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Research Article

Assessment of Risk Factors for Coronary Artery Disease in Patients Admitted to College of Medical Sciences, Bharatpur, Chitwan, Nepal- A Prospective Observational Study

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Keywords

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Abstract

Introduction: Coronary artery disease (CAD) is an increasing global problem. Reported incidences vary between developed and developing countries, however, there are several key contributing factors to the rising trend of CAD around the world. We have endeavored to describe the main risk factors for this major disease.

Method: A prospective observational study was conducted between September 2010 and August 2012 in the College of Medical Science, Bharatpur, Nepal. 100 adult admitted patients (≥18 years) with the diagnosis of coronary artery disease were selected randomly and their data was analyzed using SPSS V.16.0.

Result: This study revealed an age variation between 29 and 90 years with a mean age of 64.04±12.74 years. The majority (67%) of patients were male. 96% consumed a non- vegetarian diet and 58% were cigarette smokers. 28% of patients consumed alcohol, whereas obesity varied according to BMI, NCEP and WHR at 30%, 28% and 90% respectively. 52% of them were hypertensive and 24% had associated diabetes mellitus. Hypercholesterolemia, hyper triglyceridemia, high LDL-C and low HDL-C were found in 13%, 15%, 27% and 67% respectively. Over half of them (51%) displayed more than 5 risk factors.

Conclusion: This cohort study identified multiple risk factors, most of which can be addressed, associated with CAD. Modification of these factors by pharmacotherapy, diet and exercise, and behavior therapy can both improve the prognosis of these patients and reduce the burden of CAD in this population group.

ABBREVIATIONS

BMI: Basal Metabolic Index; CVDs: Cardiovascular diseases; CAD: Coronary Artery Disease; HDL-C: High Density Lipoprotein-Cholesterol; LDL-C: Low Density Lipoprotein-Cholesterol; NCEP ATP: National Cholesterol Education Project Adult Treatment Plan; NCD: Non-communicable Disease; WHR: Waist Hip Ratio.

INTRODUCTION

Cardiovascular diseases (CVDs) are the major causes of death in the developed world and account for almost 1 million fatalities in the United States alone every year. Of these cardiovascular deaths, nearly half result directly from CAD and another 20 percent from a stroke [1]. It is estimated that the occurrence of global cardiovascular deaths will increase from 16.77 million in 2002 to 23.3 million in 2030 [2]. In the Framingham Heart Study, participants who were initially free of CAD showed that their lifetime risk when aged 40 was 49% in men and 32% in women. Even those who were free from this disease aged 70 had a lifetime risk of 35 percent and 24 percent in men and women, respectively [3]. For people aged 18 years and over, estimates of frequency are 11.4 percent among white or Caucasian and 9.9 percent in African Americans [4]. Many studies now have shown that the increasing trend of CAD has shifted to low and middle-income countries [5-9]. In Nepal, CVDs are now finally considered as major public health issues. However, the country lacks a system to maintain cardiovascular health and non-communicable disease policy [10].

From an epidemiological prospective, a risk factor is a characteristic or feature of an individual or population that is present early in life and is associated with an increased risk of developing future disease. The risk factor of interest may be a lifestyle choice (e.g., smoking), an inherited trait (e.g., family history), or a laboratory measurement (e.g., dyslipidemias) [1]. The list of risk factors recognized by the current National Cholesterol Education Project Adult Treatment Panel III (ATP III) includes cigarette smoking, low HDL cholesterol, family history of premature coronary heart disease, age, lifestyle risk factors (obesity, physical inactivity, atherogenic diet). The emerging risk factors are liproprotein(a), homocysteine, prothombotic factors, proinflammatory factors, impaired fasting glucose and subclinical atherogenesis [11]. From a practical point of view the cardiovascular risk factors fall into two categories: those modifiable by lifestyle and /or pharmacotherapy (e.g., cigarette smoking, serum cholesterol, serum triglyceride, obesity, diabetes mellitus, and hypertension) and those such as age, family history, gender and ethnic group that are immutable [12]. A recent National Non Communicable Disease (NCD) risk factors survey revealed significant levels of smoking (18.5%), alcohol consumption (17.4%), insufficient fruit and vegetable consumption (98.9%) and obesity (4%) among Nepalese [13]. However, the weight of evidence supporting various risk factors differs [14-18]. In most developing nations like Nepal, preventive measures are not initiated due to lack of research and the government policy.

