Original Article

Lipid Profile of the Patients with Acute ST-Elevation Myocardial Infarction and Its Association with Admission Serum Troponin-I Level

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Abstract

A cross-sectional, analytical study was conducted in Mymensingh Medical College Hospital, Mymensingh, Bangladesh, between January and December of 2021, to evaluate lipid profile in patients of acute ST-elevation myocardial infarction and observe its association with admission serum troponin-I level. Patients were selected from the Department of Cardiology. All physical parameters were studied and recorded in the Department of Cardiology, while the laboratory tests were done in the Department of Physiology. A total of 70 patients having ST-elevation acute myocardial infarction participated in this study. They were grouped as: control group (Group-I) i.e., normoglycemic, and study group (Group-II) i.e., hyperglycemic but non-diabetic. Participants' general (demographic) information, personal history, physical parameters, i.e., height, weight, BMI, temperature, pulse, blood pressure and results of laboratory tests, i.e., serum troponin-I, random blood sugar, HbA1c, and lipid profile, and ECG reports were recorded. Serum troponin-I and lipid profile were measured using Time-resolved Fluorescence Immunoassay Analyzer. Serum troponin-I levels during admission were found 11.65±8.38 ng/ml in group-I and 21.75±9.53 ng/ml in group-II (P<0.001). Serum cholesterol levels were found 178.67±28.02 mg/dl and 214.09±44.07 mg/dl in group-I and group-II respectively (P<0.001). Difference was also observed in serum triglyceride levels (181.04±82.45 mg/dl vs. 240.47±74.54 mg/dl; P<0.05) and in serum HDL-C levels (36.37±5.09 mg/dl vs. 39.79±6.06 mg/dl; P<0.05). However, no difference was evident in serum LDL-C levels between the groups (117.37±20.27 mg/dl vs. 125.40±26.94 mg/dl; P>0.05) A significant positive correlation was found between serum troponin-I and serum total cholesterol as well as serum troponin-I and serum triglyceride (r=0.575 and r=0.516 respectively; P<0.001), while a significant negative correlation was observed between serum troponin-I and serum HDL-C (r= -0.351; P<0.001). Furthermore, a positive significant correlation was also observed between serum troponin-I and serum LDL-C (r= 0.375; P<0.001).

Keywords: *Ischemic heart disease, myocardial infarction, serum troponin-I, lipid profile*

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INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in Asia and most CVD deaths were due to ischemic heart disease (IHD) (47%),[1] while acute myocardial infarction (AMI) is by far the most important form of ischemic heart disease (IHD). Predictive analysis showed that IHD will contribute to the vast majority of age-standardized cardiovascular mortality burden (141 deaths per 100,000 population) in 2050 in South Asia region.[2] Impaired lipid metabolism is one of the crucial factors in pathogenesis of cardiac ischemia, e.g., acute myocardial infarction and management of dyslipidemia is an important aspect of post-myocardial infarction care.[3,4] Early treatment of hyperlipidemia following acute myocardial infarction (AMI) provides potential benefits and reduces the morbidity and mortality of IHD. Due to extensive tissue necrosis in AMI, acute phasic changes occur in patients that alter their lipid profile levels as well.[5,6] Pathophysiological mechanisms accounting for these changes include the acute phase response associated with up-regulation of LDL-receptor activity and reduction in several HDL regulatory proteins.[6] Therefore, it is recommended that serum lipids should be assessed within 24 hours after infarction for detection of hyperlipidemia (as determined values are to very close pre-infarction values) in patients with AMI.[7,8] Apart from that the association of lipid profile with and elevated serum troponin-I has other clinical significance. It confirms that lipid profile can be used in screening populations to identify high-risk subjects and prediction of future IHD events;[9] it also impacts the choice of diet and lipid-lowering therapy for high-risk group of patients.[10] Therefore, we proposed the present study to evaluate lipid profile in patients of ST-elevation acute myocardial infarction as well as observe the association between lipid profile and elevated serum troponin-I.

METHODS

This prospective, analytical study was conducted in Mymensingh Medical College Hospital, Mymensingh, Bangladesh, between January and December of 2021. Patients were selected from the Department of Cardiology of the same institution.

