Original Article

Relationship between triglyceride HDL-cholesterol ratio and severity of coronary artery disease in patient with acute coronary syndrome

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Abstract

Cardiovascular Disease (CVD) is the leading cause of death worldwide, responsible for one third of death. Coronary artery Disease (CAD) is the most common cause. Dyslipidaemia is one of the major contributors of increased CAD risk. High LDL-C, high TG and low HDL-C have all been as predictors for CAD risk. TG/HDL-C ratio could be a very important, easy, non-invasive means of predicting the presence and extent of coronary atherosclerosis. The aim of this study was to evaluate the association between TG/HDL-C ratio and the extent of CAD assessed by coronary angiogram in our setting. This cross sectional analytical study has been done in the Department of Cardiology, Sir Salimullah Medical College & Mitford Hospital. A total 118 patients with newly diagnosed ACS, undergoing coronary angiogram in were selected purposively. Previous history of PCI or CABG, patients getting lipid lowering drugs, patient with congenital heart disease or vulvular heart disease was excluded. Angiographic severity of coronary artery disease was assessed by 2 indices – vessels score' and 'Lesion score'. Smoking was found in highest percentage (65.3%) and half of the patient's risk factor were hypertension (51.7%) and overweight (50.8%). The relationship between vessel score with TG/HDL-C ratio shows that among patients with triple vessel disease on coronary angiogram, 93% had high (?4) TG/HDL-C ratio whereas among double vessel disease patients, 82% patients had high (?4) TG/HDL-C ratio. The association between atherosclerosis lesion score with TG/HDL-C ratio shows that with the increase level atherosclerosis TG/HDL-C ratio also increased. A subject with low HDL (<40 mg/dl for male and <50 mg/dl for female) had 4.75 times increase in odds of having coronary artery disease while a subject with high LDL (>100 mg/dl) had 2.60 (95% CI 1.55% to 14.26%) times increase in odds of having coronary artery disease. In this study high TG/HDL-C ratio (>4) was found with severity of CAD in relation to vessel score and atherosclerosis lesion score. High TG/HDL-C ratio indicates an atherogenic plaque and a significant risk for the development of coronary artery disease. In this study high TG/HDL-C ratio was found as the most powerful predictor of coronary heart disease among all the lipid variables examined. This finding can help us to find out high risk ACS patient and plan for treatment strategy of severe CAD in our population.

Key words : Coronary artery disease, triglyceride/ HDL-cholesterol ratio, acute coronary syndrome

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Introduction

Cardiovascular Disease (CVD) is the leading cause of death worldwide, responsible for one third of death. According to WHO estimates, 17.5 million people died of CVD in 2005[1] Among the various causes of CVD mortality, Coronary Artery Disease (CAD) is the most common cause. CAD is the term used to describe coronary arteries that are affected by a pathological process. Dyslipidaemia is a group of conditions in which there are abnormal levels of lipids and lipo-proteins in the blood. Dyslipidaemia is one of the major contributors of increased CAD risk. High LDL-C (low density lipoprotein), high TG (triglyceride) and low HDL-C (high density lipoprotein) have all been as predictors for CAD risk. Dyslipidemia can be the result of genetic predisposition, secondary cause or a combination of both.[2] High Density Lipoprotein Cholesterol (HDL-C) and TG initially are important atherogenic marker[3] and considered to be a highly significant independent predictor of the severity of CAD.[4] Carbohydrate is the main diet of Bangladeshi people and high plasma concentration of TG and low plasma concentration of HDL-C is consistent with the effects of these diets.[5] Moreover low HDL-C and high TG are components of metabolic syndrome (MS) and pointer to insulin resistance (IR). Insulin resistance and metabolic syndrome

are more common in South Asian countries and thought to be very important risk factors for the increased prevalence of CAD in this region.[6] So HDL and TG could be a promising marker of the atherogenicity and predictor of the severity of CAD, especially for the population of Bangladesh and other South-Asian countries. Considering the above facts it is clear that, TG/HDL-C ratio could be a very important, easy, non-invasive means of predicting the presence and extent of coronary atherosclerosis. Although association of high TG or low HDL-C and extent of CAD has been investigated in few Bangladeshi studies, (referrence) no one has studied the association of TG/HDL-C ratio and extent of CAD. High TG and low HDL-C are the main lipid profile pattern in Bangladeshi population with CAD.[5] High TG and low HDL-C are also markers of atherogenic small, dense LDL particles and IR. So TG/HDL-C ratio, which takes into account the role of both high TG and low HDL-C for atherogenesis, can be a very important surrogate marker for the prediction of the extent of CAD.[7] This study was intended to see whether TG/HDL-C ratio can predict the severity of angiographically detected CAD which would help a great deal in the management and preventive strategy of CAD in Bangladesh.

