The Pattern of Dyslipidemia among Patients with Acute Coronary Syndrome at Sohag University Hospital

Ali Altaher[a]*, Esraa Mustafa[a], Lofty Hamed Abodahab[a], Hamdy Saad Mohamed[a]

[a]Department of Internal Medicine, Faculty of Medicine, Sohag University, Sohag, Egypt.

Abstract

Background: One of the most significant modifiable risk factors for coronary artery disease (CAD) is dyslipidemia. Acute coronary syndromes (ACS) were shown to be a key contributing factor to patients being admitted to the Coronary Care Unit (CCU) at Sohag University Hospital.
Objectives: To analyze lipid profile in patients with ACS who presents at Sohag university hospital, and its clinical and complications pattern.
Patiets and methods: This study involved 100 patients above 18 years old diagnosed with ACS. Patients were classified into 3 groups; ST-elevation MI (STEMI), non-ST-elevation MI (NSTEMI) and unstable angina (UA) group. All participants were subjected to history taking, clinical assessment and measuring complete lipid profile values.
Results: STEMI group has higher significant total cholesterol (TC), low-density lipoprotein cholesterol LDL-C ($P < 0.001$), Triglycerides (TG) ($P = 0.022$), TC/HDL ($P = 0.027$) and TG/HDL levels ($P = 0.001$) and lower significant high-density lipoprotein cholesterol (HDL-C) ($p=0.006$) than other groups. There was a significant correlation between age groups and TC ($P<0.001$), LDL-c ($P=0.009$), very low-density lipoprotein cholesterol (VLDL-c) ($P=0.016$), HDL ($P=0.001$), Triglycerides ($P=0.008$), TC/HDL ($P<0.001$) and TG/HDL ($P=0.040$). Furthermore, there was no significant correlation between gender and TC, LDL-c, VLDL, HDL, TG, TC/HDL and TG/HDL ($P>0.05$).
Conclusion: Patients with ACS have a significant prevalence of dyslipidemia as a risk factor. These individuals are more likely to have low HDL than high LDL values; nevertheless, they are more likely to have high TG values than low HDL values.

Keywords: Acute Coronary Syndrome; Dyslipidemia; Coronary artery disease.
DOI: **10.21608/svuijm.2022.139532.1315**
*Correspondence: dr.ali.altaher30@gmail.com
Received: 24 May,2022.
Revised: 29 June, 2022.
Accepted: 3 July, 2022.
Cite this article as: **Ali Altaher, Esraa Mustafa, Lofty Hamed Abodahab, Hamdy Saad Mohamed**. (2022). The Pattern of Dyslipidemia among Patients with Acute Coronary Syndrome at Sohag University Hospital. SVU-International Journal of Medical Sciences. Vol.5, Issue 2, pp: 374-384.

Introduction

Metabolic syndrome (Mets) is defined as a cluster of metabolic abnormalities characterized by abdominal obesity, hypertension, dyslipidemia, abnormal glucose metabolism, or previously diagnosed type 2 diabetes (Alberti et al., 2009). Cardiometabolic abnormalities that are associated with the Mets can increase the risk of cardiovascular disease and type 2 diabetes mellitus (**Alberti et al., 2005**)

Coronary artery disease (CAD) is the leading cause of mortality in both genders. At least one main risk factor is present in the vast majority of individuals with Acute Coronary Syndrome (ACS) (**Tsao et al., 2002**). In comparison to nonsmokers, male smokers had a risk of CAD that was four and three times more than that of female smokers (**Arafa et al., 2021**). ACS was shown to be a key contributing factor to patients being admitted to the Coronary Care Unit (CCU) at Sohag University Hospital.

Dyslipidemia has been recognized as one of the most significant risk factors for CAD. Primary and secondary prevention of CAD in both sexes may be greatly improved by treating dyslipidemia (**Parvin et al., 2019**)

There is a strong association between dyslipidemia, including an increase in total cholesterol (TC), low-density lipoprotein (LDL-C), triglycerides (TG), very low-density lipoprotein cholesterol (VLDL-C), and a reduction in high-density lipoprotein cholesterol (HDL-C) with the occurrence of coronary heart diseases (CHD) and ischemic stroke (**Lee et al., 2017**). Dyslipidemia is the leading risk factor for mortality in the hospital (**Miyachi et al., 2016**).

The goal of this study was to examine the lipid profile of patients with ACS who presented at Sohag University Hospital, as well as the clinical and complication patterns.

