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# Association of Risk Factors of Acute Myocardial Infarction and Heart Blockage among Non-Diabetic Patients in A Tertiary Care Hospital– An Observational Study

Md. Golam Mahfuz Rabbani*[1]

***Abstract***

***Introduction:*** *Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide. Cardiovascular diseases account for more than 17 million deaths globally each year. Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors.* ***Aim of the study:*** *The aim of this study was to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.* ***Materials and Methods:*** *This was an observational study conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction.* ***Result:*** *Mean age was 53.03±11.3 years & most of our patients were male. Among all patients, majority (65%) patients had > 60% blockage, followed by 30(25%) patients had 40%-60% artery blockage, and <40% blockage was found in 10% patients. Hypertension, dyslipidemia & dyslipidemia with hypertension, age ≥ 60 years, family history of CHD, smoking, diabetes & obesity were individual risk factors of CHD among non-diabetic patients. The most common risk factors for heart blockage were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life.* ***Conclusion:*** *In our study, we found hypertension, history of CHD, dyslipidemia, dyslipidemia with hypertension, stress, age ≥ 60 years, and obesity were individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients.*

***Keywords:*** *Myocardial infarction, Non-diabetic, Risk factor.*

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***1. Corresponding Author:**
**Dr. Md. Golam Mahfuz Rabbani**
Assistant Professor
Department of Cardiology
Jashore Medical College
Jashore, Bangladesh.
E-mail: mahfuz123098@gmail.com
01711113221

**Introduction:**

Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide[1]. Cardiovascular diseases account for more than 17 million deaths globally each year. This figure is expected to grow to 23.6 million by the year 2030. Ischemic heart disease alone caused 7 million deaths worldwide in 2010, an increase of 35% since 1990[2]. CVD accounted for 27% of all deaths in South Asia in 2013. This has been a substantial rise since 1990 when CVD accounted for only 15% of deaths[3]. The prevalence of coronary artery disease (CAD) in Bangladesh is about 4-6% and CVD is responsible for 17% of total deaths[4]. Coronary artery disease may manifest clinically as either chronic stable angina or acute coronary syndrome[5]. ACS encompasses unstable angina (UA), ST-segment elevation MI (STEMI), or acute non-ST-segment elevation MI (NSTEMI). ACS without myocardial necrosis is defined as UA, whereas myocardial necrosis is a necessary component of either STEMI or NSTEMI[6]. STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with ST elevation in the ECG and release of biomarkers of myocardial necrosis[7]. At present, STEMI comprises approximately 25% to 40% of all MI presentations. Although subjects with STEMI or NSTEMI share the same cardiovascular risk factors, patients with STEMI have worse short-term mortality compared with patients with NSTEMI[8]. As there is considerable variability in short-term mortality risk, therefore, in patients with STEMI, early risk stratification is crucial for successful initial management[9].The pathogenesis of coronary artery disease remains incompletely understood. Interplay between environmental and genetic factors likely to the pathophysiology of coronary artery disease. The classic risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking undoubtedly play a vital


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role; in addition some emerging risk factors and as-yet-unrecognized factors may be important[10]. However, they do not entirely explain the variation in cardiovascular disease incidence and mortality between individuals and among population[11]. Therefore, additional risk factors have been proposed to better identify patients potentially at risk for CAD[12]. Many individual new biomarkers have been related to cardiovascular risk, including levels of CRP (C-reactive protein), B-type natriuretic peptide (BNP), fibrinogen, D-dimer and homocysteine. Among these new biomarker is microalbuminuria (MAU), which is gaining recognition as a marker of an atherogenesis, owing to its association with several atherosclerotic risk factors and early systemic vascular (endothelial) damage[13]. Microalbuminuria (MAU) as a biomarker now a day is also considered a risk marker for CHD in diabetics and non-diabetics[14]. The prevalence of coronary artery disease (CAD), a major contributor to CVD, is related to the increasing prevalence of modifiable risk factors[15]. Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors[16,17]. Other risk factors identified were waist-to-hip ratio, dietary patterns, physical inactivity, blood apolipoproteins, psychosocial factors, loneliness and social isolation and C-reactive protein , uric acid and homocysteine levels [18-22].Therefore, in this study we aimed to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.

