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Original Research Article

A Study of Risk Factors of Coronary Artery Disease and Their Association with Premature Coronary Artery Disease among Patients Attending Tertiary Care Cardiac Hospital in Pune, Maharashtra

Vijay Sampath[1], Sunil Agrawal[2], Arun Sampath[3], Swathi Y.K[4]

[1]OIC Station Health Organisation& Graded Specialist (Comm.Med), Air Force Station, Pune
[2]Group Captain-Med Services (Health) &Senior Advisor (Comm.Med), Air HQ,N. Delhi,
[3]Senior Consultant (Chest Physician) & MD(Pulm.Medicine), MIOT Hospital, Chennai,
[4]Diploma, Post Diploma-DNB (ENT) resident, Sakra World Hospital, Bangalore.

Corresponding Author: Vijay Sampath

ABSTRACT

Background: Coronary Artery Disease (CAD) occurs due to atherosclerosis of blood vessels and CAD occurring in men before the age of 45 years is understood as premature CAD (P-CAD). P-CAD presents with wide-ranging features as compared with late-onset CAD. Worldwide, morbidity and mortality due to premature CAD are rising on an alarming level.
Methods: A cross-sectional study of coronary risk factors of CAD and their association with premature CAD was conducted among male patients of freshly diagnosed and confirmed cases of CAD attending tertiary care cardiac hospital in Pune, Maharashtra. The estimated sample size was n=216. Only those patients who were freshly diagnosed as confirmed CAD and gave consent to participate in the study were included. Patients with known CAD attending either for the follow-up or review were excluded. A face-face interview method and a self-administered questionnaire were used to collect the data from the participants. Before interviewing them, they were informed of the scope and nature of the study, and their confidentiality was maintained. Data on risk factors were collected from demographic information, the previous history of diabetes mellitus, hypertension, and dyslipidemia, family history of CAD or sudden cardiac death, exercises they undergo, and history of smoking and alcohol use. Anthropometric measurements and clinical evaluations were carried out. The study was conducted for a period of one year and a total of 232 newly diagnosed CAD patients attended the study hospital. A pilot study was carried among thirty CAD patients. Since there aren't any significant revisions of the questionnaire, results from the pilot study were also included.
Results: Out of 232 participants, 109 (47%) and 123 (53%) were premature CAD and late-onset CAD patients respectively. The mean age of the participants was 44.1±7.1 years. Hypertension, dyslipidemia, diabetes mellitus, tobacco use, alcohol use, psychosocial factors (anxiety and depression) and family history of CAD were present in 42.2%, 88%, 22%, 65%, 66%, 35.8%, 42.2% and 19.3% of premature CAD patients respectively. Physical inactivity, overweight, and obesity were found in 54%, 69.4% and 14.7%of 232 participants respectively.
Conclusion: Young population warrant cost-effective interventions through various Information, Education and Communication (IEC) activities to impede the increasing

incidence of premature coronary artery disease.

Keywords: Atherosclerosis, premature coronary artery disease, coronary risk factors

INTRODUCTION

Coronary Artery Disease (CAD) is the main reason for death everywhere in the globe, [1] and it's difficult to estimate the precise prevalence as there's no extensive prospective study conducted in India. Absent centralized death registries and irregular death certificates hamper the estimation of its real burden. India is currently experiencing a frightening increase in the incidence of premature coronary artery disease (P-CAD) and can brunt the greatest burden shortly. [2] The disease complications are irreversible and chronic. When the afflicted person is young, dreadful outcomes are especially catastrophic and unexpected. [3] It is apparent that the disease signifies only a "tip of the iceberg". About one-fourth and half of Myocardial Infarction (MI) cases occur among men in India under40 and 50 years aged respectively. [4-5] The prevalence of P-CAD in India was 10%. [6] Independent risk-factor includes cigarette smoking, family history, dyslipidemia, and hypertension, and diabetes, inactive way of life, and obesity. Around 300risk factors of CAD are identified. [7] Although it's a disastrous disease with known cure neither, it's also extremely predictable, preventable, and treatable with the present knowledge. Hence this study was undertaken to evaluate various risk factors involved in CAD and correlate them with thereupon of premature CAD and recommend measures for risk reduction which not only decrease the morbidity and mortality but can even improve the lifespan of the younger generation.

