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Assessment of risk factors for coronary artery disease in patients with ischemic heart disease in the Southern region of India

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ABSTRACT

Introduction

Coronary artery disease comprises of range of disease manifestations thatvary from asymptomatic atherosclerotic disease to acute coronary syndrome. It is approximately estimated that the yearly deaths due to cardiovascular disease will increasefrom 17.5 million in 2012 to 25 million in 2030. The objective of the study is to assess thecoronary artery disease risk factor in patients with ischemic heart disease.

Objectives

Coronary artery disease comprises of range of disease manifestations that vary from asymptomatic atherosclerotic disease to acute coronary syndrome. It is approximately estimated that the yearly deaths due to cardiovascular disease will increase from 17.5 million in 2012 to 25 million in 2030. The objective of the study is to assess the coronary artery disease risk factor in patients with ischemic heart disease.

Material and Methods

This cross-sectional study was done in coronary care unit for a period of one month. Study participants with definite electrocardiography changes consistent with coronary artery disease were included in the study. Demographic details, relevant history and laboratory parameters were recorded from the case sheet. The data collected were statistically analysed with descriptive statistics and mean ± standard deviation.

Results

Among 30 study participants enrolled in this study 23 (80%) and 7 (20%) were males and females respectively. Majority of the study participants were of 51-60 years age group. 9(30%), 3(10%) male and female study participants respectively had total cholesterol level above the normal range. 16 (53.3%) and 3 (10%) male and female study participants respectively showed elevated levels of homocysteine and 5 (16.7%) male study participant had hyperuricemia.

Conclusion

This study revealed increased preponderance of CAD risk factors in the South Indian population. Regular screening and lifestyle modification of high risk groups can help in reducing prevalence of coronary disease in the population.

Keywords Coronary artery disease, Diabetes mellitus, Hypertension, Hyperlipidemia, risk factors.

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INTRODUCTION

Coronary artery disease (CAD) is a progressive condition caused by the build up of atherosclerotic plaque in the pericardial coronary arteries leading to myocardial ischemia. CAD is a chief cause of morbidity and mortality in developing and developed countries and it is a common public health catastrophe. CAD comprises of range of disease manifestation that differ from asymptomatic atherosclerotic disease to acute coronary syndrome. In low and middle income countries, the prevalence of cardiovascular disease has increased dangerously.[1] It is approximately calculated that the yearly deaths due to cardiovascular disease will increase from 17.5 million in 2012 to 25 million in 2030[2] . It has been estimated that out of 14 million Indians afflicted with CAD, 1.5 million individuals evolve to acute myocardial infarction and 500,000 of these persons will die yearly.[2]

The concept of risk factors for CAD was introduced by the Framingham Heart Study (FHS), which disclosed its results in 1957. FHS revealed the epidemiologic association of cigarette smoking, blood pressure, and cholesterol levels with the incidence of CAD.[3] The standard risk factors for CAD can be divided into non-modifiable risk factors like age, sex and family history and modifiable risk factors include diabetes mellitus, smoking, dyslipidemia, hypertension and obesity. CAD in 60% of local Indians remains unrecognised by traditional risk factors. Recently, new risk factors for cardiovascular disease have been recognized including an, increase in C-reactive protein, homocysteine and plasminogen activator inhibitor levels.[4]

In developing countries, mortality and risk factors for CAD continue to increase swiftly where as in developed countries, there is current decline in CAD. There is greater exposure to factors of risk like diabetes, dyslipidemia, hypertension and smoking for CAD in developing countries, which was considered to be due rapid socio-economic growth. In the Indian subcontinent, it is predicted that there will an increase in prevalence of CAD for next 20 years as a result of rapid population growth and life-style change following development in economy.[5] The prevalence of risk factors for CAD in a society has a high impact on health care service that account for health risk for the population and complete burden on the economy.[4] There are limited studies related to prevalence of risk factors for CAD in South Indian population. Hence, the present study in developing country was done to assess the risk factors for CAD in patients with ischemic heart disease. Scrutiny of the risk factors in this population may help in formulating CAD preventive strategy.

MATERIALS AND METHODS

The present cross-sectional study was done in the coronary care unit of cardiology department, Tirunelveli medical college, Tirunelveli District, Tamil Nadu, India. Study participants were, the patients with a diagnosis of CAD admitted in the coronary care unit. The duration of study was one month, from April 2019 to May 2019. The study was commenced after approval from Institutional ethical committee (REF NO: 1517/MBBS/2019). Informed written consent was obtained in local vernacular language from the guardian of the patients before including them in the study.

