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SHORT COMMUNICATION

Conventional risk factors of coronary artery disease in a tertiary care hospital of Chandigarh in Northern part of India

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KEYWORDS
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Abstract
There are conflicting reports about the role of conventional risk factors in coronary artery disease from some of the studies in India. The present study tried to determine the association of conventional risk factors in patients with coronary artery disease (CAD) and correlate with findings on coronary angiography.
Material and methods: Study was conducted at the PGIMER in 1003 consecutive patients with angiographic proven coronary artery disease. They were assessed for cardiovascular risk factors like age, sex, history of smoking, diabetes, hypertension (physician diagnosed) and family history of CAD. Anthropometric data for height, weight, body mass index (BMI), waist circumference and waist hip ratio were recorded using standard methods. Lipid profile and blood sugar estimation was done.
Results: The mean age was 56 ± 10.8 years with 82.8% were males. Hypertension, diabetes mellitus, history of smoking, family history and dyslipidemia were present in 59.6%, 25.8%, 32%, 6.8%, and 56% respectively. Central obesity was seen in 75.6% of male (WHR > 0.90) and 88.3% of female (WHR > 0.80) patients. Single, double and triple vessel disease was present in 50.4%, 28.2% and 16% cases respectively. Types A, B and C lesions were seen in 32.7%, 41.3%, and 37.6% cases respectively. About two fifth (39.8%) cases presented with acute myocardial infarction, 22.4% with unstable angina/NSTEMI and 37.8% with chronic stable angina. Logistic regression analysis showed that diabetes, waist hip ratio and raised triglycerides were

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significantly associated with increasing severity of lesion. Further diabetes also showed significant association with increased vessel wall involvement. Health promotion programmes focusing on conventional risk factors and secondary prevention focusing on early diagnosis, management and lifestyle modifications may be the key interventions for prevention and control of CAD.

Introduction

Coronary artery disease (CAD) has become important public health problem over the last few decades. About 80% of the global burden of cardiovascular disease death occurs in low and middle-income countries. Murray and Lopez predicted that cardiovascular disease would be the leading cause of death and disability worldwide by 2020 mainly because it will increase in low and middle-income countries [1,2]. Risk factors for coronary artery disease have been divided into conventional and novel risk factors. Hypertension, diabetes, smoking, dyslipidemia, sedentary lifestyle, and abdominal obesity are considered to be traditional risk factors for CAD. Research into newer risk factors like homocysteine, fibrinogen, C reactive protein, genetic factors and platelet polymorphisms is in progress to determine their effects on causation of CAD. Some of the earlier studies have indicated that conventional risk factors alone may not be responsible in our population and other novel risk factors may be operative [2].

The INTERHEART study [3] demonstrated that conventional risk factors play an important role in the prediction of myocardial infarction in populations around the world including India; of course the risk factors for some unknown reasons occur at younger age in South Asian patients. Cardiovascular diseases vary greatly between different ethnic groups. Patients with differing racial and cultural backgrounds may have different risk factors that contribute to the extent of CAD [4]. The World Health Organization estimates that, by 2010, 60% of the world's cardiac patients will be in India [2]. Deaths from coronary heart disease in India rose from 1.17 million in 1990 to 1.59 million in 2000 and are expected to rise to 2.03 million in 2010. About 50% of cardiovascular disease related deaths in India occur among people younger than 70, compared with about 22% in the West [2,5].

The present study looked at various conventional risk factors in patients with proven coronary artery disease on angiography and also evaluated correlation of these factors with severity of the disease.

Methods

This study included 1003 consecutive patients with coronary artery disease, proven by coronary angiography during 2005–2006. They were assessed for cardiovascular risk for age, sex, history of smoking, diabetes, hypertension and family history of CAD. Hypertensives were identified using JNC VII criteria. Patients were recorded as diabetic if they were previously diagnosed diabetics or detected to be diabetic in the current admission. Anthropometrics data in the form of height, weight, body mass index (BMI), waist circumference and waist hip ratio (WHR) were recorded using standard methods. Patients underwent tests for biochemical profile by standard methods which included lipid profile and were classified as dyslipidemic if they had raised LDL $\geqslant$ 100 mg/dl, HDL < 40 mg/dl in males and <50 mg/dl in females, triglycerides $\geqslant$ 150 mg/dl or total cholesterol > 200 mg/dl. All patients underwent coronary angiography and the number of vessels involved and lesional severity was recorded. Lesions morphology were classified into types A, B and C based on guidelines for percutaneous coronary angioplasty of American College of Cardiology [6].

