**Original Research Article**

# Prevalence of Metabolic Syndrome and Serum Lipid Profile among Patients with Myocardial Infarction - A Hospital Based Cross Sectional Study

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## Abstract

**Background:** Abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, unbalanced diet, alcohol, and lack of physical activity are the risk factors for myocardial infarction worldwide across all ages.
**Aim:** This study aimed to assess the prevalence of metabolic syndrome and serum lipid profile among patients with myocardial infarction at a tertiary care hospital.
**Materials and methods:** A hospital based cross-sectional study was conducted in coronary unit of the Department of Medicine from March 2019 until July 2020, on 176 patients admitted with myocardial infarction. The patient's demographics and lipid profile, serum creatinine, BMI, blood pressure, heart rate including co-morbidities were assessed. The presence of metabolic syndrome was defined based on the presence of 3 or more of the NCEP ATP III criteria. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. IBM SPSS version 22 was used for statistical analysis.
**Results:** Among the176 MI cases, the mean age was 50.98 years. Majority (48%) had anterior wall MI with a mean LVEF of 52.18 % in the study population. Out of 176, 99 (56.25%) subjects had five positive components of the metabolic syndrome; i) the mean total cholesterol was 216.19 ± 56.62 mg/dL, ii) the mean triglycerides was 117.98 ± 54.42 mg/dL, iii) the mean HDL was 43.7 ± 17.15 mg/dL, iv) the mean systolic BP was 131.2 ± 27.39 and diastolic BP was 81.4 ± 14.14, and v) RBS

was 151.91 ± 63.87 respectively indicating a high prevalence. Serum lipid profile for LDL was 74.02 ± 36.03 mg/dL and the mean VLDL was 29.52 ± 15.3 mg/dL.

**Conclusion:** The present study revealed high prevalence of the metabolic syndrome in MI cases. Of the individual components of the metabolic syndrome, triglyceride levels and RBS had the highest positive predictive value.

## Key words

Serum triglyceride, LDL, Lipid profile, Acute myocardial infarction, Serum cholesterol, HDL.

## Introduction

Cardiovascular disease is the leading cause of mortality and morbidity worldwide causing about one-third of all deaths in people older than 35 years [1, 2]. A myocardial infarction may be the first manifestation of coronary artery disease, or it may occur, repeatedly, in patients with established disease [3]. Abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, unbalanced diet, alcohol, and lack of physical activity are the risk factors for myocardial infarction worldwide across all ages [4]. The levels of total cholesterol and apolipoprotein B-100 were significantly associated with an increased risk of myocardial infarction [5]. Triglyceride is also found to be a risk factor for cardiovascular disease for both men and women in the general population, independent of heavy-density lipoprotein cholesterol (HDL-C) [6]. It has been established that elevated concentrations of triglycerides, total cholesterol, low-density lipoprotein cholesterol (LDL-C) and decreased HDL-C accelerate the development of atherosclerotic plaques and are major risk factors for coronary artery disease and MI [7]. Acute myocardial infarction is associated with profound alterations in the plasma lipoprotein profile irrespective of underlying hyperlipidemia [8]. Higher levels of total cholesterol and LDL cholesterol during the first 24 hours of acute myocardial infarction have a strong negative prognostic value [9]. Acute MI is associated with an increased susceptibility of serum lipids to oxidation in vitro [10]. There has been significant alterations in serum HDL cholesterol, triglycerides and ratios of TC/ HDL-C and LDL-C/HDL-C after MI [11]. The initial lipid profile of patients with acute myocardial infarction is of utmost importance in determining their prognosis [12]. There exists a dearth of literature suggesting the importance of careful monitoring of lipid profile in the acute setting of a MI in Indian population. Hence, this study was carried out to assess the prevalence of metabolic syndrome and the pattern of serum lipid profile among patients presenting with myocardial infarction.

## Aim and Objectives

The aim of the study was to assess the prevalence of metabolic syndrome and the pattern of serum lipid profile among patients presenting with myocardial infarction at a tertiary care hospital.

## Materials and methods

The present study was a hospital based cross-sectional study conducted in a coronary care unit under the Department of Medicine at a tertiary care hospital. The study was conducted among 176 consecutive patients diagnosed with MI presenting to the tertiary care hospital from March 2019 to July 2020.