Patients of all age and gender with typical history of ischemic heart disease with confirmed electrocardiography changes that correlate with CAD and patients diagnosed as acute coronary syndrome like ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, unstable angina were included in the study. Patients with doubtful history of CAD and patients having electrocardiography changes not typically correlate with CAD were not allowed to participate in the study.Demographic information regarding age, gender, height, weight, body mass index, abdominal girth and the existence of risk factors like diabetes, hypertension, status of smoking, life style and a family history of CAD of all the patients admitted in the coronary care unit were collected. The information on laboratory parameters like serum total cholesterol, low-density lipoprotein cholesterol, high density lipoprotein cholesterol levels, triglycerides, plasma homocysteine, serum uric acid, myocardial enzymes and random blood glucose levels were also recorded from case sheet. Excel Microsoft Windows operating system was used for statistical data analysis. The baseline and demographic characteristics were analysed by descriptive statistics. Continuous variables were expressed as mean ± standard deviation.

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RESULTS

In the present study, a total of 30 patients were enrolled as per inclusion criteria. Among 30 patients, 23 (80%) and 7 (20%) were males and females respectively.(Table-1).

Parameters	Value (n-30)
Male / Female n (%)	23 (80) / 7 (20)
Personal habits **Male (23)** **Smoker** **Alcoholics** **Smoker + alcoholic**	 5 (16.7) 3 (10) 7 (23.3)
Female (7) **Passive smoker** **Alcoholics**	 2 (6.7) Nil
Family History **Positive** **Negative**	 13 (43) 17 (57)
Food habits **Non- vegetarian** **Vegetarian**	 24 (80) 6 (20)
Lifestyle **Active** **Sedentary**	 8 (27) 22 (73)

Majority of the patients were of 51-60 years age group and 1 (3.3%) patient in male and female were in 21-30 years and 31-40 years age group respectively (Table-3).

Table 3:Age distribution of study population

Age in years	Males n (%)	Females n (%)	Total n (%)
21-30	1 (3.3)	0	1(3.3)
31-40	0	1(3.3)	1(3.3)
41-50	4 (13.3)	1(3.3)	5(16.7)
51-60	10 (33.3)	1(3.3)	11 (36.7)
61-70	6(20)	1(3.3)	7 (23.3)
71-80	1(3.3)	2(6.7)	3(10)
81-90	1(3.3)	1(3.3)	2(6.7)

In this study among the 23 male study participants, 5 (16.67%) patients were current smokers, 3 (10%) were currently alcoholic and 7 (23.3%) had the habit of both smoking and alcohol consumption and among the 7 females study participant, 2 (6.7%) were found to be passive smokers while the alcohol consumption was zero.-(Table-1).In this study, 13(43%) patients had positive family history of CAD and 24 (80%) patients were found to follow South Indian type of non-vegetarian diet and 22 (73%) study participants were leading a sedentary life.(table-1). A total of 2 patients (6.7%) were found to diabetic, 5 patients (16.7%) were found to be hypertensive and 3 patients (10%) were both diabetic and hypertensive among the male study participants and among the females,1(3.3%) with diabetes and hypertension and 2(6.7%) with both diabetes and hypertension (table-2).

Table 2: Co- morbid condition of study population

Parameters	Value n (%)
Male (23) **Diabetes** **Hypertension** **Diabetes + hypertension**	 2 (6.7) 5 (16.7) 3 (10)
Female (7) **Diabetes** **Hypertension** **Diabetes + hypertension**	 1 (3.3) 1 (3.3) 2 (6.7)

Anthropometric characteristics like height and weight are given in table- 4 and table-5 respectively.

Table -4 Anthropometric characters –Height in cm in population

Height	Males n(%)	Females n(%)
146-155cms	3 (10%)	5 (16.7%)
156-165cms	8 (26.7%)	2 (6.67%)
166-175cms	6 (20%)	0 (0%)
176-185cms	6 (20%)	0 (0%)

Cms – Centimeters, n is number of patients and expressed in percentage

Table -5 Anthropometric characters – Weight in kilograms

Weight in kg	Males n(%)	Females n(%)
41-50	1(3.3)	3 (10)
51-60	4(13.3)	2 (6.67)
61-70	9(30)	2(6.67)
71-80	5(16.7)	0
81-90	4(13.3)	0

Kg – kilograms, n is number of patients and expressed in percentage

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Mean waist circumference was 101±12.72 cms and 84.29±6.36 cms for the male and female patients respectively. The BMI was 24.47±0.63 kg/m2 and 24.14±2.54 kg/m2 for the male and female patients respectively (table-6). The mean systolic and diastolic blood pressure is given in table-7.