Patients and methods

It is a cross-sectional study conducted in the CCU of the Internal Medicine Department at Sohag University Hospital during the period from January 2021 to January 2022. Informed consent was obtained from all patients, ethical committee of Sohag University approved this study.

The current study involved 100 patients above 18 years old diagnosed with ACS. Patients with chronic coronary syndrome (CCS) and familial dyslipidemia were excluded.

All participants were subjected to history taking, clinical assessment, Laboratory investigation (TC, HDL-C, LDL-C, and TG) and12 lead electrocardiogram (ECG). Body mass index is calculated by a person's weight in

kilograms divided by the square of height in meters.

According to the NCEP ATP III criteria (2002)' dyslipidemia was defined as the presence of any one of the following fasting lipid profile levels within 24 hours of the occurrence: TC ≥ 200 mg/dl, TG ≥ 150 mg/dl, LDL ≥ 130 mg/dl and HDL ≤40 mg/dl, or those currently on therapy for dyslipidemia, should be evaluated.

Following **Braunwald & Morrow, 2013** ACS cases were divided into 3 categories considering clinical manifestations, electrocardiogram (ECG), and cardiac troponin levels results:

ST-elevation ACS (STE-ACS): patients presented with acute chest pain, persistent (>20 minutes) ST-segment elevation, and elevation of troponin levels [ST-elevation MI (STEMI)].

Non-ST-elevation ACS (NSTE-ACS): patients presented with acute chest pain but without persistent ST-segment elevation. The ECG shows persistent or transient ST-segment depression or T-wave inversion, flat T waves, pseudo-normalization of T waves, or no ECG changes at presentation. NSTE-ACS is further classified into; unstable angina (UA): with normal troponin levels and non-ST-elevation MI (NSTEMI): with an elevation of troponin levels

Statistical analysis

Statistical analyses had been performed using SPSS software for Windows, version 21.0. Data are given as mean ± standard deviation and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. We used the Student t-test, Chi-Square test, Kruskal–Wallis test, and Mann Whitney test to compare the different groups. Values of $p < 0.05$ were considered statistically significant.

Results

A total of 100 patients with ACS enrolled in this work divided into 2 groups; STEMI (N=64) and NSTE-ACS group (N=36) that included two subdivisions; unstable angina (N=22) and NSTEMI (N=14). Their mean age was 58.76± 11.35 years (ranged from 29 to 90 years). The most common age group represented was the age group ≥ 60 years (49%). There were 73 males and 27 females with a male: female ratio was 2.70:1. Fifty-four patients were eating unhealthy meals,11 patients were obese and 43% of patients were smokers. There was no statistically significant difference among groups considering age and gender ($P > 0.05$), (**Table 1**).

In a comparison of risk factors for CAD among the three groups, there was a significant increase in BMI in the STEMI group in comparison with the NSTEMI &

Table 1. Socio-demographic characters of the studied groups

Variables		STEMI group (N=64)		NSTEMI group (N=22)		UA group (N=14)		Test value	P-value
		No.	%	No.	%	No.	%		
Age (years)	Mean± SD	58.13±10.55		52.91±11.0		55.14±14.14		T= 0.625	0.436
	Median	59.0		63.0		52.5			
	Range	29.0- 82.0		42.0- 85.0		38.0- 90.0			
Age groups	25-39 years	2	3.1%	0	0.0%	1	7.1%	X^2= 5.16	0.524
	40- 49 years	12	18.8%	3	13.6%	4	28.6%		
	50- 59 years	19	29.7%	5	22.7%	5	35.7%		
	≥ 60 years	31	48.4%	14	63.6%	4	28.6%		
Gender	Male	48	75.0%	18	81.8%	7	50.0%	X^2= 4.76	0.093
	Female	16	25.0%	4	18.2%	7	50.0%		

P value< 0.05 is significant, SD: Standard deviation, T= Student T test, X_2= Chi- Square test

the group of unstable angina (p=0.003) while there was statistically significant difference among groups regarding dietary habits, smoking, hypertension and DM as shown in (**Table.2**).