Sample size was calculated assuming the proportion of metabolic syndrome as 19.52% as per the study by Apurva Sawant, et al. [13]. The other parameters considered for sample size calculation were 5% absolute precision and 95% confidence level and loss to follow up rate of a about 5%, the required sample size was 176.

### Inclusion criteria

- Age above 50 years
- Patients having AMI as per the WHO criteria were included in the study

**Exclusion criteria**

- Old myocardial infarction cases.
- Those taking lipid-lowering drugs.
- Who presented after 24 hours of MI.

The reason for excluding patients with these comorbidities was to reduce the bias in the results. Assessment of socio-demographic parameters including age, gender, occupation and habits was done.

**Ethical consideration:** The study was approved by the Institutional Ethical Committee. Prior to data collection, written informed consent was obtained from all the recruited participants after providing detailed information on objectives of the study and associated risk and benefits. Participants were free to leave the study at any point of time. Their confidentiality was meticulously maintained.

**Data Collection:** Blood samples were drawn at admission for creatine kinase total. The following morning, samples for triglyceride and HDL-C were collected and a sample for estimation of blood glucose level was collected. For evaluation of anthropometric profile, body weight was determined with subjects wearing light clothes and no shoes or socks, using an electronic balance. Height was determined using a wall mounted, non-extendable measuring tape with subjects in standing position and feet together. Body mass index (BMI) was calculated using the expression;

BMI = weight kg/ height ($m^2$).

The systolic and diastolic blood pressure, heart rate including co-morbidities DM/ HTN/ hypothyroidism/hyperthyroidism/obesity/other were assessed. The presence of metabolic syndrome was defined based on the presence of 3 or more of the NCEP ATP III criteria. Fasting lipid profiles were drawn within 24 hours according to protocol. Hypercholesterolaemia was defined as a total cholesterol > 200 mg/dL (5.17 mmol/L) within 24 hours of admission or previously diagnosed hypercholesterolaemia (on or off treatment). Smoking status was documented, and so was a family history of accelerated CV disease in a first-degree relative. The presence of previously diagnosed diabetes was noted as well as the mode of therapy (diet alone, oral hypoglycaemic agents or insulin). Previously undiagnosed diabetes was defined as a persistent fasting blood glucose > 126 mg/dL (6.93 mmol/L) requiring diabetic medications prior to discharge[14].

**Statistical analysis**

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. All quantitative variables were checked for normal distribution within each category of explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro-Wilk test was also conducted to assess normal distribution. Shapiro-Wilk test p-value of >0.05 was considered as normal distribution. P value < 0.05 was considered statistically significant. coGuide version V.1.0 was used for statistical analysis.

## Results

A total of 100 subjects were included in the final analysis. The mean age was 60.98 ± 13.97 years in the study population; 73 (73 %) participants were males and 27 (27 %) participants were females. Among the study population with respect to occupation, 54 (54%) participants were farmers, 25 (25%) participants were drivers, 19 (19%) participants were house wives, and 2 (2%) participants were shopkeepers. All (100%) participants had a mild life style (**Table - 1**).

Among the study population, 28 (28%) participants were type 2 diabetic and the mean duration of type 2 diabetes was 7.93 ± 4.85 years, 13 (13%) participants were hypertensive and the mean of duration of hypertension was 4.92 ± 5.2 years, 1 (1.01%) participant had thyroid disorder, 1 (1%) participant had obesity, 28 (28%) participants were smokers and the mean duration of smoking was 1.72 ± 0.45 Years, 34 (34%) participants were alcoholic and

the mean duration of alcoholism was 13.49 ± 9.17 years (**Table - 2**).