Methods

This cross sectional analytical study has been done in the Department of Cardiology, Sir Salimullah Medical College. A total 118 patients with newly diagnosed ACS, undergoing CAG in the Department of Cardiology were selected purposively. criteria Patients having previous history of PCI or CABG, patients getting lipid lowering drugs, patient with congenital heart disease or vulvular heart disease, patient with major non cardiovascular diseases and those unwilling to give consent were excluded from the study. The diagnosis of ACS was made in patient who presented with retrosternal chest pain and duration of 20 minutes or more, with electrocardiographic (ECG) changes i.e. ST segment elevation ≥1mm in at least two adjacent limb leads, ≥2 mm ST segment elevation at least two contiguous precordial leads or new onset bundle branch block STEMI). In the absence of ST segment elevation ACS is diagnosed on the basis of, Troponin-I level <0.01 µg/L (UA level), Troponin-I level >0.01 µg/L and <1.0 µg/L (NSTEMI level) ,Troponin-I level >0.1 µg/L (STEMI level).[8]

Fasting lipid profile was measured within 24 hour of admissionin. Coronary angiogram was done in all patients who fulfilled the selection criteria. Interpretations of coronary angiogram were reviewed by at least two interventional cardiologists. Angiographic severity of coronary artery disease was assessed by 2 indices – 'vessels score' and 'Lesion score'.[9,10]

Data were collected in a pre-designed data collection sheet. Analysis was done by using SPSS version 11.5 software program. Confidence interval was set at 95% level. Result was considered to be statistically significant if p value <0.05, very statistically significant if p value <0.01, and highly statistically significant if p value <0.001. In the statistical analysis, the demographic characteristics e.g age and sex were expressed as proportions. Pearson Chi-square test was used to compare between the categories between TG/HDL-C ratios with the severity CAD by vessel score & lesion score. Continuous variables were compared through multivariate stepwise logistic regression.

Results

Patients' age were ranged from 26 to 73 years and the maximum number was found in the age group of 51-60 years. The mean age was 52.48 years (±18.68 years). Male female ratio was 3.5:1 in the whole study patients.

Smoking was found in highest (65.3%) number and half of the patient's risk factor were hypertension (51.7%) and overweight (50.8%). Diabetes mellitus was found among 42.4% patients and family history (10.2%) were the least among the risk factors. High TG was found among 26.3% patients and Low HDL-C was found among 96.6% where as 66.1% had High LDL-C and 68.6% High TG/HDL-C.

Among triple vessel disease (TVD) patient's, 93% had high TG/HDL-C ratio (≥ 4) whereas among double vessel

Table-I: Relationship between TG/HDL-C ratio and vessel score in severity CAD (n=118)

	Number of vessel involvement				
TG/HDL-C RATIO	NVD (n=20)	SVD (n=43)	DVD (n=28)	TVD (N=27)	p-value
<4	16(80%)	14(33%)	5(18%)	2(7%)	<0.001
≥4	4(20%)	29(67%)	23(82%)	25(93%)	

disease(DVD) patient's, 82% patients had high ≥ 4 TG/HDL-C ratio. Similarly 67% of patients having single vessel disease(SVD) had high ≥ 4 TG/HDL-C ratio and 20% of normal vessel disease (NVD) patient's had high ≥ 4 TG/HDL-C ratio. The difference was statistically highly significant (P<0.001). (Table-I) Increased level of atherosclerosis lesion score was associated with high TG/HDL-C ratio (?4). About 50% patients with mild atherosclerosis lesion had high TG/HDL-C ratio (?4) whereas 87% patients with severeatherosclerosis lesion had high TG/HDL-C ratio (?4). The association between atherosclerosis lesion score with TG/HDL-C ratio was statistically highly significant (P<0.001). (Table- II)

Table-II: Relationship between TG/HDL-C ratio and Atherosclerosis lesion score (n=118)

	Atherosclerosis lesion score			
TG/HDL-C Ratio	Mild	Moderate	Sever	p-value
	(n=53)	(n=50)	(n=15)	
<4	26(49%)	9(18%)	2(13%)	<0.001
≥4	27(51%)	41(82%)	13(87%)	

Multiple regression analysis shows that, subjects with TG >200 mg/dl had 1.21 (95% CI 0.19% to 7.46%) times increase in odds of having coronary artery disease. A subject with low HDL (<40 mg/dl for male and <50 mg/dl for female) had 4.75 (95% CI 0.12% to 21.90%) times increase in odds of having coronary artery disease. A subject with LDL (100 mg/dl) had 2.60 (95% CI 1.55% to 14.26%) times increase in odds of having coronary artery disease. TG/HDL-C ratio is a quantitative numerical variable. A subject with TG/HDL-C ratio (>4) had 5.65 (95% CI 1.68% to 38.98%) times increase in odds of having coronary artery disease. (Table-III)

Table-III: Lipid profile analysis for coronary artery disease by multiple regression analysis models (n=118)