Table 2. Comparison of risk factors in the studied groups

Variables		STEMI group (N=64)		NSTEMI group (N=22)		UA group (N=14)		Test value	P-value
		No.	%	No.	%	No.	%	No.	%
BMI (Kg/m^2)	Normal	36	56.3%	5	22.7%	5	35.7%	X^2= 16.37	**0.003**
	Overweight	20	31.3%	17	77.3%	6	42.9%		
	Obese	8	12.5%	0	0.0%	3	21.4%		
Dietary habits	Healthy meals	27	42.2%	10	45.5%	9	64.3%	X^2= 2.26	0.323
	unhealthy meals	37	57.8%	12	54.5%	5	35.7%		
Smoking	Non smoker	25	39.1%	6	27.3%	8	57.1%	X^2= 8.61	0.072
	Smoker	31	48.4%	8	36.4%	4	28.6%		
	Ex-smoker	8	12.5%	8	36.4%	2	14.3%		
Hypertension (HTN)	Not HTN	27	42.2%	11	50.0%	8	57.1%	X^2= 5.40	0.248
	Controlled	8	12.5%	5	22.7%	0	0.0%		
	Uncontrolled	29	45.3%	6	27.3%	6	42.9%		
Diabetes mellitus (DM)	Not diabetic	25	39.1%	10	45.5%	7	50.0%	X^2= 1.78	0.776
	Controlled	9	14.1%	3	13.6%	3	21.4%		
	Uncontrolled	30	46.9%	9	40.9%	4	28.6%		

Bold = significant, P value< 0.05 is significant, SD: Standard deviation, X_2= Chi- Square test

Regarding lipid profile, The STEMI group has a statistically significant higher TC, LDL-C, TG, TC/HDL, and TG/HDL levels ($p < 0.001$, 0.022, 0.027, and 0.001, respectively) and statistically significant lower HDL-C (p=0.006) than other groups. However, there was no significant difference in VLDL-c through comparing the three groups (**Table 3 & Fig.1**). There was a significant correlation between age groups and TC (P<0.001), LDL-c (P=0.009), VLDL (P=0.016), HDL (P=0.001), TG (P=0.008), TC/HDL (P<0.001) and TG/HDL (P=0.040). However, there was insignificant correlation between gender and TC, LDL-c, VLDL, HDL, Triglycerides, TC/HDL and TG/HDL (P>0.05).

Table 3. Comparison of lipid profiles in the studied groups

Variables	STEMI group (N=64)			NSTEMI group (N=22)			UA group (N=14)			Test value	P-value
	Mean	± SD	Median	Mean	± SD	Median	Mean	± SD	Median		
Total cholesterol (mg/dl)	215.80	69.42	210.00	261.09	42.50	250.50	182.64	48.38	164.50	F= 8.81	**<0.001**
LDL-C (mg/dl)	140.77	44.47	139.50	121.95	39.84	109.50	104.50	39.49	101.00	KW = 8.96	**0.011**
VLDL-C (mg/dl)	40.32	15.67	38.00	33.09	15.79	32.00	35.71	18.86	30.00	KW = 4.704	0.095
HDL-C (mg/dl)	31.72	9.75	32.00	38.77	7.39	39.50	35.29	8.63	36.00	KW = 10.08	**0.006**
Triglycerides (mg/dl)	214.38	77.31	197.50	165.45	78.97	160.00	178.57	94.31	150.00	KW = 7.66	**0.022**
TC/HDL	8.02	5.25	6.62	5.25	1.86	5.09	5.51	1.90	6.11	KW = 7.25	**0.027**
TG/HDL	7.89	5.18	6.01	4.49	2.50	3.84	5.55	3.71	4.70	KW = 15.09	**0.001**

Bold = significant**,** P value< 0.05 is significant, SD: Standard deviation,KW= Kruskal–Wallis test

Regarding complications, The STEMI group has a higher but non statistically significant complications rate (26.6%) than the NSTEMI group (13.7%) and the UA group (21.4%) in the form of heart failure, pulmonary edema, and cerebrovascular stroke (**Table 4**).

When studying the relation between different age groups and gender differences with lipid parameters we found that there was a statistically significant relation between age groups and TC (P<0.001), LDL-c (P=0.009), VLDL (P=0.016), HDL (P=0.001), Triglycerides (P=0.008), TC/HDL (P<0.001) and TG/HDL (P=0.040)

(**Table 5**). However, the relation between gender and TC, LDL-c, VLDL, HDL, Triglycerides, TC/HDL and TG/HDL (P>0.05) was non-significant (**Table 6**).

