A STUDY OF RISK FACTORS IN MYOCARDIAL INFARCTION IN TRIBAL POPULATION

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ABSTRACT: The present study was conducted to know the relation of myocardial infarction with its risk factors and to prevent future cardiac events. MATERIAL AND METHODS: 60 cases of myocardial infarction were selected along with 60 age and sex matched healthy controls. Body mass index, blood pressure, fasting plasma glucose and lipid profile were measured. STATISTICAL ANALYSIS: All values were expressed as Mean +/- SD. The results obtained were analyzed statistically using the unpaired student ‘t’ test to evaluate the significance of difference between the mean values. RESULTS: The values of body mass index, fasting plasma glucose, systolic blood pressure, diastolic blood pressure, total cholesterol, total triglycerides and low density lipoprotein cholesterol were increased whereas high density lipoprotein cholesterol was decreased in the patients of myocardial infarction. CONCLUSION: On the basis of our results, it may be concluded that risk factors increase incidence of myocardial infarction.

KEYWORDS: myocardial infarction, atherosclerosis, ischemia, risk factors

INTRODUCTION: Myocardial infarction (MI) is one of the leading causes of death in the world today. The World Health Organization estimated in 2004 that 12.2% of worldwide deaths were from ischemic heart disease,[1] with it being the leading cause of death in high or middle income countries.[1] Ischemic heart disease is also becoming a more common cause of death in the developing world. In India ischemic heart disease had become the leading cause of death by 2004 accounting for 1.46 million deaths (14% of total deaths) and deaths due to ischemic heart disease were expected to double by 2015.[2]

Interruption of blood supply to a part of the heart causes heart cells to die and can lead to MI. This is most commonly due to blockage of a coronary artery which supplies oxygen, glucose and other nutrient rich blood to the heart muscle following the rupture of a vulnerable atherosclerotic...
plaque. The resulting ischemia and ensuing oxygen shortage if left untreated for a sufficient period of time can cause damage or death (infarction) of heart muscle tissue (myocardium). Depending on the extent of damage of heart muscle the patient may experience significant disability or die as a result of myocardial infarction.

Atherosclerosis is initiated by endothelial damage caused by elevated cholesterol and triglycerides in the blood and high blood pressure. Atherosclerosis\[^1\] (cholesterol and fibrous tissue plaque)\[^3\] slowly builds up in the inner lining of a coronary artery and then suddenly ruptures causing catastrophic thrombus formation totally occluding the artery\[^4\] and preventing blood flow downstream.

Complications of MI include arrhythmia, pericarditis, myocardial rupture and thromboembolism. Severe MI leads to heart failure.\[^1\] Cardiogenic shock and sudden death frequently occur due to the development of ventricular fibrillation in MI.\[^1\]

Risk factor assessment was taken up in the present study which can be used as screening tools for assessing the level of risk for the development of MI: age,\[^5\] gender, family history of MI,\[^5\] obesity,\[^6\] diabetes mellitus,\[^7\] hypertension,\[^8\] hypercholesterolemia,\[^8\] high low-density lipoprotein,\[^8\] high triglycerides,\[^8\] low high-density lipoprotein,\[^8\] tobacco smoking,\[^8\] and lack of physical activity.\[^5\]

Physical inactivity, a sedentary lifestyle and excessive food intake contribute obesity. Obesity is a medical condition in which excess body fat accumulates to the extent that it may have an adverse effect on health leading to reduced life expectancy and/or increased health problems.\[^9\] Diabetes mellitus is a group of metabolic diseases in which a person has high blood sugar either because the pancreas does not produce enough insulin or because cells do not respond to the insulin that is produced.\[^10\] Sustained higher levels of blood sugar cause damage to the blood vessels and to the organs they supply leading to the complications of diabetes. Hypertension places a higher workload on heart. If left untreated it damages the arteries and heart.

Hypercholesterolemia is increased levels of cholesterol in the blood which increases the risk of formation of plaques and atherosclerosis.\[^8\] Low-density lipoprotein (LDL) particles increase a risk for cardiovascular disease when they invade the endothelium and become oxidized since the oxidized forms are more easily retained by the proteoglycans. A complex set of biochemical reactions regulates the oxidation of LDL particles chiefly stimulated by presence of necrotic cell debris\[^11\] and free radicals in the endothelium.

