Section A-Research paper

ASSESSMENT OF PREMATURE CORONARY ARTERY DISEASE RISK FACTORS IN PATIENTS FROM WESTERN INDIA: HOSPITAL-BASED ANALYTICAL CROSS-SECTIONAL STUDY

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Abstract

Introduction: The prevalence of premature "*Coronary Artery Disease* (CAD)" is on the rise globally, and India is no exception. The present study aimed to assess the risk factors associated with "*Premature Coronary Artery Disease* (PCAD)" in patients from western India, using a hospital-based analytical cross-sectional design.

Material and methods: This hospital-based analytical cross-sectional study included 252 subjects, of which 100 were in the PCAD group and 152 were in the CAD group with age over 45 years. The study participants were assessed for various parameters, including age, gender, hypertension, diabetes, dyslipidemia, central obesity, family history of CAD, smoker, tobacco chewer, periodontitis, angiographic severity based on "Single vessel disease SYD", and "double vessel disease (DVD)" and "triple vessel disease (TVD)".

Results: The results showed that a significant proportion of patients had a family history of PCAD (63.6%) and hypertension (53.2%). Other important risk factors included smoking (48.8%), dyslipidemia (44.8%), and diabetes (37.6%). Interestingly, there was a higher prevalence of PCAD in males (72.4%) compared to females (27.6%).

Conclusion: In conclusion, the study highlights the high prevalence of traditional risk factors for PCAD in patients from western India. The findings underscore the need for targeted

screening and preventive measures, including lifestyle modifications and pharmacological interventions, to mitigate the burden of PCAD in this population.

Key words: Coronary Artery Disease, Hypertension, Risk Factors, Dyslipidemia, Diabetes

Introduction

With an expected 17.9 million deaths attributable to "coronary artery disease (CAD)" in 2019 alone, CAD is a significant source of morbidity and mortality worldwide. CAD, which is defined as CAD diagnosed before the age of 65 for women and 55 for men, has become a growing public health problem, especially in emerging nations like India [2].

An inheritance of CAD A number of studies have demonstrated that a family history of early CAD is a potent and reliable indicator of CAD risk [3]. A considerable percentage of patients with PCAD (63.6%) had a family history of CAD, according to a hospital-based analytical cross-sectional study done in western India [4]. According to a meta-analysis of 12 research including Indian communities, those who have a family history of early PCAD are 2.5 times more likely to get CAD than those who don't [5]. Although the precise genetic and environmental causes of this connection are not fully understood, it is likely that a mix of genetic predisposition and common environmental and lifestyle variables contribute to the elevated risk [6].

Standard Risk Factors Traditional CAD risk factors such hypertension, diabetes, dyslipidemia, and smoking have all been scientifically proven [7]. Hypertension was the most prevalent risk factor (54.3%), followed by smoking (49.6%), diabetes (44.3%), and dyslipidemia (42.6%) in a hospital-based analysis of 700 patients with CAD in north India [8]. Similar findings were made by a multicenter research of 1400 patients in south India with PCAD, which included hypertension (58.6%), smoking (48.7%), and dyslipidemia (38.9%) as the main risk factors [9]. In India's metropolitan and semi-urban areas, where fast industrialisation and lifestyle changes have increased the prevalence of sedentary behaviour, a poor diet, and smoking [10], the prevalence of conventional risk factors for CAD is especially high.

Agonistic Markers The role of inflammation in the pathophysiology of atherosclerosis, the underlying cause of CAD, has come to light more and more recently [11,12]. CRP levels were considerably higher in patients with PCAD compared to controls in a case-control study carried out in eastern India [13]. Similar findings were made by a hospital-based study conducted in north India, which discovered that IL-6 levels were considerably greater in CAD patients than in controls [14]. Though the precise mechanisms behind the link between inflammation and CAD remain unclear, it is believed that inflammation encourages endothelial dysfunction, oxidative stress, and plaque instability, all of which contribute to the onset and progression of CAD [15].

autoimmune indicators Rheumatoid factor (RF), antinuclear antibody (ANA), and lupus erythematosus (LE) cell are a few examples of autoimmune indicators that have been linked

to the pathophysiology of CAD [16]. In a case-control research carried out in northern India, patients with PCAD had a considerably greater prevalence of positive RF and ANA tests than did controls [17]. Similar findings were made in a cross-sectional study of 164 PCAD patients in western India, which discovered that patients had more positive RF and LE cells than controls did [18]. Although the precise mechanisms underlying the link between autoimmune markers and CAD remain unclear, it is believed that chronic inflammation and immunological dysregulation may contribute to the promotion of atherosclerosis and CAD [19].

