NON HIGH DENSITY LIPOPROTEIN CHOLESTEROL -BASED MINI LIPID PROFILE IN PATIENT WITH ACUTE CORONARY SYNDROME

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Introduction:

Over the last decade, cardiovascular disease (CVD), which include coronary heart disease (CHD) and stroke, has become the single largest cause of death all over the world. In 2004, CVD caused an estimated 17 million deaths[1]. By 2030, WHO predicts that worldwide, CVD will be responsible for 24.2 million deaths. [3] Of these, 14.9% of deaths in men and 13.1% of deaths in women will be caused by CHD.

Patients with coronary heart disease can be categorized into two main groups: patients with chronic coronary artery disease (CAD), who most commonly present with stable angina, and patients with acute coronary syndromes (ACS).

Atherosclerosis is recognized as a leading cause of CAD. It is a disease of the large and medium-sized arteries, characterized by a gradual build up of fatty plaques within the wall of the arteries. . Elevated serum cholesterol level, among others, is recognized as an important risk factor for development of atherosclerotic ACS.

Cholesterol and triglycerides (TG) are hydrophobic, thus they are carried in the blood in lipoproteins. Chylomicron particles are the largest and most TG-rich lipoproteins. These are the major transporters of dietary fat from the intestines to peripheral tissues. The liver takes up chylomicron remnants after been processed by lipoprotein lipase in peripheral tissues (e.g., adipose and muscle). VLDL particles are also TG-rich and are secreted by the liver for transporting TG and cholesterol to the peripheral tissues. As VLDL particles is deprived from cholesterol , they become IDL and ultimately LDL particles. LDL particles are taken up by the liver and their cholesterol content is recycled for synthesis of new lipoproteins or other hepatic products such as bile acids. Nascent HDL particles are secreted by the liver and intestine and participate in reverse cholesterol transport from the peripheral tissues back to the liver. Higher circulating levels of HDL are associated with lower CVD risk, whereas higher circulating levels of all of the other lipoproteins are associated with increased risk.

In clinical practice, lipoprotein particles are not usually measured *per se*. Instead, lipoprotein cholesterol (total, LDL, HDL) and the total circulating TG concentration are typically reported. Guidelines for cholesterol management have generally identified LDL-c as the primary target for therapy.[11] The problem is that LDL-cholesterol does not correlate well with the actual atherogenicity of LDL particles. Small sized and dense LDL particles are much more atherogenic than buoyant one. They are predominant in patients with ACS but unfortunately , due to their small size, they will give a misleadingly low serum LDL-c levels. In addition, LDL-c is calculated, most of the time, using a formula that depends on other variables thus increasing the cumulative error rate. Furthermore, LDL-c calculation made two assumptions that the patient

was fasting (10-12) hours prior to the test and presence of a constant cholesterol to triglyceride ratio.

In this study we investigate the role of mini lipid profile that contains only total cholesterol and HDL-c from whom non-HDL-c can be calculated as a more representative and cost effective alternative to LDL-c based conventional lipid profile.

Materials and Methods:

This is a hospital-based case control study. It was conducted through April to June 2015 in Alshaab teaching hospital, Khartoum, Sudan. The study group consists of 44 patients with 44 healthy controls. Patients were those been diagnosed as having Acute Coronary Syndrome (ACS) and admitted in the Coronary Care Unit (CCU).

Ethical clearance was obtained from Federal Ministry of Health and from Research Department in Alshaab teaching hospital. Also, written consent was obtained from each patient.

Blood sampling procedure:

After an overnight fasting, blood was drawn by venipuncture into heparin containing vacu-tainer tubes. Plasma was isolated thereafter for determination of LDL-C, Total cholesterol, HDL-C, Triglyceride and APO-B levels.

Analytical methods :

Total plasma cholesterol, triglycerides(TG) and HDL-cholesterol(HDL-c) levels were determined with Biosystem S.A. Costa Brava, 30. 08030 Barcelona(Spain) enzymatic kits.

LDL-c was estimated using Friedewald's equation. Also nonHDL-c was calculated by subtracting HDL-c from total cholesterol.

Statistical methods :

Independent samples T-test was used to analyze the differences in lipoproteins cholesterol between patients and controls groups. Pearson's correlation coefficient was computed to determine the correlation between values. All values were presented as mean±SD. Statistical analysis was performed with procedures available in SPSS/PC software(Statistical Package For Social Sciences) from IBM SPSS Statistics version 22.

Results:

Figure 1 shows the gender distributions of the study population with 75% of patients are males.

