Pattern and Prevalence of Dyslipidemia among Patients with Acute Coronary Syndrome Admitted in a Tertiary Level Hospital

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Abstract:

Background: The leading cause of mortality in men and women worldwide is coronary artery disease (CAD). For hospitalization in our country, acute coronary syndrome (ACS) is a major reason. Dyslipidemia is found one of the most important modifiable risk factors for CAD.

Aim: The aim of the study was to determine the pattern and prevalence of dyslipidemia among patients with ACS admitted in National Institute of Cardiovascular Diseases (NICVD), Dhaka.

Subjects and methods: One thousand (1000) patients with ACS were included and classified according to clinical presentation, the findings on the admission electrocardiogram (ECG) and the results of serial cardiac troponin levels, into myocardial infarction(MI), either ST-elevation or non ST- elevation MI, and unstable angina(UA) subgroups. In the other group 500 healthy subjects were included as controls. All subjects were subjected determination lipid profile. ECG and Troponin-I were done for diagnosis and follow up of the patients.

Results: In patients with ACS, high levels of TC (>200 mg/dl) were found in 60.67%,high levels of LDL (> 130 mg/dl) were found in 58%, high levels of TG (>150 mg/dl) were found in 63.33%, however, low levels of HDL (< 40 mg/dl) were found in 66%. There was a statistically significant elevation in TC, LDL, TG serum levels in patients with ACS compared to control subjects (p<0.05) while the HDL was significantly low in ACS patient compared to control subjects (p <0.05). TC/HDL > 5 and TG/HDL> 4 were significantly higher in patients with ACS than controls. There was no significant difference between MI and UA patients regarding all lipid profile parameters. TC, LDL, TG were significantly higher in males than in females while HDL was significantly higher in females compared to males. Also TC/HDL and TG/HDL ratios were significantly higher in males compared to females. All lipid components were significantly more prevalent in males than in females except TG where there was no significant difference between males and females. Stepwise regression analysis of lipid parameters revealed that TC/HDL and TG/HDL ratios were independent risk factors for ACS.

Conclusion: Dyslipidemia is one the major risk factors which is widely prevalent in patients with ACS and is more prevalent in males than in females. We recommend paying more attention to serum lipids and other modifiable risk factors for prevention of ACS and more studies about them as risk factors of atherosclerosis and its impact on other systems is advised.

Key words: Dyslipidemia, Acute Coronary Syndrome (ACS)

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Introduction:

Worldwide, coronary artery disease (CAD) is the most important cause of death in men and women[1]. Despite of declines in developed countries, both mortality by CAD and the prevalence of risk factors of CAD is continued to increase rapidly in developing countries[2].The risk factors of CAD used for the categorization and setting of management targets have been established on the basis of evidence accumulated over a long time[3]. Hypertension, Diabetes Mellitus and cigarette smoking have been reported to be risk factors of CAD and stroke through many studies[4-6] respectively. The risk of CAD was about 4 and 3 times higher in male and female smokers than nonsmokers respectively[6]. Elevated levels of total- and low density lipoprotein cholesterol (TC and LDL-C), elevated levels of triglyceriges (TG) and low levels of high density lipoprotein cholesterol (HDL-C) are important risk factors for CAD[7]. LDL-C is considered as 'bad cholesterol' since too high level of this cholesterol is associated with an increased risk of coronary artery disease and stroke[8,9].Treating dyslipidemia has clear benefits in the primary and secondary prevention of coronary heart disease (CHD) in both sexes[10,11].This study focused on dyslipidemia as a risk factor of acute coronary syndrome (ACS). The aim of the study was to determine the prevalence and pattern of dyslipidemia in subjects with acute coronary syndrome, its relation to age, gender and other modifiable risk factors.

Subjects and Methods:

This cross sectional comparative study was carried out in the National Institute of Cardiovascular Diseases (NICVD), Dhaka during the period from September 2016 to February 2018.

The study included two groups.