This study aims to assess the risk factors associated with coronary artery disease in hospital admitted patients at the College of Medical Sciences and Teaching Hospital, Bharatpur, Nepal. We believe that the findings would address the extent of CVDs in the population around central terai and would be useful to implementing CVD prevention programs.

MATERIALS AND METHODS

This prospective observational study was conducted in College of Medical Sciences -Teaching Hospital (COMS), a 700 - bed referral center for the population of Chitwan and neighboring districts, from September 2010 to August 2012. Out of all admitted cases in the cardiology ward, one hundred adult patients (>18 yrs) of both genders with the temporal profile of coronary artery disease were randomly selected in the study.

Inclusion criteria: [19]

1. Chest pain suggestive of CAD (angina pectoris, unstable angina or myocardial infarction) [20]

2. Resting ECG changes based on Minnesota code i.e. ST- T changes (reversible or non reversible ST depression, ST elevation, T inversion), presence of Q waves, new onset Left bundle branch block [21]

3. With or without elevated Cardiac biomarkers (CK-MB and or Troponin I) [22]

Patients with congenital heart disease, valvular heart disease, previously diagnosed chronic heart failure and other cardiopulmonary diseases that clinically resemble coronary artery disease such as pulmonary embolism, aortic dissection were excluded in the current study.

Risk Factors Assessment

We collected general information on patients' demographic data, diet, physical activity, cigarette smoking and alcohol consumption. The data also included family history of CAD and medical history of hypertension, diabetes mellitus, dyslipidemia and current treatment for such chronic illnesses.

a. Smoking: The duration of smoking and number of cigarettes smoked daily were recorded in pack years; i.e. number of cigarettes smoked per day multiplied by number of years smoking which is then divided by 20. Patients were classified as non-smokers only if they had never smoked.

b. Alcohol consumption: The duration and units of alcohol consumed per week were recorded according to concentration of the alcohol. If alcohol consumed was more than 30gm per day i.e. 21 unit per week (1unit=10gm) it was classified as a risk factor. The unit conversion was calculated according to the concentration and amount of alcohol consumed per week. The unit conversion of homemade or local alcohol was made as 100ml ~ 1 unit [23].

c. Physical activity: Brisk walk or equivalent activity for less than 30 minutes per day for at least 5 days in a week was considered an indirect risk for CAD according to American Heart Association. This information was verbally recorded.

d. Hypertension: Blood pressure was measured both with palpation and auscultation methods using mercury sphygmomanometer and a standard adult cuff (12X24 cm). Hypertension was defined according to the guidelines of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure [24], that is, systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg and/or concomitant use of antihypertensive medications.

e. Obesity: Weight and height were measured using calibrated digital weighing scales and stadiometers respectively in standing position with light clothes on. Similarly, the waist circumference was measured in the point midway between the iliac crest and the costal margin (lower rib); while the hip circumference was measured at the widest circumference over the buttocks and below the iliac crest. Obesity was considered if the Body Mass Index (BMI) [25] was more than or equal to 30kg/ $m^2$and participants were classified as overweight when BMI was more than or equal to 25kg/ m^2 or had a waist circumference as per NCEP ATP III 2001 for South Asian population group or waist to hip ratio as per WHO criteria, for both genders [26].

