

Conventional risk factors among newly diagnosed coronary heart disease patients in Delhi

Sanjiv K Bhasin, Shridhar Dwivedi, Ali Dehghani, Rahul Sharma

Sanjiv K Bhasin, Ali Dehghani, Rahul Sharma, Department of Community Medicine, University College of Medical Sciences and GTB Hospital, Delhi 110095, India

Shridhar Dwivedi, Department of Medicine/Preventive Cardiology, Hamdard Institute of Medical Sciences and Research, Jamia Hamdard (Hamdard University), Delhi 110062, India

Author contributions: Bhasin SK and Dwivedi S designed the research; Bhasin SK, Dwivedi S and Dehghani A performed the research; Bhasin SK, Dwivedi S, Dehghani A and Sharma R analyzed the data; Bhasin SK, Dehghani A and Sharma R wrote the paper; Bhasin SK and Dwivedi S edited and reviewed the manuscript.

Correspondence to: Sanjiv K Bhasin, Professor, Department of Community Medicine, University College of Medical Sciences and GTB Hospital, Dilshad Garden, Delhi 110095, India. sk1bhasin@gmail.com

Telephone: +353-21-4901228 Fax: +353-21-4901289

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Abstract

AIM: To analyze the conventional risk factors among newly diagnosed cases of coronary heart disease (CHD) admitted to a hospital in Delhi, India.

METHODS: This hospital-based prospective study included 276 consecutive newly diagnosed cases of CHD in the Coronary Care Unit of a tertiary care hospital in Delhi.

RESULTS: The mean age of the cases was 49.7 ± 9.5 years, with the youngest case aged 27 years. The two risk factors present most frequently among the cases were inadequate physical activity and abnormal lipid profile. Just about 3.6% of cases in our study had a physical activity level (PAL) that could be termed as "active", with a large proportion (96.4%) having a PAL suggestive of a sedentary lifestyle. A majority of patients were found to be current tobacco smokers

(53.3%) and 188 (68.1%) subjects were lifetime ever smokers. There was not a single case who did not have one or more of the risk factors. More than one-quarter ($n = 76$) had six or more of the studied risk factors.

CONCLUSION: Indians have among the CHD highest mortality rates amongst all ethnic groups studied so far. It is important to study the regional epidemiology of the cardiovascular events to allow for location-specific prevention and control programs.

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Key words: Risk factors; Coronary heart disease; Geographical-distribution; Epidemiology

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INTRODUCTION

Studies show that at the beginning of the 20th century, coronary heart disease (CHD) accounted for less than 10% of all deaths worldwide. At the beginning of the 21st century, CHD accounts for nearly 50% of all deaths in the developed world and 25% in developing countries, such as India^[1]. Currently, cardiovascular diseases are the leading cause of mortality in the developing world and their incidence rate in India is now 4-fold higher than that in the

United States^[2]. Mortality due to CHD in India is 24.2% and CHD accounts for 8.1% of disability^[3].

Cardinal features of CHD among Indians compared to other populations are higher prevalence, incidence, hospitalization and mortality, with 5-10 years earlier onset of first myocardial infarction (MI)^[4]. Since the early 1960s, many countries have been able to reduce the rate of CHD, and subsequently mortality, by implementing preventive and control measures along with better treatment. In contrast, India still has the highest CHD mortality rates amongst all ethnic groups studied so far. The most worrying part of the whole scenario is its rapid spread in younger people. We therefore planned to study the major risk factors among CHD subjects presenting to a large tertiary care hospital in Delhi.

MATERIALS AND METHODS

We conducted a hospital-based prospective study and collected data of all subjects newly diagnosed with coronary artery disease admitted to the Coronary Care Unit (CCU) of Guru Tegh Bahadur (GTB) Hospital in Delhi. GTB Hospital is one of the larger tertiary care hospitals located in Delhi, the capital of India. It caters to patients mostly belonging to the lower and middle socioeconomic strata, who come from all over Delhi and also from other neighboring states of India. The present study was part of an ongoing larger study of the CHD patients admitted for care to the CCU of the hospital. We did a comprehensive analysis of the conventional risk factors for CHD among 276 consecutive newly diagnosed cases of CHD admitted from May 2008 to July 2009.

