Original Research

Typical findings of epidemiological and clinical characteristics of patients with coronary artery diseases in South India: a retrospective analysis

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Abstract

Background: Cardiovascular disease (CVD) remains a major cause of morbidity and death not only in developed countries but also in developing countries. The associated risk factors which have been linked to CVD include diabetes, hypertension, and the like and non-modifiable risk factors such as age, sex, and family history. However, one cannot fully explain why some individuals are prone to CAD and others are not. Indians, like the Americans, Europeans, and Japanese also have the highest rate of heart disease, but are associated with high mortality.

Objective: The aim of this study was to analyze various demographic and clinical characteristics retrospectively to investigate any unreported parameters.

Materials and Methods: It has been examined and statistically analyzed the records of 530 patients with coronary heart disease on angiography and who underwent cardiac evaluation at Mahavir Hospital and Research Centre, Hyderabad, Telangana, India between July 2012 and March 2014. Also, a few routine parameters like TC, HDL, LDL, triglycerides and conventional risk factors, serum electrolytes, blood grouping, pattern, and severity of the disease were included.

Result: Among 530 patients 70% were males, 30% were females. Smokers were 320 patients, and very few (10%) were alcoholics. 30.18% patients suffered from hypertension, 40.56% had diabetes mellitus, 47.16% had dyslipidemia, and about 15–20% had family history. The levels of TC, LDL-C and triglycerides were higher in males than females as compared to HDL-C. Angiographic analysis showed 20% patients had single vessel disease (SVD), 24.5% patients had double vessel disease (DVD), and 40.56% had triple vessel disease (TVD). Further 4.33% had left main disease and 10% had normal coronary angiogram. The mean values for serum creatinine, serum potassium, and serum sodium were highly associated ($p = 0.001$).

Conclusion: The present study recorded major abnormalities in mean lipid levels as elevated TC and LDL-C levels and low HDL-C in CAD patients. The male preponderance indicted smoking as the major risk factor, while associated complications like diabetes and hypertension were significantly more common. Double and triple vessels disease was most common in this study. One interesting observation was that CVD patients with B blood group were more in numbers in this study followed by O group, then A and very few with AB group. Further most of them were non-alcoholic. These results reinforces in the control of biochemical parameters, improvement of quality of life, in the prevention and management of CAD.

KEY WORDS: Coronary artery disease (CAD), Epidemiology, Angiography, Cholesterol, Electrolytes.

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Introduction

Cardiovascular diseases (CVD) are the commonest cause of death globally and are the major contributor to the burden of premature mortality and morbidity. Cardiovascular diseases accounted for 85 millions disability adjusted (DALYs) life years in 1990.[1] By the year 2020, coronary heart disease and stroke will hold first and fourth places, respectively, in the World Health Organization's list of leading causes of disability.[2]

It is now common knowledge that Coronary artery disease (CAD) is leading cause of death and account for approximately 12 million deaths annually worldwide.[3,4] In 2004, few American reports showed that CAD resulted in 6, 95,000 hospital admissions and $31 billion hospital charges.[5–7] It is believed that the identification of major risk factors and their effective control through population based strategies of prevention and awareness can reduce the incidence of CAD. Extensive epidemiological research has established cigarette smoking, as the major risk factor associated with diabetes, hyperlipidemia, and hypertension as independent risk factors for CAD.[4,5,8,9] In addition, treatment of these risk factors has been convincingly shown to reduce the risk of future cardiac events.[4,9]

The gold standard for the diagnosis of CAD invariably uses invasive coronary angiography (CA), defines therapeutic options and determines prognosis.[10] CAD is defined as more than 50% angiographic diameter stenosis in one or more of the epicardial coronary arteries. Based on disease severity, obstructive CAD is classified as single, double-, or triple-vessel disease.[10,11] Further diagnosis can also be based on biomarkers which indicate a variety of health or disease characteristics, such as the level or type of exposure to an environmental factor, genetic susceptibility based on the phenotype of the individual, genetic responses to exposures, markers of subclinical or clinical disease, or indicators of response to therapy. Thus, Fox and Growdon[12] defining biomarkers have stated that—a simplistic way to think of biomarkers is as indicators of disease trait (risk factor or risk marker), disease state (preclinical or clinical), or disease rate (progression).