Group I included 1000 patients with ACS with the age ranged from 20 to 80 years with a mean age ±SD of 59 ys±8.24. Male patients in the study were 600 (60% of patients) [mean age ±SD (58.85 ys±7.70)] while female patients were 400 (40% of patients) [mean age±SD (61.29 ys±9.37)]. ACS were classified according to clinical presentation, the findings on the admission electrocardiogram (ECG) and the results of troponin-I levels into ST-elevation ACS (STE-ACS) patients presented with acute chest pain, persistent ST-segment elevation and a rise in troponin levels [ST-elevation MI (STEMI)].

Non-ST-elevation ACS (NSTE-ACS) patients were 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-normalisation of T waves, or no ECG changes at presentation. NSTE-ACS is further divided into: Unstable angina (UA) normal troponin levels, Non-ST-elevation MI (NSTEMI) with a rise in troponin levels.

Group II included 500 healthy subjects of non-diabetic, non-hypertensive and nonsmokers. They were selected from attendants coming with the patients. Their ages ranged from 20 to 72 years with a mean age of 57ys±3.53 years. They were 275 (55%) males and 225 (45%) females.

Exclusion Criteria

Patients with stable angina and those receiving anti lipid drugs were excluded from the study.

Methods:

A written consent to participate in the study was taken from each subject. Thorough history of present illness and history of any other diseases were taken. History of previous attacks of acute coronary syndrome and family history of ischemic heart disease were recorded, history of smoking and previous hospital admission were taken in consideration. Clinical examinations of all participants were done. Investigations for lipid profile [total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL) and triglycerides (TG)], 12 leads ECGs were performed for diagnosis of the case.

Normal and abnormal levels of lipid profile were set shown in Table I

Table-I
Normal and abnormal levels of lipid profile [12]

	Recommended	Borderline	High risk
TC	<200 mg/dl	200-240 mg/dl	>240 mg/dl
HDL	≥40 mg/dl	<40 mg/dl	
LDL	<130 mg/dl	130-160 mg/dl	>160 mg/dl
TG	<150 mg/dl	150-200 mg/dl	>200 mg/dl

Procedure of cholesterol estimation

5ml blood were withdrawn from each case after 4 hours of admission, then centrifuged at 3000 rpm for 10 minutes. 1 ml of serum was kept at -20°C for measurement. The patients were not getting anti lipid drugs.

Statistical Analysis

Statistical presentation and analysis of the collected data were conducted, using the mean, standard deviation, analysis of variance [ANOVA] test and chi-square test by the SPSS statistical software version 18 for windows.

Results:

Regarding risk factors, we found that 620 patients (62% of patients) were hypertensive, 520 patients (52% of patients) were diabetic and 470 patients (47% of patients) were smokers. All smokers were males.

33   Pattern and Prevalence of Dyslipidemia among Patients with Acute Coronary
Parvin et al.

Bangladesh heart j Vol. 34, No. 1
January 2019

Myocardial infarction patients included STEMI and NSTEMI. Hypertension was found in 620 patients (62% of subjects). 520 patients were diabetics (52% of patients). Smoking was a habit in 470 patients (47% of patients).

Table-II

Disease distribution in the study

Disease	Whole study		Gender	
	N	%	Male (n=600)	Female (n=400)
Myocardial infarction	786	78.6%	n=4 98(83%)	n=284 (71%)
Unstable angina	214	21.4%	n=102 (17%)	n=116 (29%)

Table-III

Prevalence of the risk factors in relation to gender and ACS

	Hypertension		DM		Smoking	
	Number	%	Number	%	Number	%
Male	434	72%	260	43.3%	366	61%
Female	186	46%	296	74.0%	0	0%
MI	520	52%	63	6.3%	393	39.3%
UA	100	10%	107	10.7%	80	37.4%

Table IV show high levels of TC (more than 200 mg/dl) were found in 606 patients(60.6% of patients), high levels of LDL (more than 130 mg/dl) were found in 580 patients (58% of patients), high levels of TG (more than 150 mg/dl) were found in 633 subjects (63.3% of patients). However, low levels of HDL (less than 40 mg/dl) were found in 660 patients (66% of patients).

