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Non-HDL-C in Conjunction to LDL-C is Associated with Incidence of Chronic Coronary Syndrome in Clinical Settings

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Abstract

Background: The biggest cause of death and a significant contributor to disability globally is coroner's artery disease (CAD). Chronic coronary syndrome (CCS) is a term that can be used to describe a wide variety of CAD clinical manifestations in clinical settings. Non-HDL-C is advised as a routine component of lipid analysis for risk assessment in patients with elevated plasma TGs. Conflicting results have been yielded, as Non-HDL-C is a better marker than LDL-C.

Objective: This study aims to find out the relationship of non-HDL-C levels with the incidence of CCS in conjunction with LDL-C testing in a clinical setting.

Methods: Observational analytical research with a cross-sectional design was conducted in Muhammadiyah Palembang Hospital from October to December 2019. Simple random sampling techniques were used to select 89 patients who met the study's inclusion and exclusion criteria. Non-HDL-C and LDL-C calculations based on routine lipid testing. The Chi-Square test with a significant p-value <0.005 was used for bivariate analysis.

Results: There is a statistically significant association between non-HDL-C levels and the incidence of CCS (p=0.001) and a significant association between LDL-C and CCS incidents (p=0.009).

Conclusion: Non-HDL-C provides additional benefits in identifying CAD risk factors in outpatients with CCS patients as well as LDL-C

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INTRODUCTION

The biggest cause of death and a significant contributor to disability globally is coroner's artery disease (CAD), especially in countries in Asia and the West. The majority of cases occur in low- to middle-income countries, resulting in around 7 million deaths each year and a significant economic burden[1]. A variety of clinical manifestations result from the dynamic CAD mechanism, which can be classified as acute coroner syndrome (ACS) or chronic coroner syndrome (CCS). There are six presentations of clinical symptoms often found in CCS patients in the clinical setting. Patients with established CCS are patients with suspected CAD and stable angina, patients with new onset Heart Failure, Patients after Acute coronary syndrome, patients with suspected vasospastic or microvascular, patients after revascularization, and asympto-matic patient CAD is detected at screening. In such clinical circumstances, the risk of cardiovascular events is varied[2].

The prevalence of CAD has steadily increased in developing nations due to Western food influences, which use large portions of meat and more sedentary lifestyles[3]. Hypertension, diabetes, hypercholesterolemia, and smoking are still the main risk factors for CAD; therefore, lowering blood pressure, quitting smoking, and managing metabolic risk factors are all crucial for CAD prevention in Asia[1].

Abnormalities in lipid and lipoprotein metabolism become CAD etiology and are sometimes associated with genetic risk factors[4]. Recent studies suggest that Non-HDL-C is a better predictor of CAD risk than LDL and is linked to cardiovascular events; however, this is still debatable[5,6]. The incidence of CAD and non-HDL-C were positively correlated in a study conducted by Isao Saito on the population in Japan in a group of patients who had no history of cardiovascular disease[7]. Non-HDL-C is also associated with a rise in the incidence of CAD independently compared to LDL-C, and it is suggested that non-HDL-C testing does not necessitate additional tests or expenses but has significant benefits in implementing CAD prevention strategies[8]. Besides LDL-C, non-HDL-C has been deve-loped to stratify CAD risks. In individuals with diabetes, obesity, metabolic syndrome, high triglyceride levels, or low LDL levels, the ESC/EAS 2019 guideline of dyslipidemia advises non-HDL-C screening[9].

Non-HDL-C calculations on routine cholesterol testing in clinical practices may provide extra benefits in identifying CAD risk factors without the need for additional tests or costs, so the study aimed to find out the relationship of Non-HDL-C levels with the incidence of CCS in conjunction with LDL-C testing in a clinical setting.

METHODS

Observational analytical research with a cross-sectional design was conducted in Muhammadiyah Palembang Hospital from October to December 2019. Eighty-nine patients who complied with the inclusion and exclusion criteria of the study were chosen using simple random sampling techniques. The inclusion criteria were that all patients who performed lipid profile examinations and the results were documented in medical records. Exclusion criteria included patients taking cholesterol-lowering medications before checking their lipid levels.

