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Research Article

Risk Factors for Acute Myocardial Infarction among Rural Population of Bihar: A Community-Based Study

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Abstract: Coronary artery disease is progressively assuming an alarming proportion as a cause of morbidity and mortality in India and other developing countries in South Asia. There are a number of studies on coronary risk factors in Indian subcontinent, mostly in urban population, which pointed to differences in the prevalence of the risk factors in different geographical territories of the country. There was no such community-based study in rural population of Bihar. Hence this case control study was undertaken to evaluate the important biochemical risk factors for rural patients admitted to hospital with acute myocardial infarction. 100 consecutive cases of first attack of AMI aged 30 to 90 years were compared to 50 ages and sex matched healthy controls. Age, gender, blood pressure, history of smoking and diabetes mellitus, waist-hip ratio and Body Mass Index were recorded in each subject. Blood samples for fasting blood glucose, HbA1C, serum cholesterol, triglyceride, HDL–cholesterol and LDL-cholesterol were collected within 24 hours of admission in cases. It was found that high FBG, HbA1c, TG, low HDL cholesterol were significant in all the age groups above 40 years. Smoking, hypertension, abdominal obesity were important risk factors for AMI in our study. Interestingly our study is not associated with increased risk of AMI with either cholesterol or LDL levels. . In order to implement preventive approach to CAD, our findings suggest that policy makers, physicians and non government organizations and public must work together and develop risk reduction strategies that focus on promoting healthier lifestyles in the rural communities.
Keywords: Coronary artery disease, risk factors, rural population

INTRODUCTION

India and other developing countries in South Asia are currently in a stage of epidemiological transition and burden due to coronary artery disease assuming an alarming proportion. In India the prevalence of CAD has increased from 40 per thousand in 1968 to nearly 110 per thousand in 2001[1]. By 2020 of 2.6 million Indians are predicted to die due to coronary heart disease, which constitute 54.1% of all Cardio vascular disease death. [2, 3] In the recent past probably no disease other than IHD has so extensively been studied and the efforts have yielded remarkable advances in our understanding about the various aspects of the disease including its etiology, pathogenesis management and rehabilitation. There are a number of studies on coronary risk factors in Indian subcontinent, which pointed to differences in the prevalence of the risk factors in different geographical territories of the country [4, 5]. Over the time this disease has also changed some of its patterns. Contrary to the previous concept of it being the disease of affluent urban society it has entered the houses of poor and rural populations. Almost 75% of the Indian population lives in rural areas. Most of the studies conducted on IHD in India are based on urban population. Only a few studies were conducted in rural areas suggested that CAD was not a major problem in rural communities [6].

However admission data of our hospital located in rural area of Bihar showed that CAD has moved up the ranking by several folds (unpublished observations). Though the association of the risk factors with IHD is well established, there was no such community-based study in rural population of Bihar. Hence this case control study is being undertaken with the aim of evaluating the important biochemical risk factors for patients from rural population admitted to our hospital with acute myocardial infarction.

MATERIALS AND METHODS

The present study is a prospective hospital based case control study. 100 consecutive cases of first attack of Acute Myocardial Infarction (AMI) aged 30 to 90 years were compared to 50 ages and sex matched healthy controls. Required permission for the research methodology was obtained from the ethical committee of the institute where study was conducted.

Selection of cases and controls

A) Cases

Patients with first episode of myocardial infarction who presented within 24 hours of the onset of the chest pain admitted to clinical care unit were recruited. The diagnosis of AMI was formally established as recommended by WHO with patients fulfilling at least two of the following criteria

1. A suggestive history of chest pain
2. Typical changes on the ECG having ST segment elevation of >1mm in at least 2 contiguous chest leads or new onset left bundle branch block.
3. Elevation of enzyme creatine kinase at least two times the upper normal level with 10% CK-MB fraction.

B) **Controls**

Age and sex matched controls were recruited either from volunteers or patients admitted. None of them had any evidence of coronary artery disease (angina, chest pain, dyspnoea, fatigue etc.)

C) Exclusion criteria applied

Any person having evidence of disease which may adversely affect the outcome was not included in case or control group. They were

- Patients who presented >24 hours after the onset of chest pain
- Patients with history of previous myocardial infarction
- Patients with liver disease
- Patients with renal disease
- Patients with joint pain
- Patients with hypothyroid/hyperthyroid disease
- Patients with cerebrovascular disease
- Patients with anaemia
- chronic obstructive lung disease

Evaluation of risk factors

Following risk factors were evaluated in all subjects (cases and controls) included in the study. Data was recorded using standard forms on age, gender,blood pressure history of smoking and diabetes mellitus. Waist hip ratio (WHR) and Body Mass Index (BMI in Kg/m2) were also measured in each subject. Blood samples were withdrawn from all the subjects (within 24 hours of admission in cases) for the analysis of fasting blood glucose, HbA1C, lipid profile that included investigations of serum cholesterol, triglyceride, HDL –cholesterol and LDL-cholesterol. All the biochemical investigations (except HbA1C) were carried out on a semi automated chemistry analyzer using standard kits. HbA1C was determined using ion exchange resin method.