CVD, the leading cause of mortality in the United States and in Western countries,[13] is no less common in the developing countries. It is attributed to dietary insufficiency or malabsorption of folate, vitamin B12, or vitamin B6 which leads to hyperhomocysteinemia and consequently leads to an increased risk of CVD.[14,15] With the explosive rise in the incidence of CAD or CVD, it is now estimated that this will be the leading cause of mortality and morbidity even in the developing world by the year 2015.[16] Over 200 risk factors for CAD have been identified or postulated, of which dyslipidemia, hypertension, and smoking appear to be the most important.[17] A major component of this epidemic is due to treatable factors, which if controlled will go a long way in stemming the epidemic.

Most commonly associated complications like macrovascular complications are the leading causes of morbidity and mortality in diabetic patients; 60% of diabetic patients die of cardiovascular diseases.[18] In all populations studied, individuals with diabetes have a greatly increased risk of coronary heart disease (CHD) compared with nondiabetic individuals,[19] and risk of CVD death in diabetic individuals may be as high as that in nondiabetic individuals with previous myocardial infarction.[20] Despite such alarming scenarios, there is a paucity of information on the relative importance of CVD risk factors in persons with diabetes and strategies for risk factor reduction. A question of particular importance is the relative role of various lipoprotein abnormalities in determining CVD risk in diabetic individuals. In many individuals with diabetes, LDL cholesterol is not elevated,[21] but there is a characteristic dyslipidemia consisting of elevated triglycerides, decreased HDL cholesterol levels, and LDL particles of altered composition. Although 3 recent clinical trials of cholesterol lowering have shown that lowering LDL cholesterol in diabetic persons does reduce the incidence of CVD,[22,23] the relative importance of LDL cholesterol, compared with the characteristic dyslipidemia, in determining CVD risk in diabetic individuals is still a subject of debate.

In view of such lacunae in the knowledge, this retrospective study is taken to analyze the risk parameters in south Indian population, as the risk factors vary in different ethnic groups and also with geographic locations. Further the aim was to investigate the correlation of the clinical parameters with epidemiological findings and to determine the risk factors leading to CVD.

Materials and Methods

This retrospective study was carried out at the, Mahavir Hospital and Research Centre Hyderabad, India, during the period of July 2012–March 2014. To determine the risk parameters in the south Indian population we have recorded demographics, and analyzed the clinical and biochemical parameters and other characteristics like serum electrolytes, blood grouping, and angiographic records of 530 patients.

The study was approved by the hospital's ethics committee. Study populations consisted of patients with CAD, age 40 years and above, of both sexes that were undergoing coronary angiography for diagnostic or revascularization purposes.

Baseline demographics, clinical, and risk factors data was collected from hospital records and by discussing with the attending Cardiologists. Only conventional risk factors including diabetes mellitus, hypertension, dyslipidemia, smoking, and family history for premature CAD as defined in operational definitions were assessed in this study. The clinical presentations of patients were categorized as stable angina, unstable angina, and myocardial infarction.

Statistical analysis

Continuous variables were expressed as mean values and standard deviation for normally distributed data and median and interquartile range for non-normally distributed data, while categorical variables were expressed as frequencies and percentages. Relationships between two variables were analyzed by MedCalc version 14.10.2 (MedCalc Software, Mariakerke, Belgium).

Result

Baseline characteristics

The most common symptoms with patients in this study were angina (also called angina pectoris). Pain or discomfort in other areas of the upper body including the arms, left

shoulder, back, neck, jaw, or stomach were also reported by some patients. Studies show that women's symptoms are less likely identified as heart disease related. The symptoms of coronary artery disease and heart attack can be different for women than they are in men.

A total of 530 patients were included in the study with 372 (70.18%) males, 158 (29.81%) females, 320 (60.37%) smokers and 210 (39.62%) were non smokers, alcoholic 55 (10%), Tobacco 135 (25.47%). Frequencies of risk factors for CAD were; hypertension 160 (30.18%), diabetes mellitus 215 (40%), dyslipidemia 250 (47.16%) as shown in Table 1. The majority in the study group were found not to consume fruits and salads.

The values of TC, HDL, LDL, and triglycerides were 205.26 ± 60.25, 40.23 ± 13.44, 134.28 ± 15.16, 148.33 ± 57.89, respectively (Table 2). In addition, the levels of TC, LDL-C, and triglycerides were higher in males than females as compared to HDL-C (Table 3).

