Original Article

Determinants of Myocardial Infarction in Saurashtra Region, Gujarat: A Case–control Study

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Abstract

Background: Myocardial infarction (MI) is a multifactorial noncommunicable disease. The study was conducted with an objective to assess the role of various sociodemographic and clinicoepidemiological determinants of MI. **Materials and Methods:** The cases and controls were selected in the ratio of 1:1 and were group matched for age, sex, and type of residence. Cases of MI were selected from the intensive coronary care unit of the medicine department at a tertiary care hospital, Rajkot, for 1 year. Controls were selected from the general population of Rajkot district. Information was collected in pretested pro forma using the interview technique. **Results:** A total of 406 cases and equal number of controls were enrolled in the study. Several risk factors identified for MI included illiteracy, upper socioeconomic class, family history of MI, Type A personality, hypertension, diabetes mellitus, obese or overweight, high waist–hip ratio, low intake of leafy vegetables, low intake of fruits, and history of acute life event for the past 1 year. On applying logistic regression model, these factors were also identified as independent determinants for MI. **Conclusion:** The findings confirm the role of conventional risk factors for MI and also highlight the role of sociodemographic factors such as illiteracy, higher social class, low intake of leafy vegetables and fruits, and history of acute life event.

Keywords: Case–control study, myocardial infarction, risk factors

Introduction

India has seen a rapid transition in its disease burden from communicable diseases to noncommunicable diseases (NCDs) over the past couple of decades. As per the situation in 2014, ischemic heart disease (IHD) ranked 1st in causing death as well as disabilities both globally and nationally.[1,2] Demographic changes are also driving the rise in NCDs.[3] It is estimated that the overall prevalence of IHD is 37/1000 population in India (2012).[4] IHD was ranked 6th among the leading causes of years of life lost (YLLs) to premature death in 1990 in India. In the year 2013, it was ranked 1st among leading causes of YLLs with a significant rise of 23% from the level of the year 1990.[2] An analysis of the global status report on NCDs in India (2014) showed a current tobacco smoking prevalence of 23.6%. It is higher than the global prevalence of 22%.[5] A meta-analysis of prevalence studies done in India reported a 300% rise in the incidence of myocardial infarction (MI) for the past 50 years.[6]

For decades, all these indicate that the problem of MI would be continued if not addressed otherwise. It is expected to keep track of MI and is determinants at global and local level. This study is designed as a case–control study having a community sample as a source of controls. This would provide scope to select controls which represent the general population and an opportunity to study clinicoepidemiological and sociodemographic determinants of MI simultaneously.

Materials and Methods

The study was conducted from April 1, 2016, to March 31, 2017, at a tertiary care center of Rajkot. Case was considered as the one, who was a conscious, cooperative, well-oriented patient admitted in the intensive coronary care unit of a tertiary care center having MI. A person was defined as a case of MI if any two of the following three criteria were satisfied:[7,8] (1)

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electrocardiogram (ECG) showing ST elevation, (2) rise in creatine kinase–myocardial band levels >25 IU/l, and (3) symptoms of ischemia lasting for >20 min (complaint of left-sided chest pain which was compressive in nature, ill localized, radiating to upper extremity, mandibular, or epigastric region; may or may not be associated with nausea, vomiting, palpitation, excessive sweating, or difficulty in breathing). Patients were admitted and treated by the treating physician. All investigations were done on the basis of a physician's description. After an acute MI (AMI) attack, there are likely chances that a person's habits and risk factor profile might be altered because of post-MI lifestyle modifications. Hence, the persons having first-known AMI incident were enrolled in the study.

To minimize the selection bias, cases and controls were matched for proven nonmodifiable risk factors such as age and sex. Type of residential setup can also influence lifestyle, behavior, and socioeconomic status. Hence, to maintain uniform distribution of cases and controls from a relatively identical environment, matching was done for the type of residential area. Age matching was done with the liberty of ±2 years of that of the case. The same number of controls of the same residential setup having the same sex as that of the case was included in the study. For the cases belonging to the rural area, controls were selected from the rural field practice area of the community medicine department. For the cases belonging to urban areas, controls were selected from the urban field practice area of Rajkot city. Control was defined as any conscious, cooperative, well-oriented person from the defined areas of the community who had never suffered from MI, angina pectoris, or a type of chest pain suggestive of cardiac history.