MATERIALS & METHODS

A cross-sectional descriptive study of coronary risk factors was conducted among male patients of freshly diagnosed and confirmed CAD cases attending a tertiary care cardiac hospital in Pune, Maharashtra. About two hundred forty newly diagnosed male CAD patients were found to be admitted each year in this cardio-thoracic hospital. The estimated sample size was n=216, with the reported prevalence of P-CAD of 10%. Only those patients who were freshly diagnosed as confirmed CAD and gave consent to participate in the study were included. Patients with known CAD attending either for follow-up or review were excluded. A face-face interview method and a self-administered questionnaire were used to collect the information from the participants. Before each interview, participants were informed of the scope and nature of the study, and their confidentiality was maintained. Data on demographic information, previous history of diabetes mellitus, hypertension, and dyslipidemia, family history of CAD or sudden cardiac death (SCD), history of smoking and alcohol use, and details of exercises they undergo were collected. Findings of physical examination, Anthropometric measurements, and various investigations (blood sugar, lipid profile, ECG, and Echo-cardiography) of participants were recorded. A pilot study was conducted among thirty male freshly diagnosed CAD patients to validate the questionnaire. The study was conducted for a period of one year. Two hundred and thirty-two male newly diagnosed CAD patients (N-232) had attended study hospital. No subject has refused and every CAD patient's participated. Results from the pilot study have also been included.

Presence of definite MI or sudden cardiac death (SCD) before 45 years of age in first-degree male relative or before 55 years of age in first-degree female relative was considered as a positive family history of CAD. [8] Patients with a history of smoking or chewing tobacco, and drinking alcohol in any form and quantity during the study period were considered as current tobacco-users and current-alcoholics respectively. Patients with a history of cessation of smoking or chewing tobacco, and drinking alcohol in any form and quantity for the last one year from the study were considered as ex-users and ex-alcoholics respectively. Patients who had never consumed tobacco and alcohol were considered as never users and non-alcoholics respectively. Participants who have smoked ≥10 cigarettes per day and who drank over three units of alcohol per day were considered as high-risk current tobacco consumers and high-risk current alcoholics respectively. [9]

Participants with a history of physical exercises lesser than recommended (60 minutes of mild intensity/40-45 minutes of moderate intensity/20-30 minutes of high-intensity/very high-intensity exercises) or not underwent before the one-year duration of the study period were considered as a physically inactive. [9] Clinical anxiety and depression were determined by administering the Goldberg scale. [10] CAD occurring in men before the age of 45 years is defined as premature CAD based on earlier epidemiologic studies. [5,11] Hypertension was defined as systolic pressure ≥140 mm Hg or diastolic pressure ≥90 mm Hg and/or on anti-hypertensive medications. [12] Hypercholesterolemia is defined as total cholesterol>200 mg/dl, LDL cholesterol>130 mg/dl, HDL cholesterol<40 mg/dl, TC: HDL>4.5 or triglycerides>150 mg/dl, and dyslipidemia was defined as one or more abnormal serum lipid values. [13] Diabetes mellitus was defined as fasting blood sugar ≥126 mg/dl, and/or 2-hour postprandial blood sugar ≥200 mg/dl and/or on anti-diabetic medications. [14] The participant either with body mass index (BMI)≥23or ≥27.5 was considered as overweight and obese respectively, similarly, a participant with Waist Hip Ratio (WHR) >0.9 were considered as central obesity. [8]

Statistical Analysis

3.5-2006 of Epi-info software is employed for statistical analysis. Data are presented as categorical and continuous variables. To determine coronary risk factors and their association with P-CAD, participants were categorized into two groups. The statistical procedures applied are mean, variance, 95% CI, chi-square test. A p-value <0.05 was considered as significant.

RESULTS

This study was conducted to evaluate the proportion of varied epidemiological risk factors involved in CAD and their association with premature CAD. Distribution of patients according to age, education level, presence of risk factors, and categorization of participants were shown in table-I. The mean age of the participants was 44.1±7.1 years (range: 25-57). Out of 232 participants, 47% were of premature CAD patients (i.e. group-I).

Table-I. Characteristics of the study population

Age (years)	No (%)	Educational level	No (%)	Presence of risk factor	No (%)	Category of participants	No (%)
<35	27(11.6)	<Matriculation	61(26.3)	Nil risk factors	04(1.7)	Group-I (age <45 years)	109(47)
35-39	30(12.9)	Matriculation (10th passed)	69(29.7)	Anyone risk factor	9(3.9)	Group-II (age ≥45)	123(53)
40-44	52(22.4)	Higher secondary (12th passed)	54(23.3)	Two risk factors	26(11.2)		
45-49	69(29.7)	Graduate & above	48(20.7)	Three risk factors	52(22.4)		
50-54	39(16.8)			≥4 more factors	141(60.8)		
>55	15(6.5)						

The distribution of non-modifiable and modifiable coronary risk factors of participants was shown in table-II. The mean with S.D and range of various variables of participants were shown in table-III. Distribution of non-modifiable and selected modifiable coronary risk factors with premature CAD status was shown in table-IV.