**Table - 1:** Descriptive analysis of demographic parameters (N=100).

| **Parameter** | **Summary** |
|---|---|
| **Age (in years)** | 50.98 ± 13.97 |
| **Gender n(%)** | |
| Male | 73 (73 %) |
| Female | 27 (27 %) |
| **Occupation n(%)** | |
| DRIVER | 25(25%) |
| FARMER | 54(54%) |
| HOUSEWIFE | 19(19%) |
| SHOPKEEPER | 2(2%) |
| **Lifestyle n (%)** | |
| MILD | 100 (100%) |

**Table - 2:** Descriptive analysis of co-morbidities.

| **Parameter** | **Summary** |
|---|---|
| Type 2 diabetes (N=99) n(%) | 28 (28%) |
| Duration of Type 2 diabetes in years | 7.93 ± 4.85 |
| Hypertension (N=99) n(%) | 13(13%) |
| Duration of Hypertension in years | 4.92 ± 5.2 |
| **Thyroid (N=99) n (%)** | |
| Yes | 1(1.01%) |
| No | 98(98.9%) |
| **Obesity n (%)** | |
| Yes | 1(1%) |
| No | 99(99%) |
| Smoker (N=99) n (%) | 28 (28%) |
| Duration of Smoking in Years | 3.56 ± 7.64 |
| Alcoholic n (%) | 34(34%) |
| Duration of Alcoholism in years | 4.77 ± 8.44 |

Among the study population, the mean systolic (BP) was 131.2 ± 27.39 mm of Hg, mean diastolic (BP) was 81.4 ± 14.14 mm of Hg, the mean of heart rate was 83.31 ± 14.4 per minute, the mean total cholesterol was 216.19 ± 56.62 mg/dL, the mean triglycerides was 117.98 ± 54.42 mg/dL, the mean HDL was 43.7 ± 17.15 mg/dL, the mean LDL was 74.02 ± 36.03 mg/dL, the mean VLDL was 29.52 ± 15.3 mg/dL, the mean total bilirubin was 1.44 ± 0.65 mg/dL, the mean direct total bilirubin was 0.79 ± 0.46 mg/dL, the mean indirect total bilirubin was 0.66 ± 0.33 mg/dL, the mean SGOT was 63.86 ± 61.3 U/L, the mean SGPT was 47.77 ± 17.92 U/L, the mean ALP was 81.71 ± 16.74 U/L, the mean total protein was 7.23 ± 0.69 U/L, the mean albumin was 5.04 ± 14.22 U/L, the mean urea was 43.02 ± 24.83 mg/dL, the mean of creatinine was 1.36 ± 0.97 mg/dL, the mean T3 was 0.01 ± 0.07 mg/dL, the mean T4 was 0.25 ± 1.33 , the mean TSH was 0.97 ± 6.2 µU/mL, the mean of Tropt total protein was 0.5 ± 0.5 ng/mL, and the mean of RBS was 151.91 ± 63.87 mg/dL (**Table - 3**).

**Table - 3:** Descriptive analysis of anthropometric and laboratory parameters.

| **Parameter** | **Summary** |
|---|---|
| Systolic BP in mm of Hg | 131.2 ± 27.39 |
| Diastolic BP in mm of Hg | 81.4 ± 14.14 |
| Heart rate / minute | 83.31 ± 14.4 |
| Total cholesterol mg/dL | 216.19 ± 56.62 |
| Triglycerides mg/dL | 117.98 ± 54.42 |
| HDL mg/dL | 43.7 ± 17.15 |
| LDL (N=99) mg/dL | 74.02 ± 36.03 |
| VLDL (N=99) mg/dL | 29.52 ± 15.3 |
| Total bilirubin (N=99) mg/dL | 1.44 ± 0.65 |
| Direct total bilirubin (N=99) mg/dL | 0.79 ± 0.46 |
| Indirect total bilirubin (N=97) mg/dL | 0.66 ± 0.33 |
| SGOT (N=99) U/L | 63.86 ± 61.3 |
| SGPT (N=99) U/L | 47.77 ± 17.92 |
| ALP (N=95) U/L | 81.71 ± 16.74 |
| Total Protein (N=99) g/dL | 7.23 ± 0.69 |
| Albumin (N=99) g/dL | 5.04 ± 14.22 |
| Urea (N=99) mg/dL | 43.02 ± 24.83 |
| Creatinine (N=99) mg/dL | 1.36 ± 0.97 |
| Serum T3 (N=97) ng/dL (total) | 0.01 ± 0.07 |
| Serum T4 (N=97) µg/dL(total) | 0.25 ± 1.33 |
| Serum TSH (N=98) µU/mL(total) | 0.97 ± 6.2 |
| Troponin – T ng/mL | 0.5 ± 0.5 |
| Random Blood Sugar mg/dL | 151.91 ± 63.87 |

Among the study population 78 (78%) had RWMA (**Table - 4**) (**Figure - 1**). The mean LVEF was 52.18 % ± 9.27% (**Table - 5**).