Table 1: Demographic risk factors and clinical diagnosis of patient with coronary artery disease (*N*=530)

Characteristics	No. of patients	Percentage (%)
Male	372	70.18
Female	158	29.81
Smoker	320	60.37
Non Smoker	210	39.62
Alcohol	55	10.37
Tobacco	135	25.47
Hypertension	160	30.18
Family history HTN	90	16.98
Diabetes mellitus	215	40.56
Family history DM	120	22.64
Dyslipidemia	250	47.16

Serum electrolytes

Electrolyte levels measured before surgery were normal or slightly higher (in case of creatinine) before surgical intervention. Severe electrolyte depletion was observed in CAD patients after surgery. The differences between CAD patients before and after surgery was significant for creatinine ($p < 0.001$), potassium ($p < 0.001$), and sodium ($p < 0.001$) (Table 4).

Blood grouping

In the Table 5, A 20.75%, B 38.67%, AB 10% and O 30.56% blood groups in patients. It has been found that CVD patient with B blood group are more in this study and next is O group then A and very less AB group.

Table 6 shows coronary artery involvement on angiography. Angiographic distribution of lesion shows 108 (20.37%) patients had single vessel disease (SVD), 130 (24.52%) patients had double vessel disease (DVD), 215 (42.56%) had triple vessel disease (TVD), 23 (4.33%) had left main disease and 54 (10.18%) had normal coronary angiogram.

Discussion

The scenario of CVD is now widely recognized and the fact remains that at present developing countries contribute a greater share to the global burden of cardiovascular disease than developed countries.[24] The disease was very common in westernized population affecting the majority of adults over the age of 60 years, but now this is rising in developing world.

There was a clear high male ratio (70.18%) in the present study, which is in agreement with previous studies, suggested that it is predominantly a disease of men.[25, 26] Female represented 29.81% of patients. Although, this is a much higher frequency compared with data from other parts of India (5%).[27]

Table 2: Clinical characteristics/mean lipid levels of patients with heart diseases (*n*=530)

Parameters assessed	Mean values for CAD patients	Normal values
Pulse	85.43 ± 24.12	72 beats per minute
Systolic blood pressure	130 ± 48.50	less than 120 mmHg
Diastolic blood Pressure	82 ± 16.70	less than 80 mmHg
Total cholesterol (mg/dl)	205.26 ± 60.25	150–200 mg/dl
HDL (mg/dl)	40.23 ± 13.44	40–45mg/dl (males), 45–60 mg/dl (females)
LDL (mg/dl)	134.28 ± 15.16	<130 mg/dl
Triglycerides (mg/dl)	148.33 ± 57.89	50–150 mg/dl

Table 3: Cholesterol levels in males (*n* = 372) and females (*n* = 158)

High Values	Male	Percentage (%)	Female	Percentage (%)
TC ≥ 200 mg/dl	150	40.32	56	35.44
HDL-C<40 mg/dl	75	20.16	35	22.15
LDL-C ≥ 130 mg/dl	162	43.54	55	34.81
Triglycerides ≥ 150 mg/dl	95	25.53	32	20.25

Table 4: Serum electrolytes mean values in CAD patients before and after surgery

Electrolytes	Cases before surgery	Cases after surgery	*p*-Value
Creatinine	2 ± 0.75	0.9 ± 0.25	0.001
Potassium	3.99 ± 1.0	1.7 ± 0.65	0.001
Sodium	135.86 ± 5.5	132 ± 3.55	0.001

Table 5: Patients profile of blood grouping (*n* = 530)

Blood group	No. of patients	Percentage (%)
A	110	20.75
B	205	38.67
AB	53	10
O	162	30.56

Table 6: Clinical features of coronary artery disease on angiography (*n* = 530)

Angiographic findings	No. of patients	Percentage (%)
SVD	108	20.37
DVD	130	24.52
TVD	215	40.56
LM	23	4.33
Normal CAG	54	10.18
Total	530	

All reported data show that smoking is the commonest risk factor encountered in patients with acute myocardial infarction.[28,29] This study also found that smoking was indeed the leading risk factor present in 60.37% patients while non smokers were 39.62%. The male preponderance and smoking being the major risk factors has been well documented in many studies in this subcontinent.[30, 31]

Even though heavy drinking of alcohol is associated with an increased risk of cardiovascular disease, It has not recorded as it is a known risk parameter and aware that there are social risks associated with heavy or binge drinking, particularly among young people.

