammatory cells and could be used to secret inflammatory substances in atherosclerosis production[8]. Research into inflammatory atherosclerosis biomarkers has been a popular issue in recent years based on the function of non-HDL-C, HDL-C, and monocytes in atherosclerosis. The non-HDL-C and highly dense were more convinced to predict the severity of coronary heart diseases, which are being given great attention by clinicians. The purpose of the study was to evaluate the connection of non-HDL-C with CAD gravity.

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MATERIALS AND METHODS

There were a total of 1460 patients registered and prospectively analyzed at the National Institute of

Cardiovascular Diseases Karachi from 1st December 2019 to 30th November 2020. CAD was identified. The control group was selected for 300 patients hospitalized for non-coronary artery disease and the three SYNTAX- subgroups were classed of 500 patients who were diagnosed with coronary arterial disease.

Exclusion criteria are various infectious diseases, blood therapy, severe anemia, operation and severe trauma within three months, autoimmune or immunosuppression, malignant tumor, hepatic and kidney disorder, preliminary myocardial infarction, previous coronary artery or coronary bypass grafting, cardiomyopathy and decompensated heart failure were not included.

Coronary angiography: Two competent cardiologists in our hospital conducted coronary angiography and analyzed the angiographical results. Coronary angiography was carried out by radial or femoral approach following the Judkin procedure. The degree of coronary artery stenosis, anterior down arteries, circumflex arteries, and the right coronary arteries were assessed.

SYNTAX score and group: The degree of CAD was measured using a SYNTAX grading method based on coronary angiography results. A novel tool to measure coronary artery diseases complexity is the SYNTAX Score. The SYNTAX score has been calculated with the website of the SYNTAX score. The results were sorted into three categories according to the scoring therapies: a moderate (<8), a moderate (8-15), and a serious (>15) group.

Laboratory measurements: In the morning, blood samples from the antecubitus have been gathered in our hospital (fasting for more than 10 hours). The blood cell counts, HDL-c, and other biochemical markers were measured using the biochemical analyzer. The ratio between the serum non-HDL-C level and the serum level was determined by non-HDL-C cholesterol minus HDL-C, and the MHR by the separation of the monocyte count by the monocyte count with HDL-C.

Statistical analysis: Statistical analysis was carried out with the Software SPSS Version 23.0. The continuous variables are reported as mean ± SD. The percentages for categorical variables were reported. The categorical variables between groups were compared with the μ2 trial. Univariate and multivariate logistical regression tests have been conducted to determine the independent CAD predictors. The results were assessed within a trust interval of 95 percent with a P-value of less than 0.05.

RESULTS

Table 1 indicated a reduced proportion of diabetes, high bloody blood pressure, males, and smokers in the control group. The CAD group was greater than the CAD groups, such as fast blood glucose, serum creatinine, triglycerides, hypersensitive C-reactive protein, white blood cell counting, monocyte counts, non-HDL-C.

The SYNTAX tertiary score groupings for coronary heart disease were separated into three groups. There are three groups compared non-HDL-C and MHR levels. The results indicated the greater non-HDL-C levels compared to the mild group ($P < 0.05$), while the smaller group, modest and severe groups had no important differences. The levels of MHR for the severe group were greater than in the mild and moderate groups, whereas the levels of MHR for the moderate group and the moderate group were not significantly differing ($p<0.05$).

Non-HDL-C and MHR with SYNTAX scores were analyzed with Spearman correlation. The results have indicated a favourable correlation between Non-HDL-C and SYNTAX (($r=0.071$, $P<0.001$; $r=0.316$, $P<0.001$).

We did multivariable logistic regression analysis with factors that exhibit statistically significant relationships in the univariate regression study to discover independent CAD predictors. The results showed that the C-reactive protein, non-HDL-C, age, smoking, diabetes, hypertension, and hypersensitivity might be considered as independent risk factors for CAD.