Among the study population, 48 (48%) of participants had involvement of anterior wall, 20 (20%) had inferior walls involvement, 1 (1%) had antero walls involved, 14 (14%) participants posterior walls involved, 13 (13%) participants had CAD walls involved. Among the study population, 14 (14%) had diabetes, 17 (17%) had hypertension, 2(2%) participants had hypothyroidism hypothyroid, and all 100 (100%) had rheumatic heart disease (**Table - 6**).

**Table - 4:** Descriptive analysis of Regional Wall Motion Abnormalities in the study population (N=100).

| RWMA | Frequency | Percentages |
|---|---|---|
| Present | 78 | 78.00% |
| Absent | 22 | 22.00% |

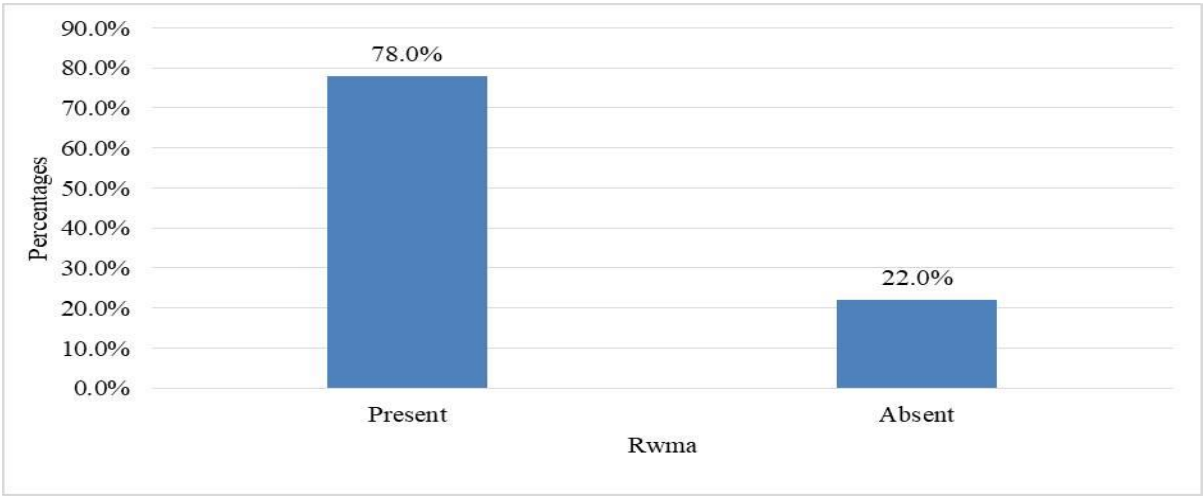
**Table - 5:** Descriptive analysis of Left Ventricular Ejection Fraction (N=100).

| Parameter | Summary |
|---|---|
| LVEF in % | 52.18 ± 9.27 |

**Table - 6:** Descriptive analysis of Diagnosis (N=100).

| Parameter | Summary n(%) |
|---|---|
| **Acute coronary syndrome in regard with the walls involved** | |
| Anterior | 48(48%) |
| Inferior | 20(20%) |
| Antero septal | 1(1%) |
| Posterior | 14(14%) |
| CAD(coronary artery disease) | 13(13%) |
| **Diagnosis** | |
| Diabetic | 14(14%) |
| Hypertensive | 17(17%) |
| Hypothyroid | 2(2%) |
| Rheumatic Heart Disease | 100(100%) |