Table-6 Waist circumference and BMI in study population

Parameter	Waist circumference in cms	BMI in Kg/m²
Males	101 ± 12.72	24.47 ± 0.63
Female	84.29 ± 6.36	24.14 ± 2.54

cms- Centimeters, Kg – Kilograms, m²-meter square, BMI- Body mass index

Table -7 Pulse rate and blood pressure of study population

Parameter	Males Mean ± SD	Females Mean ± SD
Pulse rate (Beats per minute)	82.5 ±3.8	86.4 ±3.53
Systolic BP (mmHg)	143.04 ±28.28	147.86 ±21.21
Diastolic BP (mmHg)	96.3 ± 10.06	100

BP- Blood pressure, mmHg – millimeters of mercury, SD – Standard deviation

In this study, 9(30%) and 3(10%) male and female study participants respectively had total cholesterol level above the normal range (table-8). 16 (53.3%) and 3 (10%) male and female study participants respectively showed elevated levels of homocysteine and 5 (16.7%) male study participant had hyperuricemia (Table-8). The mean random blood glucose levels in the study population were 188.13 ± 82.73mg /dL and 184.86 ±70.71 mg/dL in males and females respectively. Among the 30 study participants, 19 (73.3%), were diagnosed to had ST-elevation myocardial infarction, 8 (26.6%) study participants had non-ST-elevation myocardial infarction, and 3 (10%) had unstable angina.

Table - 8 Comparison of lipid profile, Plasma homocysteine and serum uric acid levels with normal values

Parameter	Below normal range		Normal range		Above normal range	
	Males n (%)	Females n (%)	Males n (%)	Females n (%)	Males n (%)	Females n (%)
Total cholesterol	5(16.7)	0	9 (30)	4(13.3)	9(30)	3 (10)
HDL	8 (26.67)	2(6.67)	15 (50)	5(16.7)	0	0
Triglyceride	2(6.67)	2(6.67)	13(43.3)	2(6.67)	8 (26.7)	3 (10)
LDL	1(3.3)	0	12 (40)	5(16.7)	10(33.3)	2(6.67)
Plasma homocysteine	0	0	7(23.3)	4(13.3%)	16(53.3)	3(10)
Serum uric acid	0	0	18 (60)	7(23.3%)	5(16.7)	0

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DISCUSSION

The present study showed that there is an association between smoking, diabetes, hypertension, non-vegeterian food habit, positive family history, sedentary life style, hyperlipidemia, increase in homocysteine and CAD in south Indian population. Age, male gender, family history, diabetes mellitus, dyslipidemia, hypertension, obesity, and tobacco smoking are considered as the leading proved risk factors for CAD.[1] In the present study, men (80%) had greater predisposition towards CAD than women (20%) and among the male patients 33.3% were of 51-60 years age group and 6.7% females were of 71-80 years age group. CAD is acknowledged to be more in men than women of the same age group.[6] It has been accepted that the manifestations of atherosclerotic disease in women is delayed due to endogenous estrogens exposure during reproductive period of life.[7] Menopause transition is related to exacerbation of CAD.[7] DeSmedt et al had demonstrated in his study that prevalence of various risk factors was significantly higher in female than male patients.[6] The lifetime liability of developing CAD in men after 40 years is 49% and women after 40 years is 32%.[8] In this study, 16.67% of male patients were current smokers, the most well known modifiable risk factors for CAD is smoking. In a case control study done in Nepalese population had shown that the risk of CAD in their population was found to be smoking.[9] In a review article by Salehi et al, where 6 articles were reviewed had shown that there is no significant connection between location of occlusion of CAD and smoking and they insist that smoking cessation could help to improve the health of patients with CAD.[10]In this study 43% of the study participants had desirable family history of CAD. A similar study conducted in Kerala showed that 57% of the patients had a positive family history.[1] Family history is an indication for genetic susceptibility to CAD and it also indicates an interactions between genetic, environmental, cultural and behavioral factors. CAD develops at younger age in individuals with genetic susceptibility. Detection of CAD at an early stage in these individuals may help to modify the risk factors.[1] History in the family for early heart disease is another risk factor for CAD, diagnosis of CAD in father and brother earlier than 55 years and mother and sister earlier than 65 years are hazard factor for CAD.[3]

In this study, 73% of study population was leading sedentary life. Increase in physical activity and cardio respiratory fitness is needed worldwide throughout the health care system to reduce cardiovascular disease.[11] In this study 80% of the study participants were following South Indian type of non- vegetarian diet. The risk for ischemic heart disease is more for people who consume meat than who consume fish and who consume vegetarian diet.[12] In a study by Shridar K et al had shown that there is beneficial association between vegetarians and cardiovascular risk factors compared to non-vegetarian diet. Vegetarians showed lower level of triglycerides and low density lipoprotein.[13]