Diabetes mellitus alone was a risk factor in 40.56% patients and hypertensions has been found in 30.18% patients. Family history for diabetes mellitus and hypertension were 22.64% and 16.98%, respectively. Dyslipidemia being the major risk factor was found in 47.16%. Dyslipidemia and diabetes mellitus is well known to have an adverse influence on the prognosis of patient with acute myocardial infarction.[32]

In addition to demographics, total cholesterol and LDL were found to be powerful risk factors for CAD, stroke, and peripheral arterial disease.[33, 34] Atherosclerosis accounts for nearly 80% of all deaths among North American diabetic patients compared with one third of all deaths in the general North American population.[35] More than 75% of all hospitalizations for diabetic complications are attributable to cardiovascular disease. Prolonged exposure to hyperglycemia is now recognized as the primary casual factor in the pathogenesis of diabetic complications.[31] Hyperglycemia induces a large number of alterations in vascular tissues that potentially promoted or accelerated atherosclerosis.

Coronary artery disease has a complex etiology generated by combined effects of both, genetic and environmental factors.[1] The polymorphic genes, encoding products involved in atherosclerotic process, predispose individuals to a greater or lower extent to CAD. However, traditional risk factors, such as cigarette smoking, hypercholesterolemia, hypertension and overweight, interacting with the genetic risk factors (in cumulative or synergistic ways), may increase or not the risk of the disease. It is known that interactions between genetic and environmental factors are very important in subjects with a high-risk genetic profile.[2] Genetic factors have greater contribution to the development of CAD at younger age.[3]

Since as many as half of the patients have no symptoms, despite the presence of CAD, coronary deaths in India are expected to be double over 20 years (Ghaffar et al., 2004). They may have silent ischemia orbe unaware of the potentially dangerous abnormal heartrhythms (arrhythmias). The absence of chest pain or other common symptoms can also set the stage for a heart attack that occurs without warning. Hence, it is important to look at biomarkers for early detection of CAD.

Therefore, the present study determined the level of biochemical parameters, such as TC, LDL, HDL and triglycerides in South Indian patients with coronary artery disease.

A large body of epidemiological and pathological data documents that diabetes is an independent risk factor for cardiovascular disease (CVD) in both men and women.[36,37] In the present study, there was an abnormally higher level of total cholesterol (≥ 200 md/dl) and LDL-C (≥ 130 mg/dl) in CVD patients, also lower levels of HDL-C (<40 mg/dl) and triglycerides (≥ 150 mg/dl). In addition, the levels of TC, LDL-C and triglycerides were higher in males than females as compared to HDL-C (Table 3). The results are no different with those presented elsewhere, that most CAD patients have high levels of LDL cholesterol and total cholesterol.[38] Moreover, a low level of HDL cholesterol has been observed in CAD patients.[39]

The study demonstrates that patients undergoing cardiac-surgical procedures with extracorporeal circulation are at high risk for electrolyte depletion and so potassium supplementation was given throughout the surgical procedure. The reason for this appears to be a combination of increased urinary excretion and intracellular shift, induced by a combination of extracorporeal circulation and decreased body temperature during surgery (hypothermia induced diuresis and intracellular shift).

Study limitations

This cross-sectional study covered a relatively small number of patients in a single center study, so that future studies

of larger patient populations with longitudinal cohort design are necessary to assess this finding. The present study populations included both type 1 (28%) and type 2 (72%) DM patients. However, when performed the analyses for type 2 DM patients only, the overall results were similar. Finally, the confounding factors for logistic regression analysis and sequential logistic regression models were based on previously reported findings, so that a more complete description for this analysis may be necessary.

Conclusion

It can be concluded that strong case exists for the efficacy and safety of primary prevention through lifestyle changes. Further awareness and primary prevention efforts need to be extended to both public health and clinical arenas. The essential changes in life leading to preventive measures include smoking avoidance or cessation, lowering alcohol consumption, modifying intakes of foods and nutrients, weight control, and physical activity.

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Abbreviations

CAD	Coronary artery disease
CA	Coronary angiography
HDL	High density lipoproteins
LDL	Low density lipoproteins
BMI	Body mass index
CI	Confidence interval
DM	Diabetes mellitus
E	Early diastolic wave velocity
E'	Spectral pulsed-wave Doppler-derived early diastolic velocity from the septal mitral annulus
EF	Ejection fraction
GFR	Glomerular filtration rate
GLS	Global longitudinal strain
HF	Heart failure
LAVI	Left atrial volume index
OR	Odds ratio

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