Risk Factors for Acute Myocardial Infarction in Goa, India: A Case Control Study

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ABSTRACT

Introduction: Myocardial infarction is turning to be a significant health problem in India along with other lifestyle diseases. The risk factors identified included sedentary life style, cigarette smoking, hypertension, dyslipidemia and diabetes mellitus. The excess risk of coronary heart disease in Indians appears to be greater at younger ages, while some features and risk factors of coronary heart disease in India are peculiar. The state of Goa boasts of a westernized and urbanized culture is conducive to development of any of the lifestyle diseases. Study objectives were to study certain risk factors associated with acute myocardial infarction in Goa, India

Material and methods: A hospital based case-control study was conducted at a tertiary care hospital in Goa, India. Age and sex matched cases and controls (group matching) in the ratio of 1:1 constituted the study sample. Cases of acute myocardial infarction were defined as per the MONICA criteria. Interview was carried at patient's bedside using a predesigned structured questionnaire. In addition, blood pressure measurements, anthropometric measures, ECG and laboratory investigations were done. Approval for the study was obtained from the Institutional Ethics Committee of the Institute prior to the conduct of the study. Statistical analysis was carried using SPSS software package version 21.0. Statistical tests included odds ratio with 95% confidence interval, chi square test and t test. Multiple logistic regression analysis (step wise forward method) was used to examine the independent effect of different risk factors.

Results: Smoking (OR=3.59; 95% CI: 2.25-5.73) and Alcohol use (OR=2.98; 95% CI: 1.8-4.9) were found to be significantly associated with acute myocardial infarction. The risk of developing acute myocardial infarction increased with the number of drinks consumed per day and number of cigarettes smoked per day. Similarly, hypertension (OR=3.3; 95%CI: 2.18-5.0), diabetes mellitus (OR=3.06; 95% CI: 2.0-4.7), obesity (OR=1.91; 95% CI: 1.18-3.10) and low physical activity (OR=1.81; 95% CI: 0.96-3.42) were also identified as significant risk factors for myocardial infarction. On multiple logistic regression analysis, current smoking, number of cigarettes smoked per day, duration of smoking, frequency of smokeless tobacco per day, number of alcohol drinks per day, hypertension, diabetes mellitus and obesity were identified as significant independent risk factors for acute myocardial infarction.

Conclusion: Considering the risk factors identified in the study there is an urgent need to develop policy measures to promote healthy life style habits. Such measures could include risk factor interventions among those with risk factors, health education campaigns for the general public and development of a comprehensive healthcare programme.

Keywords: Myocardial Infarction, India, Risk Factors, Tertiary Care Hospital, Logistic Regression

INTRODUCTION

Globally, cardiovascular disease made up 30 per cent of global deaths according World Health Report 2015[1], over 20 per cent of these deaths occurred in low and middle income countries. The World Health Organisation further estimates that, at least 80% of premature deaths from heart disease and stroke could be avoided through healthy diet, regular physical activity and avoiding tobacco smoke.[2] The south Asian countries of India, Pakistan, Bangladesh, Sri Lanka and Nepal contribute the highest proportion of the burden of myocardial infarction compared to any other regions globally.[3]

Risk factors for myocardial infarction were for the first time well established by the Framingham Heart Study, USA[4] The risk factors identified included sedentary life style, cigarette smoking, hypertension, dyslipidaemia and diabetes mellitus. The excess risk of coronary heart disease in Indians appears to be greater at younger ages, while some features and risk factors of coronary heart disease in India are peculiar.[5]

The state of Goa boasts of a westernized and urbanized culture is conducive to development of any of the lifestyle diseases. Therefore, it was imperative to undertake this case control study to identify risk factors for acute myocardial infarction in Goa, India.

MATERIAL AND METHODS

The hospital based case-control study was conducted at a tertiary care hospital in Goa, India. Age and sex matched cases and controls (group matching) in the case: control ratio of 1:1 constituted the study sample. The study was conducted over a period of one year.

Sample size was calculated using the formula[6]: $n = (Z_{1-\alpha/2} + Z_{1-\beta})^2 \, \overline{p} \, \overline{q} \, (r+1) / (P_1 - P_2)^2 \, r$

Where, $\alpha = 0.05$ and $\beta = 0.2$, and for these values of type I and type II errors, the values of power of detecting these errors are as under; $Z_{1-\alpha/2} = 1.96$ and $Z_{1-\beta} = 0.84$. Proportion of smokers among the cases in previous studies[7] P1=0.55 and proportion of smokers among the controls in previous studies P2=0.38. Similarly $\overline{p} = (P_1 + P_2)/2 = 0.465$ and $\overline{q} = 1-p = 0.535$.