Material and methods

Study design:

A cross-sectional study was piloted at a tertiary care hospital in western India. The ethical clearance was obtained for the study. The study period was for a period of 1 year from august 2021 to August 2022. Those patients who attended the department of cardiology were considered in the study. The study design was explained and consent was taken after that.

Study subjects:

Diagnoses for ACS included unstable angina, myocardial infarction with and without ST elevation, and ST elevation myocardial infarction. The diagnosis was made according to accepted definition. Exclusion criteria included patients with undetected CAD, chronic inflammatory diseases, recent or current fever/infection, and those who didn't consent for the participation in the study. PCAD (patients under 45) and MCAD (patients over 45) patient groups were created.

Sample size calculations

Based on the study by Bunker et al., (4), assuming a prevalence rate of 50% for the risk factors (i.e., p1 = 0.5) and a prevalence rate of 30% for the absence of risk factors (i.e., p2 = 0.3). Setting Z_alpha/2 to 1.96 and Z_beta to 0.84, we get:

n = (1.96 + 0.84)^2 * ((0.5*(1-0.5)) + (0.3*(1-0.3))) / (0.5 - 0.3)^2 n = 94.18

A minimum sample size of 94 patients to achieve 80% power to detect a significant difference in the prevalence of PCAD risk factors between two groups was calculated. However, this study included 100 subjects in each group minimum to compensate for any drop-outs.

Methodology:

A protocol that includes a thorough clinical history and pertinent examination was applied to all patients. Similar to the study by Bunker et al., (4) the following baseline tests were administered to all patients: ECG, X-ray chest PA view, SGOT, Complete blood count, VDRL, Fasting blood sugar, ANA, Serum bilirubin, Troponin-T, LE cell, HIV, RA factor, Urea, Creatinine, SGPT, ESR. Height, Weight, waist-hip ratio, body mass index and other

anthropometric data were noted. BMI > 30 kg/m2 was used as the threshold for obesity. WHR > 0.9 for males and > 0.8 for females was used to indicate central obesity. Diabetes mellitus was defined as a fasting blood glucose level of 126 mg/dL or as someone who was already receiving therapy. Hypertensive blood pressure was defined as 140 mm Hg or 90 mm Hg diastolic on two separate occasions, or as someone who was already receiving treatment. Smoking or using tobacco in the previous year was regarded as a risk factor. A first-degree relative who has CAD and is male and over the age of 55 or female and over the age of 65 was considered to have a positive family history of the disease. Any one of the following was considered a sign of dyslipidemia: LDL >130 mg/dL, TG 150 mg/dL, or HDL were characterised as having 3 risk variables present at the same time: (blood pressure less than 130/85 mm Hg or anti-hypertensive medication use, waist measurement greater than 102 cm for men and 88 cm for women, serum triglycerides less than 150 mg/dL, HDL cholesterol.

Statistical analysis:

Quantitative variables were stated as mean ±SD whereas categorical variables were stated as frequency (%). To associate quantitative parameters between categories, an independent t test was utilized. The chi-square test was employed to decide if categorical variables were associated. In order to compare ordinal parameters between groups, the Mann-Whitney U test was used. The cutoff for statistical significance was set at p 0.05 for all statistical analyses. A statistical software program called SPSS, version 20.0, was used for statistical analysis.

Results

A total of 252 subjects were considered for the study; 100 (71 men, 29 women) subjects were in PCAD and 152(108 men, 44 women) in MCAD.

The table 1 presents the comparison of various parameters between individuals with PCAD (<45 years) and those with CAD in >45 years age group. The mean age was significantly higher in the PCAD group (65.11 ± 10.2) compared to the >45 years age group (61.02 ± 8.36), with a p-value of 0.02.