Table 1: Cut off levels for different biochemical parameters used in study

Biochemical Parameters	Cut off level
Fasting blood glucose	>125mg/dl
Glycated hemoglobin (HbA1C)	>7
Cholesterol	>200mg/dl
Triglyceride	>150mg/dl
HDL cholesterol	<40mg/dl
LDL cholesterol	>130mg/dl

The SPSS statistical package was used for analysis. P value < 0.05 was considered as significant.

RESULTS

In our study 82% of the cases were above 50 years old and 76% were males suggesting that AMI is more common in elderly population and in males.

The Mean ±SD FBG levels was significantly high in all age groups except in the <40 years group compared to the corresponding age groups in controls (p=0.001). However the number of cases with higher FBG was significantly high in all age groups.

Mean HbA1C levels were significantly high in all age groups of cases (p=0.009)

The total cholesterol levels (mean±SD values) ranged between 192.43±32.80 to 197.5±35 in different age groups of cases and these values were not significantly different compared to the CHO levels in corresponding age groups of controls (p= 0.145) There is also no significant difference in the number of individuals with higher cholesterol levels in all age groups of cases and controls.

Except in the age groups of < 40 years the triglyceride levels were significantly high in all the other age groups of cases compared to control groups(p=0.008)

The HDL cholesterol levels were significantly low in all age groups of cases except in <40 years age group compared to the levels in control groups (p=0.0114).

The mean LDL cholesterol levels were not significantly different in any of the age groups compared to the levels in control groups (p=0.219). Accordingly the numbers of cases with raised LDL cholesterol levels in all the age groups were also not significantly high compared to the control groups.

Comparative analysis of different biochemical parameters in cases and controls (Table 1)

Mean and SD levels of six biochemical parameters except cholesterol and LDL were statistically significant between cases and controls (p <0.05)

Table 2: Comparative analysis of different biochemical parameters in cases and control groups

Biochemical parameters	Mean±SD values in		p value
	Cases (n=100)	Controls (n=50)	
Fasting blood glucose(mg/dl)	159.16±85.63	96.4±18.68*	0.001
Glycated hemoglobin	6.94±1.84	5.32±0.85*	0.009
Cholesterol(mg/dl)	193.94±32.03	185.20±37.28	0.145
Triglyceride(mg/dl)	190.66±77.84	154.70±76.57*	0.008
HDL cholesterol(mg/dl)	42.97±10.62	47.64±10.31**	0.0114
LDL cholesterol(mg/dl)	111.34±38.36	103.14±38.37	0.219

*Mean levels were significantly high in cases compared to the levels in control group.
**Mean HDL cholesterol levels in cases were significantly low compared to the levels in controls

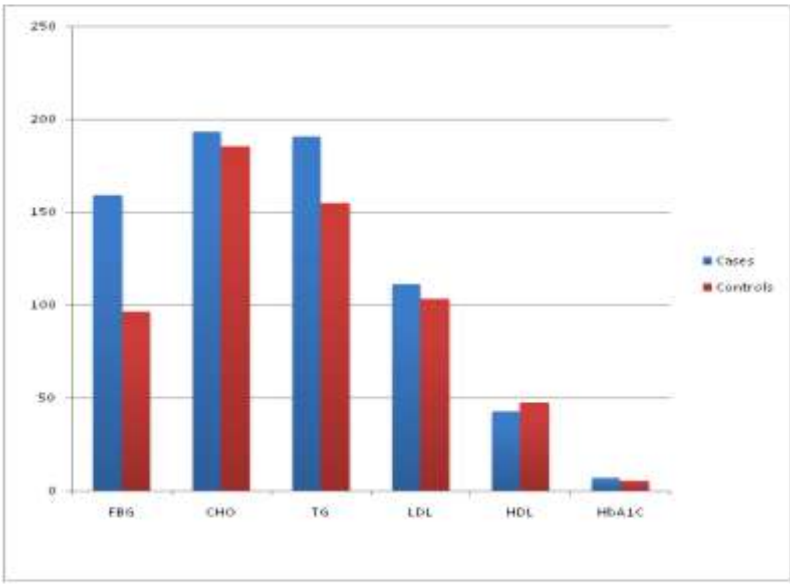

Fig. 1: Comparative analyses of different biochemical parameters in case and control groups. Bars represent mean ± SD levels in each group