**Materials and Methods:**

This was an observational study and conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction. These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged above 20 years old; b)Patients with ST-elevation myocardial infarction; c) Patients with non ST-elevation myocardial infarction; d) Patients with acute myocardial infarction; e) Patients who were willing to participate were included in the study And a) Patients with Diabetes mellitus; b) Patients with Coagulopathy; c) Patients with previous H/O of myocardial infarction ; d) Patients with cardiomyopathy; e) Patients with any history acute illness (e.g., renal or pancreatic diseases etc.) were excluded from our study.

After admission of a patient with chest pain suggestive of acute coronary syndrome, a detailed history and physical examination was performed. Patients were asked about the major modifiable risk factors profile of coronary artery disease such as hypertension, diabetes mellitus, smoking status, dyslipidemia and family history of CVD. Previous medical records were also checked for these risk factors. A 12 lead resting ECG was done at a paper speed of 25 mm's and 10 mm standardization at admission by placing the leads in proper position. Under aseptic precaution blood sample for highly sensitive troponin I was drawn on first assessment (designated as 0 hour). sample was then sent to same standard laboratory for estimation of highly sensitive cardiac troponin-l level. Another sample was sent 3 to 6 hours after first sample. The diagnosis of acute STEMI was made with electrocardiographic (ECG) changes i.e. ST-segment elevation at the J point in 2 contiguous leads with the cut-point: 21 mm in all leads other than V2-V3 where the following cut-points apply. ≥2 mm in men 240 years: ≥2.5 mm in men <40 years, or ≥1.5 mm in women regardless of age. Plus clinical evidence of acute myocardial ischemia and detection of a rise and /or fall of Tn I values with at least 1 value above the 99th percentile of upper reference limit.

**Statistical Analysis:**

All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Jashore Medical College Sadar Hospital , Jashore, Bangladesh.

**Results:**

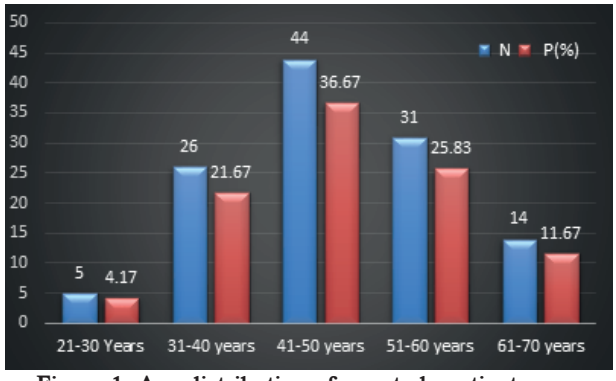


**Figure 1: Age distribution of our study patients**

Figure 1 shows that majority (36.67%) of participants belonged to the age group 41-50 years, followed by 25.83% of participants were 51-60 years and 21.67% belonged to the age group 31-40 years. Only 11.67% & 4.17% patients were found in 61-70 years & 21-30 years age group respectively.

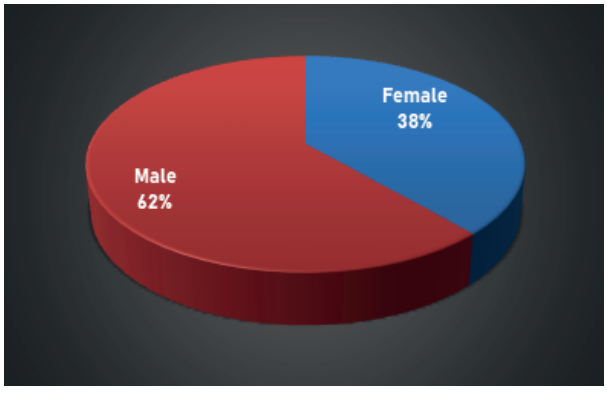


**Figure 2: Gender distribution of our study patients**

Figure 2 shows that most of the participants were male (62%) compared to female (38%).