Inclusion Criteria:

1) Patients with first attack of ST-elevation myocardial infarction (the diagnosis was done according to the 'third universal definition of myocardial infarction');[11]
2) For the control group (Group-I): normal plasma glucose level (Random) <7.8 mmol/L, with ST elevation myocardial infarction; plasma glucose level; and
3) For the study group (Group-II): elevated plasma glucose level (but not diabetic) plasma glucose level (Random) >7.8 mmol/L.

Exclusion Criteria:

1) Patients having any previous history of myocardial infarction (MI);
2) Patient diagnosed with diabetes mellitus (DM), valvular heart disease, congenital heart disease and cardiomyopathies;
3) Patients having major non-cardiovascular disorders which may cause elevation of troponin-I, such as severe renal impairment, prolonged immobilization, major surgery, chest trauma, rheumatoid arthritis, myocarditis (pericarditis), acute pulmonary embolism, prolonged tachyarrhythmia, etc.;
4) Patients having any systemic infection; and
5) Patients under chemotherapy for any known malignancy.

In the data collection sheet, the items included were participants' general (demographic) information, personal history, physical parameters, i.e., height in meters, weight in kg, BMI, temperature, pulse, systolic and diastolic blood pressure in mm of Hg, and results of biochemical tests like serum troponin-I, random blood sugar, HbA1c, and lipid profile. Baseline and prognostic ECG were done and recorded. All physical parameters were studied and recorded in the Department of Cardiology, while the biochemical tests were done in the Department of Physiology. The troponin kit reagent used in this study has a cut-off value of 0.30 ng/ml for diagnosis of acute myocardial infarction. Diagnostic cut-off value for raised troponin indicating myocardial infarction were set at 2µg or higher (according to the ACC/AHA guidelines).[12] Serum troponin-I was measured using time-resolved fluorescence immunoassay analyzer [Cardiovascular disease POCT analyzer Axceed P200; Bioscience (Tianjin) Diagnostic Technology Co., made in China]. Lipid profile was determined as follows: serum total cholesterol, triglycerides and HDL-cholesterol was estimated through enzymatic colorimetric method in autoanalyzer [Auto Chemistry Analyzer BK-200mini;

Biobase Biodusty (Shandong) Co. Ltd., made in China]. LDL-cholesterol was measured by Friedewald formula. ECG was done by using Fukuda Denshi-FX-2111 EKG Machine (made in Japan). Collected data were screened manually through editing, coding, and final verification. All the analyses were done using the Statistical Package for the Social Sciences (SPSS) version 23.0 for Windows (SPSS Inc., Chicago, IL, USA). The results were presented in tables and figures. Data were expressed as mean±SD. Comparison between the groups was done using unpaired Student's 't' test. Correlations between admission serum troponin-I levels and different lipid levels were determined using Pearson's correlation test.

The study was approved by the Institutional Review Board (IRB) of Mymensingh Medical College, Mymensingh, Bangladesh (MMC/IRB/2021/342).

RESULTS

Among the study participants, BMI were found 20.24±1.65 kg/m^2 and 20.61±1.97 kg/m^2 in group-I and group-II respectively. Mean systolic blood pressure was 113.70±16.44 mm of Hg in group-I and 118.60±19.34 mm of hg in group-II, while mean diastolic blood pressure were observed 73.33±10.38 mm of Hg and 74.65±11.41 mm of Hg respectively. No difference was observed in BMI and blood pressure between the groups (P>0.05) (Table-I). Serum troponin-I levels during admission were found 11.65±8.38 ng/ml and 21.75±9.53 ng/ml in group I and group II respectively; the difference was statistically significant (P<0.001). Looking at the lipid profile, serum cholesterol levels were found 178.67±28.02 mg/dl and 214.09±44.07 mg/dl in group-I and group-II respectively (P<0.001). Differences were also observed in serum triglyceride levels (181.04±82.45 mg/dl vs. 240.47±74.54 mg/dl; P<0.05) and in serum HDL-C levels (36.37±5.09 mg/dl vs. 39.79±6.06 mg/dl; P<0.05). However, no difference was found in serum LDL-C levels between the groups (117.37±20.27 mg/dl vs. 125.40±26.94 mg/dl; P>0.05) (Table-II). A significant positive correlation was found between serum troponin-I and serum total cholesterol in both control and study groups (r= 0.575; P<0.001) (Fig.1). Similarly, a significant positive correlation was observed between serum troponin-I and serum triglyceride in both control and study groups (r= 0.516; P<0.001) (Fig. 2). Moreover, a significant negative correlation was observed between serum troponin-I and serum HDL-C in both control and study groups (r= -0.351; P<0.001) (Fig. 3), and a significant positive correlation was observed between serum troponin-I and serum LDL-C in both control and study groups (r= 0.375; P<0.001) (Fig. 4).