	OR	95.0% CI for OR		P value
		Lower	Upper	
High TC	1.21	0.19	7.46	0.030
Low HDL-C	4.75	0.12	21.90	0.001[s]
High LDL-C	2.60	1.55	14.26	0.009[s]
High TC	1.21	0.19	7.46	0.030[s]
Low HDL-C	4.75	0.12	21.90	0.001[s]
High LDL-C	2.60	1.55	14.26	0.009[s]
High TG	3.42	0.34	18.52	0.002[s]
High TG/HDL-C	5.65	1.68	38.98	0.005[s]
Constant	0.01	-	-	0.045[s]

Discussion

Several studies have found association of coronary artery disease and higher cholesterol level. [4,8,10] The present study observed the mean age was 52.48±18.64 years ranging from 26 to 63 years and maximum number of the patients was found in the age range of 51-60 years. In Bangladesh, Rahman et al[11] found that, the mean age was 50.21 ± 8.01 years and most of the patients were found in the age range of 40 to 59 years, which closely resembles the present study. On the other hand, Penalva et al,[12] da Luz et al[4] and Gimeno-Orna et al[9] have observed the mean age were 68±8 years, 57.2±11.1 and 64.8±9.06 years respectively. The higher age range may be due to increased life expectancy in their study patients. Male were predominant in the current study which has similarities with other studies. In the present study it was observed that more than a half (50.8%) of the patients was overweight, 8.0% were obese and only 1.7% were underweight. Bolibar et al[14] found the mean (±SD) BMI was 26.2±2.9 kg/m2 in ACS patients, which is comparable with the current study. On the other hand, Bampi et al[15] and Flohlich, Gimeno-Orna et al[13] have observed higher mean BMI in patients with IHD in their studies. Regarding the traditional risk factors it was found

that smoking (65.3%) was the most common risk factor, followed by HTN in 51.7% and Diabetes mellitus in 42.4%. Almost similar finding was also found by Rahman[11]regarding the traditional risk factors, where the investigators found smoking as the most common risk factor. Nikkila et al[16] study showed serum triglyceride was a good discriminator, better than total cholesterol, between patients with coronary artery disease and those without. Triglyceride concentrations were significantly (p<001) higher in those with single, double, and triple vessel disease than in those without disease.

A raised triglyceride concentration was a significant discriminator especially in single vessel disease, when patients tended to be young or middle aged, and their total cholesterol did not differ significantly from patients without disease. There are no firm recommendations on triglyceride measurement in risk assessment and treatment for raised triglycerides by Nikkila et al.[16] Nevertheless, reanalysis of the Framingham data done by Castelli[17] indicated that serum triglycerides are independently predictive of coronary artery disease in patients with low serum concentrations of HDL cholesterol.

In the current study coronary angiographic severity was assessed by number of vessel involvement. It was observed that 16.9% patients did not have any vessel involvement, 36.4% had SVD, 23.7% DVD and 22.8% TVD. In Bolibar et al[14] and Rahman[11] study, almost similar result has been found.

This study shows that about 50% patients with mild atherosclerosis lesion had high TG/HDL-C ratio (> 4) whereas 87% patients with severe atherosclerosis lesion had high TG/HDL-C ratio (≥ 4). Bolibar et al[14] and Yusuf et al[18] found a significant relationship of TG/HDL-C ratio with atherosclerosis lesion score, which is consistent with the present study. The multivariate analysis by logistic regression showed that a subject with high TG had 1.21 (95% CI 0.19% to 7.46%) times increase in odds of having ACS; a subject with low HDL (<40 mg/dl for male and <50 mg/dl for female) had 4.75 (95% CI 0.12% to 21.90%) times increase in odds of having ACS, a subject with LDL (>100 mg/dl) had 2.60 (95% CI 1.55% to 14.26%) times increase in odds of having ACS; a subject with high TG (>150 mg/dl) had 3.42(95% CI 0.34% to 18.52%) times increase in odds of having ACS and a subject with high TG/HDL-C ratio (4) had 5.65(95% CI 1.68% to 38.98%) times increase in odds of having extensive coronary disease. As regards to TG/HDL-C ratio and its relationship with the presence and severity of ACS, clinical and angiographic studies by Schwertner et al,[19] Cobbaert et al[20] and Ladeia et al,[21] have correlated it with the progression or regression of CAD. Therefore, this finding reinforces the importance of the measurement of the TG/HDL-C ratio as an individual risk factor for ACS, as well as an indicator of extent and severity of CAD, even in the presence of normal cholesterol levels.

In this study high Triglyceride cholesterol ratio (>4) corelated with severity of CAD in terms of vessel score and atherosclerosis lesion compared to patients who had TG/HDL-C ratio <4. High TG/HDL-C ratio indicates an atherogenic plaque and a significant risk for the development of coronary artery disease. High TG/HDL-C ratio was found as the most powerful predictor of coronary heart disease among all the lipid variables examined. This finding can help us to find out high risk ACS patient and plan for treatment strategy of severe CAD in our population.

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