f. Diabetes Mellitus: Plasma glucose values (Random/ Fasting/Post prandial) were determined by hexokinase enzymatic method using an auto analyzer. The diagnosis of diabetes was confirmed by the American Diabetes association criteria i.e. either random plasma glucose ≥ 200 mg/dL, associated with symptoms of diabetes and/ or fasting plasma glucose ≥ 126 mg/ dL or Post prandial glucose ≥ 200 mg/dL. Patients with self-reported or ongoing treatment of diabetes were classified as having previously diagnosed diabetes.

g. Dyslipidemia: A serum lipids profile (8 hours of overnight fasting) that includes total cholesterol, high-density lipoprotein

(HDL), low-density lipoprotein (LDL), and triglycerides (TG) was measured using a semi auto analyzer. Hypercholesterolemia was considered when total serum cholesterol was above 200mg/dl, and hypertriglyceridemia when serum TG was above 150 mg/dl. Patients with LDL level > 130 mg/dl and HDL< 40mg/dl in males and <50mg/dl in females was identified as a risk factor [27].

Novel risk factors such as hsCRP, homocysteine level, Lipoprotein A, coronary artery calcification, carotid artery intima media thickness were not assessed due to lack of facilities during the study period.

Validity and Reliability: Consultation with the research advisor and the expert cardiologist opinion was maintained throughout the research period. Native Nepali language was used to obtain more accurate information from the patients and relatives. All the biochemical tests were completed in semiautomatic analyzers (Microlab 300) using standard biochemical reagents, regular internal and external quality control checks were undertaken (CMC Vellore, India).

Statistical Analysis: All the data obtained was imported to SPSS version 16.0. The difference of the various variable risks of CAD was statistically tested. Results were expressed as mean ± standard deviation. Different statistical tests of significance were applied to find the 'P' value. A 'P' value of less than 0.05 was considered statistically significant.

Ethical clearance: Ethical Clearance was gained from the Institutional Review Board of COMS, Teaching Hospital. Informed consent was taken by each respondents or relatives.

RESULTS

Out a total of 100 CAD patient participants, who underwent the risk factors evaluation, the youngest was 29 years old, whereas the oldest was 90 years old and the mean age determined was 64.04 ±12.74 years. The majority were male (67%) as opposed to female (33%), which was statistically insignificant (t=.777, df=98, P=.439). The socio-demographic characteristics are detailed in Table 1. The patients were mainly from Chitwan districts (78%) and surrounding districts belonging to various ethnic groups. 73% of them were Hindu and most were dependent on agriculture (35%). Only few patients (4%) were found to be vegetarian.

Of 100 patients, 58% were cigarette smokers with a mean pack year for males and females of 60.23±18.94 and 13.76±6.36 respectively, showing that males smoked more cigarettes than females, this was statistically significant (t=1.943,df=98, P=.023). However, the percentage of cigarette smokers in males and females (61.2% and 51.5%) was statistically insignificant, P=.362 (table 2). Prevalence of smoking was found to be higher in the 61-80 age group (68.1%), Chhetri (64.7%), Buddhist (87.5%) and retired patients (80%). 28% of CAD patients consumed alcohol of which,32.8%(n= 22/67) were male and 32.8% (n=22/67) were female. Among them, 14.9% (n=10/67) of the men consumed a significant amount of alcohol i.e. more than 21 units per week, but none of the female patients consumed a significant amount of alcohol. The groups that consumed the highest amount of alcohol were the following: Newar, 88.9% (n=8/9), Christian, 60% (n=3/5) and business personnel 70% (n=7/10) compared to the others (Table 2). Nevertheless, over half (52.5%) of the patients unanimously agreed that smoking cigarette and alcohol consumption can cause cardiac and respiratory diseases. Out of the total patient participants, 50% were recorded as engaging in inadequate physical activity. This was identified significantly in other castes than Christian, P=.020. Similarly, 52% had associated hypertension, one of the risk factors, of which, 32.6%

Table 1: Details of the socio-demographic pattern of the patients.