Table-II. Summary distribution of coronary risk factors

Risk factors	No (%)	95% CI
Non-Modifiable:		
❖ Family history of CAD	47(20.3)	(15.3-26.0)
Modifiable:		
❖ Hypertension	103(44.4)	(37.9-51.0)
(i) High systolic BP (≥140 mmHg)	51 (22)	(16.8-27.9)
(ii) High diastolic BP (≥90 mmHg)	62 (26.7)	(21.1-33)
❖ **Dyslipidemia**	192 (82.8)	(77.3-87.4)
❖ **Lipid abnormalities:-**		
(i) Total-Cholesterol (≥200mg/dl)	53(22.8)	(17.6-28.8)
(ii) High LDL-C (≥130mg/dl)	45(19.4)	(14.5-25.1)
(iii) Low HDL-C (≤40mg/dl)	149(64.2)	(57.7-70.4)
(iv) High triglycerides (≥150mg/dl)	114(49.1)	(42.5-55.8)
❖ **Diabetes mellitus**	55(23.7)	(18.4-29.7)
High FBS (≥ 126 mg/dl)	48(20.7)	(15.7-26.5)
High PPBS (≥ 200 mg/dl)	23(9.9)	(6.4-14.5)
❖ **Obesity:-**		
Overweight (BMI ≥23)	161(69.4)	(63.0-75.3)
Obese (BMI ≥ 27.5)	34(14.7)	(10.4-19.9)
Central obesity (WHR >0.9)	159(68.5)	(62.1-74.5)
❖ **Smoking and tobacco use**	97(41.8)	(35.4-48.4)
❖ Alcohol consumption	94(40.5)	(34.1-47.1)
❖ **Physical inactivity**	125(53.9)	(47.2-60.4)
❖ Psychosocial factors		
(i) Anxiety	66(28.4)	(22.7-34.7)
(ii) Depression	79(34.1)	(28.2-40.3)

CAD-coronary artery disease, BP-Blood pressure, LDL-C Low-density cholesterol, HDL-C High-density cholesterol, FBS-Fasting blood sugar, PPBS-Postprandial blood sugar, BMI-Body mass index, WHR-Waist-hip ratio

Table-III. Mean with SD and range of variables of participants

Variables	Mean±S.D	Range
Systolic BP	129.2±14	95-185
Diastolic BP	83.7±9	65-115
Total cholesterol	166.18±32.16	96-272
Low-density cholesterol	98.6 ±30.6	31-190
High-density cholesterol	38.5±4.1	25-58
Triglycerides	153.4±59.2	46-452
Fasting blood sugar	107.8±32.5	63-305
Postprandial blood sugar	141±53.6	84-424
Body mass index	25.0±2.4	18-32
Waist-hip ratio	94±0.12	0.6-2.39

Table-IV. Distribution of coronary risk factorswith premature CAD status.