Table-I: *Comparison of BMI and blood pressure between two groups*

Physical Parameters	Group-I(n=27)	Group-II(n=43)	P value
BMI (kg/m^2)	20.24±1.65	20.61±1.97	0.407^{NS}
Systolic blood pressure (mm of Hg)	113.70±16.44	118.60±19.34	0.262^{NS}
Diastolic blood pressure(mm of Hg)	73.33±10.38	74.65±11.41	0.621^{NS}

Data were expressed as mean±SD. P value reached from unpaired Student's 't' test; NS=not significant.

Table-II: *Comparison of serum troponin-I and lipid profile between two groups*

Biochemicalparameters	Group-I(n=27)	Group-II(n=43)	P value
Serum troponin-I during admission (ng/ml)	11.65±8.38	21.75±9.53	0.000^{S}
Serum cholesterol(mg/dl)	178.67±28.02	214.09±44.07	0.000^{S}
Serum triglyceride(mg/dl)	181.04±82.45	240.47±74.54	0.004^{S}
Serum HDL-C(mg/dl)	36.37±5.09	39.79±6.06	0.014^{S}
Serum LDL-C(mg/dl)	117.37±20.27	125.40±26.94	0.161^{NS}

Data were expressed as mean±SD. P value reached from unpaired Student's 't' test; S=significant, NS=not significant.

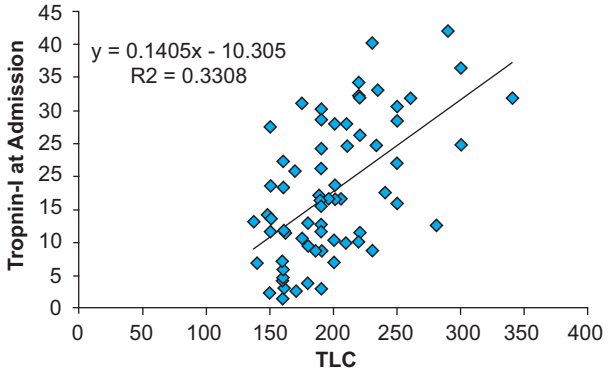

Fig. 1: *Scattered diagram showing positive correlation of serum troponin-I with serum total cholesterol in both control and study group (r = 0.575; P<0.001).*

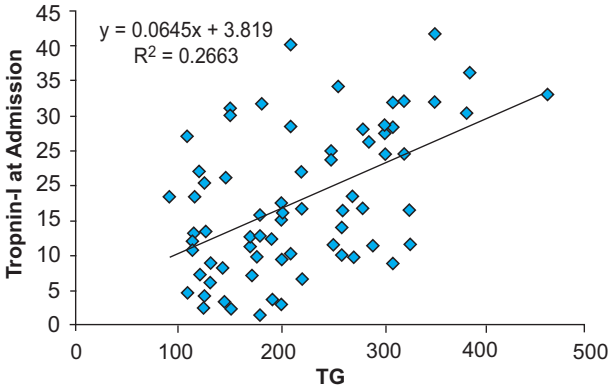

Fig. 2: *Scattered diagram showing positive correlation of serum troponin-I with serum triglyceride in both control and study group (r = 0.516; P<0.001).*