Table 3: Analysis of different biochemical and other biophysical parameters in study population

Variables	Odds Ratio	95%CI	P value
FBG>125mg/dl	5.67	2.28, 14.05	0.001
HBA1C>7	6.8	1.91, 24.19	0.009
Cholesterol>200mg/dl	2.84	1.31, 6.11	0.145
TG>150mg/dl	1.56	1.29, 3.14	0.008
HDL<40mg/dl	1.53	1.35, 3.17	0.0114
LDL>130mg/dl	2.15	1.18, 5.47	0.219
Ever smoked	2.10	1.03,4.24	0.000
H/O DM	4.64	2.15, 9.97	0.000
Hypertension SBP>140/DBP>90	2.82	1.12, 7.11	<0.01
WHR>0.85(F) or>0.95(W)	3.70	1.04, 5.24	0.0001
BMI>25Kg/m2	2.24	1.66, 8.26	0.0008

Analysis of different parameters showed that patients with raised fasting blood glucose (OR 5.67, CI 2.28, 14.05), glycated hemoglobin (OR 6.8, CI 1.91, 24.19), triglyceride (OR 1.56, CI 1.29, 3.14), decreased HDL cholesterol (OR1.53, CI 1.35, 3.17) were at greater risk of AMI in our study population. The same were true for people having smoking habit (OR 2.10, CI 1.03,4.24), hypertension (OR2.82, CI1.12,7.11), diabetes mellitus (or 4.64, CI 2.15, 9.97), high waist hip ratio (OR3.7, CI 1.04,5.24) and increased BMI (OR 2.24, CI 1.66,8.26).

DISCUSSION

Epidemiological studies have identified a number of important risk factors for CAD. Previous case control studies from India have reported importance of smoking, hypertension, diabetes and abnormal lipids in pathogenesis of CAD [7].

This study was designed in a tertiary care hospital in rural region of Bihar. Cases and controls represent a homogenous population. The consistency of results across different types of comparative analysis weighs against the existence of major bias. We avoided selection bias by excluding cases with known history of acute myocardial infarction and enrolled those who had an attack of AMI in the last 24 hours. Matched case control study was designed because it ensures that cases and controls were comparable with respect to major risk factors related to the disease. To reduce the effect of confounding we chose age and sex matched controls.

Almost all studies on risk factors for IHD in Indians or abroad except one [4] have been cross sectional surveys. Epidemiologically the strongest way to demonstrate a cause and effect relationship between a risk factor and disease would be a cohort study but is expensive in terms of money and time. So we believe that case–control design provides a reasonable alternative between a cross sectional and cohort study.

Diabetes mellitus is an independent risk factor for cardiovascular mortality, increasing this risk by 1.5 to 4.5 fold [8]. In our study patients with raised fasting blood glucose was not only the powerful predictor of AMI but its association with AMI was stronger than that reported in two previous Indian studies Pais et al 1996 and Gerstein et al 1999 who found that high fasting blood sugar values were associated with a 2.84 (95% CI 1.63, 4.93) and 3.22 (95% CI 1.51, 6.85.) fold risk of developing AMI respectively [4, 9]. We found that patients with a history of diabetes had 4.64 times of more risk of developing acute myocardial infarction , the true value of this risk lies between 2.15 and 9.97. The wide confidence intervals suggest that our study lacked enough patients to detect the true risk posed by diabetes. 48% of our cases had fasting hyperglycemia compared to 14% controls (OR 5.67, 95% CI 2.28, 14.05). This may be due to lack of awareness regarding diabetes mellitus and its control in the rural population. These patients may also find it difficult to undergo screening for diabetes because of financial, logistic, and cultural reasons. Thus our results correlate with the previous studies and suggest fasting plasma glucose level as a strong predictor of AMI.

Our present study showed cases having 6.8 (95% CI 1.91, 24.19) fold risk of developing AMI with high glycated hemoglobin (p =0.009). Diabetic patients with poor glycaemic control have a higher frequency of CAD as compared to the euglycaemic population [10, 11].

Hyperlipidemia is recognized as a potent modifiable risk factor for CAD. Gupta et al 2002 has shown that total cholesterol and triglycerides were higher while HDL levels were lower in individuals with IHD than in those without IHD [12]. A higher prevalence of low HDL cholesterol and an elevated triglyceride level was found in the rural than in the urban population by Chadha *et al*. [13]. Rural populations who consume low fat and high carbohydrate diets have low HDL cholesterol and high triglyceride levels [13, 14]. In our study the logistic regression showed that after adjusting for other risk factors , raised triglycerides (OR 1.56, 95% CI 1.29, 3.14) and low HDL cholesterol (OR 1.53, 95% CI 1.35, 3.17) levels were independently associated with higher risk for AMI. Our findings agree with those of

Gupta *et al*. and Panwar *et al*. who reported high triglycerides, with low HDL [15, 16].