Permission was taken from the institutional ethics committee before carrying out the study. The enrolled subjects gave informed consent after a full explanation of the purpose of study and liberty to drop out. This was done in both Hindi and English languages for easy comprehension. Study subjects were male and female newly diagnosed cases of CHD in the age group 25-65 years. CHD patients were diagnosed as per the Monica criteria: (1) two or more ECG showing specific changes; (2) an ECG showing probable changes plus abnormal cardiac injury enzymes; or (3) typical symptoms such as retrosternal pain plus abnormal enzymes^[5]. Pregnant women, known CHD patients, and patients suffering from dementia and/or severe psychiatric illness were excluded. A descriptive analysis was used to assess the demographic and risk profile. The risk factors studied included the conventional ones as mentioned by the World Health Organisation^[6], and other studies^[7-11].

Data collection was performed using a pre-tested, semi open-ended questionnaire. Anthropometric measurements (weight, height, waist circumference, hip circumference), blood pressure and laboratory investigations, such as fasting and post-prandial blood sugar, glycosylated hemoglobin, lipid profiles were performed using standard accepted techniques. The lipid profile values were classified as per the National Cholesterol Education Program-Adult

Treatment Panel III Guidelines that are endorsed by the American Heart Association^[12,13]. Body mass index (BMI) and waist circumference were classified as per the new national consensus guidelines for India^[14]. The subject was classified as obese if the BMI was 25 kg/m² or higher, and abdominal obesity was defined as a waist circumference > 90 cm in males and > 80 cm in females. The occupation was classified as per the Kuppuswami classification^[15].

We measured depression, anxiety and stress based on Depression Anxiety Stress Scale (DASS, 42 items)^[16]. Physical activity level (PAL) was calculated using the validated proforma by Bharathi *et al.*^[17] according to which an individual is classified as sedentary if the PAL is less than 1.40^[18]. The data collected through the questionnaires, clinical examination and investigations was fed into a spreadsheet and analyzed using SPSS software.

RESULTS

The study consisted of an analysis of 276 consecutive cases of newly diagnosed CHD, presenting to the CCU of GTB Hospital during the study period. The age of the patients ranged from 27 to 66 years (mean, 49.7 ± 9.5 years) and 44 (15.9%) were below the age of 40 years. Of the 276 subjects 222 (80.4%) were male and 54 (19.6%) were female. The mean age among males was 49.1 ± 9.4 years and among females was 52.3 ± 9.8 years, a significant difference ($t = 2.27$, $df = 274$, $P = 0.02$). Most of the subjects (234; 84.8%) were from an urban background. Of the total, 195 (70.7%) were Hindu by religion, 77 (27.9%) were Muslim, three were Christian and one was Sikh. A large proportion (246; 89.1%) were currently married. Regarding type of family, 141 (51.1%) came from a nuclear family and 135 (48.9%) belonged to a joint family.

While 46 (16.7%) were currently unemployed, 87 (31.5%) were unskilled, 81 (29.3%) were semi-skilled, and only 51 (18.5%) were a skilled worker or higher. Eleven (4.0%) were retired from work. The education level of the cases too were skewed towards a lower level, with the majority (78; 28.3%) being illiterate, 52 (18.8%) having a primary education, 123 (44.6%) having middle to higher levels of schooling and only 23 (8.3%) being college graduates. Among the cases, the clinical diagnosis was established as ST wave elevation MI (STEMI) in the vast majority (209; 75.7%), as non-STEMI type MI in 53 (19.2%) and as angina pectoris in 14 (5.1%).