Socio-demographic Characteristics		Male No. (%)	Female No.(%)	Total No. (%)	P Value
Age (group in years)	20-40	1(1%)	1(1%)	2(2%)	.439
	41-60	28(28%)	11(11%)	23(39%)	
	61-80	31(3%)	16(16%)	47(47%)	
	81-100	7(7%)	5(5%)	12(12%)	
Ethnicity	Brahman	28(28%)	14(14%)	42(42%)	.832
	Chhetri	11(11%)	6(6%)	17(17%)	
	Newar	7(7%)	2(2%)	9(9%)	
	Magar	5(5%)	2(2%)	7(7%)	
	Tharu	3(3%)	0(0%)	3(3%)	
	Gurung	1(1%)	3(3%)	4(4%)	
	Others	12(12%)	6(6%)	18(18%)	
Religion	Hindu	50(50%)	23(23%)		.062
	Budhist	7(7%)	9(9%)		
	Muslim	6(6%)	0(0%)		
	Christian	4(4%)	1(1%)		
Occupation	Agriculture	27(27%)	8(8%)	35(35%)	.639
	Housework	6(6%)	17(17%)	23(23%)	
	Business	9(9%)	1(1%)	10(10%)	
	Service holder	15(15%)	1(1%)	16(16%)	
	Retired	4(4%)	1(1%)	5(5%)	
	Unemployed	6(6%)	5(5%)	11(11%)	
Diet	Non-vegetarian	64(64%)	32(32%)	96(96%)	.732
	vegetarian	3(3%)	1(1%)	4(4%)	

Table 2: Prevalence of CAD risk factors.

Characteristics	Smoking No. (%)	Alcohol consumption No. (%)	Inadequate Physical activity No. (%)	Hypertension No. (%)	Diabetes mellitus No. (%)
Total	58/100(58%)	28/100(28%)	50/100(50%)	52/100(52%)	24/100(24%)
Gender					
Male	41/67(61.2%)	22/67(32.8%)	34/67(50.7%)	36/67(53.7%)	14/67(20.9%)
Female	17/33(51.5%)	22/67(32.8%)	16/33(48.5%)	16/33(48.5%)	10/33(30.3%)
P value	.362	.127	.834	.626	.305
Age group in years					
20-40	1/2(50%)	1/2(50%)	1/2(50%)	2/2(100%)	2/2(100%)
41-60	18/39(46.2%)	11/39(28.2%)	20/39(51.3%)	21/39(53.8%)	8/39(20.5%)
61-80	32/47(68.10%)	15/47(31.90%)	22/47(46.80%)	23/47(4.90%)	14/47(29.8%)
81—100	7/12(58.3%)	1/12(8.3%)	7/12(58.3%)	6/12(50%)	0/12(0%)
P value	.0.81	.298	.888	.417	.131
Ethnicity					
Brahmin	24/42(57.1%)	6/42(14.3%)	17/42(40.5%)	20/42(47.6%)	6/42(14.3%)
Chhetri	11/17(64.7%)	4/17(23.5%)	12/17(70.6%)	10/17(58.8%)	5/17(29.4%)
Newar	4/9(44.4%)	8/9(88.9%)	4/9(44.4%)	6/9(66.7%)	1/9(11.1%)
Magar	4/7(57.1%)	3/7(42.9%)	3/7(42.9%)	3/7(42.9%)	2/7(28.6%)
Tharu	2/3(66.7%)	2/3(66.7%)	2/3(66.7%)	2/3(66.7%)	0/3(0%)
Gurung	2/4(50%)	3/4(75%)	2/4(50%)	1/4(25%)	3/4(75%)
Others	11/18(61.1%)	2/18(11.1%)	10/18(55.6%)	10/18(55.6%)	7/18(3.9%)
P value	.908	.382	.438	.858	.019
Religion					
Hindu	39/73(53.4%)	21/73(28.8%)	41/73(56.2%)	38/73(52.1%)	17/73(23.3%)
Buddhist	14/16(87.5%)	3/16(18.8%)	6/16(37.5%)	9/16(56.3%)	3/16(18.8%)
Muslim	2/6(33.3%)	1/6(16.7%)	3/6(50%)	1/6(16.7%)	2/6(33.3%)
Christian	3/5(60%)	3/5(60%)	0/5(0%)	4/5(80%)	2/5(40%)
P value	.049	.597	.020	.877	.447
Occupation					
Agriculture	22/35(62.9%)	7/35(20%)	18/35(51.4%)	20/35(57.1%)	7/35(2%)
Housework	11/23(47.8%)	5/23(21.7%)	12/23(53.2%)	8/23(34.8%)	5/23(21.7%)
Business	7/10(70%)	7/10(7%)	3/10(30%)	6/10(6%)	2/16(2%)
Service holder	7/16(43.8%)	4/16(25%)	10/16(62.5%)	8/16(5%)	5/16(31.3%)
Retired	4/5(80%)	1/5(20%)	3/5(60%)	5/5(100%)	1/5(20%)
Unemployed	7/11(63.6%)	4/11(36.4%)	4/11(36.4%)	5/11(45.5%)	4/11(36%)
P value	.932	.267	.726	.754	.263