Table-IV

Prevalence of dyslipidemia in patients with ACS

Type of lipid	Number	Percentage
Total cholesterol [TC] (>200 mg/dl)	606	60.6%
Low density lipoprotein [LDL] (>130 mg/dl)	580	58%
High density lipoprotein [HDL] (<40 mg/dl)	660	66%
Triglycerides [TG](>150 mg/dl)	633	63.3%

The table 5 show that there was a statistically significant elevation in TC (total cholesterol), LDL (low density lipoprotein), TG (triglyceride) serum levels in patients with ACS compared to control subjects while the HDL (high density lipoprotein) was significantly low in ACS patients compared to control subjects. TC/HDL>5 and TG/HDL>4 were significantly higher in patients with ACS than controls.

There was no significant difference between myocardial infarction and unstable angina regarding all parameters.

TC, LDL, TG were significantly higher in males than in females while HDL was significantly higher in females compared to males. Also TC/HDL and TG/HDL ratios were significantly higher in males compared to females.

All components were significantly more prevalent in males than in females except TG where there was no significant difference between males and females. This table revealed that TC/HDL and TG/HDL ratios were independent risk factors for ACS.

Table-V

Comparison between lipid profile parameters in patients with ACS and control subjects

	Control group (Mean ± SD)	ACS group (Mean ± SD)	p-value
TC (mg/dl)	167.45± 3.23	217.87±43.61	0.023
LDL(mg/dl)	97.67± 6.42	139.25±38.43	0.02
HDL (mg/dl)	49.65± 2.32	37.88±4.79	0.034
TG (mg/dl)	137.41±5.78	174.41±61.42	0.043
TC/HDL	3.37	5.75	0.015
TG/HDL	2.77	4.604	0.032

Table-VI

Comparison between lipid profile parameters in MI and UA patients

	Myocardial Infarction (Mean ± SD)	Unstable Angina (Mean ± SD)
TC (mg/dl)	217.84±44.99	217.97±38.75
LDL (mg/dl)	139.34±39.94	138.91±32.82
HDL (mg/dl)	37.80±4.77	38.15±4.91
TG (mg/dl)	176.45±66.04	175.75±52.95
TC/HDL	5.74	5.71
TG/HDL	4.72	4.60

*p <0.05 means significant.

Regarding prevalence and pattern of dyslipidemia in our study,(Table 6), we found that high levels of TC (more than 200mg/dl) were found in 91 patients (60.67% of patients) [mean±SD (217.87 mg/dl±43.61)].

Table-VII

Pattern of dyslipidemia in ACS patients in relation to gender

	Male (Mean ± SD)	Female (Mean ± SD)	p-value
TC(mg/dl)	225.17±43.90	206.61±41.02	0.01
LDL(mg/dl)	146.18±40.14	128.56±33.19	0.006
HDL(mg/dl)	36±4.64	42.91±4.86	0.034
TG (mg/dl)	183.54±66.18	163.64±57.37	0.012
TC/HDL	6.19	4.81	0.037
TG/HDL	5.04	3.85	0.029

*p <0.05 means significant.

The prevalence of MI was higher in male gender than females (83.52 % vs 71.19 % respectively) (Table 7).

The prevalence of dyslipidemia and its pattern in patients with ACS were more significant in males than females (p<0.01)(Table 8).

Table-VIII
Prevalence of dyslipidemia in ACS patients in relation to gender

	Male (n=600)		Female (n=400)		p-value
TC(>200 mg/dl)	160	26.67%	131	32.75%	0.023
LDL(>130 mg/dl)	180	30.00%	127	31.75%	0.042
HDL(<40 mg/dl)	102	17.00%	84	21.00%	0.011
TG(>150 mg/dl	182	30.33%	76	19.00%	0.053

*p <0.05 means significant.

