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Risk factors of acute coronary syndrome: A cross sectional study at a tertiary care center in India

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Abstract

Background- Acute coronary syndrome (ACS) is among the main causes of hospital morbidity and mortality in western countries. Risk factors for ACS are on a rise in India and it is emerging out to be one of the most lethal non communicable diseases in India.

Aims And Objective- To find the prevalence of various modifiable and non-modifiable cardiovascular risk factors associated with ACS and to study gender difference among the risk factors of ACS.

Participants- The study was conducted on 100 clinically diagnosed patients of ACS admitted in Medicine indoor / ICCU at GMC/ Rajindra Hospital, Patiala selected as per inclusion and exclusion criteria.

Approach- This study was a hospital based descriptive cross sectional study.

Results-94% of the subjects had ≥1 risk factor. 65% of subjects had ≥2 risk factors. Only 6% subjects had none of the risk factors under evaluation. Dyslipidemia, as a single risk factor, ranked first (55%), closely followed by hypertension (53%) followed by abdominal obesity (39%), increased LDL (38%), hypercholesterolemia (35%) decreased HDL (34%) and diabetes mellitus (28%). More males were hypertensive (68.7%) and alcoholic (50%) as compared to females (25% and 0% respectively). Diabetes mellitus (DM), obesity, central obesity and hypercholesterolemia were more prevalent in females. There was a higher prevalence of non-vegetarian diet and alcoholism in rural patients than the urban population but this difference was not statistically significant. None of the risk factors showed any significant urban - rural difference in its prevalence.

Conclusion- The prevention of ACS provides the potential area of intervention. This provides a public health policy to counter the out of pocket expenditure on population as well as government public expenditure on health. Modifiable risk factors are the foremost areas of concern.

Keywords: Acute Coronary Syndrome, Risk factors, modifiable, dyslipidemia, hypertension, obesity

Introduction

Coronary artery disease (CAD) is now becoming a leading cause of death throughout the world.[1] Risk factors for ACS are on a rise in India and it is emerging out to be one of the most lethal non communicable diseases in India. Mortality from ACS and CAD in Indians is predicted to increase and overtake that of the developed countries.[2] According to WHO, nearly 50% of cardiovascular related deaths in India occur in patients below the age of 70 years, compared with just 22% in the West.[3] Data on prevalence or incidence of ischemic heart disease in developing countries including India is very scarce, and routinely collected data is often incomplete and unreliable.[4] The same applies to the prevalence of various risk factors associated with increased incidence of both CAD and ACS in India, due to which we are unable to take proper primary and secondary preventive measures especially in context of Indian population.[5,6] World Health Organisation (WHO) has recommended the development of national programmes for the prevention and control of CAD through simultaneous adoption of several strategies.[7]

Risk factors associated with ACS can be largely categorized into modifiable and non modifiable. Modifiable risk Factors include smoking, alcohol consumption, hypertension, obesity, hyperglycemia and hyperlipidemia. Smoking is probably the most important avoidable cause of atherogenic vascular disease. Nicotine increases the release of catecholamines, mediating peripheral vasoconstriction and increase in blood pressure and heart rate thereby greater oxygen demand and increased likelihood of dysrhythmias. Nicotine stimulates platelets and induces proliferation of smooth muscle cells in the coronaries. The chances of CAD is lowered by 50% after 1 year of quitting smoking.[8] Consuming alcohol in excess is a risk condition as this leads to increased atherosclerotic progression. It can cause an irregular heartbeat by direct damage on the heart muscle (alcoholic cardiomyopathy). A number of mechanisms have been postulated to show the association between heavy alcohol consumption and atherosclerosis including weight gain, high triglycerides and high blood pressure.[9] Systolic blood pressure becomes a more important predictor of the risk of cardiovascular disease. It is detrimental to the coronary artery endothelium and enhances the risk of ACS. It increases the work pressure of the heart by increasing after load, enlarging and weakening the left ventricle overtime. Although hypertension cannot always be prevented, it should be treated to optimum level to lower the risk of CAD and premature death.[10] Abdominal obesity is an independent risk factor for ACS. BMI is considered to be the most reliable marker to measure obesity. Obese people are more likely to have high blood pressure, diabetes and high blood fats. Mechanisms which link obesity and atherosclerosis are abnormalities in lipid metabolism, insulin resistance, inflammation, endothelial dysfunction and adipokine imbalance.[11] Diabetics are more prone to CAD. Infact, CAD is a macrovascular complication of diabetes. Diabetics also have higher incidence of high blood pressure, altered lipid profile and obesity, which cumulatively contribute to their high predisposition towards CAD.[12,13] ACS has a strong correlation with altered lipid profile viz. increased total cholesterol, LDL and a weak correlation with plasma triglycerides.[14] They tend to deposit in the arterial wall where they are oxidized and lead to the development and progression of atherosclerosis. HDL aids to remove excess cholesterol from the tissues to the liver. Thus, low levels of HDL considered as a predictor for heart disease. [15] Non-modifiable risk factors include age, gender and race. Age is the most powerful independent risk factor for CAD. The highest incidence of ACS is found around 5 th and 6 th decades of life. Nearly 80% of heart disease death happens in humans aged above 65.[16] Premenopausal women have much lower risk as compared age and risk matched males; however the gender difference disappears after menopause. Therefore, gender should be considered in studies of CAD risk factors. Men are more prone to ACS during young age than women. Even though the incidence of ACS for women goes up after menopause, it is still less than that in men.[17] South Asians living in the US are twice as likely to develop coronary heart disease compared to the rest of the US population. Also, people from African Caribbean backgrounds have a higher than average risk of developing high blood pressure.[18]