(n=17/52) were recently diagnosed with hypertensive disorder during admission and rest 67.3% (n=35/52) had previously been diagnosed with hypertensive disorder. 14% of them had a family history of hypertension. It was associated 100% (n=5/5) in retired persons, 100% (n=2/2) in the 20-40 age group and 80% (n=4/5) in those identifying as Christian. Overall prevalence of diabetes was 24%, of which 54.1% (n=13/24) had ongoing diabetes.12.8% of patients had a family history of diabetes mellitus. A significant percent of diabetes was observed in Gurung, 75% (n=3/4), P=0.19 (table 2).

In this study, low HDL level was observed in 67 % (n=67/100), High LDL cholesterol 27% (n=27/100), Hypertriglyceridemia 15% (n=15/100) and Hypercholesterolemia was noted 13% (n=13/100). A majority of the cases were found to have combined dyslipidemia than an isolated abnormal lipid profile (Figure 1). According to the BMI profiles, 13% (n=13/100) were underweight, 27% (n=27/100) were overweight and 3% (n=3/100) were obese. Central obesity was observed in 28% of total patients as per NCEP criteria (mean waist circumference: male =83.17±15.11, female=75.51±16.25 and P value .022) and 90% (n=90/100) of the patients as per WHO waist hip ratio. There was significant difference in obesity criteria between NCEP and waist hip ratio, P=.000

However, 98% patients had multiple risk factors and just 2% had one risk factor. Figure 2 shows the percentages of associated multiple risk factors in given study.

DISCUSSION

Many studies have shown that the risk factors for CAD are multi-factorial in etiology and each risk factor is attributable to CAD by accentuating the coronary vessels atherosclerosis. It is therefore important to assess the prevalence of risk factors to then reduce subsequent CVDs.

Increasing age is a major risk for CAD, and in this study, most patients were above 60 years of age, with a mean age of 64.04±12.74. In the study of Shrestha *et al.,* [28], the mean age was

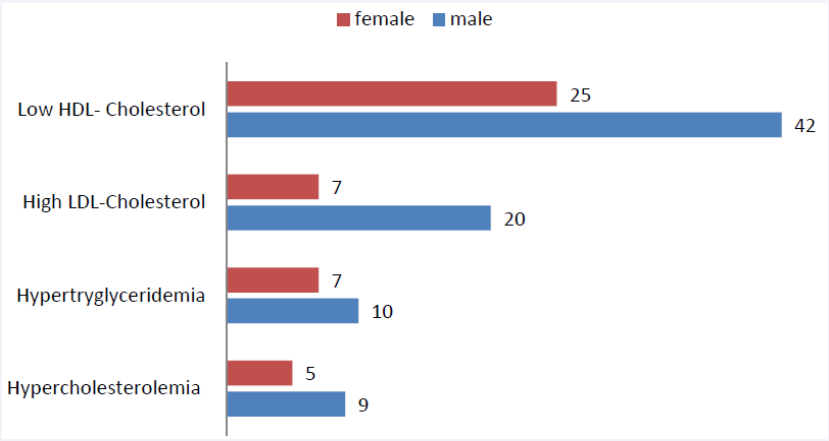

Figure 1 Percentages of abnormal lipid profile in both genders
Abbreviations: HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein

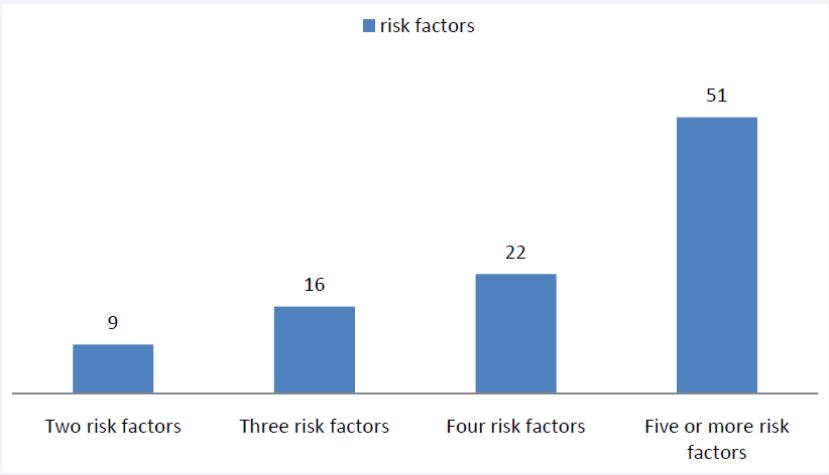

Figure 2 Percentages of multiple risk factors in the patients.

62±12 years. Similarly in a community study of eastern Nepal by Kalra *et al.,* [29], the mean age was 54.1±10.5. In another study done in western Nepal by Poudel *et al.,* [30], the mean age was 64.77 ± 10.8 years. In other various studies by Faizal *et al.,* [31], Hasdai *et al.,* [32] and PRAIS-UK [33], the mean age was 61±11.38, 63·4±13·0 and 66±12 respectively which correlates with the current study. In this study, numbers of male participants outweigh females with 67% and 33% respectively and the ratio is 2.03:1. The Framingham Heart study, conducted over a period of 25 years, with male and female participants aged between 35 and 84 years, indicated that CAD was twice as high in men as women. However in an earlier study by Pandey et al between 1960 and1968 in Nepal, the male to female ratio was 6.5:1. The current study is consistent with several other studies conducted in Nepal (Shrestha *et al.,* [28] and Poudel *et al.,* [30]) with a gender difference of CAD risk.

The current study results revealed that the most common caste group to be affected was Bhramin 42%, followed by Chhetri 17% and Newar 9 %. Similar results were shown in another study by Vaidhya *et al.,* [18] in eastern Nepal, 33% of CHD patient were Bhramin, Chettri and Newar. These ethnicities in Nepal are considered to be contemporary and developing groups; and as a result their average level of physical activities is declining, which may be a reason for the increasing numbers of CAD identified.

Cigarette smoking was major risk factor in this study, 58% and it was higher in males (61.23%) and in the 61-80-year group, 68.10%. The prevalence was higher than other studies of Nepal, Vaidya *et al.,*[18] (33.3%), and the nationwide NCD risk factors survey, 2013 [13]. However, a recent study presented by Dhungana *et al.,* [34] revealed a lower percentage of smoking, 28.6% predominantly among females. Moreover, this study presented similar results to the Framingham study i.e. association of smoking differed with different age groups.