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Ratio of number of controls to cases (r) =1. The minimum sample size was calculated to be 135. Considering ease of calculation, non-response etc. it was decided to include 200 cases and 200 controls in the study.

Cases of acute myocardial infarction were defined as per the MONICA criteria[8] i.e 1. Two or more ECG showing specific changes (ST elevation in two contiguous leads, atleast 2mm in chest leads and 1mm in limb leads) 2. An ECG showing probable changes, plus abnormal cardiac injury enzymes (doubling of creatinine kinase with atleast 10% MB fraction). 3. Typical symptoms and either ECG changes or diagnostic enzyme changes. Cases with previous history of heart disease were excluded.

Age and sex matched controls were selected from Ophthalmology, Orthopaedic, Skin and otorhinolaryngology wards of the same hospital. Individuals with any previous diagnosis of heart disease were excluded i.e. 12 lead ECG showing pathological Q waves, ST segment deviation, T wave inversion, bundle branch or AV block, tachyarrhythmia other than isolated atrial ectopics. Patients with alcoholic liver disease and cancer were not enrolled as controls.

Same investigator interviewed both cases and controls for almost same duration of time using the same predesigned structured questionnaire. Interview was carried at patient's bedside. In addition, blood pressure measurements, anthropometric measures, ECG and laboratory investigations were conducted. Hypertension was defined as per JNC VII classification.[9] BMI categories were based on ICMR recommendations.[10] Dyslipidaemia defined as per merican Association of Clinical Endocrinologists (ATP III guidelines)[11] while physical activity was classified based on WHO GPAQ version 2 scoring[12]

Approval for the study was obtained from the Institutional Ethics Committee of the Institute prior to the conduct of the study.

STATISTICAL ANALYSIS

Statistical analysis was carried using SPSS software package 14.0. Statistical tests included odds ratio with 95% confidence interval, chi square test and t test. Multiple logistic regression analysis (stepwise forward method) was used to examine the independent effect of different risk factors.

RESULTS

Two hundred cases with equal number controls matched for age and sex constituted the study sample. The mean age of cases and controls was 58.3±11.5 years; it was 56.5±10.4 for male participants compared to 65.0±11.5 among female participants. Majority of the cases and controls were in the age group of 70-80 years (30.5%) followed by 50-60 years age group (28.5%), 60-70 years (17.0%) and 40-50 years age group (13.0%). Least number of participants were in the age group of 20-30 years (2.0%) followed by 80-90 years (3.5%) and 30-40 years (5.5%). As far as gender distribution was concerned male participants were 154 (79%) compared to 21% females. Demographic variables like religion, socioeconomic status and education are described in table

1. Majority of the cases (75.5%) and controls (70.5%) were Hindus followed by Christians and Muslims. As regards educational status, majority of cases (33.0%) and controls (35.5%) were illiterate followed by those educated up to secondary school. In terms of socioeconomic status, majority of cases (55.5%) and control (50.5%) were in the socioeconomic class III of BG Prasad classification.

Table 2 describes risk factors for acute myocardial infarction like tobacco use and alcohol use. As regards tobacco smoking was current smokers were 3.5 times at risk of developing acute myocardial infarction compared to non-smokers (OR=3.59; 95% CI: 2.25-5.73). The odds of getting an acute myocardial infarction increased with the increasing number of cigarettes smoked per day. The highest odds ratio was observed for those smoking 20 or more cigarettes per day (OR=11.42; 95% CI: 3.93-33.16) compared to non-smokers. As regards duration of smoking, the risk of acute myocardial infarction increased with increasing duration of smoking. Use of smokeless tobacco was found to increase the risk of acute myocardial infarction (OR=1.92; 95% CI: 1.1-3.35). Those consuming smokeless tobacco 5-8 times per day were almost five times at risk of developing acute myocardial infarction compared to those consuming 1-4 times per day (OR=5.4; 95% CI: 1.67-17.5)

Alcohol intake was found to be significantly associated with acute myocardial infarction (p<0.0001, OR=2.98; 95% CI: 1.8-4.9). This risk of developing acute myocardial infarction increased with the number of drinks consumed per day, with those having 9-12 standard drinks per day being 6.49 times more likely to suffer from acute myocardial infarction (OR=6.49; 95% CI: 0.75-56.21) compared to those not consuming alcoholic drinks closely followed by those consuming 5-8 standard drinks per day (OR=4.63; 95% CI: 2.46-8.75). Duration of alcohol consumption was also found to be significantly associated with acute myocardial