Both the cases and controls were included in a study as a participatory subject only after written consent.

In the previous year, a total of 357 patients with the first MI were admitted in the study institute. Hence, 357 sample sizes were proposed for the present study for 1 year from April 1, 2016, to March 31, 2017. The study included 406 patients admitted and fulfilling all the criteria of the standard case definition of MI case during the study period. Keeping the case-to-control ratio 1:1,406, controls were selected from the community. A total of 812 patients participated in the present study.

Data collection was done by an interview technique using preformed, pretested, and semi-structured questionnaire. The questionnaire included information regarding the sociodemographic profile, history of preexisting illnesses such as diabetes and hypertension, notes on examination measurements, addiction history, family history, diet profile, and felt stress profile. Modified Prasad's socioeconomic classification was used considering All India Consumer Price Index of April 2017 of Rajkot.[9] Body mass index (BMI) was calculated and categorized on the basis of the World Health Organization classification.[10] Detailed laboratory investigations were available for MI cases, while it was not available for controls who were from the general population.

Data entry was done in Microsoft Office Excel 2007 and analysis was done using the software package Epi Info (version 7.2.2.6) from CDC, Atlanta, U.S.A.[11] Appropriate statistical tests such as *t*-test and Chi-square test were used to analyze quantitative and qualitative data. Logistic regression analysis was done using MI as dependent outcome variable. Logistic regression model was applied to the variables which was found to have a significant role ($P < 0.05$) as a risk factor in univariate analysis. The study was approved by the institutional ethics committee.

Results

The present study reported maximum patients of MI in the age group of 51–60 years (28.3%) and lowest among below 30 years (range 24–90 years). Out of total MI cases, 81.8% of the participants were male and 18.2% were female with male: female ratio of 4.5:1. The occurrence of MI was significantly high among those with a joint family, upper socioeconomic class, and married and illiterate persons [Table 1].

Positive family history, presence of diabetes or hypertension, and the use of tobacco or alcohol were significant risk factors for MI [Table 2]. The event of MI was significantly high among females having a history of oral contraceptive (OC) pill use ($P = 0.007$). Sedentary lifestyle during leisure hours was found as a significant risk factor causing MI, while activity status during job hours was not significant. Using protective food such as green leafy vegetables (GLVs) and fruits in the regular diet (≥5 days a week) was found to have a preventive role in MI. The risk of getting MI was significantly high among obese persons with BMI ≥25 kg/m^2. High waist–hip (W:H) ratio (≥0.95 for male and ≥0.85 for female) was also found to be positively associated with MI. High mean stress score, the occurrence of acute life event-related stressful condition for the past 1 year, and Type A personality were also significant risk factors for MI.

Table 1: Sociodemographic profile of cases and controls

Variable	Cases ($n=406$)	Control ($n=406$)	*P*
Marital status			
Married	371	355	0.02
Unmarried	4	15	
Others	31	36	
Literacy status			
Illiterate	94	54	0.00
Literate	312	352	
Occupation			
Nonmanual	208	211	0.83
Manual	198	195	
Socioeconomic class			
Upper class	183	40	0.00
Middle class	164	182	
Lower class	59	184	
Type of family			
Nuclear	62	27	0.00
Joint	344	379	

Table 2: Risk factor profile of cases and controls

Variable	Cases (*n*=406), *n* (%)	Control (*n*=406), *n* (%)	OR (CI)	*P*
Family history of CAD (yes)				
Present	146 (36.0)	26 (6.4)	8.2 (5.25-12.82)	0.00
Hypertension				
Present	260 (64.0)	96 (23.6)	5.8 (4.23-7.81)	0.00
Diabetes				
Present	119 (29.3)	53 (18.3)*	1.9 (1.28-2.67)	0.00
Tobacco consumption				
Present	240 (59.1)	148 (36.5)	2.5 (1.94-3.43)	0.00
Leisure time physical activity				
Sedentary	275 (67.7)	203 (50.0)	2.1 (1.58-2.79)	0.00
Days of leafy vegetables diet per week				
<5 days	145 (35.7)	15 (3.7)	14.4 (8.32-25.20)	0.00
Days of fruits consumption per week				
<5 days	355 (87.4)	123 (30.3)	16.0 (11.15-22.99)	0.00
Type of personality				
Type A	81 (20.0)	19 (4.7)	5.0 (3.01-8.55)	0.00
BMI				
Overweight or obese (BMI ≥25 kg/m^2)	258 (63.5)	145 (35.7)	3.1 (2.35-4.17)	0.00
History of acute life event				
Present	92 (22.7)	15 (3.7)	7.6 (4.34-13.44)	0.00