The predominant diet for 114 (41.3%) of the cases was vegetarian while 162 (58.7%) were non-vegetarian by habit. Two-thirds (187; 67.8%) were using predominantly mustard oil for cooking at home, 11 (4.0%) sunflower oil, 62 (22.4%) soybean oil while the remaining 16 (5.8%) had been using other types of cooking oil. The 24-h recall method was used for dietary assessment. The majority (248; 89.8%) of the respondents had a calorie deficit, mean deficit being 734 ± 409 Calories per day from the recommended calorie intake. A few of the subjects (33; 11.9%) had an excess fat intake daily, with the mean excess intake being 26.8 ± 30.2 g/d above the recommended total daily fat intake.

Table 1 Results of hematological investigations of the cases

Investigation	<i>n</i>	Mean	Median	Minimum	Maximum	SD
Lipid profile (mg/dL)						
Total cholesterol	276	159.3	152.0	65	424	48.47
Triglycerides	268	135.4	115.5	39	556	80.0
HDL	267	36.5	36.0	13	57	7.73
LDL	257	94.8	90.0	19	312	41.66
Glycosylated hemoglobin						
HbA1c (%)	68	10.1	10.2	4.5	13.2	1.73
Blood sugar (mg/dL)						
Fasting	212	112.6	98.0	63	322	43.46
Post-prandial	208	163.4	141.0	68	547	69.75

n: No. of cases for which a value was available; LDL: Low density lipoprotein cholesterol; HDL: High density lipoprotein cholesterol.

Only 10 (3.6%) had a PAL of 1.40 or more and could be termed as active. The other 266 (96.4%) had a PAL of < 1.40 and were classified as sedentary. Among the 54 female patients in the present study, 11 were currently menstruating whereas the majority (43) were post-menopausal. Among the female patients, none was currently taking oral contraceptive pills.

A set of questions were asked regarding their lifestyle habits. Among the subjects, 73 (26.4%) were current alcohol users with a total of 89 (32.2%) being lifetime ever users of alcohol, i.e. either current users or regular users in the past. Among the total, 188 (68.1%) were lifetime ever smokers with 154 (55.8%) of the subjects being current smokers. Of the current smokers (*n* = 154), the majority (126; 81.8%) smoked "beedis", 16 (10.4%) smoked cigarettes and 12 (7.7%) smoked both. The current smokers had been smoking for a mean of 21.7 ± 12.2 years. If we consider only the male cases (*n* = 222), the proportion of current smokers was 149 (67.1%) and the proportion of "beedi" smokers was 122 (55.0%).

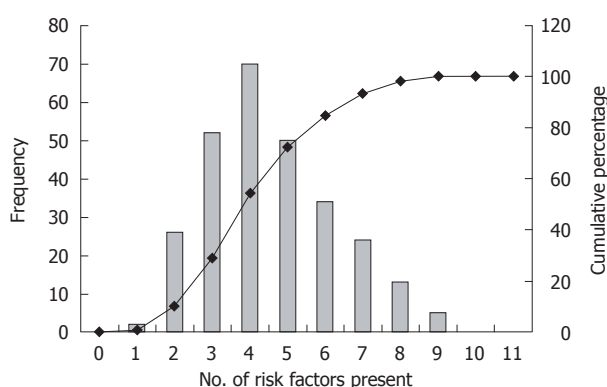
The medical history of the patients was also elicited. Among the 276 cases of CHD, 92 (33.3%) were known hypertensives, 134 (48.6%) were not hypertensive and the status of the remaining 50 (18.1%) was not known. Among the known hypertensives, only 39 (42.4%) were taking medication for it regularly, 45 (48.9%) were taking medication but not regularly, while 08 (8.7%) were not taking any medication at all. Of the total, 50 (18.1%) were known diabetics, 191 (69.2%) had no history of diabetes and the status of 35 (12.7%) was not known. Anthropometric measurements were recorded as part of the study. BMI ranged from 13.8 to 33.7 kg/m² (mean, 23.2 ± 3.8 kg/m²). Waist circumference was studied separately by gender. As per the new Indian consensus guidelines, waist circumference was found to be raised in 157 (56.9%) of the subjects.

The results of the hematological investigations are presented in Table 1. Taking the standard cutoffs for dyslipidemia, it was seen that 44 (15.9%) had raised total cholesterol (> 200 mg/dL), 80 (29.9%) had raised triglycerides (> 150 mg/dL), 80 (39.3%) had raised low density lipoprotein (LDL) cholesterol (> 100 mg/dL) and 188

Table 2 Presence of conventional risk factors among the newly diagnosed coronary heart disease patients in our study (*n* = 276)

Risk factor	No. for which value was available	Proportion having the risk factor
Inadequate physical activity	276	266 (96.4)
Reduced HDL cholesterol	267	188 (70.4)
Raised waist circumference	276	157 (56.9)
Current smoker	276	154 (55.8)
Raised LDL cholesterol	257	101 (39.3)
Hypertension	276	92 (33.3)
Obesity ¹	276	91 (33.0)
Raised triglyceride	268	80 (29.9)
Diabetes	276	50 (18.1)
Raised total cholesterol	276	44 (15.9)
Stress	276	38 (13.8)

¹Classified by the new guidelines for obesity among Indians. LDL: Low density lipoprotein cholesterol; HDL: High density lipoprotein cholesterol.

**Figure 1 Distribution of cases by the number of conventional risk factors present (*n* = 276).**

(70.4%) had reduced high density lipoprotein (HDL) cholesterol (< 40 mg/dL among males and < 50 mg/dL among females). The percentages are of the number of subjects for whom each investigation result was available. Only 50 (18.1%) of the cases had a clear family history of CHD, 180 (65.2%) had a negative family history while the family history of 46 (16.7%) was not known. The depression, anxiety and stress levels among the cases were assessed using the DASS questionnaire. Using the normative cut-offs for the subscales of the DASS scale, 55 (19.9%) of the cases had depression, 73 (26.4%) had anxiety, while 38 (13.8%) had stress.

Table 2 summarizes the presence of the conventional risk factors that we studied among the cases. Based on this, a further analysis was carried out to study the distribution of the conventional risk factors among the CHD cases. The distribution by the number of risk factors is shown in Figure 1. There was not a single case that did not have one or more of the risk factors studied.

DISCUSSION

CHD is a rising epidemic of the modern world. A com-

prehensive study of the demographic and epidemiological profile of 276 consecutive cases with newly diagnosed CHD, admitted to a large tertiary care hospital in Delhi, India was carried out. It was seen that the mean age of the cases was 49.7 ± 9.5 years, with the youngest case of an acute coronary event occurring at the age of 27 years. The mean age in our study is much lower than that found in the Iran study (60.6 years)^[7]. The INTERHEART study had found the mean age among the Indians (53.0 ± 11.4 years) to be significantly lower than in other countries^[8]. The mean age was also lower than that reported in Kerala, India (58.3 ± 15.6 years)^[19]. The INTERHEART study had found the proportion of cases below 40 years to be 11.7%, compared with 15.9% in the current study.

The proportion of males in our study was 80.4%, with females comprising only 19.6% of the total. This concurs with previous findings that males predominate among the coronary event cases presenting to hospital^[7,8,19,20]. The mean age was found to be significantly lower among males compared with females, again in line with international experience^[7,8,19]. In our study, most of the patients were illiterate (28.3%), with others having done various levels of schooling, and only 8.3% being college graduates. Gupta *et al.*^[21] had found a link between the prevalence of CHD and lower education status of the patients.

In our study, a majority of the cases (58.7%) were predominantly non-vegetarian by habit. It has been observed earlier that a diet rich in plant foods is associated with a lower risk of cardiovascular diseases^[9]. A large scale systematic review of the association between diet and CHD concluded that the beneficial substances in a vegetarian diet have a big role in reducing risk of CHD^[22]. Most of the patients were found to have a calorie deficit (89.8%) rather than a calorie excess, on eliciting dietary history by a 24-h recall method. A few of the subjects (11.9%) had a daily fat intake that exceeded the recommended upper limit. While the dietary recall method is subject to limitations, and particularly taking a single 24-h recall period, the results that we obtained still point to the fact that CHD occurs in a majority of Indian patients, despite no evident over-nutrition.

A significant factor can be the sedentary lifestyle, especially of the urban population. This was evident by the finding that just about 3.6% of the cases in our study had a PAL that could be termed as “active”, with a large proportion (96.4%) having a PAL suggestive of a sedentary lifestyle. A low level of physical activity has been noted to be a significant risk factor for premature CHD in Indians^[23].

A majority of the female patients in our study were post-menopausal (43 out of 54) which reinforces the observation by Rissam *et al.*^[11] that post-menopausal females need special attention as they constitute a distinct subgroup at a high risk for CHD.

A majority of the patients were found to be current tobacco smokers (53.3%), and a total of 188 (68.1%) subjects were lifetime ever smokers. The proportion was higher than the Iran study where 32% had a history of

smoking^[7], but matched the results among South Asians found in the INTERHEART study^[8], in which 61.1% of acute MI cases had a history of current and former smoking. A point of special notice was that among the tobacco smokers, a significant proportion (81.8%) smoked “beedis” (a local form of cigarette that has tobacco in a rolled leaf). The risk of tobacco smoking is greater if smoked in the form of a “beedi” than a cigarette. Rissam *et al.*^[11] reported that tobacco use in India is mainly in the form of “beedis” rather than cigarettes. If we consider just the male cases, two-thirds were current smokers, and more than half (55%) smoked “beedis” exclusively.

The proportion of known hypertensives in our study (33.3%) was similar to that in the CREATE registry study (37.7%)^[24], and in the INTERHEART study (29.6%)^[8]. The proportion of known diabetics was 18.1% in the present study, which matched the findings in the INTERHEART study (20.2%), but was lower than that in the CREATE study (30.4%). An important finding was that less than half (42.4%) of the known hypertensives were taking regular antihypertensive treatment.

Obesity is also known to be one of the conventional risk factors for CHD^[23]. If classified as per the conventional cut-off of BMI (30 kg/m^2 or more), only 19 (6.9%) of the cases could be termed obese. In the CREATE study too (that utilized the older cut-offs), a similar proportion of obesity cases was found (6.2%)^[24]. However, India has recently published new guidelines regarding the classification of BMI, and if we go by the new cut-off for obesity (25 kg/m^2), 91 (33%) of the patients could be termed as obese.

The large-scale INTERHEART study indicated that the presence of psychosocial stressors is associated with increased risk of acute MI, but it also acknowledges that measuring stress objectively is a problem^[10]. In our study, we used the DASS questionnaire to assess depression, anxiety and stress among the cases. It was seen that 19.9%, 26.4% and 13.8%, respectively, had scores indicating the presence of these conditions.

The results of the hematological investigations carried out among the cases were also noted. The mean total cholesterol level was lower in our study ($159.3 \pm 48.5 \text{ mg/dL}$) than that found among MI cases in Tirupati, India^[25], in the Kolkata, India study^[26], and also in the Iran study^[7]. The same was noticed for the mean LDL level also. However, the levels of the protective HDL were also found to be lower in our study (36.5 ± 7.7) than in the earlier studies^[7,25,26]. The levels of serum triglycerides were roughly in the same range as the previous studies. The mean level of glycosylated hemoglobin was found to be very high ($10.1 \pm 1.7 \text{ mg/dL}$), but this can be explained by the fact that the test was carried out in only 68 of the total subjects, indicating that it was probably done only for cases with a high index of suspicion for diabetes.

The waist circumference was classified as per the new consensus national guidelines for India^[14]. Based on this, it was found that 157 (56.9%) of the cases had an increased waist circumference. It has been stated that based

on current evidence, waist circumference is preferred over waist-hip ratio as a measure of abdominal obesity^[14].

Based on an analysis of the conventional risk factors, it was found that all the risk factors were present to some extent among the subjects presenting to the hospital. The two risk factors found to be present most frequently among the cases were inadequate physical activity and abnormal lipid profile. A significant proportion of the cases were also had the known risk factor of tobacco smoking.

We also analyzed the distribution of these known conventional risk factors for CHD among the cases. There was not a single case among the 276 studied, who did not have one or more of the risk factors considered. Nearly 90% ($n = 248$) had three or more risk factors present, indicating the importance of multiple risk factors in the etiology of CHD. More than one-quarter of cases ($n = 76$) had as six or more of the studied risk factors present.

A comprehensive analysis of the presence of conventional risk factors of CHD was carried out among the newly diagnosed cases visiting a tertiary hospital in Delhi. While the risk factors remain generally the same globally, it is important to study the regional epidemiology of the occurrence of cardiovascular disease events.

A limitation of the present study was that the patient recruitment was done through a CCU setting only. The risk profile of the patients who did not come to a health facility may differ from those who did. More community-based studies can be planned to study the risk factor distribution among CHD patients in general. Another limitation of the current study design was that the course of management of the patients in-facility and the subsequent outcomes in terms of coronary angiographies performed, interventional procedures performed, *etc.*, were not recorded. The outcome of the CHD events may differ by the risk factor profile, and further studies can be planned to investigate the prognostic factors for CHD events.

Our finding that there was not even a single case without one or more of the risk factors studied, shows the importance of targeting these risk factors for reducing the burden of CHD in the population. The majority of the CHD patients had multiple (three or more) risk factors present at the time of the event, which means that the focus should also be on reducing the clustering of risk factors in an individual at-risk person, as a step towards the ultimate impact at the community level in terms of reducing the CHD burden of disease.

COMMENTS

Background

Currently, cardiovascular diseases are the leading cause of mortality in the developing world, including India. Since the early 1960s, many countries have been able to reduce the rate of coronary heart disease (CHD) and subsequently the death rates due to them by implementing preventive and control measures along with better treatment. In contrast, India still has the highest mortality rates due to CHD amongst all ethnic groups studied so far. Considering also the fact that India has a population in excess of one billion, it becomes pertinent to study the distribution of risk factors for cardiac disease among the Indian ethnic population.

Research frontiers

The important focus in the current study was to identify the distribution of conventionally regarded risk factors for CHD among newly diagnosed patients of CHD in an Indian population. The observation of the distribution of such risk factors and the study of clustering of more than one risk factor in an individual patient, would help to show the importance of targeting these risk factors for reducing the burden of CHD in the general population.

Innovations and breakthroughs

A comprehensive analysis of risk factors has been carried out among newly diagnosed patients of CHD. This involved taking detailed personal and family histories, a general physical examination, anthropometric measurements and laboratory investigations. A profile of each individual subject was created so that we could study the clustering of risk factors in each patient.

Applications

The finding that there was not even a single case without one or more of the risk factors studied, shows the importance of targeting these risk factors for reducing the burden of CHD in the population. The authors have also brought out the clustering effect of risk factors, as a majority of the diagnosed patients had three or more risk factors present. This knowledge can be applied to focus public health attention on identifying "high-risk" individuals in the community who have clustering of risk factors and to aggressively target them with measures to prevent manifest cardiac disease. The other application for a public health approach to cardiac diseases is to renew the attention on reducing the conventional risk factors for CHD among the general population, to achieve a long-term reduction in the burden of disease due to CHD in a large populous country like India.

Terminology

CHD is a narrowing of the small blood vessels that supply blood and oxygen to the heart. CHD is usually caused by a condition called atherosclerosis. Atherosclerosis is a condition in which fatty material collects along the walls of arteries. This fatty material thickens, hardens (forms calcium deposits), and may eventually block the arteries.

Peer review

In this paper the authors report the results of a study performed to assess the major risk factors present in an Indian sample of 276 consecutive subjects newly diagnosed with coronary artery disease admitted to the Coronary Care Unit of Guru Tegh Bahadur Hospital in Delhi. The study is well performed and the results are interesting.

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