Table No.1: Basic clinical characteristics of the study participants (n = 800)

Variables	Control group n = 300	CAD group n = 500	P value
Age	57.18 ± 10.70	64.13 ± 11.53	0.679
Gender [man (%)]	209 (69.66%)	417 (83.4%)	0.000*
Smoking	94 (21.7%)	594 (40.1%)	0.014**
Diabetes	48 (12.5%)	151(30.2%)	0.000*
Hypertension	290 (96.6%)	343 (68.5%)	0.000*
FBG (mmol/l)	4.36 ± 1.20	5.36 ± 17.60	0.013**
Cr (mmol/l)	72.06 ±18.40	78.58 ± 32.34	0.001*
UA (mmol/l)	323.61 ± 96.65	363.01 ± 101.42	0.597
TC (mmol/l)	4.40 ± 1.00	4.25 ± 1.33	0.198
TG (mmol/l)	1.61 ± 1.13	1.56 ± 1.72	0.007*
HDL (mmol/l)	1.18 ± 0.29	1.07 ± 0.27	0.170
LDL (mmol/l)	2.68 ± 0.88	2.51 ± 0.94	0.599
ApoA-I (mmol/l)	1.20 ± 0.24	1.06 ± 0.25	0.677
Non-HDL-C (mmol/l)	3.21 ± 0.99	2.52 ± 0.88	0.317
hs-CRP (mg/l)	3.11 ± 7.52	8.20 ± 21.20	0.000*
WBC (10^9/l)	5.34 ± 1.98	6.50 ± 3.14	0.000*
MONO(10^9/l)	0.45 ± 0.15	0.53 ± 0.23	0.000*
LYMP (10^9/l)	2.65 ± 0.67	1.56 ± 0.6	0.000*
MHR	0.40 ± 0.20	0.53 ± 0.30	0.000*
Non-HDL-C	2.52 ± 0.88	2.71 ± 1.17	0.043**

Table No.2: Multivariable logistic regression analysis of independent factors for coronary artery disease (n = 800)

Variables	B	Wald	P value	OR	95% CI
Age	0.043	45.600	<0.01	1.044	1.039–1.071
Smoking	0.510	11.461	<0.01	1.741	1.272–2.664
Diabetes	0.671	16.363	<0.01	2.263	1.471–3.181
Hypertension	0.508	8.238	0.007	1.404	1.117–2.026
hs-CRP	0.034	4.081	0.024	1.024	1.003–1.046
MHR	1.183	6.755	0.016	3.545	1.267–10.486
Non-HDL-C	0.830	13.828	<0.01	2.086	1.438–3.054

DISCUSSION

The effect on the quality of life of the person is the high incidence and mortality of CAD. The process involves numerous mechanisms including oxidative stress, hypoxia, inflammation, vascular endothelial damage, pl atelet aggregation, etc. Atherosclerosis is a pathologic process. In the process of forming, developing, and breaking up the atherosclerotic plaque, activation of inflammatory cells and releasing of inflammatory factors play a major role. Monocyte activation is an essential step in atherosclerosis development[9]. During atherosclerosis, vascular endothelium damage, circulating monocytes stick to vascular endothelium and penetrate the wall of the blood vessel into macrophages which are transformed into foam cells by phagocytosis by oxidizing the LDL via scavenger receptors (LDL)[10].