Using stepwise regression of lipid profile parameters we found that TC/HDL and TG/HDL ratios were independant risk factors for ACS (Table 9).

Table-IX
Stepwise regression analysis of dyslipidemia in relation to ACS

B	Std. Error for B	β	Sig.		95%Confidence Interval for B	
					Lower	Higher
TC	.000	.003	-.034	NS	-.007	.006
LDL	.000	.003	.032	NS	-.006	-.006
HDL	.003	.008	.040	NS	-.012	.019
TG	.000	.001	-.141	NS	-.002	.002
TC/HDL	2.435	1.231	0.031	Sig.	1.549	78.86
TG/HDL	2 201	0.768	0.41	Sig.	1.386	56.12
(Constant)	1.133	.364	—-	0.002	—-	—-

Discussion:

CAD is a complex and multifactorial process that manifests as stable angina, unstable angina or myocardial infarction. The atherosclerotic process underlies each of these pathologies. Indeed, clinical symptomatology in CAD is frequently triggered by a thrombus formation on an eroded or ruptured atherosclerotic, lipid-rich plaque characterized by a thin fibrous cap[12].

CAD is the leading cause of death in men and women[1]. Dyslipidemia preponderated among the nine major risk factors (smoking, diabetes, hypertension, visceral obesity, psychosocial stress, sedentary life, low fruit and vegetable consumption and alcohol consumption), and alone accounted for more than 50% of population attributable risk[13]. Regardless of declines in developed countries, both CAD mortality and the prevalence of CAD risk factors continue to rise rapidly in developing countries[2].

Hypertension is a clear risk factor of atherosclerotic CAD[14]. The risk of CAD has been reported to be 2-6 times higher in diabetics than in non-diabetics[4]. Cigarette smoking has been reported to be a risk factor of CAD and stroke through many studies[5]. The risk of CAD was about 4 and 3 times higher in male and female smokers than nonsmokers respectively[6].

Dydlipidemia, manifested by elevated levels of total- and low density lipoprotein cholesterol (TC, LDL-C), low levels of high density lipoprotein cholesterol (HDL-C) and high levels of triglycerides (TG), is an important risk factor for CAD[15,16].

Our study revealed that hypertension is the most common risk factor of ACS (62.67%) followed by diabetes mellitus (52.67%). Cigarette smoking came at the last (47.33%). Our results agreed with some other studies[17-19]. Saito et al.,[20] found that the prevalence of hypertension was 45.8%, diabetes mellitus was 15.8% while cigarette smoking was 16.7% which differs regarding the prevalence from our study. According to Saito et al.[20], hypertension was the commonest risk factor of acute coronary syndrome followed by cigarette smoking, diabetes mellitus came at the last. In our study smoking, as a risk factor for ACS, came after hypertension and diabetes mellitus, probably, because all our female patients (39.33% of our subjects) were nonsmoker.

Our study revealed that myocardial infarction (MI) was found in 787 patients (78.67% of patients) while unstable angina (UA) was found in 213 patients (21.33% of patients). In MI, 79 patients (66.95%) were hypertensive, 63 patients (53.39%) were diabetic and 59 patients (50%) were smokers. On the other hand, in UA, 15 patients (46.88%) were hypertensive, 16 patients (50%) were diabetic and 12 patients (37.50%) were smokers. The increased prevalence of hypertension and smoking were significant in patients with MI (p<0.05) compared to those with UA while it was insignificant regarding diabetes, (table-5). Esteghamati et al.[21], in agreement with our results, found that the prevalence of hypertension and smoking were significantly higher in patients with MI compared to those with UA (96% vs 89.2% for hypertension and 52.8% vs. 38.6% for smoking) while diabetes mellitus was significantly higher in patients with MI compared to patients with UA which was different from our results (44.6% vs 25.2%). Also our results revealed that there was no significant difference between patients with MI and UA regarding all lipid profile parameters (Table 6) which did not agree with that of Guler et al.[22], and Esteghamati et al.[21], who reported that Low levels of HDL were significantly low in subjects with MI compared to those with UA.