		Group-I No (%)	Group-II No (%)	x^2	p-value
Family history	Present	21(19.3)	26(21.1)		
	Absent	88(80.7)	97(78.9)	0.13	0.72(df=1)
Hypertension	Present	46(42.2)	57(46.3)		
	Absent	63(57.8)	66(53.7)	0.40	0.53(df=1)
Total Cholesterol	Abnormal	29(26.6)	24(19.5)		
	Normal	80(73.4)	99(80.5)	1.65	0.19(df=1)
LDL Cholesterol	Abnormal	25(22.9)	20(16.3)		
	Normal	84(77.1)	103(83.7)	1.65	0.19(df=1)
HDL Cholesterol	Abnormal	75(68.8)	74(60.2)		
	Normal	34(31.2)	49(39.8)	1.88	0.17(df=1)
Triglycerides	Abnormal	55(50.5)	59(48.0)		
	Normal	54(59.5)	64(52.0)	0.14	0.70(df=1)
Dyslipidemia	Abnormal	96(88.1)	96(78)		
	Normal	13(11.9)	27(22)	4.07	0.04(df=1)
Diabetes mellitus	Present	24(22.0)	31(25.2)		0.57(df=1)
	Absent	85(78.0)	92(74.8)	0.32	
BMI	< 23	22(20.2)	15(12.2)		
	≥23 (Pre-obese)	74(67.9)	87(70.7)		
	≥27.5 (Obese)	13(11.9)	21(17.1)	3.42	0.18(df=2)
WHR	≤0.9	40(36.7)	33(26.8)		
	>0.9 (central obesity)	69(63.3)	90(73.2)	2.61	0.11(df=1)
Smoking or tobacco use					
	Current user	57(52.3)	40(32.5)		
	Ex-user	14(12.8)	37(30.1)		
	Never user	38(34.9)	46(37.4)	13.32	0.0013(df=2)
Number of cigarettes smoked*					
	<10/day	26(49.1)	14(50)		
	10-19/day	21(39.6)	11(39.3)		
	≥20/day	6(11.3)	3(10.7)	0.01	>0.05 (df=1)
Alcohol use	Current alcoholics	49(45)	45(36.6)		
	Ex-alcoholics	23(21.1)	42(34.1)		
	Non-alcoholics	37(33.9)	36(29.3)	4.9	0.09(df=2)
Alcohol drinking#	1-3 units/day	32(65.3)	31(68.9)		
	>3 units/day	17(34.7)	14(31.1)	0.14	0.71(df=1)
Physical inactivity	Present	51(46.8)	74(60.2)	4.16	0.041(df=1)
	Absent	58(53.2)	49(39.8)		
Psychosocial factors	Anxiety presents clinically	39(35.8)	27(22)		
	Anxiety absent	70(64.2)	96(78)	5.43	0.019(df=1)
	Depression present clinically	46(42.2)	33(26.8)		
	Depression absent	63(57.8)	90(73.2)	6.08	0.014(df=1)

* Rows where the number of cigarettes smoked ≥10/day was clubbed for analysis purpose.
#1 unit of alcohol intake = 285 ml of beer (or) 30 ml of rum (or) 30 ml of whiskey (or) 60 ml of wine. LDL-C Low-density cholesterol, HDL-C High-density cholesterol, BMI-Body mass index, WHR-Waist-hip ratio.

DISCUSSION

The difference observed in the incidence of CAD and mortality in various countries was according to the extent and distribution of risk factors. [15] CAD tends to occur in young with widespread angiographic changes. [16] Out of the entire number of 232 CAD patients, 109 (47%) participants were of premature CAD and 123 (53%) participants were of elder CAD patients (table-I). The mean age of participants in this study were 44.1±7 years (range: 25-57 years). 6.33% (n=56) of male CAD patients were reported as premature CAD group in a cross-sectional study by Kasliwal RR et al. [17] Strong family history of CAD in the present study was present in 20.3% (n=47), 19.3% (n=21) and 21.1% (n=26) of total patients, premature CAD patients and in elder CAD group respectively (table-II, IV). In a study conducted by Friedlander et al, [18] with 1044 men aged 40-70 years, 29% (n=35) of their patients had reported a history of coronary failure in the first-degree relative before 60 years of age. 39% (n=39) and 11% (n=100) of premature CAD and late-onset CAD male patients respectively were reported with a strong family history of CAD in a study by Chen et al. [5] Most of the chance factors have key genetic determinants that are deemed to be of familial aggregation. [18] Classical remedial risk factors (smoking, hypertension, lipid abnormalities, and diabetes) are highly prevalent in familial P-CAD patients. [19] This risk factor can't be modified or excluded. Hypertension could be a ubiquitous risk factor that directly contributes to CAD. [20] The relative risk of CAD in diabetes mellitus is as high as compared to the general population. [21] Hypertension in the present study was present in 44.4% (n=103), 42.2% (n=46) and 46.3% (n=57) of total patients, premature CAD patients and elder CAD group respectively and diabetes mellitus was present in 23.7% (n=55), 22% (n=24) and 25.2% (n=31) of total patients, premature CAD patients and elder CAD group respectively (table-II &IV). 47.5%, 29.5%, and 48.7% of total CAD, premature CAD, and elder CAD male patients respectively were shown to possess diabetes mellitus in a study by Kasliwal RR et al. [17] In a study conducted by Gupta R et al, [22] with 550 men aged 20 years and above, diabetes was reported to be present in 13.1% (n=72) of their subjects. This proportion was even lesser than in our present study, and in the study by Kasliwal RR et al. [17] A low proportion of hypertension and diabetes mellitus was found in premature CAD participants as against in elderly age CAD in this study, as well as in compared studies. The connection between serum lipid levels and CAD is continuance. Higher the value, greater is the concern, but no single value separates those in danger from those who are not. Translating cholesterol levels in terms of lipoprotein is of more help in indicating coronary risk.