High-density cholesterol (HDL) helps to keep the LDL cholesterol from getting lodged into the arterial walls. Several steps in the metabolism of HDL can contribute to the transport of cholesterol from lipid-laden macrophages of atherosclerotic arteries (foam cells) to the liver for secretion into the bile. This pathway has been termed reverse cholesterol transport and is considered as the classical protective function of HDL toward atherosclerosis. HDL and their protein and lipid constituents help to inhibit oxidation, inflammation, activation of the endothelium, coagulation and platelet aggregation. All these properties may contribute to the ability of HDL to protect from atherosclerosis.

Smoking was associated with endothelial dysfunction and precipitate coronary spasm\[^12\]. Lack of physical activity\[^5\] and sedentary lifestyle increases adipose tissue (predominantly central), triglycerides, blood pressure, glucose and reduces HDL cholesterol.
Even though there are different studies, the alarming severity warrants further in-depth studies to assess the risk factors of MI. Hence we have taken up the present study with an aim to assess risk factors of MI and suggest preventive measures.

**MATERIAL AND METHODS:** The present study was carried out in the Department of Biochemistry, Mamata Medical College and Mamata General Hospital, Khammam, Andhra Pradesh. The present study was carried out during January 2011 to June 2012.

**SUBJECTS:** A total of 120 individuals were included in this study. Out of these 60 were patients of MI and 60 were age and sex matched healthy controls aged between 40 to 70 years. Informed consent was obtained from each subject.

**EXCLUSION CRITERIA OF CASES:**
1. Alcoholics
2. Subjects on lipid lowering drugs
3. Acutely ill patients
4. Subjects with previous history of heart disease
5. Occasional smokers

**INCLUSION CRITERIA OF CASES:** Freshly diagnosed MI cases

**INCLUSION CRITERIA OF CONTROLS:** Healthy controls aged between 40 to 70 years

**Exclusion criteria of controls:**
1. Hypertensive
2. Smoker
3. Diabetic
4. Persons with obesity
5. Alcoholics

The diagnosis of MI was based on clinical history, electrocardiogram, echocardiogram and biochemical markers (troponin and cardiac enzymes). History of hypertension, smoking, diabetes mellitus and physically activity were recorded.

Anthropometric measurements: Height and weight were measured. Body mass index (BMI) was calculated using the formula weight (kg)/height (m$^2$). People are considered obese when their BMI exceeds 25 kg/m$^2$.

Patients with persistent elevation of blood pressure ($\geq$140/90 mmHg) or who were on anti-hypertensive drugs were classified as hypertensives$^{[13]}$. Diabetes in our study was defined using the American Diabetes Association criteria$^{[14]}$ or patients on treatment. Smokers: regular dialy and current smokers (irrespective of number) were included.

**SAMPLE COLLECTION:** 5 ml of venous blood was collected after overnight fasting from each subject and divided into two parts. EDTA is added to 1 ml blood and then centrifuged, plasma separated and used to determine fasting plasma glucose (FPG). Remaining 4 ml of venous blood was also centrifuged at 3000 rmp for 15 minutes, serum separated and used for the estimation of total cholesterol (TCH), serum triglycerides (TAG) and high density lipoprotein cholesterol (HDL-C).
**ORIGINAL ARTICLE**

**BIOCHEMICAL ESTIMATIONS:** Measured by Erba semiautomated analyzer. Glucose was determined by using the Glucose Oxidase/Peroxidase (GOD/POD) method. Cholesterol was determined by using Enzymatic method (Cholesterol Oxidase). Triglycerides was determined by using Enzymatic method (Glycero Phosphate Oxidase). HDL-C was determined by using Precipitation-Enzymatic method (Cholesterol Oxidase Peroxidase). Low density lipoprotein cholesterol (LDL-C) was calculated using Friedewald formula: LDL = total cholesterol – (HDL + triglycerides/5).

**STATISTICAL ANALYSIS:** All values were expressed as Mean +/- SD. The results obtained were analyzed statistically using the unpaired student ‘t’ test to evaluate the significance of differences between the mean values.

**RESULTS:** 60 patients of MI and 60 age and sex matched healthy control subjects were enrolled. Distribution of age and sex were recorded in table 1. Demographic profile of the study group is in table 2. The mean sum of levels and p values of different parameters were noted in table 3.