**Figure - 1:** Bar chart of RWMA in the study population (N=100).



## Discussion

Lipid abnormality is one of important risk factor for cardiovascular disease in AMI patients. In particular, LDL-C and HDL-C are important factors for atherosclerosis and cardiovascular disease development [15]. There is sufficient evidence to point out that a decrease in LDL-C levels or increase in HDL levels can prevent the occurrence of cardiovascular disease [2, 16-18]. This study was carried out to assess the prevalence of metabolic syndrome and the pattern of serum lipid profile among patients presenting with myocardial infarction. In this study, majority of the subjects were males and their primary occupation was farming. Their mean age was 60.98 years. Majority (48%) had anterior wall MI with a mean LVEF of 52.18% in the study population. The mean total cholesterol was 216.19 ± 56.62 mg/dL, the mean triglycerides was 117.98 ± 54.42 mg/dL, the mean HDL was 43.7 ± 17.15 mg/dL, the mean LDL was 74.02 ± 36.03 mg/dL, and the mean VLDL was 29.52 ± 15.3 mg/dL.

In the literature, the total cholesterol and LDL-cholesterol levels are noted to be higher during the first 24 hours of acute myocardial infarction in patients with complicated clinical course giving a strong negative prognostic value [9, 19]. Compared to females, we observed that males were majorly affected. Albrektsen G, et al. [20] found that the association between total cholesterol and risk of MI was stronger for men than women, and incidence rate ratios (IRR) for men *vs.* women accordingly increased with increasing cholesterol, but the risk was higher for men in all subgroups (IRR in range 1.63–3.27), except among older people with low cholesterol levels [20]. In our study total cholesterol, triglycerides and RBS were seen higher among the population. In another study, levels of TC, LDL, and TG were lower in elderly than in non-elderly for the males [2] TC, LDL, HDL, and TG were all significantly higher in females than in males in the elderly. However, in the non-elderly group, there were no significant differences in TC, LDL, TG between male and female except HDL [2]. Similar to our study, Iqbal MP et al in their study observed that the mean values of serum total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol were 181 ± 50 mg/dl, 177 ± 127 mg/dl, 35.7 ± 11.3 mg/dl, and 110 ± 47 mg/dl, respectively [16]. Diabetic population was in majority in our study. In study by Khan SR, et al. [21], Serum triglycerides and VLDL were raised in both male and female diabetics. No significant differences were observed in levels of serum total cholesterol, LDL, HDL and the LDL/HDL ratio between their study and our study [21]. The levels of lipid profile change significantly in acute myocardial infarction patients and they have significantly higher levels of total cholesterol, LDL-cholesterol, VLDL cholesterol, TG, LDL-cholesterol /HDL-cholesterol, total cholesterol /HDL-cholesterol, LDH, CPK and CPK-MB and lower level of HDL-cholesterol [17]. Hence, it is recommended to maintain a low-density lipoprotein cholesterol (LDL-C) level of <70 mg/dL for such patients [18]. Non-HDL and remnant cholesterol are strongly associated with an unfavorable outcome in patients with premature myocardial infarction (</=40 years) and might be the preferred treatment target for lipid-lowering therapy [22]. Low-density lipoprotein cholesterol, low triglycerides, and high Killip severity were associated with significantly higher 30-day in-hospital mortality in patients presenting with acute myocardial infarction [12].

Lipid metabolites are indispensable regulators of physiological and pathological processes in MI patients and there are altered signatures in lipid metabolism in patients with angina or MI [23] Therefore, the initial lipid profile of patients with acute myocardial infarction is of utmost importance in determining their prognosis [12]. Effective management of hyperlipidemia is of utmost importance for prevention of recurring cardiovascular events after an acute coronary syndrome (ACS).

**Limitations and Recommendations**

The generalizability of the study findings is limited, as the study has been conducted in a single centre and is a cross sectional study. The lack of statistical significance of many of the differences between the study groups may be attributed to smaller sample size. The role of potential confounding by key variables like gender, the presence of comorbidities etc. also, could not be assessed due to a smaller sample size of the study. There is a need for large-scale multicentric studies on the subject, to enhance the quality of available evidence on the Indian population. Till such quality evidence is awaited, it is difficult to make any strong clinical practice recommendations.

## Conclusion

The present study reveals the high prevalence of the metabolic syndrome in MI cases. Of the individual components of the metabolic syndrome, triglyceride levels and RBS had the highest positive predictive value. As the prevalence of the metabolic syndrome is high worldwide and increasing day by day due to sedentary lifestyles, the findings of the present study has important implications for clinical practice.

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