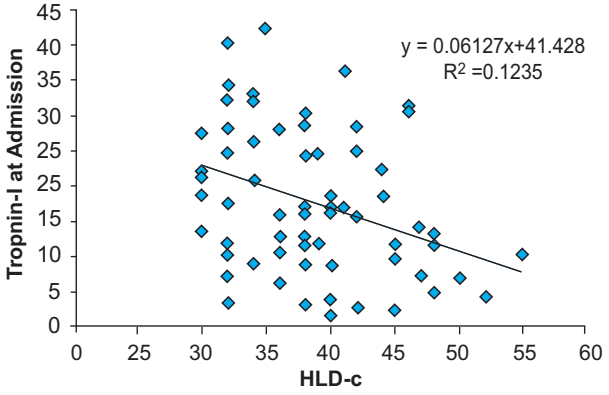

Fig. 3: *Scattered diagram showing negative correlation of serum troponin-I with serum HDL-C in both control and study group (r = -0.351; P<0.001).*

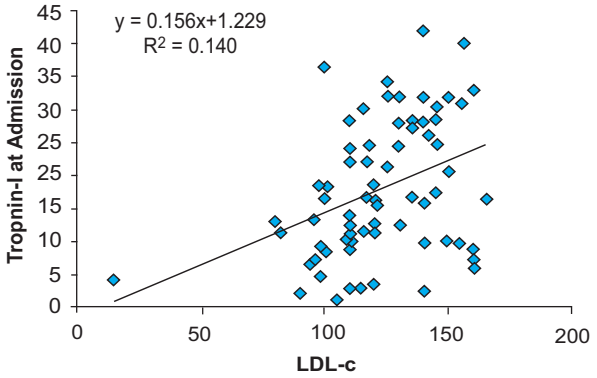

Fig. 4: *Scattered diagram showing positive correlation of serum troponin-I with serum LDL-C in both control and study group (r = 0.375; P<0.001).*

DISCUSSION

In this study, the mean serum total cholesterol of control group (normoglycemic STEMI) and study group (hyperglycemic non-diabetic STEMI) were found 178.67±28.02 and 214.09±44.07 respectively. The difference was statistically significant (P<0.001). This finding is in congruence with previous studies.[13-16] In contrast, several studies showed that after acute myocardial infarction there was a reduction of serum total cholesterol found in patients of AMI (compared between values determined within 24 hours and after 48 hours of infarction).[10,17] Therefore, the findings of that study is not in congruence with our study.

Our study also showed an increased serum triglyceride levels (181.04±82.45 mg/dl vs. 240.47±74.54 mg/dl; P<0.05) and in serum HDL-C levels (36.37±5.09 mg/dl vs. 39.79±6.06 mg/dl; P<0.05) in the study group (hyperglycemic non-diabetic STEMI) compared to control, i.e., normoglycemic STEMI. These findings are in congruence with previous studies.[14,15] In contrast, another study showed a reduction in HDL-C levels in AMI patients,[16-18] while Iqbal et al.[19] showed no association of TG or HDL-C in AMI patients with hyperglycaemia. Another study showed an elevation of triglycerides and lowering of HDL-C.[20]

In the present study, no difference was found in serum LDL-C levels between two groups (117.37±20.27 mg/dl vs. 125.40±26.94 mg/dl; P>0.05). We observed an increased level of LDL-C in AMI patients. This finding was consistent with previous studies.[13-16,20] Nonetheless, LDL-C levels were found decreased significantly after acute myocardial infarction in another study.[17]

It may be mentioned that trend of dyslipidemia is very common among South Asian (SA) population (including Bangladesh). The SHARE study evaluated disease risk factors and its relationship to subclinical atherosclerosis in 985 participants of South Asian, European, and Chinese descent residing in Canada. SAs were found to have higher total cholesterol, triglycerides, and low-density lipoprotein cholesterol (LDL-C) as well as increased prevalence of glucose intolerance as compared with Europeans and Chinese descents.[21] Traditional lipid profile levels still can be used in screening the populations to identify those subjects with high risk of developing cardiac events.

Our study had a small sample size and was a single-centre study. The results derived from this a study might not represent the whole population of the country. Moreover, since this was not a prospective study, the inference derived from the study need to be tested by prospective study.

CONCLUSION

Our data revealed significantly higher levels of total cholesterol (TC) and triglyceride (TG) and high-density lipoprotein cholesterol (HDL-C) among hyperglycemic AMI patients compared to normoglycemic AMI patients. Positive correlations of serum troponin-I were also found with total cholesterol, triglycerides and LDL-C levels, while a negative correlation was observed between serum troponin-I and HDL-C levels in both groups.

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