Table I shows the baseline characteristics of our study participants. We found the mean age was 53.03±11.3 years. Among all patients, 36.67% had family history of hypertension, 35.83% & 31.67% had history of CVD & dyslipidemia respectively. Among all patients, BMI was 28.97±4.24 kg/m$^2$. Heart rate was 86 ± 17 per mins. Both systolic & diastolic bp were 135.24 ± 20.78 & 83.94 ± 10.69 respectively. Cholesterol was found 199.83 ± 42.16 mg/dL, and HDL & LDL were found 40.21 ± 9.05 & 122.35 ± 35.59 mg/dL respectively. Among all patients, majority (65%) patients had > 60% blockage, followed by 30(25%) patients had 40-60% artery blockage , and <40% blockage was found in 10% patients.

**Table I: Baseline characteristics of our study subjects**

| Baseline characteristics | N | P(%) |
|---|---|---|
| Mean age (years) | 53.03±11.3 | |
| History of hypertension | 44 | 36.67 |
| Family History of CHD | 43 | 35.83 |
| History of dyslipidemia | 38 | 31.67 |
| BMI (kg/m$^2$) | 28.97±4.24 | |
| Heart Rate (per minute) | 86 ± 17 | |
| Systolic blood pressure (mm Hg) | 135.24 ± 20.78 | |
| Diastolic blood pressure (mm Hg) | 83.94 ± 10.69 | |
| Mean FBG (mg/dL) | 119.45 ± 63.10 | |
| Triglycerides (mg/dL) | 187.85±55.04 | |
| Total cholesterol (mg/dL) | 199.83 ± 42.16 | |
| HDL (mg/dL) | 40.21 ± 9.05 | |
| LDL (mg/dL) | 122.35 ± 35.59 | |
| CAG findings | | |
| <40% | 12 | 10.00 |
| 40% - 60% | 30 | 25.00 |
| >60% | 78 | 65.00 |

CVD= cardiovascular disease, BMI = body mass index, FBS = fasting blood glucose, HDL=high-density lipoprotein, LDL=low-density lipoprotein

Table II shows the risk factors for myocardial infarction. Among 120 cases, majority (68.33%) patients had hypertension. We found dyslipidemia was 55.83%. Dyslipidemia with hypertension was found in 48.33% cases. Stress, age ≥ 60 years, family history of CHD, history of CHD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients.

**Table II: Risk factors for myocardial infarction among non-diabetic patients**

| Risk Factors | N | P(%) | P-value |
|---|---|---|---|
| Dyslipidemia | 67 | 55.83 | 0.02 |
| Hypertension | 82 | 68.33 | 0.04 |
| Dyslipidemia with hypertension | 58 | 48.33 | 0.03 |
| Stress | 26 | 23.33 | 0.01 |
| Age ≥ 60 years | 12 | 10.00 | 0.01 |
| Family history of CHD | 35 | 29.17 | 0.02 |
| History of CHD | 43 | 35.83 | 0.03 |
| Smoking | 49 | 40.83 | 0.01 |
| Obesity | 38 | 31.67 | 0.01 |

Table III shows the association of risk factors for heart blockage in myocardial infarction patients. The most common risk factors were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life. There were some other individual risk factors that were found in our patients like smoking, being overweight, rheumatoid arthritis, and physical inactivity.

**Table III: Association of risk factors for heart blockage in myocardial infarction patients**

| Risk Factors | N | P(%) | P-value |
|---|---|---|---|
| Age > 45 years | 75 | 62.50 | 0.01 |
| High blood pressure | 82 | 68.33 | 0.01 |
| High low-density lipoprotein (LDL) cholesterol | 72 | 60.00 | 0.01 |
| Overweight or obesity | 28 | 23.33 | 0.01 |
| Unhealthy diet | 94 | 78.33 | 0.02 |
| Smoking | 43 | 35.83 | 0.01 |
| Rheumatoid arthritis | 27 | 22.50 | 0.04 |
| Stressful life | 89 | 74.17 | 0.01 |
| Physical inactivity | 45 | 37.50 | 0.02 |