Foam cells release proinflammatory cytokines, which can lead to the proliferation, migration, and development of plaques of vascular smooth muscle cells. Various cytokines act on hematological tissue during the formation and occurrence of atheroma and encourage the compensation for the proliferation of monocytes, and cause the increase of mononuclear peripheral cells of the blood. Peripheral blood monocytes are employed therefore as the source of tissue macrophages, and the quantity of foam cells represents plaque progression and can be used to prevent atherosclerosis from progressing[11]. The main risk factor of CAD is dyslipidemia. HDL-C plays its part in antioxidants by eliminating cholesterol from macrophages and preventing thrombosis[12]. In addition, the endothelial function and low viscosity of the blood of HDL-C are antiatherosclerotic[13]. Apo A-I is the principal component of HDL and is primarily involved in cholesterol transportation and has a key function in inflammatory and immunological regulatory action[14,15]. Duong pointed out that upon-I predominantly mediates the transport of intercellular cholesterol via ABCA1 on the cell membrane[16]. Furthermore, ApoA-I promotes acyltransferase of lecithin cholesterol, resulting in HDL particles maturing[17]. Studies have demonstrated that apoA-I may suppress cell and platelet death to carry out antitherosclerosis[18]. Therefore, studies have indicated the ability to ameliorate atherosclerosis and lower the risk of cardiovascular events by certain increasing serum HDL-C levels[19]. Non-HDL-C is the total of HDL-C excluding serum lipids. Many investigations have indicated that atherosclerotic cardiovascular disease has a major effect on the occurrence of incidents. A study reveals that asymptomatic cerebral artery stenosis is closely linked to non-HDL-C[20].

The study showed that the link between non-HDL-C levels and cardiovascular predicts and the risk of major cardiovascular events has increased in comparison to LDL-C objectives, with the increase in non-HDL-C levels following acute myocardial infarction[21]. It is therefore found that the amount of non-HDL-C for atherosclerotic cardiovascular disease is a major risk factor[22]. MHR is a significant indication and predictor for CAD and cardiovascular events based on the processes and function of monocytes and HDL-C in atherosclerosis.[23] Increasing MHR is connected with cardiovascular adverse events and is an automatic predictor of chronic renal illness and significant cardiovascular events, as proven by Kanbay and others. In Karataş et al.[24], the MHR has been connected with major cardiovascular adverse events and mortality, with 2.81 times the main cardiovascular adverse events, and the risk of death increases to 19.15 times in the higher group of MHRs, amongst the ST segments. Akboga et al[25] have demonstrated that MHR is linked to coronary atherosclerosis scale and SYNTAX scale in individuals with stable angina.

The higher the MHR, the better the score of SYNTAX is. Canpolat has confirmed that high levels of MHR could represent increased inflammation and oxidative stress and that MHR is closely linked to sluggish coronary flow[26]. MHR additionally has been identified as an independent predictor of recurrence following the removal of atrial fibrillation from radiofrequency[27]. The SYNTAX score for measuring the amount of CAD and severity of arterial stenosis is an anatomic integrated system based on coronal angiography. There are now fewer MHR and CAD gravity investigations and they are smaller sample studies with a single center. The results demonstrated a positive association between scores of MHR and SYNTAX. The greater the MHR, the higher the score for SYNTAX, and the more severe the coronary stenosis were discovered.

Multivariate logistic regression study has shown MHR to be an autonomous CAD risk factor. In our investigation, the CAD scale also was added to the non-HDL-C. Our findings have shown that the increase in

the score of SYNTAX is greater with the increase of non-HDL-C levels. The logistic regression study of the multivariate system has shown that non-HDL-C was also an independent coronary heart disease risk factor. The use of non-HDL-C and MHR to measure the severity of the easy, quick, economic, and less inflammatory effect of other inflammation markers, like White Blood Cells and C-Reactive Protein, in clinical practice. To conclude, the biomarker of inflammatory response that is close to the severity of CAD and artery stenosis can easily be obtained from non- HDL-CI and MHR, which can be an independent risk factor for CAD. It should be stressed in clinical practices the importance of non-HDL-C and MHR. The diagnosis and prognosis of CAD patients might be enhanced by early detection.

CONCLUSION

This study showed that non-HDL-C and CAD are significant to SYNTAX scores and that the potential for the detection of the severity of coronary atherosclerosis is easily measured, and is inexpensive. The identification of patients with CAD may be part of a cardiovascular assessment. However, large-scale and forward-looking trials remain necessary for the predictive utility of non-HDL-C and MHR, particularly in CAD patients.

Author's Contribution:

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