Males had higher risk of MI in our study. 37 were males (61%) and 23 (39%) were females. Women were at more risk in postmenopausal period. None of the females were smokers due to their cultural habits. 27(45%) patients had diabetes and 43 (71%) had hypertension. Our study demonstrated that 7 patients (11%) had a known family history of MI. 17(29%) of patients had a history of smoking. 35(57%) patients were physically inactive.

The mean levels of BMI, FPG, systolic blood pressure, diastolic blood pressure, TCH, LDL-C and TAG were increased in MI cases when compared with controls and the mean difference was statistically significant. The mean HDL-C level was decreased in cases when compared with controls and the mean difference was statistically significant.

**TABLE 1:** Age and sex distribution of cases

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number(%)</th>
<th>41-50 years</th>
<th>51-60 years</th>
<th>61-70 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>37(61%)</td>
<td>5</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Female</td>
<td>23(39%)</td>
<td>2</td>
<td>5</td>
<td>16</td>
</tr>
</tbody>
</table>

**TABLE 2:** Demographic profile of the study group MI (n=60)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>37(61%)</td>
</tr>
<tr>
<td>Female</td>
<td>23(39%)</td>
</tr>
<tr>
<td>Family history of MI</td>
<td>7(11%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>43(71%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>27(45%)</td>
</tr>
</tbody>
</table>
TABLE 3: Mean± SD of variables in the study and control groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>MI(n=60)</th>
<th>controls(n=60)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure</td>
<td>148.4±18.6</td>
<td>115.9±5.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>90.1±20.6</td>
<td>75.8±5.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI</td>
<td>26.9±1.5</td>
<td>20.5±1.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fasting plasma glucose</td>
<td>129.2±32.1</td>
<td>83.2±10.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum total cholesterol</td>
<td>228.4±25.3</td>
<td>166.7±10.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum triglycerides</td>
<td>192±35.8</td>
<td>102.9±20.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum HDL-C</td>
<td>36.5±3.5</td>
<td>47.6±5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Serum LDL-C</td>
<td>157.4±25.2</td>
<td>98.6±8.4</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

DISCUSSION: We observed that the population of tribal areas in Andhra Pradesh had not been previously taken up for the study of risk factors of MI and its preventive measures. Hence the study has been taken up to know association of the risk factors of MI independently or in combination in the population in Khammam district and surrounding areas which are mostly populated with tribals. In this study it was observed that the risk of MI increased with the advancing age. Our results showed that the peak incidence of MI was 50-60 years in men and 60-70 in women. As per our study the cases among men were 61% (37) and women were 39% (23). Our study found that the incidence of cases in men in the group of 50-60 years was 48% (18) and 70% (16) in women in the group of 60-70 years. 88% (53) cases were 50 years of age or older in men and women. Female cases were more after menopause. At any given age men are more at risk than women particularly before the menopause. [16]

Prevalence of obesity is alarmingly increasing in the worldwide population which we found a major risk factor for MI. Obesity has been found to reduce life expectancy. [9] Our results showed that the measurement of BMI was significantly raised (p<0.001) in the patients than controls. The observations of Yusuf et al were in accordance with our findings. [6] Obesity raised blood pressure and cholesterol and increased the risk of diabetes.

Hyperglycemia is a condition in which an excessive amount of glucose circulates in the blood plasma. Our results showed significantly raised (p<0.001) level of FPG in the patients of MI than controls. In our study diabetes was found in 45% (27) cases. As per our results diabetes mellitus was one of the major and independent risk factors for MI. Similar findings were made by Buse JB et al. [7] High blood pressure is a chronic medical condition in which the blood pressure in the arteries is elevated. [13] Different studies reported that though vegetarianism was common...
among Indians most of them consumed high carbohydrate, high salt and low fiber diet such as green leafy vegetables and fruits which contributed to increase in triglyceride, blood pressure and plasma sugar and also have higher risk for MI.

In our findings 71% (43) were hypertensive. Our results showed that hypertension alone or in association with other risk factors increased the risk for MI. Our study revealed that the levels of both systolic blood pressure and diastolic blood pressure increased in the patients when compared with controls. These were in accordance with earlier findings. According to different studies hypertension was a major risk factor for atherosclerosis in coronary arteries leading to MI and was most important risk factor for cardiovascular morbidity and mortality.