**Discussion:**

In our study majority (36.67%) of participants belonged to the age group 41-50 years. A study conducted by Bahall et al found the majority of patients were in 60-69 years age group[23]. In this study we found female were 38% and male were 62%. Bahall et al found male 55% & female 45% in their study similar to our study[23]. We found the mean age was 53.03±11.3 years. In the study by Haffner et al., with 7 years of follow-up, the mean age of the study population at baseline was less than 60 years,24 whereas in many other studies the mean age of the study population was 60–65 years at baseline[25-27]. Bahall et al found the overall mean age of all patients was 59.9 ± 12.07 years[23]. In our study, hypertension was the most common risk factor for AMI in non -diabetic patients. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥ 60 years, family history of CHD, CAD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients. Traditional risk factors such as hypertension,

diabetes mellitus, history of IHD, family history of IHD, smoking and alcohol consumption, but not stress and hypercholesterolemia, were associated with AMI. These risk factors were also identified in the Framingham Heart study and the INTERHEART study[28,29]. Stress and hypercholesterolemia have been identified as risk factors in other studies[30,31]. This may have been related to the patients' unclear understanding and lack of uniformity among patients' understanding of hypercholesterolemia confirmation. The lack of an association, though, has also been noted in other studies[23]. Quintana et al. found that hyperlipidemia was not associated with myocardial infarction-related fatality[32]. In a study conducted by Goldfeld et al., patients with cardiac symptoms without overt CAD showed similar depression and/or stress levels as postmyocardial infarction patients[33]. Hypercholesterolemia is still a cause of concern since it is related to dietary patterns and type of food consumption[34]. Clusters of risk factors for CAD have been identified in numerous studies in Trinidad[23]. Thomas et al. revealed that diabetes mellitus, hypertension, hyperlipidemia and cigarette smoking were prevalent among patients presenting with AMI[35]. Mungrue et al. identified smoking and BMI as predictors of AMI-related death or survival[36]. Smoking was associated with a 1.6-times higher risk for AMI and BMI with a 1.3-times higher risk[36]. Alfred et al. found the most common risks associated with AMI in Tobago to be dyslipidemia, hypertension and diabetes mellitus[37]. Smoking, diabetes, hypertension and history of CAD were found to be the most common cardiovascular risk factors in Libya,[38] and smoking and a family history of CAD were the common ones in Pakistan[39]. In a study on the epidemiology of myocardial infarction, associated risk factors for AMI mortality included age of > 84 years, female sex, educational level and smoking[40]. In the Nurses' Health Study the excess risk of CHD mortality associated with prior CHD was higher than that associated with diabetes in all age groups studied (<55 years, 55–64 years and ≥65 years). This was, however, dependent on the duration of diabetes so that in women with a diabetes duration of more than 15 years the risk of CHD death was similar to that in women with prior CHD but no diabetes[41]. It is well-documented that diabetes raises the risk of CHD to a greater extent in women than in men[42,43]. It is as yet unknown what generates this increased risk in diabetic women that already exists in the prediabetic stages as it is only partly explained by an excess of the classic risk factors[44,45]. However, in the study by Mukamal et al. the results were sensitive to the duration of diabetes; when newly detected cases of diabetes were added to the analysis, CHD conferred a higher risk than diabetes[42]. Bahall et al found that diabetes, hypertension, smoking and alcohol consumption were significantly associated with AMI cases. However, stressful life, hypertension, hypercholesterolemia and smoking showed significant associations among controls[23]. This is in contrast to the findings of Kawano et al. who found that hypercholesterolemia is an independent risk factor for AMI in men but not in women[46].

**Conclusion and recommendations:**

In our study, we found hypertension, history of CHD, family history of CHD, smoking is associated with CHD. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥ 60 years, and obesity were also individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients. Early identification of modifiable risk factors is important to set the strategy for prevention. So further study with a prospective and longitudinal study design including a larger sample size needs to be done to identify more risk factors to prevent mortality among non-diabetic patients.

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