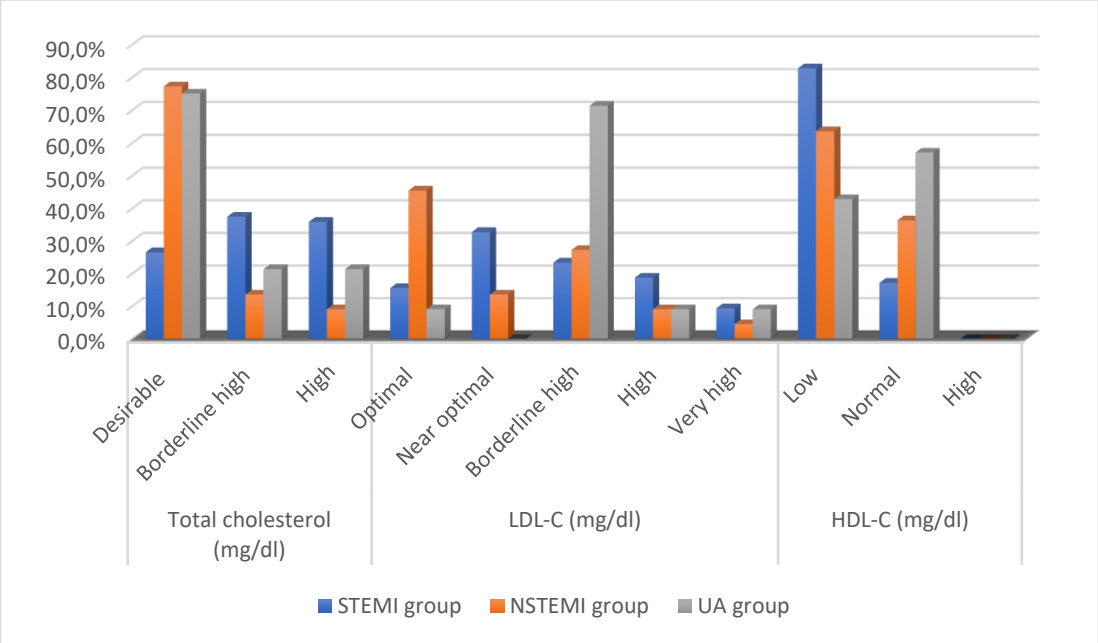

Fig.1. Comparison between studied groups regarding lipid profile

Table 4. Comparison of clinical history in the studied groups

Complications	STEMI group (N=64)		NSTEMI group (N=22)		UA group (N=14)		Test value	P-value
	No.	%	No.	%	No.	%		
No complications	47	73.4%	19	86.4%	11	78.6%	X^2= 3.87	0.694
Heart failure	10	15.6%	2	9.1%	3	21.4%		
Pulmonary edema	4	6.3%	1	4.5%	0	0.0%		
Cerebrovascular stroke	3	4.7%	0	0.0%	0	0.0%		

P value< 0.05 is significant, SD: Standard deviation, X_2= Chi- Square test

Table 5. Associations between age groups and lipid profile

Variables	Age groups								Test value	P-value
	25-39 years		40- 49 years		50- 59 years		≥ 60 years			
	Mean	± SD	Mean	± SD	Mean	± SD	Mean	± SD		
Total cholesterol (mg/dl)	120.00	7.00	171.84	39.57	255.31	42.17	199.71	64.88	T= 2.02	**<0.001**
LDL-C (mg/dl)	75.00	25.71	119.68	22.11	148.21	43.01	131.76	44.50	^{Z}MWU = 2.84	**0.009**
VLDL-C (mg/dl)	54.67	11.93	47.78	18.40	40.38	19.01	36.31	15.28	^{Z}MWU = 2.14	**0.016**
HDL-C (mg/dl)	45.33	7.23	34.84	6.34	28.10	6.73	35.14	10.34	^{Z}MWU = 2.95	**0.001**
Triglycerides (mg/dl)	180.00	25.00	275.79	103.87	186.97	65.97	209.39	75.70	^{Z}MWU = 2.96	**0.008**
TC/HDL	2.71	.63	5.14	1.65	9.58	2.77	6.72	4.69	^{Z}MW= 2.64	**<0.001**
TG/HDL	4.10	1.27	8.23	4.26	7.04	3.10	6.90	4.43	^{Z}MWU = 3.78	**0.040**

P value< 0.05 is significant, SD: Standard deviation, ^{Z}MWU = Z value of Mann Whitney U test, T=Student t-test