*n=290 for controls, as diabetes status of all controls not known. OR: Odd's ratio, CI: Confidence interval, BMI: Body mass index, CAD: Coronary artery disease

On multivariate logistic regression analysis, marital status, type of family, tobacco consumption, and leisure time physical activity found to have nonsignificant association with MI [Table 3]. Other risk factors such as illiteracy, type of personality, diabetes mellitus, BMI, and W:H ratio were identified as having a significant association with MI. Socioeconomic class, family history of coronary artery disease (CAD), hypertension, regular intake of GLVs and fruits, stress score, and history of acute life event were found highly significant risk factors of MI.

Discussion

The conventional risk factors such as hypertension, diabetes mellitus, tobacco use, obesity, and family history of cardiovascular disease are not able to fully explain the emerging epidemic of MI. From the public health point of view, it is more important to implement various interventions at different levels of prevention to reduce the burden of MI by identifying risk factors in terms of deaths and disabilities. A majority of case–control studies reported were conducted in a hospital setup. However, the present study included controls from the community, showing the actual presence of risk factors in the population, increases generalizability of findings and also minimizes selection bias and confounders.

The present study reported majority cases of MI in age group of 51–60 years (28.3%) with male preponderance (70.2%) similar to other studies.[12-16] However, cases of MI were also reported at young age below 30 years. A similar finding was reported in the previous study from Nagpur.[13] Several studies also reported cases of MI ranging 10.0%–11.1% in younger age group having age <40 years.[12,14,16] This indicates that people in their 30s and 40s are also at risk of getting MI. Previous studies reported that literacy has no role in the occurrence of MI.[12,15] In contrast, the present study reported more cases of MI among illiterates. The finding of Delhi-based case–control study was in accordance with the present study.[14]

Higher socioeconomic class was associated with a higher risk of MI as reported in the previous study of India.[17] Similarly, the present study reported a significant risk of MI with higher socioeconomic status. However, other studies reported no such association,[14,15] which may be due to different sample sizes, geographical locations, and demographic structures of participants. Living in a joint family increases the risk of MI ($P < 0.001$). More social responsibilities to be shared in a joint family may be the reason for more stress and risk of MI. However, a study from the same area in the past reported no such significance.[12] Type of occupation had no significant role in causing MI. Other studies also showed the consistent result for the role of occupation in MI.[14]

Persons with family history of CAD were 8.2 times more likely to get MI (odd's ratio [OR] = 8.2, confidence interval [CI] = 5.25–12.82) which was similar to other studies reported from India.[13-15,18] The risk of MI remains high in patients of hypertension and diabetes. Various studies have reported similar findings for the occurrence of MI.[12,14,15,18,19] Addiction in the form of tobacco or alcohol was found as a significant risk factor for MI in the current study, likewise observed in many other studies reported from different states of India.[12,14-16,18-20] Intake of OC pills plays no role in the

Table 3: Logistic regression analysis showing independent determinants of myocardial infarction

Determinant	β co-efficient	OR	95% CI	*P*
Marital status	0.63	0.53	0.23-1.18	>0.05
Literacy	0.77	2.17	1.13-4.14	<0.05
Socioeconomic class	2.24	9.38	5.12-17.19	<0.001
Family history of CAD	2.55	12.83	6.33-26.02	<0.001
Type of family	0.11	1.11	0.50-2.49	>0.05
Type of personality	1.32	3.74	1.63-8.59	<0.05
Hypertension	1.57	4.82	2.88-8.05	<0.001
Diabetes mellitus	0.96	2.62	1.43-4.83	<0.05
Tobacco consumption	0.42	1.52	0.91-2.53	>0.05
Leisure time physical activity	0.31	1.36	0.82-2.85	>0.05
BMI	0.66	1.93	1.16-3.20	<0.05
Waist hip ratio	0.55	1.74	1.02-2.94	<0.05
Intake of leafy vegetables	1.80	6.05	2.92-12.54	<0.001
Intake of fruits	2.30	9.98	5.68-17.55	<0.001
History of acute life event	2.19	8.90	3.51-22.55	<0.001

OR: Odd's ratio, CI: Confidence interval, BMI: Body mass index, CAD: Coronary artery disease

occurrence of MI as stated by various studies, in contrast to the present study.[13,21] The use of different generations of OC pills, different intake duration, dosage, age of starting OC pills, and any underlying illness may be some possible explanations for the same.