Dyslipidemia in the present study was present in 82.8% (n=192), 88.1% (n=96) and 78% (n=96) of overall participants, premature CAD and elder CAD group respectively (table-II&IV) and the difference was significant between groups ($p<0.05$). Dyslipidemia was the foremost common risk factor present in participants with any single risk factor. Dyslipidemia, physical inactivity, central obesity, and tobacco smoking were the foremost common risk factors present in participants with any four risk factors. Obesity, a significant part of metabolic syndrome and an independent risk factor were present in 14.7% (n=34), 11.9% (n=13) and 17.1% (n=21) of total patients, premature CAD patients and in elder CAD group respectively (table-II&III). Central obesity in the present study was present in 63.3% (n=69) and 73.2% (n=90) of premature CAD and elder CAD group patients respectively. In a study by Kasliwal RR et al [17] dyslipidemia was reported in 84.5%, 100% and 84.6% of total CAD, premature CAD, and elder CAD male patients respectively and the difference was significant between groups. 24.5%, 19.8%, and 28.5% of total CAD, premature CAD, and elder CAD male patients respectively were found to be obese in a study by Gupta R et al. [22] Study by Kasliwal RR et al [17] also reported that obesity to be present in 14.6% of male CAD patients. Since other studies classify BMI differently, it was unable to compare obesity with our results. The difference in the proportion of obesity might be probably due to their studies includes only urban subjects whereas in this study, subjects from any geographic location were involved. 41.3% and 71.1% of premature CAD and late-onset CAD male patients respectively were reported to have central obesity in a study by Gupta R et al. [22] Same wasn't statistically significant in our present and the compared studies.

The tobacco smoking is rapidly increasing in younger populations due to urbanization, independence, easy availability and stressful life situations. Around 4.45 million cases of CAD in the year 2002 were due to tobacco smoking in India. [23] Cigarette smoking is a high-risk for MI and SCD. [24] Current smoking/tobacco users in the present study were present in 52.3% (n=57) and 32.5% (n=40) of premature CAD and elder CAD group patients respectively (table-IV) and the difference was significant between groups. In a study by Chen et al [5] current smoking consumption was reported among 73% and 46% of premature CAD and late-onset CAD male patients respectively. Smoking/tobacco use was reported in 36.5% (n=201) of men aged 20 years and above in a study by Gupta R et al, [22] In a survey, it had been shown that 47.9% of men were of current tobacco users in any form. [25] Current alcoholics in the present study were present in 45% (n=49) and 36.6% (n=45) of premature CAD and elder CAD group patients respectively (table-IV) and the difference was significant between groups. Alcohol is one of the major substances of abuse in India. National Household Survey of 40,697 male populations shows that 21% were found to be current alcohol users and the highest proportion was in 41-50 years of age. [26] Smoking and drinking alcohol habits of the present study were higher among young age patients. In the present study, physical inactivity was present in 46.8% (n=51) and 60.2% (n=74) of premature CAD and elder CAD groups respectively (table-IV) and the difference was significant. Our study results and a study by Folsom AR et al [27] in the Minnesota Heart Study were similar. In their study, it had been shown that 34% of men spend on 2000 kcal/week on leisure-time physical activities. Gupta R et al [22] observed that physical inactivity was present in 61.5% of male subjects. Modern lifestyle and affluence have reduced the typical level of exercise in daily activities. This, in turn, results in mass obesity and diminished work capacity. Out of the entire number of 232 participants, clinical anxiety and depression were present in 66 (28.4%) and 79 (34.1%) patients (table-II). Out of various coronary risk factors, psychosocial factors are implicated within the etiology of CAD, its progression, and prognosis to a great extent. Strong evidence of possible etiological and prognostic role exists for anxiety and depression of CAD. [28]

CONCLUSION

The author observes that the frequency of premature CAD (age $\leq$ 45 years) in 47% of the participants. Though the frequency of hypertension and diabetes was less, factors like smoking, alcohol and psychosocial cause were more common as compared to elder CAD patients. The frequency of abnormal lipid profile was seen high in younger patients. 60.8% of study patients were having $\geq$ 4 coronary risk factors i.e. dyslipidemia, physical inactivity, central obesity, and tobacco smoking. Obesity features a greater impact on CAD and its prognosis because it's a crucial epidemiological factor of diabetes mellitus, hypercholesterolemia, and hypertension. The greater proportion of several risk factors of the young population is a matter of concern. It is pertinent now to act upon on risk reduction strategies like cessation of tobacco and alcohol use, reduction of overweight by dietary modifications and active lifestyle, effective stress management to curtail this burden of morbidity and mortality as well as to lead a healthy and economically productive life.

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