Table 6. Association between lipid profile with gender

Variables	Gender				Test value	P-value
	Male (N=73)		Female (N=27)			
	Mean	± SD	Mean	± SD		
Total cholesterol (mg/dl)	209.36	68.07	198.11	48.76	T= 0.786	0.434
LDL-C (mg/dl)	131.30	46.81	132.22	38.29	^{Z}MWU = 0.365	0.715
VLDL-C (mg/dl)	38.10	14.98	37.96	19.87	^{Z}MWU = 0.569	0.569
HDL-C (mg/dl)	33.81	9.70	33.67	9.15	^{Z}MWU = 0.086	0.932
Triglycerides (mg/dl)	192.88	67.32	202.96	113.63	^{Z}MWU = 0.303	0.762
TC/HDL	7.14	4.48	6.84	4.70	^{Z}MWU = 0.144	0.886
TG/HDL	6.66	4.10	7.24	6.19	^{Z}MWU = 0.404	0.686

P value< 0.05 is significant, SD: Standard deviation, ^{Z}MWU = Z value of Mann-Whitney U test, T=Student t-test

Discussion

In current society, dyslipidemia is a risk factor that can be controlled. It goes unnoticed until the initial presentation with ACS when it is discovered. Lipid profile and clinical and pathological patterns in individuals with (ACS) were the primary goals of this work.

On comparison of risk factors for CAD between the three groups, there was a significant increase in BMI comparison (p=0.003) while there was insignificant differences as regards dietary habits, smoking, hypertension, and DM. In agreement with our results **Akbulut et al. (2020**) revealed that the STEMI, NSTEMI and UA groups didn't differ significantly regarding Hypertension, DM and smoking rates (P > 0.05). STEMI patients had significantly greater smoking rates than the controls. while in contrast to our results they found that there was no significant difference among groups regarding BMI. Also, a study by **Rahman et al.(2021)** reported that the STEMI, NSTEMI and UA groups didn't differ significantly regarding DM and family history of premature CAD (P > 0.05). However, BMI was significantly different among groups. While in contrast to our results they found that patients with UA had a greater rate of hypertension and dyslipidemia than those with NSTEMI/STEMI.

Regarding lipid profile, The STEMI group has significantly higher TC, LDL-C, TG, TC/HDL, and TG/HDL levels (p < 0.001, 0.022, 0.027, and 0.001 respectively) and significantly lower HDL-C (p=0.006) than other groups. Similarly, **Parvin et al.(2019)** reported that TC, LDL, and TG serum levels were statistically higher in ACS patients than in controls, although HDL values were considerably lower in ACS patients than in controls. Patients with ACS had TC/HDL>5 and TG/HDL>4 levels that were significantly greater than those in the control. The TC/HDL and TG/HDL ratios were shown to be independent risk factors for ACS using stepwise regression of lipid profile. The same findings were observed by **Abdelaziz and Fawzy(2014)**.

In addition, **Akbulut et al.(2020)** reported that TC and LDL levels were similar in ACS subgroups, they were higher compared to the controls. The lowest HDL values were observed in the NSTEMI group, and there was a significant difference from the controls. Triglyceride levels were similar among ACS subgroups and the controls. Also, the study by **Charach et al.(2021)** reported that HDL had the highest correlations with Gensini score (to estimate the severity of STEMI, NSTEMI, &unstable angina) in all groups (R=-0.38, P<.001). while non significantly correlated with TC, LDL, and TG.

The current study also revealed that there was significant relation between age groups and TC (P<0.001), LDL-c (P=0.009), VLDL (P=0.016), HDL (P=0.001), Triglycerides (P=0.008), TC/HDL (P<0.001) and TG/HDL (P=0.040). However, the relation between gender and TC, LDL-c, VLDL, HDL, Triglycerides, TC/HDL, and TG/HDL (P>0.05) was non-significant. The same findings were reported by **Rahman et al.(2021)**. Furthermore, **Qi et al. (2015)** reported that women's age was linked to a higher risk of dyslipidemia, whereas men's age was found to be inversely related.

Finally, The STEMI group has a higher nonsignificant complications rate (26.6%) in the form of heart failure, pulmonary edema, and cerebrovascular stroke. To our knowledge, none of the related studies compared the rate of complications among STEMI, NSTEMI, and UA groups.

Our study has some limitations. First, there are just a few patients in this hospital-based study. Additionally, the lipid profile was taken during the first 24 hours following the incident, thus baseline levels were unavailable for comparison. The apolipoprotein (Apo B and Apo AI) measurements, which are significantly linked to an increased risk of MI, were also not included in this study.

Conclusion

Patients with ACS have a significant prevalence of dyslipidemia as a risk factor. These individuals are more likely to have low HDL than high LDL values; nevertheless, they are more likely to have high TG values than low HDL values. We also found that dyslipidemia was significantly correlated with age and non-significantly with sex.

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