High levels of LDL (more than 130 mg/dl) were found in 87 patients (58% of patients) [mean±SD (139.25 mg/dl±38.43)]. Low levels of HDL (less than 40 mg/dl) were

35   Pattern and Prevalence of Dyslipidemia among Patients with Acute Coronary
Parvin et al.

Bangladesh heart j Vol. 34, No. 1
January 2019

found in 99 patients (66% of patients) [mean±SD (37.88 mg/dl±4.79)]. High levels of TG (more than 150 mg/dl) were found in 95 patients (63.33% of patients) [mean±SD (174.41 mg/dl±61.42)]. Also, our results revealed that the TC/HDL ratio was more than five (TC/HDL>5) and TG/HDL ratio was more than four (TG/HDL>4). According to the American Heart Association, the goal is to keep TC/HDL ratio <5 and TG/HDL <4. A higher ratio indicates a higher risk of heart disease; a lower ratio indicates a lower risk.

Assessment of lipid profile parameters revealed that there was a statistically significant elevation in serum levels of TC, LDL, TG, TC/HDL, TG/HDL in ACS patients compared with the control subjects while regarding HDL it was significantly low in ACS patients compared to the control subjects (p < 0.05) (Table 7).. Our results were in agreement with that of Kamariya et al.[23], and Yadav and Bhagwat[15] who reported increased TC, TG, LDL and decreased HDL levels in patients with ACS than controls.

The prevalence of MI was higher in male gender than females (83.52 % vs 71.19 % respectively) (Table 7). This can be explained by our finding that hypertension and smoking were more prevalent in males than in females. Smokers were only males. Regarding the prevalence of diabetes, there were 45 diabetic males (49.45 %(vs 34 diabetic females (57.63%) which was statistically insignificant (Table 4) Another factor which can explain occurrence of MI in males than females was the more prevalent dyslipidemia in male than female patients (Table 7). Our results agreed with that of Leebmann et al.[24], El-Menyal et al[25], Youssef et al.[26] and Noureddine et al.[27], who reported that MI was more prevalent in males than females.

A higher levels of TG [mean ±SD (174.41mg/dl±61.42)] were found in males compared to that in females [mean ±SD (173.41mg/dl±5, 78)], which was insignificant (p=o.172). These results were the same results of Jacob et al., [32] who reported that men had higher TG and TC levels and lower HDL-levels compared to women (P < 0.001). On the other hand, Esteghamati et al.[21], found that mean levels of TG were lower in male patients [170.6±97.3 mg/dl] than in female patients [188.4±88.3 mg/dl]. That would be due to differences in genetics, body fat distribution, life styles and dietary habits between different countries where studies were carried out.

Conclusions:
In conclusion, this study revealed that hypertension was the most common risk factor followed by diabetes mellitus and smoking. Hypertension and smoking were more

prevalent in males than in females. Regarding dyslipidemia, it was prevalent in ACS patients compared to control. Low level of HDL was the most common, followed by high TG, high TC then high level of LDL, TC/HDL and TG/HDL ratios. Dyslipidemia was significantly related to gender. TC, LDL, TG were significantly higher in males than in females. There was no significant difference between patients with MI and those with UA regarding all lipid profile parameters, also found that HDL was significantly lower in male than females. Using backward stepwise logistic regression analysis of dyslipidemia, we found that TC/HDL and TG/HDL ratios were independent risk factors for ACS. Based on these results, we can recommend paying more attention to serum lipids for prevention of acute coronary syndrome, periodic check of fasting lipid profile and enriching the people culture about dyslipidemia, its hazards and how to avoid.

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36   Pattern and Prevalence of Dyslipidemia among Patients with Acute Coronary
        Parvin et al.

Bangladesh heart j Vol. 34, No. 1
January 2019

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