Several studies reported a sedentary lifestyle at workplace as a significant risk factor for MI, however the present study reports no such association.[17,19,22] A sedentary lifestyle during leisure hours was found high among cases of MI than controls as mentioned in previous studies.[13,23]

Many risk factors of MI like hypertension, obesity, diabetes mellitus and mean blood sugar level are related to the diet of a person. Diet deficient in protective food like, GLVs (OR = 14.48. CI = 8.32–25.2) and fruits (OR = 16, CI = 11.15–22.99) was found to be an important risk factors as reported in previous studies.[24,25] A meta-analysis of cohort studies also reported the protective role of vegetables and fruits in MI.[26] As stated in the previous study, Type A personality with competitive drive was as an important risk factor of MI.[14] In the present study also, the risk of getting MI was found five times more among persons having Type A personality (OR = 5.08, CI = 3.01–8.55).

Almost two thirds (63.5%) of the cases were either overweight or obese. BMI ≥25 kg/m^2 was found to be one of the highly significant risk factors. Studies from other states of India also reported similar observation pointing BMI ≥25 kg/m^2 as one of the significant risk factors.[13-15] In the present study, 52.2% cases were having high W:H ratio. A study done in North East Indian population observed a statistically significant association between MI and W:H ratio.[13,14,19] Thus, both the parameters (BMI and W:H ratio) proved obesity as an important risk factor of MI.

In the present study, acute life event for the past 1 year was significantly associated with MI (OR = 7.64, CI = 4.33–13.44). Similar findings were observed in other studies too.[13,15] A significantly higher mean stress score was reported among MI cases in the present study. A study from Delhi, South India, and Gujarat state also reported stress as an important risk factor for MI.[12,14,27]

Considering MI as the dependent outcome variable, multivariate analysis was done using logistic regression model. It included all those variables which were reported significant in univariate analysis. It revealed that illiteracy, higher socioeconomic class, family history of CAD, Type A personality, higher W:H ratio (≥0.95 for male, ≥0.85 for female), BMI ≥25 kg/m^2, hypertension, diabetes mellitus, weekly intake of leafy vegetables, weekly intake of fruits, and history of acute life event in the last year were independent determinants of MI. However, marital status, type of family, tobacco consumption, and leisure-time physical activity were discarded on multivariate analysis. Probable reasons for discarding tobacco as a risk factor on multivariate analysis would be overall high prevalence of tobacco among cases and control[16] or dose duration link. Studies have reported tobacco consumption, higher W:H ratio hypertension, BMI ≥25 kg/m^2, family history of CAD, diabetes, stress for the past 1 year, and physical inactivity as independent determinants for MI.[13,19]

Limitations

There are chances of getting cases admitted from a wide range of divert areas of the entire region; control selection having perfect matching was not possible. Inclusion of MI cases from only one government hospital leads to selection bias. Severe cases that died before reaching the study hospital were not included in thestudy. There were chances of subjective bias in reporting of physical activity status and diet pattern. Gujarat being a dry state, a history of alcoholism may become biased due to stigma in society and fear of law even after explanation. Dose and duration were not inquired in case of tobacco and alcohol users. Due to limited resources, clinical laboratory parameters could not be assessed among controls. Though all the controls were asked about any history of chest pain in the past, a technical method such as ECG was not used.

Conclusion

Several risk factors for MI were identified including illiteracy, higher socioeconomic class, family history of CAD, Type A personality, higher W:H ratio, obesity, hypertension, diabetes mellitus, weekly intake of leafy vegetables, weekly intake of fruits, and history of acute life event for the past 1 year. Many of the identified risk factors are modifiable, with a change in lifestyle risk of MI can be averted.

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Conflicts of interest

There are no conflicts of interest.

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