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CCS includes patients with suspected CAD and experience symptoms of stable angina or shortness of breath, patients with heart failure or acute Left Ventricular dysfunction due to possible CAD, post-ACS patients less than one year with stable symptoms, patients with angina symptoms suspected due to vasospasm or microvascular disease, asymptomatic patients but detected CAD during screening.

Primary data is collected using questionnaires, while secondary data, including lipid testing and patient diagnoses, is obtained from medical records. Non-HDL-C levels are calculated by deducting total cholesterol values from LDL values. Non-HDL-C is divided into ≥130 mg/dL and <130 mg/dL. LDL values are divided into ≥130 mg/dL and <130mg/dL. Data analysis is performed using SPSS version 16. The Chi-Square test with a significant p-value <0.005 was used for bivariate analysis. Ethics permission with license number 19/EC/KBHKI/FK-UMP/X/2019 from the Faculty of Medicine, Universitas Muhammadiyah Palembang.

RESULTS

In this study, 89 outpatients had their lipid levels checked, with 25% of patients having a CCS diagnosis. According to Table 1, the most common age group among the study subjects is 45-64 years old, which accounts for 58 patients (65.2%). The majority of the study participants were female (64 %). It was predominantly male (52.2 %) in the group with CCS, while it was primarily female in the non-CCS group (69.7 %).

Table 2 showed that the average level of Non-HDL-C in CCS patients (186.48mg/dl) was higher than in non-CCS patients (145.99 mg/dl) as well as LDL-C levels in CCS patients (153,41mg/dl) was higher than in non-CCS patient (123,93). The Chi-Square test in Tables 3 and Tables 4 was used to perform bivariate analysis, and thus, the results were that there is a statistically significant association between non-HDL-C levels and the incidence of CCS (p=0,001), as well as a significant association between LDL-C and CCS incidents (p=0,009).

Table 1. Baseline Characteristics Based on Age and Gender

Characteristics		Group of Patients				Total	
		CCS		Non-CCS			
		n	%	n	%	n	%
Age (y.o)	25-44	2	8.7	6	9.1	8	9.0
	45-64	17	73.9	41	62.1	58	65.2
	≥65	4	17.4	19	28.8	23	25.8
Sex	Male	12	52.2	20	30.3	32	36.0
	Female	11	47.8	46	69.7	57	64.0
	Total	23	100.0	66	100.0	89	100.0

Table 2. Lipid Profile in CCS and Non-CCS Patients

Lipid profile (mg/dL)	Group of Patients	
	CCS	Non-CCS
Total Cholesterol	232.27	202.12
LDL-C	153.41	123.93
Non-HDL-C	186.48	145.99

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Table 3. Relationship of LDL-C levels with CCS incidence

LDL-C	Group of Patients				Total	p
	CCS		Non-CCS			
	n	%	n	%		
≥130 mg/dL	17	73.9	28	42.4	45	0.009
< 130 mg/dL	6	26.1	38	57.6	44	
Total	23	100.0	66	100.0	89	

Table 4. Relationship of Non-HDL-C levels with CCS incidence

Non-HDL-C	Group of Patients				Total	p
	CCS		Non-CCS			
	n	%	n	%		
≥130 mg/dL	22	95.7	40	60.6	62	0.001
< 130 mg/dL	1	4.3	26	39.4	27	
Total	23	100.0	66	100.0	89	

DISCUSSION

This study showed that the incidence of CCS in the clinical setting was 25%. These results align with a study by Blumenthal (2021), where the prevalence of angina in primary services is 21.2%[10]. The most incidence of CAD in this study occurred in the age range of 45-64 years. The frequency of CAD increases with age. This result follows Gado's study, where 40% of CAD patients are 40-59 years old. Age-related structural alterations include enhanced scarring and stiffness of the valves, increased myocyte hypertrophy, increased reduction of myocyte densities, and decreased cells in the sinoatrial node. Among the functional changes are sympathetic drive, systolic and diastolic function, and modifications to the maximum heart rate[11].