In this study 6.7% of male study population and 3.3% of female study participant were diabetic. Diabetes is a vital risk factor for the evolution of CAD with increased incidence of myocardial infarction in patients with diabetes mellitus. After myocardial infarction, the morbidity, mortality and re-infarction is higher in diabetic patients with one year mortality of 50%.[14] The prevalence of CAD in Indian population is 21.4% for diabetics and 11% for non-diabetics.[15] 16.7% and 3.3% of male and female study participants respectively were hypertensive in this study. Endothelial dysfunction is induced by hypertension leading to exacerbation of atherosclerotic process which makes the atherosclerotic plaque unsteady.[16] Diabetes and hypertension are components of metabolic syndrome and develop one after another in the same individual. In this study 10% and 6.7 % of male and female study participants respectively were both diabetic and hypertensive.[17]

Genetically predicted waist circumference (WC) is strongly associated with CAD and measurement of WC must be done routinely by health professionals in clinical practice as it is an important vital sign of CAD.[18,19] Body mass index (BMI) more than 30 is a risk factor for early development of CAD.[20] In this study the mean WC was 101 ± 12.72 and 84.29 ± 6.36 among males and females respectively and BMI was 24.47 ± 0.63 and 24.14 ± 2.54 among males and females respectively. In a meta-analysis by Dong feng had observed that there is significant increased risk of cardiovascular mortality at heart rate of 90 beats per minute. High resting heart rate is a marker of sympathetic over activity associated with sudden death, ischemic episode and serious arrhythmias.[21] The mean pulse rate in this study was 82.5 ±3.8 and 86.4 ±3.53 beats per minute among males and female

patients respectively. Similarly, the systolic and diastolic blood pressure among male and female patients respectively were 143.04 ±28.28, 147.86 ±21.21 mmHg and 96.3 ± 10.06, 100 mmHg. Primary goal for blood pressure in patients with established CAD is 140/90 mmHg and the strongest foreteller of CAD in younger and middle aged group is the diastolic blood pressure .[22]

In the present study 30% and 10% of male and female study participants respectively had increase in total cholesterol level. Hyperlipidemia remains the strongest risk factor for CAD and there is a solid link between elevated low density lipoprotein cholesterol and cardiovascular disease. First line drug therapy, statin should be titrated to keep low density lipoprotein cholesterol level at or below the target range recommended by the Adult Treatment Panel-III guidelines.[23]

53.3% and 10% of male and female study participants respectively had increased homocysteine level and 16.7% male participant had hyperuricemia. Homocysteine is an independent cardiovascular disease risk factor for CAD.[24] Asymptomatic hyperuricemia without co-morbidity had significant risk for developing CAD event and it is an important biomarker for CAD.[25] The overall risk of CAD death increased by 15% for each increase of 1mg/dl of uric acid.[26] eight coronary risk factors for CAD were identified by INTERHEART –South Asia study and they are abnormal lipids, smoking , hypertension, diabetes, abdominal obesity, psychosocial factors, low fruit and vegetable consumption and lack of physical activity other emerging risk factors are high homocysteine levels, ambient air pollution, variation in outdoor temperature, psychosocial factor, increase in high sensitivity C-reactive protein.[16,27] Within India the cardiovascular disease is highest in states of Kerala, Punjab and Tamilnadu.[15] The strength of the study is that the study participants were the patients admitted with ischemic heart disease in the coronary care unit. The present study is retrospective single centre study with smaller sample size with short duration which is considered as limitation of the study. Prospective study with increase in sample size with longer duration and apparently multicentre study can be done to overcome the limitations.

Avoidance and check on the at risk factors for CAD would probably diminish the rate of occurrence of CAD and this can be achieved by bringing changes in the individual level along with community level.[4] Estimation of the risk factors in the specified patients becomes useful in formulating a successful strategy for CAD prevention. Regular screening of patients can also be done to identify the high risk patients at an early stage. Lifestyle modifications and routine screening of high risk group patients can go a long way in cutting down CAD prevalence in the population. The benefit of CAD prediction is distinct when this information is applied to the general population, individuals at high risk are identified and successful interventions are applied.

CONCLUSION

In order to reduce the incidence of CAD in Southern region of India, certain emergency measures may be taken to regulate the increasing risk factors. Lifestyle changes, such as adopting a healthy diet and doing regular exercise, quitting smoking, can help to prevent the rapid spike in CAD as observed in developing countries. As CAD has become a global health problem, studies of this nature are of vital importance in formulation of preventive strategies for the disease.

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