Hypercholesterolemia is the presence of high levels of cholesterol in the blood. Longstanding elevation of serum cholesterol can lead to atherosclerosis and obstruct blood flow of a coronary artery leading to MI. In our study we observed significantly raised level of total cholesterol in patients. We found that increased serum total cholesterol level was one of the risk factors for MI which was in conformity with the study of Smith SC et al. LDL particles can transport cholesterol into the artery wall, retained there by arterial proteoglycans and attract macrophages that engulf the LDL particles and start the formation of atherosclerotic plaques. In our study, we observed significantly raised level of serum LDL-C in patients when compared with controls. We found that increased serum LDL-C level was one of the risk factors for MI.

Hypertriglyceridemia denotes high blood levels of triglycerides. High levels of triglycerides in the bloodstream have been linked to atherosclerosis and by extension the risk of heart disease. In our study, we observed significantly raised (p<0.001) level of serum triglyceride in the cases. We found that increased serum triglyceride level was one of the risk factors for MI. Smith SC et al in their study also reported the same.

The level of HDL-C was significantly decreased (p<0.001) in cases than controls. We found that decreased serum HDL-C level was one of the risk factors for MI. Smith SC et al in their study reported the same. Low HDL-C levels have increased rates for heart disease. High HDL levels correlated with better cardiovascular health. The HDL cholesterol removes excess cholesterol in the blood and can help to protect against heart disease.

Smoking accelerates the progression of CAD, diminishes the blood's capacity to carry oxygen to body tissues, damages the blood vessel walls and makes the blood more likely to clot leading to MI. In our study 29% (17) cases were found to be smokers. Our results showed that smoking was a risk factor for MI. Other studies also revealed the same.

Graham I et al. stated that lack of physical activity was one of the risk factor for MI which was in conformity with our study. It was observed in our study that 57% (35) were physically inactive. Our study also found that physical inactivity was associated with other risk factors of MI.

Our results showed that family history of MI increased the risk for MI which was in conformity with the observations of Graham I et al. It was observed in our study that 11% (7) cases were having a family history of MI. Family history of ischaemic heart disease or MI was a risk factor particularly if one has a first-degree relative (father, brother, mother, sister) who suffered a 'premature' MI [defined as occurring at or younger than age 55 years (men) or 65 (women)].

According to Graham I et al, Devlin RJ and Henry JA important risk factors for MI were older age, high blood levels of certain lipids (LDL cholesterol and triglycerides) and low levels of HDL cholesterol, diabetes, high blood pressure, lack of physical activity and obesity. According to
Framingham Heart Study the main risk factors for MI were age, gender, diabetes, total cholesterol, HDL cholesterol, tobacco smoking and systolic blood pressure.[32]

In our study hypertension (71%) stood first in the risk factors and physical inactivity (57%), diabetes (45%) and smokers (29%) were also found more significant.

The risk factors for MI can be prevented by taking necessary lifestyle modifications:

Physical activity: Aerobic exercise for 30 minutes every day at least 5 days a week reduces weight (obesity), diabetes, blood cholesterol[33], triglyceride levels, improves blood pressure[34], produces more HDLs and reduces the risk of MI.[35]

Dietary changes: Reducing the consumption of energy-dense foods such as those high in fat and sugars and increasing the intake of dietary fiber reduce weight (obesity). Reduced salt intake[36] improves blood pressure. A diet low in saturated fats,[25] trans-fat-free and low cholesterol foods reduce cholesterol level. Diet free from trans-fat, limiting carbohydrates and processed sugars reduce production of LDL-C and triacylglycerol.[37,38,39] These dietary changes reduce the risk of MI. Weight loss improves diabetes and blood pressure,[9,40] reduces blood cholesterol and triglyceride levels. Cessation of smoking reduces blood cholesterol, improves blood pressure and reduces the risk of myocardial infarction.

The 2004 British Hypertension Society guidelines[41] and US National High BP Education Program in 2002[42] were in confirmation with the above recommended hypertensive preventive measures. These have all been shown to significantly reduce blood pressure in people with hypertension.[43]

Our study showed that there was an increase in the prevalence of MI with its risk factors either independently or in combination. Therefore counselling and education about lifestyle modifications are crucial to reduce and prevent the incidence of MI and the resultant morbidity and mortality.

As per our study there is no awareness about the risk factors of MI in rural and tribal population. Hence they are not taking any preventive measures. Based on our study we recommend that measures should be taken to improve the awareness about the MI and associated risk factors and initiate lifestyle measures including diet management and weight reduction.

REFERENCES:


