Original Article

RISK FACTORS FOR CORONARY ARTERY DISEASES: A STUDY AMONG PATIENTS WITH ISCHEMIC HEART DISEASE IN INDIA (KERALA)

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Summary

Coronary artery disease (CAD) is a condition that develops due to accumulation of atherosclerotic plaque in the epicardial coronary arteries, leading to myocardial ischemia. It is the leading cause of death worldwide and is a common complex disease. A study was carried out in a group of 496 patients with acute coronary syndrome or with angiographic or stress test evidence for coronary artery disease, admitted to the Department of Cardiology at Lourdes Heart Institute and Neuro Centre during the period June –August 2012. The risk factors studied were hypertension, diabetes mellitus, dyslipidemia, body mass index, smoking and family history of CAD. The results demonstrated that in both males and females of the Indian population studies, diabetes and dyslipidemia were major risk factors for CAD, while hypertension was not a major risk factor. Therefore, early detection and treatment of diabetes mellitus and dyslipidemia play a vital role in prevention of CAD in Indian population.
Key words: coronary artery disease, risk factors, hypertension, diabetes mellitus, dyslipidemia, body mass index

Introduction

CAD is a condition resulting from accumulation of atherosclerotic plaque in the epicardial coronary arteries and leading to myocardial ischemia. It is a common multifarious public health issue today and a leading cause of morbidity and mortality in both developing and developed countries [1]. Cardiovascular disease affects millions of people in both developed and developing countries. Although the rate of death attributable to the disease has declined in developed countries in the past several decades, it is still the leading cause of death and extorts a heavy social and economic toll globally. In low and middle income countries, the prevalence of cardiovascular disease has increased dramatically. By 2020, the disease is forecasted to become the major cause of morbidity and mortality in most developing nations [2, 3]. CAD includes a spectrum of disease manifestations ranging from

asymptomatic atherosclerotic disease to acute coronary syndrome, which includes ST elevation myocardial infarction (STEMI), Non-ST elevation myocardial infarction (NSTEMI) and unstable angina.

The risk factors for CAD are broadly classified as modifiable and non-modifiable risk factors. Modifiable risk factors include hypertension, diabetes mellitus, dyslipidemia, obesity and smoking. Non-modifiable risk factors include age, sex, race, and family history for CAD [4]. The Systematic Coronary Risk Evaluation system is recommended to assess an individual's total cardiovascular risk. CAD is closely related to lifestyle and modifiable physiological factors, and risk factor modification has been shown to reduce cardiovascular morbidity and mortality. CAD is the most common cause of mortality in India [5], homing approximately one-sixth of the world population. Hence understanding the predominant risk factors among the Indian population is important [6, 7]. Furthermore, the South Asian population, especially that of the Indian subcontinent, is believed to have a higher risk and prevalence of CAD as compared with European and African populations [8,9].

The prevalence and incidence of CAD along with the risk factor profile vary greatly across the regions of the world. Regional differences in the prevalence and incidence of atherosclerotic coronary disease may depend upon genetic variability, lifestyle differences and regional differences in medical care systems, etc.

A key factor that hampers the development of preventive strategies in developing countries such as India is the meagre amount (8%) of published literature on CVD research available from these countries [10]. Much of the knowledge of risk factors for coronary artery disease (CAD) has been acquired from studies conducted on the Western population. It is widely believed that the association of these risk factors with CAD in other populations needs to be ascertained, and there is speculation that differences might range from the frequency of presence of classical risk factors to their total absence or irrelevance in these populations. Therefore, it is imperative to undertake large population-based, prospective studies in developing countries such as India to identify CAD risk factors, both conventional and novel. However, careful scrutiny of available scientific evidence for modifiable CAD risk factors (elevated serum total and low-density lipoprotein cholesterol [LDL-C], low high-density lipoprotein cholesterol [HDL-C], smoking, diabetes, hypertension, low level of physical activity, and obesity) in this population may be helpful in formulating a more relevant CAD prevention strategy. A cost-effective preventive strategy will need to focus on reducing risk factors both in the individual and in the population at large.

The aim of the study was to analyse the major risk factors among the Indian population in the State of Kerala for CAD.

Patients and Methods

The study was conducted at the Lourdes Heart Institute and Neuro Center (LHINC), a tertiary Hospital in Cochin in the state of Kerala located in the southernmost part of India. Ethical approval for the study was obtained from the Institutional Ethical Review Committee.

The study was carried out on 496 patients, admitted to the Department of Cardiology in the hospital during the study period from June 1, 2012 to August 31, 2012 and met the inclusion criteria. The inclusion criteria were:

• Acute coronary syndrome - STEMI, NSTEMI or unstable angina;

• Post-myocardial infarction state - with history of coronary bypass graft or percutaneous coronary intervention with or without stenting or with history of medical management either with fibrinolytics or with heparins;

• Chronic ischemic heart disease - evidence from coronary angiogram or from a positive stress test.

The data used for the study was collected from the patients and their previous medical records. Smoking was defined as use of bidis (small, thin hand-rolled cigarettes found primarily in India, consisting of tobacco, wrapped in leaves of tendu or temburni - plants native to Asia) or cigarettes. Physical examination of patients included height, weight, abdominal circumference and two blood pressure measurements: at the time of admission and on the following day. Hypertension was classified based on the JNC 7 Classification for Hypertension (reviewed) [11]. Laboratory investigations included random blood sugar, fasting blood sugar, 2-hour post prandial blood sugar, HbA1c, fasting lipid profile (total cholesterol, LDL cholesterol, HDL cholesterol and triglyceride level), and Troponin T and ECG. Patients were defined as diabetic or with impaired

glucose tolerance based on their blood sugar levels and HbA1c values. Dyslipidemia was defined based on the Fasting Lipid Profile. Classification of the patients according to the inclusion criteria was made based on ECG findings, Troponin T and medical records.

The acquired data were analyzed statistically using Microsoft Excel. In T-test analysis, P value<0.05 was considered as statistically significant.

Results

A total of 496 patients admitted to the Department of Cardiology in the hospital during the study period were analysed according to the study parameters. Of the total number of patients included in the study, 310 (62%) were males and 186 (38%) were females.
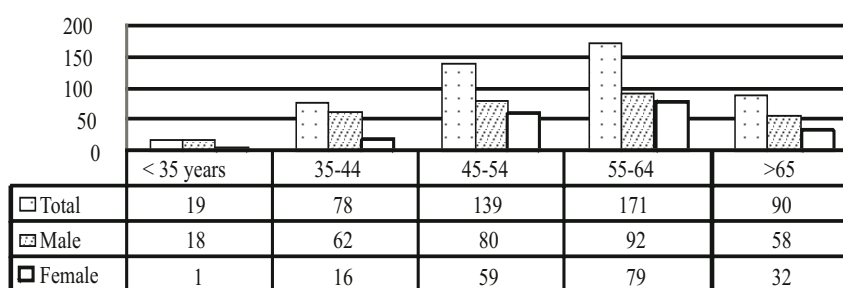
Acute coronary syndrome was established in 278 (56%) patients, 184 (31%) of the patients were with history of myocardial infarction and 64 (13%) of the patients were with evidence of chronic ischemic heart disease (Figure 1).

	Acute Coronary Syndrome	Post MI Patients	Chronic Ischemic Heart Disease
☐ Total	278	154	64
▨ Male	182	106	22
☐ Female	96	48	42
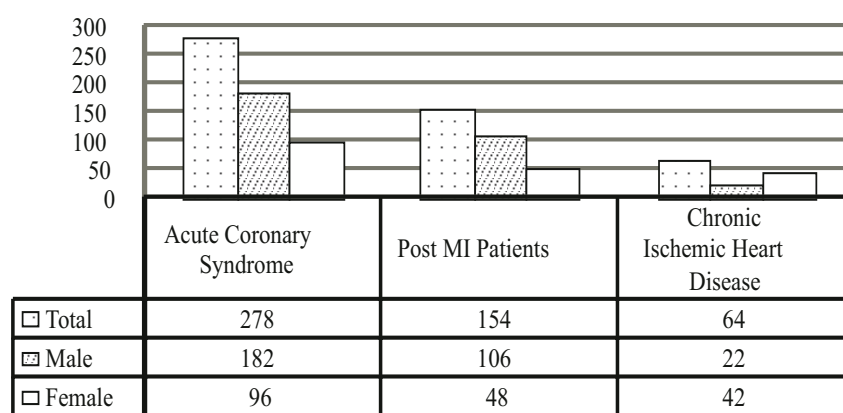
Figure 1. Distribution of study group by inclusion criteria and gender

Of the patients studied, 19 (3.8%) were under the age of 35; 78 (15.7%) were in the age group 35-44; 139 (28%) were in the age group 45-54; 171 (34.4%) were in the age group 55-64, and 90 (18.1%) were above the age of 65 (Figure 2).

	< 35 years	35-44	45-54	55-64	>65
☐ Total	19	78	139	171	90
▨ Male	18	62	80	92	58
☐ Female	1	16	59	79	32

Figure 2. Distribution of study group based on age group

Peak incidence of CAD occurred between the age group 45-64, and the incidence of CAD was negligible in females below the age of 44 (9%). The study showed that CAD in males started a decade earlier that in females. The incidence of CAD in males (20%) was higher than in females (8.6%) in the age group 35- 45. In patients older than 45 years, the male/female ratio of CAD occurrence was the same (Figure 2).

A positive family history for CAD was found in 282 (57%) patients in our study.

Based on blood pressure monitoring, the patients were classified according to JNC 7 (reviewed) Classification for Hypertension as normotensive 232 (47%), pre-hypertensive 17(14%), stage I hypertensive 52 (10%), stage II

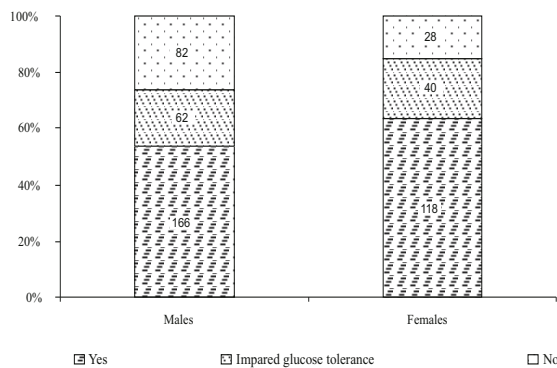hypertensive 82 (17%). Isolated systolic hypertension was found in 60 patients (12%) (Figure 3) There was no gender difference noted in the occurrence of hypertension.
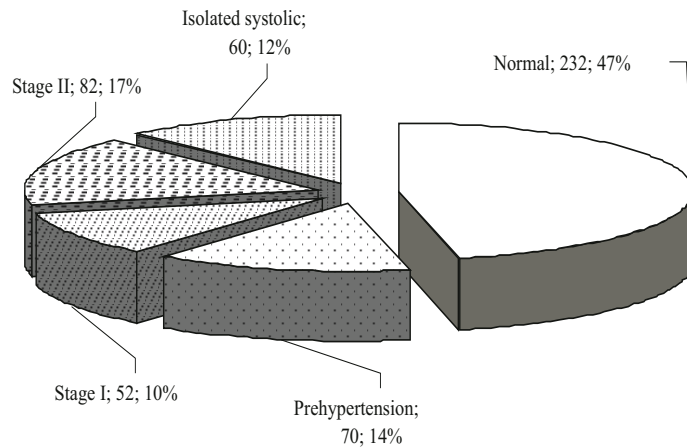
Figure 3. Distribution of patients based on blood pressure monitoring according to JNC 7 (reviewed) classification for hypertension

Diabetes mellitus was found to be a major risk factor in both males and females in the study population. Of all the 496 patients, 284 (58%) had diabetes mellitus, and 102 (21%) were with impaired glucose tolerance. Of the male patients, 166 (54%) were diabetics, and 62 (20%) were found with impaired glucose tolerance. For the female group, the values were 118 (54%) and 40 (20%), respectively (Figure 4).

Figure 4. Diabetic status of the study population

Dyslipidemia was also a major risk factor along with diabetes mellitus for the Indian population. In the study group, the fasting lipid profile tests revealed evidence of dyslipidemia in 352 (71%) of the patients: 206 (66%) of the males and 146 (78%) of the females. All the patients (100%) included in the study population reported using saturated oil for cooking, mainly coconut oil. This may be considered a causative factor for the high incidence of dyslipidemia among the study group (Figure 5).
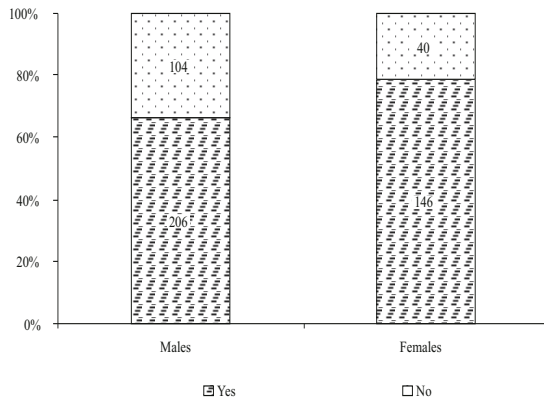
Figure 5. Dyslipidemia status of the study population

Of the study population, 378 (76%) had never smoked in their lifetime, and only 40 (8%) were current smokers. The number of female smokers in the study population was 0.

Considering obesity as the risk factor for CAD, based on the body mass index (BMI), only 50 (16%) of the males had a BMI higher than 30, whereas it was higher than 30 in 102 (55%) of the females. Only 62 (12%) of the studied population reported walking at least 30 minutes a day.

Discussion

This study showed that CAD started in males a decade earlier than in females. The incidence of CAD in males (20%) was higher as compared to that in females (8.6%) in the age group 35-45 (P<0.05). In the 45+age group, the male/female ratio for the occurrence of CAD was the same. In a study done by the World Health Organization, the male population was found to have approximately 40% increased CAD mortality as compared to the female population [12].

The peak incidence of CAD was seen in patients aged 45-64. Heart disease incidence increased in Asian Indians 5-10 years earlier than in other populations around the world. The mean age of first presentation of acute myocardial infarction in Indians is 53 years [13]. Coronary artery disease (CAD) that manifests at a younger age can have devastating consequences for an individual, family and society. A case-control study of risk factors for coronary heart disease in urban Indian middle-aged males, done by Jain et al. showed the presence of family history of premature CVD in 4.4% of patients [14].

A low incidence of hypertension (39%) was seen among the study population. Hence hypertension was found to be an insignificant risk factor among the population studied. The prevalence of hypertension in India is low as compared to world figures. In India, 23.1% of men and 22.6% of women over 25 years old suffer from hypertension, says the WHO "Global health statistics 2012"[15]. Sofia Study and EUROSPIRE III have shown that with advancing age, all forms of CAD increase among Bulgarians. In Sofia Study and EUROSPIRE study hypertension has been seen as a major risk factor for CAD [16]. Vladimirov V. et al. found a high incidence (56.3%) of hypertension among the Bulgarian population [17], in contrast to the low incidence of hypertension among the Indian population (39%).

A high incidence of diabetes and impaired glucose tolerance were seen among the population we studied. Of the total 496 patients, 284 (58%) had diabetes mellitus, and 102 (21%) were with impaired glucose tolerance. Of the male patients, 166 (54%) were diabetics, and 62 (20%) were found with impaired glucose tolerance. In the female group, the values were 118 (54%) and 40 (20%), respectively. There was no statistically significant difference in the incidence of diabetes mellitus in the male and female patients with CAD (P>0.05).

Indians are genetically prone to develop type II diabetes mellitus due to insulin resistance. The hyperinsulinimia in these patients accelerates the atherosclerotic process in the coronary arteries. Diabetes is second only to CAD as a health burden in India. During the past decade, the number of people with diabetes in India increased from 32 million to 50 million, and the projected figure may reach 87 million by 2030 [18]. Hyperinsulinaemia, insulin resistance, and the higher rate of prevalence of metabolic syndrome in people with type 2 diabetes were attributed to high coronary risk in south Asians [19, 20]. In Chennai (formerly Madras), India, an urban population study demonstrated that the prevalence rates for coronary artery disease were 9.1% in normal subjects and 21.4% in those with type2 diabetes. According to the Interheart study, the risk for myocardial infarction attributable to diabetes was 9%.

In the study group, the fasting lipid profile tests revealed dyslipidemia in 352 (71%) of the patients: 206 (66%) of the males and 146 (78%) of the females. The study did not reveal a statistically significant difference in the incidence of dyslipidemia in male and female patients with CAD (P>0.05).The role of dyslipidemia in the pathogenesis of CAD is well known [21]. In a study conducted between 1998 and 2002 in a North Indian population, Goel et al. showed that CAD occured at much lower levels of total cholesterol and LDL-C than in other populations, and high triglyceride and low HDL levels were universal in this population. Our study revealed a high prevalence of dyslipidemia (71%) - elevated levels of total cholesterol, LDL-C and high triglycerides with concurrent low HDL-C values.

Positive family history for CAD was seen in 57% of the patients. A family history reflects both genetic susceptibility and interactions between genetic, environmental, cultural and behavioural factors [22]. Individuals with genetic susceptibility develop the disease at an earlier age. Early detection of CAD in these individuals may help to modify risk factors. Non-invasive methods, e.g. coronary calcium scoring, might help predicting CAD in these patients. Some studies indicate that positive family history is a predictor of impaired endothelium-dependent coronary blood flow regulation in humans [23].

Enas et al. have shown that Indian emigrants to Western states have a high prevalence of dyslipidemia and insulin resistance, thereby

increasing the risk for CAD [24]. A modest increase in body fat with central distribution has

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