Demographic variable	Cases No. (%)	Controls No. (%)
Religion		
Hindu	151 (75.5%)	141 (70.5%)
Christian	33 (16.5%)	40 (20%)
Muslim	16 (8%)	19 (9.5%)
Educational Status		
Illiterate	66 (33%)	71 (35.5%)
Completed primary school	45 (22.5%)	45 (22.5%)
Completed secondary school	53 (26.5%)	44 (22%)
Completed higher secondary school	24 (12%)	20 (10%)
Diploma/graduate/ post graduate	12 (6%)	20 (10%)
Socio-economic status (B.G. Prasad)		
Class I (upper class)	8 (4%)	12 (6%)
Class II (upper middle)	48 (24%)	44 (22%)
Class III (Lower middle)	111 (55.5%)	101 (50.5%
Class IV (upper middle)	33 (16.5%)	41 (20.5)
Class V (lower)	0 (0%)	2 (1%)
Table-1: Baseline characteristics of cases and controls		

Risk factor	Cases No. (%)	Controls No. (%)	Odds ratio (95% CI)	p value
Current smoker				
Yes	83 (41.5%)	33 (16.5%)	3.59 (2.25-5.73)	0.000001
No	117 (58.5%)	167 (83.5%	1 (ref)	
No. of cigarettes smoked per day				
None	117 (58.5)	167 (83.5)	1 (ref)	
1-9	16 (8%)	17 (8.5%)	1.34 (0.65-2.77)	0.006
10-19	35 (17.5%)	12 (6%)	4.16 (2.07-8.36)	
20 and above	32 (16%)	4 (2%)	11.42 (3.93-33.16)	
Duration of smoking (Years)				
None	117 (58.5%)	167 (83.5%)	1 (ref)	0.000001
1-9	2 (1%)	10 (5%)	0.29 (0.06-1.33)	
10-19	20 (10%)	16 (8%)	1.78 (0.89-3.590	
20 and above	61 (30.5%)	7 (3.5%)	5.44 (2.99-9.91)	
Alcohol use				
Yes	69 (34.5%)	30 (15%)	2.98 (1.8-4.9)	0.00001
No	131 (65.5%)	170 (85%)	1 (ref)	
No. of standard drinks consumed per day				
None	131	170	1 (ref)	
1-4	14	15	1.21 (0.56-2.60)	0.000004
5-8	50	14	4.63 (2.46-8.75)	
9-12	5	1	6.49 (0.75-56.21)	

Table-2: Association of tobacco and alcohol use with myocardial infarction

Risk factor	Cases No. (%)	Controls No. (%)	Odds ratio (95% CI)	p value
Hypertension				
Present	116 (58%)	59 (29.5%)	3.30 (2.18-4.99)	0.000001
Absent	84 (42%)	141 (70.5%)	1 (ref)	
Diabetes Mellitus				
Present	97 (48.5%)	47 (23.5%)	3.06 (2.0-4.71)	0.000001
Absent	103 (51.5%)	153 (76.5%)	1 (ref)	
BMI				
Under weight	23 (11.5%)	29 (14.5%)	0.99 (0.54-1.81)	
Normal weight	99 (49.5%)	123 (61.5%)	1 (ref)	
Over weight	60 (30.0%)	39 (19.5%)	1.91 (1.18-3.10)	0.013
Obese	18 (9.0%)	9 (4.5%)	2.48 (1.07-5.77)	
Physical activity				
High	22 (11.0%)	29 (14.5%)	1 (ref)	
Moderate	83 (41.5%)	102 (51.0%)	1.09 (0.57-2.0)	0.03
Low	95 (47.5%)	69 (34.5%)	1.81 (0.96-3.42)	

Table-3: Risk factors for myocardial infarction

infarction (p=0.031).

Table 3 describes risk factors like hypertension, diabetes mellitus, obesity and physical activity. Hypertensives were three times more likely to develop acute myocardial infarction compared to normotensives (OR=3.3; 95%CI: 2.18-5.0); Similarly, those suffering from diabetes mellitus were at higher risk of developing acute myocardial infarction (OR=3.06; 95% CI: 2.0-4.7). Obesity was identified as a significant risk factor for myocardial infarction, with overweight (OR=1.91; 95% CI: 1.18-3.10) and obese individuals (OR= 2.48; 95% CI: 1.07-5.77) at higher risk compared to those with normal weight according to BMI.