It is important to consider the role of air pollution in the pathogenesis of coronary heart disease in the urban population. The toxic compounds involved in air pollution e.g. oxides of nitrogen, sulfur dioxide and suspended particles, are powerful pro-oxidants that enhance the oxidation of lipoproteins and oxidized lipoproteins, particularly LDL cholesterol, are powerful inducers of atherosclerosis [13]. Interestingly our study is not associated with increased risk of AMI with either cholesterol or LDL levels. This observation may be due to relatively low air pollution and low concentration of pro-oxidants in rural areas.

In our population the waist–hip ratio (abdominal obesity) was a strong independent risk factor associated with a 3.7 (95% CI 1.04, 5.24) fold risk of developing AMI. Hypertension (OR 2.82, 95% CI 1.12, 7.11) and smoking (OR 2.10, 95% CI 4.24, 1.03) were found to be important risk factors for AMI in our study. Our findings accord with those of Pais *et al*., Gupta *et al*. and Panwar *et al*. [4, 15, 16]. The odds of AMI were almost four fold higher for current smokers compared to nonsmokers [4]. Smoking acts synergistically with other risk factors substantially increasing the risk of CHD [17]. In India tobacco exposure takes the form of beedis, cigarettes, ghutka, pan, cheelum, and chewing tobacco. Most villagers in India smoke beedis (unfiltered cigarettes) which deliver a higher content of carbon monoxide and nicotine than conventional Indian cigarettes. In fact, in our study most of the patients were beedi smokers than cigarette smokers. Our study supports the conclusion that tobacco control programmes in India and other countries of the region could have an important public health impact.

Our study is limited by the fact that the sample of AMI may not be the representative of all patients with the disease because those who were undiagnosed, misdiagnosed, had non ST elevation AMI, those who reported late to the hospital or died soon after arrival were not included. We measured glucose, glycated hemoglobin and lipid levels only once at the time of admission which reflected only current levels. We cannot exclude the possibility that an isolated increase in blood glucose within 24 hours of AMI may reflect stress hyperglycemia.

Table 4: Comparison with previous studies

Risk factor	Pais *et al*., 1996	Gupta *et al*., 2009	Panwar *et al*., 2011	Our study
Smoking	3.6 (2.20 ,6.3)	6.3 (10.5, 21.5)	19.41 96.82, 55.25)	2.10 (4.24, 1.03)
Hypertension	1.76 (0.96, 3.22)	13 (6.9, 24.6)	8.91 (5.4, 14.68)	2.82 (1.12, 7.11)
diabetes	2.28 (1.28, 4.06)	4.0 (0.3, 64.5)	1.88 (0.99, 3.57)	4.64 (2.15, 9.97)
Impaired fasting blood glucose	2.84 (1.63, 4.93)	-	-	5.67 (2.28, 14.05)
High Cholesterol	NS	-	1.44 (0.94, 2.22)	NS
High LDL	NS	6.4 (3.3, 12.2)	2.49 (1.62, 3.84)	NS
Low HDL	NS	2.4 (1.5, 3.8)	10.32 (6.3, 16.91)	1.53 (1.35, 3.17)
High Triglyceride	NS	3.7 (1.9, 7.1)	3.62 (2.35, 5.59)	1.56 (1.29, 3.14)
Waist-hip ratio	3.12 (1.8, 5.4)	21.1 (12.9, 34.2)	_	3.7 (1.04, 5.24)

Figures in parenthesis indicate 95% confidence intervals

CONCLUSION

This community based case-control study in rural population of Bihar shows that high FBG, HbA1c, TG, low HDL cholesterol are significant in all the age groups above 40 years, increase in HbA1C being significant in all the age groups. Smoking, hypertension, abdominal obesity are important risk factors for AMI in our study. Our study is not associated with increased risk of AMI with either cholesterol or LDL levels. Creating awareness about diabetes mellitus in villages, timely diagnosis, treatment and proper glycaemic control along with reduction of triglycerides, blood pressure, central obesity and elevation of HDL cholesterol (perhaps through physical activity and dietary interventions) and cessation of smoking may be important in controlling the burden of coronary artery disease in the rural population. In order to implement preventive approach to CAD, our findings suggest that policy makers, physicians and non government organizations and public must work together and develop risk reduction strategies that focus on promoting healthier lifestyles in the rural communities. Ultimate public health goal is not just to control diseases or just to reduce high risk, but to prevent high risk in the first place among individuals and entire population.

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