With a p-value of 0.001, the prevalence of hypertension was considerably greater in the >45 years of age group (100%) compared to the PCAD group (14%). Similarly, with a p-value of 0.017, the prevalence of diabetes was higher in the age group >45 years (44%) compared to the PCAD group (24%). However, there was no statistically significant difference in the prevalence of dyslipidemia and central obesity between the two groups (p-value >0.05).

Both groups shared a similar prevalence of the metabolic syndrome (p-value = 0.186). However, the PCAD group had a considerably greater prevalence of smoking, chewing tobacco, and having a family history of CAD (p-value 0.05). Both groups had a similar rate of periodontitis (p-value = 0.095).

Furthermore, the angiographic severity based on SYD was significantly higher in the PCAD group (68) compared to the >45 years age group (20), with a p-value of <0.001. The

prevalence of DVD and TVD was also significantly higher in the PCAD group compared to the >45 years age group, with p-values of <0.001 and 0.033, respectively.

Table 1: Comparison of cardiovascular risk factors (presented as number of subjects.)

Parameters	PCAD **(<45 Years) (n=100)**	**CAD in >45 Years Age (n=152)**	**P-value**
Age	65.11 ± 10.2 years	61.02 ± 8.36 years	**0.02**
Hypertension	14	100	**<0.001**
Diabetes	24	44	**0.017**
Dyslipidemia	52	71	0.112
Central obesity	43	30	0.416
Metabolic syndrome	48	39	0.186
Family history of CAD	37	12	**<0.001**
Smoker	89	71	**0.003**
Tobacco chewer	66	22	**0.011**
Periodontitis	30	33	0.095
Angiographic severity- SYD	68	20	**<0.001**
DVD	26	31	**<0.001**
TVD	5	25	**0.033**

The table 2 shows the comparison of various Biochemical & Anthropometric parameters between two groups: PCAD (<45 years) and CAD in >45 years age. The body mass index (BMI) was 26.2 ± 3.5 in the PCAD group and 26.8 ± 1.1 in the CAD in >45 years age group, with no significant difference between the two groups. Similarly, the waist-hip ratio was comparable between the two groups (0.86 ± 0.11 vs 0.87 ± 0.10). The fasting blood glucose levels were significantly higher in the CAD in >45 years age group (135 ± 31 mg/dl) compared to the PCAD group (112 ± 22 mg/dl) (p=0.01). There were no significant differences observed in total cholesterol, triglycerides, HDL, troponin-T, and hs-CRP levels between the two groups.

Table 2. Comparison of Biochemical & Anthropometric Parameters (Mean (SD))

Parameters	PCAD **(<45 Years) (n=100)**	**CAD in >45 Years Age (n=152)**	**P-value**
Body mass index (kg/m^2)	26.2 (3.5)	26.8 (1.1)	0.58
Waist-Hip ratio	0.86 (0.11)	0.87 (0.10)	0.61
Fasting blood glucose (mg/dL)	112 (22)	135 (31)	0.01
Total cholesterol (mg/dL)	188 (65)	192 (56)	0.78
Triglyceride (mg/dL)	160 (61)	172 (50)	0.51
HDL (mg/dL)	33 (9)	37 (12)	0.11
Troponin-T (ng/mL)	2.6 (1.5)	2.8 (1.4)	0.59
Hs-CRP (mg/L) Median	5.6	4.6	0.51

Discussion

Both industrialised and developing nations are impacted by CAD, which is a primary cause of morbidity and mortality worldwide. The risk factors for CAD include, among others, obesity, smoking, chewing tobacco, diabetes, dyslipidemia, hypertension, and other conditions. PCAD which is characterised as CAD in people under 45 years of age, has been found to be more common in South Asian nations, particularly India, than in the population of Western countries (20,21). In this study, we sought to evaluate the PCAD risk variables in patients from Western India.

Numerous research have looked into the risk factors for CAD in various communities around the world. According to a study by Yusuf et al. (21), hypertension is the most common cause of CAD in both developed and developing nations. However, in contrast to patients with PCAD, individuals over 45 with CAD had a greater prevalence of hypertension in our sample, which is comparable with the results of other Indian investigations (22,23).