Alcohol consumption in moderate amounts is cardio-protective, but heavy alcohol consumption causes cardiac muscle dysfunction. In this study, alcohol consumption was found in 28% of cases and among them, significant amounts (≥ 30 gm per day) were found to be consumed only by males (14.92%). This result could be due to cultural taboos that only men should consume more alcohol, and not women. Additionally, the participant

history given was not fully reliable and the estimated volume and the types of locally available alcohol they consumed differ widely. A study presented by Dhungana *et al.,* [34] showed higher percentage of alcohol consumers, 47.80% and the NCD risk survey 2013 resulted only 17.4%. As the concentration and type of locally available alcohol differs in places and communities, it is expected to get different values across similar studies in Nepal.

Another major risk which is quickly becoming more of an issue is the lack of physical activity. With development and modernization occurring in parts of Nepal, there are easier transport connections and communication, causing people to reduce their daily physical activities. In this study, nearly one out of two patients in both genders in all age groups had a history of inadequate physical activity according to the recommendations by the American Heart Association for the prevention of cardiovascular diseases. This correlated with other studies presented by Dhungana *et al.,* [34], 48.80% and Nestal *et al.,* [35], 51.45%.

Hypertension, a global affliction, was associated in 52% of the patients in the current study, and is growing in developing countries like Nepal. Several surveys showed that the prevalence rate has increased; as evidenced by WHO [36] (27.8%), NCD risk survey in 2007 [14] (21.50%) and 2013 [13] (25.70%). However, a recent study conducted among women in the rural community of eastern Nepal [37] showed a surprisingly lower rate of 3.30% prevalence of hypertension which differs greatly from the current study. This could be explained by the cultural norm for women in rural areas of Nepal to engage in more active daily routines. Diabetes prevalence was 24% in the study as per ADA criteria. In a study by Pandey *et al.,* [15], 14.3% were found to have diabetic. In a longitudinal study of 4 years (2002-06) by Gikas *et al.,* [38] in Greek adults, diabetes was found in 20% of patients. In contrast, Raghvan *et al.,*[39], identified diabetes in 43.1 % of patients of south Asian descent admitted to Montreal Quebec who were diagnosed with acute coronary syndrome compared to non South Asian, 23.1%.

In this study, most patients have combined dyslipidemias than isolated. However, low HDL was seen in 67%, High LDL Cholesterol in 27%, Hypertriglyceridemia in 15% and Hypercholesterolemia in 13%. In a study by Kalra *et al.,* [29] Hypercholesterolemia was seen in 12.6% of patients. In the Greek adults study by Gikas *et al.,* [38], 12.2% of patients had Hypercholesterolemia. In the Croatian hospital base study of 1298 CAD patients studied by Vrazic *et al.,*[40], 72% had hypercholesterolemia, 51.5% had hypertriglyceridemia, 42.6% had lower rates of HDL cholesterol and 72.3 % had increased LDL cholesterol.

In this study, according to the BMI, 30% of patients were classified as obese. When considering the central obesity according to NCEP ATP III for South Asian population, 28% were found to have obesity. However, taking the parameter of WHO waist hip ratio as marker for obesity, 93% were obese. Therefore the figure was higher for central obesity than obesity detected by BMI. In the study of Parajuli *et al.,* [41], in western Nepal, obesity accounts for 64.6% of the participants. In another study by Kalra *et al.,* [29], at community level revealed 33.6% with a BMI≥25kg/m^2 and 42.1% had central obesity.

CONCLUSION

It can be seen that the current study identified multiple risk factors were associated in the majority of cases and the most common amendable risk factors were cigarette smoking, systemic hypertension, diabetes mellitus, central obesity and dyslipidemia. These globally recurrent risk factors play a major role in the early onset of coronary heart disease in this study population. Modification of these factors by pharmacotherapy, diet, exercise and behavioral therapy can improve the prognosis in these patients and can also lower the incidence of CHD within this population.

LIMITATIONS

The study sample was small and limited to hospital admitted patients. A true representation of the community could not occur. Novel risk factors were not included in the present study.

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