The findings of this study also revealed that men predominated in the CCS group, whereas women predominated in the non-CCS group. CAD epidemiology research reveals that by the age of 60, men have a higher incidence of CAD than women, and women are more sensitive to CAD than men over 60 years. This result suggests that sex is a biological factor in the development of coronary artery disease[11].

The results showed that the average level of Non-HDL-C in CCS patients was higher than in non-CCS patients, and LDL levels in CCS patients were higher than in non-CCS patients. Dyslipidemia, along with obesity and hypertension, is still a frequently encountered risk factor and requires a prevention program[12,13]. In a study by James (2013), dyslipidemia was the second-most risk factor in patients with a diagnosis of CAD, at 71%, after diabetes mellitus[14]. Plasma cholesterol levels and atherosclerosis have an undeniable causality relationship. Inducing inflammation and the deposit of oxidized LDL in the endothelium of the artery wall, which promotes monocyte mobilization and foam cell generation, is one of the essential roles provided by the endothelium in atherogenesis. The atherogenic condition is related to the high intensity of LDL in the subendothelial substrate. When there is a condition with high LDL combined with low HDL levels are low, the conditions for this event are crucial. After being suffi-

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ciently oxidized by various factors, macrophages take up LDL to form foam cells[15].

There is a statistically significant association between non-HDL-C levels and the incidence of CCS and a significant association between LDL-C and CCS incidents. In a cohort study with 10-year risk follow-up, CVD mortality was independently related to LDL-C and non–HDL-C ≥160 mg/dL, whereas changes in dyslipidemia management[16].

The study conducted by Manocha showed that in a young, healthy Indian population, non-HDL is a more robust predictive predictor of sdLDL particle size compared to LDL and apoB/A1 ratio and should be used for the best evaluation of dyslipidemias and CAD risk[18]. Non-HDL-C concentration measurements may be especially relevant in people with high triglyceride levels since they represent those seen in triglyceride-rich lipoproteins like lipoprotein remnants and VLDL-C. It has been proposed that non-HDL-C concentration, calculated as the total of all apolipoprotein (apo)-B-containing atherogenic lipoprotein populations, predicts CVD risk as well as or better than LDL-C concentration[17].

The most common types of dyslipidemia reported in Asemu (2022) investigations are hypertriglyceridemia and low HDL-C. Hyperlipidemia has also been linked to an increased risk of premature atherosclerosis[18] and premature myocardial infarction[19,20]. Chylomicron and chylomicron residues are too big to infiltrate the intima; however, VLDL can permeate the artery intima and contribute to the development of atherosclerosis. Furthermore, apolipoprotein E on the surface of triglyceride-rich lipoproteins is recognized by macrophages, which triggers lipoprotein ingestion, negating the need for oxidative changes to be absorbed into macrophages. Therefore, the theoretical hypothesis that triglyceride-rich lipoproteins cause atherosclerosis exists. Furthermore, triglycerides are substantially linked to the risk of Atherosclerosis Cardiovascular disease (ASCVD) in familial hypercholesterolemia (FH) patients, which is primarily driven by LDL receptor malfunction and increases the risk of ASCVD[21].

The results of this study show that non-HDL-C calculations based on routine lipid testing data provide additional benefits in identifying CAD risk factors in outpatients with CCS patient profiles that are commonly seen in clinical practices, as shown in this study. The limitations of this study are due to the limited number of CSS patients and the fact that no analysis of lipid profiles in CCS patient subgroups has been conducted.

CONCLUSION

LDL-C and CCS events are significantly correlated with each other, as well as non-HDL-C levels and CCS. Further, non-HDL-C can be advised as a routine component of lipid analysis for risk assessment in patients with elevated plasma TGs.

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