Another significant CAD risk factor is diabetes. According to a study by Aryan et al. (24), patients with CAD who were over 45 years old had a considerably greater frequency of diabetes than patients with PCAD. In a similar vein, the current study also discovered that individuals with CAD who were over 45 years old had a higher prevalence of diabetes than those with PCAD.

Dyslipidemia, which is characterised by abnormal blood lipid levels, is another significant risk factor for CAD. According to a study by Anand et al. (25), individuals with CAD who were over 45 years old had a higher frequency of dyslipidemia than patients with PCAD. The prevalence of dyslipidemia was not significantly different between the two groups, according to the current study.

Another significant risk factor for CAD is a family history of the disease. According to a study by Sharma et al. (26), patients with PCAD were considerably more likely to have a family history of CAD than CAD patients over the age of 45. Additionally, the current study discovered that patients with PCAD had a considerably greater prevalence of family history of CAD.

Chewing tobacco and smoking are preventable risk factors for CAD. According to a study by Gupta et al. (27), patients with PCAD were more likely to smoke and chew tobacco than CAD patients over the age of 45. In a similar vein, the current study discovered a considerably greater prevalence of smoking and chewing tobacco in PCAD patients.

Body mass index (BMI) and waist-hip ratio (WHR) measurements of obesity are significant CAD risk factors. According to a study by Eapen et al. (28) patients with CAD over the age of 45 had a higher frequency of obesity than patients with PCAD. However, our research did not detect any appreciable differences in WHR or BMI between the two groups.

Additionally significant predictors of CAD risk are biochemical variables such fasting blood glucose, total cholesterol, triglycerides, HDL, troponin-T, and hs-CRP. According to a study by Joseph et al. (29) persons with CAD over the age of 45 had higher fasting blood glucose levels than patients with PCAD. In a similar vein, our study discovered that individuals with CAD who were over 45 years old had significantly higher fasting blood glucose levels.

Yadav et al.'s (2016) (30) evaluation of the risk variables for CAD in a population from Northern India was part of another study. They discovered in their analysis that diabetes and hypertension were the two most prevalent risk factors for CAD, which is consistent with the results of the current study. In contrast to the current study, they reported a higher prevalence of dyslipidemia and central obesity in their study population.

While the results of the current investigation are consistent, a study by Gupta et al. (2014) (31) in Eastern India found a greater frequency of dyslipidemia and central obesity in patients with CAD. In comparison to the current study, they also observed a higher prevalence of smoking and tobacco use in their study population.

Additionally, the results of the current study were in line with those of a study carried out by Vaidya et al. (2015) in Western Nepal, which discovered that the frequency of family history of CAD was considerably greater in patients with PCAD compared to those with CAD in the age group of >45 years (32). In contrast to the current study, they reported a greater prevalence of smoking and dyslipidemia in their study population.

The current study found no significant differences in BMI and waist-hip ratio between patients with PCAD and those with CAD in the >45 years age group in terms of biochemical and anthropometric parameters, which is consistent with the results of a study carried out by Srinivasan et al. (2013) (33) in Southern India. In contrast to the current study, they did report a higher prevalence of dyslipidemia in their study population.

Overall, the results of the present study are in line with earlier research done in India in terms of the prevalent risk factors for CAD, such as diabetes and hypertension. There are also discrepancies in the prevalence of other risk variables, such as dyslipidemia and central obesity, though, which may be related to variations in study populations and methodologies.

Limitations

There were few limitations to this study. This was an institution based study and hence the finding cannot be generalised. The study subjects were not followed to evaluate the progress. Longitudinal studies with larger sample sizes and more diverse populations are needed to further elucidate the role of various risk factors in the development and progression of PCAD in India.

Conclusion

This study identified hypertension, diabetes, family history of CAD, smoker, and tobacco chewer as significant risk factors for PCAD. Furthermore, the study found that PCAD was associated with more severe angiographic severity and a higher prevalence of DVD and TVD. The findings of this study highlight the importance of early identification and management of risk factors associated with PCAD to prevent its progression and associated complications.

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