Individuals involved in low physical activity were at almost twice at risk of developing acute myocardial infarction compared to those engaged in high level of physical activity (OR=1.81; 95% CI: 0.96-3.42). As regards lipid profiles, those with raised cholesterol levels (OR=2.31; 95% CI: 1.5-3.5), raised triglyceride levels (OR=1.57; 95% CI: 1.06-2.35), raised LDL levels (OR=1.53; 95% CI: 1.03-2.27) and low HDL levels (OR=2; 95% CI: 1.32-3.03) were at higher risk of developing acute myocardial infarction compared to those with normal levels.

Table 4 describes results of multiple logistic regression analysis of risk factors of myocardial infarction using stepwise forward method. Current smoking, number of cigarettes smoked per day, duration of smoking, frequency of smokeless tobacco per day, number of alcohol drinks per day, hypertension, diabetes mellitus and obesity were identified as significant independent risk factors for acute myocardial infarction.

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DISCUSSION

Factors like tobacco and alcohol use were found to be significant risk factors for acute myocardial infarction. Those currently smoking were 3.5 times at risk of developing acute myocardial infarction compared to non-smokers (OR=3.59; 95% CI: 2.25-5.73). Meenakshisundaram R et al[13] reported an odds ratio of 4.59 for the association between smoking and acute myocardial infarction in their study in the South Indian population. Similarly, Patil S. et al[14] reported the odds ratio for smoking and acute myocardial infarction to be 2.07 (95% CI: 1.12-3.82). On the other hand Tilak AH. et al[15] reported 1.55 times higher risk of acute myocardial infarction among smokers compared to non-smokers (OR=1.55; 95%CI: 1.28-1.89).

The risk of acute myocardial infarction increased with the increasing number of cigarettes smoked per day and also with increasing smoke years. Rohit VR. et al[16] found odds ratio of 3.72 (95% CI: 1.46-9.60) for acute myocardial infarction among those smoking more than ten cigarettes per day while, Pais P et al[17] reported that those smoking more than ten cigarettes per day were 6.7 times more likely to suffer from acute myocardial infarction compared to non-smokers (OR=6.7; 95% CI: 3.51-12.8) Use of smokeless tobacco was found to increase the risk of acute myocardial infarction (OR=1.92; 95% CI: 1.1-3.35). Rohit VR. et al[16] also reported similar findings among smokeless tobacco users (OR=2.06; 95%CI: 1.21-3.49).

Alcohol intake was found to be significantly associated with acute myocardial infarction (p<0.0001, OR=2.98; 95% CI: 1.8-4.9). Rohit VR.[16] et al reported odds ratio of 2.31 (95% CI: 1.02-5.33) for developing acute myocardial infarction among alcohol users while Anand S. et al[18] reported odds ratio of 0.88 (95% CI: 0.82-0.94) among alcohol users. The risk of developing acute myocardial infarction increased with the number of drinks consumed per day while, duration of alcohol consumption was also found to be significantly associated with acute myocardial infarction.

Similarly, hypertension (OR=3.3; 95%CI: 2.18-5.0), diabetes mellitus (OR=3.06; 95% CI: 2.0-4.7), obesity (OR=1.91; 95% CI: 1.18-3.10) and low physical activity (OR=1.81; 95% CI: 0.96-3.42) were also identified as significant risk factors for myocardial infarction. Meenakshisundaram R. et al[13] reported odds ratio of 9.59 (95% CI: 7.34-12.52) for the association between hypertension and acute myocardial infarction and an odds ratio of 7.87 (95% CI: 5.95-10.41) for the association of diabetes mellitus with acute myocardial infarction. Similarly Anand S. et al[18] found the odds ratio of 2.95 (95% CI: 2.66-3.28) for hypertension and odds ratio of 4.26 (95% CI: 3.68-4.94) for diabetes mellitus in their association with acute myocardial infarction. As regards physical activity, Rohit V et al[16] in their study found low physical activity as risk for acute myocardial infarction (OR=3.57; 95% CI: 1.58-8.23).

On multiple logistic regression analysis, current smoking, number of cigarettes smoked per day, duration of smoking, frequency of smokeless tobacco per day, number of alcohol drinks per day, hypertension, diabetes mellitus and obesity were identified as significant independent risk factors for acute myocardial infarction.

CONCLUSION

Considering the risk factors identified in the study there is an urgent need to develop policy measures to promote healthy life style habits. Such measures could include risk factor interventions among those with risk factors, health education campaigns for the general public and development of comprehensive healthcare programme.

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