The diagnosis of metabolic syndrome was made as per ATP III which needs three out of five components, which are (i) triglycerides $\geqslant$ 150 mg/dl, (ii) HDL < 40 mg/dl in males and <50 mg/dl in females, (iii) hypertension, $\geqslant$135/85 mm Hg or medication, (iv) fasting plasma glucose $\geqslant$ 110 mg/dl, (v) waist circumference of >102 cm in males and >88 cm in females [7]. The proposed cut offs for central obesity in Indians and used in the study include >90 cm in males and >80 cm in females [8].

Analysis of data was done using statistical package for social sciences (SPSS) software version 13. Univariate analysis assessed the significance of risk factors for increasing

Table 1 Presentation and extent of coronary artery disease.

	No.	% (n = 1003)
Presentation		
Acute STEMI	399	39.8
Unstable angina/NSTEMI	225	22.4
Chronic stable angina	379	37.8
Number of vessels involved		
Single	505	50.4
Double	282	28.2
Triple	160	16.0
Vessels involved		
LAD	511	51.0
LCX	368	36.7
RCA	301	30.1
Lesions		
Type A	328	32.7
Type B	415	41.3
Type C	376	37.6

STEMI — ST elevation myocardial infarction; NSTEMI — Non-ST myocardial infarction;
LAD — Left Anterior descending coronary artery;
LCX — Left circumflex artery; RCA — Right Coronary artery.

Table 2 Distribution of risk factors with vessel wall involvement.

Characteristics (n = 1003)	No vessel inv N = 54 (%)	SVD N = 506 (%)	DVD N = 283 (%)	TVD N = 160 (%)	p value
Gender					
Male (824)	3.9	50.8	29.6	15.7	<0.001
Female(179)	12.3	48.6	21.8	17.3	<0.001
Age					
Male					<0.001
21—40 (79)	5.1	73.4	16.5	5.1	
41—60 (492)	4.9	51.7	29.7	13.6	
>60 (253)	1.6	41.8	33.5	23.1	
Female					0.009
21—40 (7)	42.9	57.1	0	0	
41—60 (97)	17.5	45.4	20.6	16.5	
>60 (75)	2.7	52	25.3	20	
Hypertension					
Male (458)	4.4	49.3	29.0	17.2	0.7
Female (140)	12.1	46.4	22.9	18.6	0.4
Diabetes					
Male (210)	2.4	41.4	35.2	21.0	0.4
Female (53)	13.4	37.7	20.8	28.3	0.6
Smoking					
Male (314)	3.5	57.6	25.2	13.7	0.3
Female (9)	0	77.8	11.1	11.1	0.02
Family history					
Male (57)	5.3	47.4	29.8	17.5	0.03
Female (8)	0	50	25	25	0.3
Dyslipidemia					
Male (462)	3.5	51.1	30.7	14.7	0.8
Female (98)	14.3	44.9	23.5	17.3	0.7
Raised total cholesterol					
Male (105)	4.8	42.9	36.2	16.2	0.3
Female (22)	13.6	50.0	13.6	22.7	0.7
Low HDL					
Male (382)	2.9	51.3	30.4	15.4	0.6
Female (153)	10.5	50.3	21.6	17.6	0.3
Raised LDL					
Male (272)	2.6	50.0	29.8	17.6	0.4
Female (64)	14.1	46.9	17.2	21.9	0.5
Raised TG					
Male (236)	4.2	45.8	31.8	18.2	0.3
Female (55)	9.1	49.1	16.4	25.5	0.2
BMI ($\geqslant$25 kg/m^2)					
Male (516)	3.9	50.8	28.5	16.9	0.6
Female (115)	11.3	47.0	26.1	15.7	0.3
WHR					
Male (623) (>0.90)	4.2	49.6	29.9	16.4	0.5
Female(171) (>0.80)	12.9	47.4	22.2	17.5	0.4

(*Continued on next page*)

Table 2 (*continued*)

Characteristics (n = 1003)	No vessel inv N = 54 (%)	SVD N = 506 (%)	DVD N = 283 (%)	TVD N = 160 (%)	p value
Increased waist circumference					
Male (278)	3.6	52.2	29.9	14.4	0.9
Female (135)	15.6	44.4	21.5	18.5	0.07
Metabolic syndrome					
Male (240)	3.3	46.3	32.1	18.3	0.3
Female (116)	12.9	46.6	20.7	19.8	0.6

SVD — Single vessel disease; DVD — Double vessel disease; TVD — Triple vessel disease.