Figure 1 Gender distribution

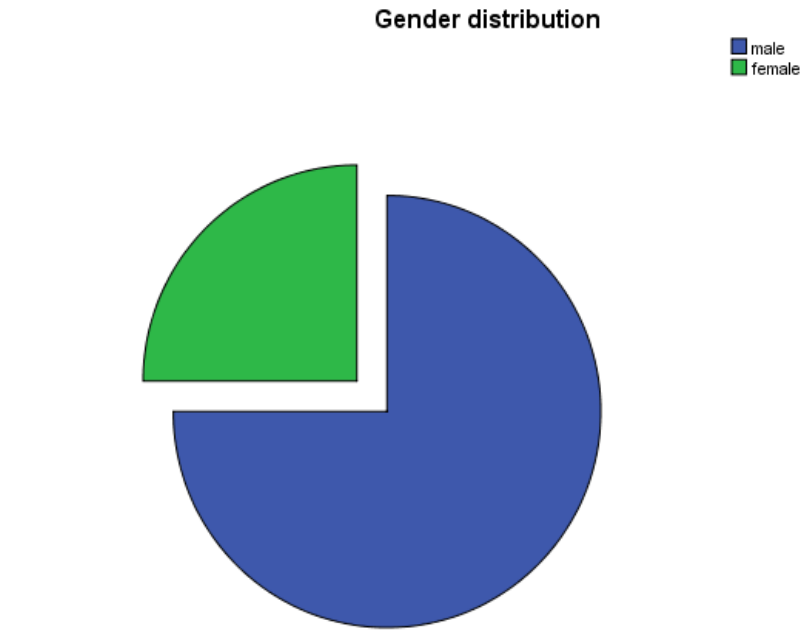

Table 1 shows the general clinical characteristics of the study population including the presence of chronic illnesses like diabetes and hypertension and whether the acute coronary syndrome is STEMI or NSTE-ACS.

Table 1 general clinical characteristics of the study group

Characteristic	No. of patients	Percentage
Diabetes	23	52.3
Hypertension	13	29.5
Diabetes and hypertension	8	18.1
STEMI	34	77.3
NSTE-ACS	10	22.7

Table 2 indicates a significant increase in HDL-C, LDL-C and NHDL-C in the study group relative to the control group.

Table 2 Plasma levels of HDL-C, NHDL-C and LDL-C

	variable	N	Mean	Std. Deviation	P value
HDLcholestrollevel	case	44	33.9493	14.59404	
	control	44	52.8761	14.60059	0.00
nonHDL	case	44	158.2780	83.93326	
	control	44	126.8198	34.50754	0.025
LDL	case	44	149.3875	90.84606	
	control	44	98.1907	30.82017	0.001

Table 3 identify a strong significant correlation between NHDL-C and LDL-C among the study group. (*p* value<0.01, r^2=0.57) Similar significant correlation exists between NHDL-C and APO-B (p=0.04, r^2=0.13) but not between LDL-C and APO-B(p=0.125, r^2=0.058)

Table 3 Correlation between NHDL-C and LDL-C

		LDL	nonHDL
LDL	Pearson Correlation	1	.757**
	Sig. (2-tailed)		.000
	N	44	44
nonHDL	Pearson Correlation	.757**	1
	Sig. (2-tailed)	.000	
	N	44	44

Discussion:

This study revealed that the level of N-HDL is significantly higher in the patient group compared to the controls. This result is very justifiable based on the wide range of atherogenic lipoproteins presented by N-HDL. It encompasses not only LDL-C but also cholesterol on other atherogenic particles like VLDL and IDL. Therefore it can give a more holistic picture about the lipid status of the patient. N-HDL is highly correlated with LDL-C levels. That is to show it is not inferior to LDL-C as both of them are significantly higher in the patient group and they are highly correlated with each other. On the other hand we can

see that N-HDL have the advantage of been significantly correlated with APO-B levels which is not the case with LDL-C. Therefore, although N-HDL is a measure of lipoprotein cholesterol content, it can be a good surrogate to lipoproteins particles number. It can be of great importance since the bulk of atherogenic potential resides in the lipoprotein part rather than the lipid cargo. Moreover, N-HDL measurement adds no cost to the patient as it is easily calculated from the lipid profile results. It can be reported as part of lipid panel or can be calculated by doctor or even the paramedical. Also as it depends only on total cholesterol and HDL-C levels, the cumulative error rate will be lesser than using Friedewald's equation which is used to calculate LDL-C based on TC, TG and HDL-C. Furthermore, it doesn't involve triglyceride measurement and accordingly fasting of the patient is no longer needed. The last point is of great clinical significance since most of patient especially diabetics and CCU-admitted patients find problem with fasting. In addition, N-HDL has an already well established targets levels in some clinical guidelines.

One can argue that APO-B is straight forward representative of lipoprotein particles and thus atherogenicity. But the problem with APO-B level is that it has no established clinical cutoffs yet and it is still not widely implemented. Another issue, in less developed countries like Sudan, is the cost effectiveness as APO-B will add new burden to the patient and to the already overwhelmed health budget.

Conclusion:

This study highlights the pivotal role of N-HDL as a reasonably good representative marker of hyperlipidemia that is easy to implement, interpret and cost effective.

Also we would like to recommend a mini lipid profile that contains only total cholesterol, HDL-C and the calculated N-HDL as an alternative to the conventional lipid profile.