Table 3 Characteristics of the study population according to lesional severity.*

Characteristics (n = 1003)	Total (%) N = 1003	No type N = 68 (%)	Type A N = 204 (%)	Type B N = 315 (%)	Type (C) N = 416 (%)	p value
Gender						
Male (824	82.8	5.1	20.1	32.4	42.4	<0.001
Female (179)	17.2	14.5	21.2	26.8	37.4	<0.001
Age						
Male						0.09
21—40 year (79)	9.6	3.8	25.3	36.7	34.2	
41—60 years (492)	59.7	6.5	20.7	31.9	40.9	
⩾61 years (253)	30.7	2.8	17.4	32.0	47.8	
Female						<0.001
21—40 years (7)	3.9	57.1	42.9	0.0	0.0	
41—60 years (97)	54.2	20.6	21.6	26.8	30.9	
⩾61 years (75)	41.9	2.7	18.7	29.3	49.3	
Hypertension						
Male (458)	55.6	5.0	19.2	31.7	44.1	0.7
Female (140)	78.2	12.9	20.7	27.9	38.6	0.6
Diabetes						
Male (210)	25.5	3.8	16.2	29.0	51.0	0.02
Female (53)	29.6	15.1	17.0	24.5	43.4	0.6
Smoking						
Male (314)	38.1	5.1	21.7	32.2	41.1	0.8
Female (9)	5.0	0.0	33.3	33.3	33.3	0.5
Family history						
Male (57)	6.9	3.5	24.6	24.6	47.4	0.4
Female (8)	4.5	0.0	25.0	37.5	37.5	0.6
Dyslipidemia						
Male (462)	56.2	4.8	20.6	31.0	43.7	0.6
Female (98)	54.7	17.3	20.4	29.6	32.7	0.3
Raised total cholesterol						
Male (105)	12.7	5.7	21.0	31.4	41.9	0.3
Female (22)	12.3	22.7	22.7	13.6	40.9	0.7
Low HDL						
Male (382)	46.4	3.1	21.2	35.9	39.8	0.02
Female (153)	85.5	11.8	22.9	28.8	36.6	0.04
Raised LDL						
Male (272)	33.0	3.7	18.8	32.0	45.6	0.3
Female (64)	35.8	14.1	25.0	23.4	37.5	0.7

Table 3 (*continued*)

Characteristics (n = 1003)	Total (%) N = 1003	No type N = 68 (%)	Type A N = 204 (%)	Type B N = 315 (%)	Type (C) N = 416 (%)	p value
Raised TG						
Male (236)	28.6	5.9	16.1	29.7	48.3	0.08
Female (55)	30.7	10.9	18.2	34.5	36.4	0.4
BMI ($\geqslant$25 kg/m^2)						
Male (516)	62.6	5.6	19.0	33.3	42.1	0.6
Female (115)	64.2	13.9	17.4	32.2	36.5	0.1
WHR						
Male (623) (>0.90)	75.6	5.5	18.3	32.4	43.8	0.09
Female(171) (>0.80)	88.3	15.2	19.9	27.5	37.4	0.8
Increased waist circumference						
Male (278)	61.9	4.3	19.4	36.7	39.6	0.2
Female (135)	75.4	15.6	20.0	28.1	36.3	0.7
Metabolic syndrome						
Male (240)	29.1	3.8	15.4	33.3	47.5	0.07
Female (116)	64.8	12.9	20.7	29.3	37.1	0.7

BMI — Body mass index; WHP — Waist hip ratio.
* If the person is having two types of lesions only the highest grade was considered.

lesional severity and vessel involvement using the Chi Square test. Sensitivity analysis was done and the factors taken for logistic regression modeling included age, gender, hypertension, diabetes, smoking, family history, WHR, dyslipidemia. The impact of metabolic syndrome was analyzed in a separate model after removing highly correlated variables. The odds ratio, p value and confidence intervals were calculated.

The study was cleared by institute ethical committee and informed consent was taken for each patients.

Results

The mean age of the patient was 56 ± 10.8 years with predominant males (82.8%). The clinical presentation included acute ST segment elevation myocardial infarction (STEMI) in 39.8%, unstable angina in 22.4% and stable angina in 37.8% patients. Coronary angiography revealed single vessel involvement in 50.4%, double vessel disease in 28.2% and triple vessel disease in 16% cases (Table 1). Involvement of the LAD was seen in 51%, LCX in 36.7% and RCA in 30.1% cases. Types A, B and C lesions were seen in 32.8%, 41.3% and 37.6% of patients respectively.

The distribution of risk factors with increasing vessel involvement and severity of disease is shown in Table 2 and on univariate analysis, it was observed that increasing age had significant association with increasing vessel involvement among males and females ($p < 0.001$).

The risk factors analysis revealed presence of diabetes in 25.5% males and 29.6% females, hypertension in 55.6% males and 78% females, dyslipidemia in 56.2% of males and 54.7% females and smoking in 38% of males and 5% of females respectively (Table 3). Smoking was seen more frequently among young patients ($\leqslant$40 years) who mostly presented with acute MI. The state of metabolic syndrome was seen more in elderly females. The mean WHR was 0.90 ± 0.07 in males and 0.87 ± 0.08 in females. Central obesity (increased WHR) was seen in 75.6% of male and 88.3% of female patients.

Stepwise logistic regression analysis showed that diabetes, waist hip ratio, raised triglycerides and low HDL were significantly associated with increasing lesional severity and diabetes with vessel wall involvement. (Table 4).

Discussion

This study tries to find out prevalence of risk factors among patients with angiographically proven CAD and also their correlation with severity of the disease. Clinical diagnosis of CAD, based on history of chest pain or ECG, without angiography may not give information on the extent and severity of vessel involvement. The risk factors evaluation revealed that conventional risk factors were present in 92% of patients. These findings are consistent with the results of INTERHEART study [3] where 86% had risk factors for CAD and other studies from India [9,10].

The presence of diabetes has been associated with CAD and increases the risk of coronary heart disease to two to four times [11]. South Asians have been reported to have a higher concentration of small, less protective HDL particles1 [12,13]. In our study, higher TG level and low HDL were significantly associated with increasing severity of lesion. Increased triglycerides are inversely related to HDL and it has also been postulated to be an independent risk factor for CAD [14].

Studies from Caucasian populations have demonstrated that abdominal obesity is an independent risk factor for coronary artery disease and associated with increased risk of acute coronary events [15,16]. The influence of increased

Table 4 Logistic regression analysis of risk factors for severe coronary artery disease.

Variable	Lesional severity		Vessel Wall Involvement	
	Odds ratio	95% CI	Odds ratio	95% CI
Male	1.322	0.787–2.221	1.483	0.860–2.555
Age				
21–40	1		1	
41–60	0.502	0.254–.995	0.134	0.046–0.393
>60	0.681	0.460–1.007	0.503	0.343–0.738
Diabetes	1.608	1.061–2.437	2.062	1.375–3.091
Smoking	0.969	0.652–1.440	0.839	0.548–1.285
Family history	0.945	0.482–1.854	1.293	0.629–2.659
Waist hip ratio (Male > 0.9 and Female > 0.8)	1.938	1.225–3.067	1.555	0.928–2.606
BMI				
<25 kg/m^2	1		1	
25–<28 kg/m^2	0.889	0.561–1.410	1.425	0.896–2.268
$\geqslant$28 kg/m^2	2.189	0.857–5.591	1.331	0.611–2.901
Increased waist circumference	0.859	0.565–1.306	0.884	0.572–1.365
Low HDL	0.779	0.646–1.428	1.081	0.725–1.611
Raised LDL	0.961	0.535–1.135	1.178	0.780–1.778
Raised TG	1.584	1.039–2.415	1.377	0.909–2.086
Hypertension	1.090	0.748–1.590	1.013	0.672–1.526

abdominal girth and the metabolic syndrome as risk factors for CAD may be more relevant in the Indian population [17]. BMI is not considered to be a good estimate of obesity in Asian Indians as for any given BMI, Indians tend to have increased waist circumference, excess, abdominal and truncal adiposity [18–21]. In our study, increased abdominal girth was present in large number of patients.

The metabolic syndrome was common among males and females in this study. Subjects with the metabolic syndrome had 2-fold greater risk of all- cause mortality and a 2- to 3-fold increased risk of cardiovascular mortality compared with those without the syndrome [14]. A sub group analysis among young patients with CAD (age < 40 years), smoking was a significant risk factor in males. It remains one of the most important modifiable risk factors in young patients with acute myocardial infarction [22].

India is facing advanced health transition and there are isolated reports that social gradient is also reversing with risk factors becoming common even in rural areas. Health promotion strategies must be devised focusing on population approach by preventing occurrence of conventional risk factors (primordial prevention) combined with high-risk approach to reverse and reduce the prevalent risk factor elevations (primary and secondary prevention). It must be supplemented with healthy policy initiatives based on some of experiences from community based interventions in the country [23]. The present study thus emphasizes that conventional risk factors are present in significant number of patients with CAD proven on angiography. Some of the risk factors like diabetes, waist hip ratio and raised triglycerides and low HDL were significantly associated with increased vessel wall involvement and severity of lesion on angiography. The study is limited as it is done in patients with significant symptoms resulting in referral to a tertiary care center for advanced care. The study again support the emphasis focusing on conventional risk factors, lifestyle modifications, smoking cessation, reduction of central obesity through dietary modification and exercise, which may prove to be the key interventions for preventing CAD in our population.

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