Material And Methods

This study was a hospital based descriptive cross sectional study conducted on 100 patients of ACS admitted in medicine indoor/ICCU at GMC/ Rajindra Hospital, Patiala. Inclusion criteria were adult male and female patients of acute coronary syndrome, aged between 30-80 years. Exclusion criteria were all established patients of chronic kidney disease (CKD), unconscious patients, patients who refused to give informed written consent and patients who were discharged before completion of treatment for any reason. Written consent from patients was obtained. Formal approval of Institutional Ethical Committee was obtained. A detailed history of each patient was taken and complete clinical examination and biochemical investigations were done. The data collected during the study was entered in the Microsoft Excel Format and analyzed using SPSS.22.0 version. For descriptive statistics frequencies, percentages, means and standard deviations of different variables were calculated. For Categorical variables, Chi Square test was used. The p values were two tailed and probability level of significant difference was set at <0.05.

The patients were taken as hypertensive if they satisfied any of the two criteria: - 1. The patient was already on antihypertensive medications 2. According to the JNC VIII classification, if the patient was having Systolic B.P ≥ 140 mm Hg and Diastolic B.P ≥ 90 mm Hg as an average of two readings taken 5 minutes apart.[19] BMI was derived as per standard formula i.e. B.M.I. = WEIGHT (in kg) divided by HEIGHT (in meter)^2. In our study, we used criteria propounded by WHO in which overweight was defined as BMI of 25-29.9 kg/m^2 and obesity as BMI of ≥ 30 kg/m^2. WHO also identifies overweight when BMI ≥ 23kg/m^2; and obesity when BMI is ≥ 25kg/m^2 with or without abdominal obesity specifically for Asian population. But these criteria are not in much use and are applied for specific studies only Abdominal obesity (AO) was taken as waist circumference (WC) ≥90 cm for men and ≥80 cm for women with or without generalized obesity.[20] Hyperglycemia was defined on the basis of fasting plasma glucose/random plasma glucose/2 h plasma glucose. 100-125 was considered as impaired fasting glucose (IFG) and FPG ≥126 was diagnostic of diabetes mellitus. Random plasma glucose ≥200 along with the symptoms of diabetes mellitus (polyuria, polydypsia, polyphagia) was defined as DM. Post Prandial 2 h-plasma glucose in range 140-199 was taken as impaired glucose tolerance; and value ≥ 200 was diagnostic of diabetes mellitus.[21] Early morning fasting sample was sent to obtain lipid profile. Hyperlipidemia was defined on the basis of ATP III guidelines:- LDL Cholesterol ≥ 130 mg/dl was considered abnormal. HDL Cholesterol ≤ 40 mg/dl in males and ≤ 50 in females was considered abnormal. Total cholesterol ≥ 200 mg/dl was considered abnormal.[22] For smoking, total pack years were calculated. Whether patient had left smoking was also enquired.[8] Age, gender and race were noted for non modifiable risk factors.[16-18]

Results

Out of the 100 patients we studied, 64 were males and 36 were females, yielding a male: female ratio of 1.8: 1. 63% hailed from urban background and 37% belonged to rural area with an urban: rural ratio of 1.7. The highest number of patients was in the age group of 60-70 years (31%) followed by 50-60 year age group (27%) and 70-80 year age group (21%). The mean age of the participants was 60.17 ±9.99 years. Majority of male patients fell in 60-70 year age group (34.4%), and women belonged to 70-80 year age group (30.6%) but this gender difference was not statistically significant ($p=0.220$).

The most common presenting symptom was chest pain present in 80% of the patients in either gender followed by breathlessness (40%), ghabrahat (39%) and diaphoresis (34%). Family history of CAD, hypertension and DM was present in 9%, 8% and 10% of the patients respectively. 21% of the subjects had a history of CAD in the past. 37% subjects were non vegetarian, 24% were smokers and 32% had history of alcohol abuse. 45.3% men and 22.2% women were non vegetarian, 29.7% men were smokers and 13.9% women were smokers, 50% males and no female had history of alcohol abuse. Gender differences for smoking and dietary habits were not statistically significant, but were highly significant for alcoholism ($p<0.0001$) (Table 1).

53% patients were hypertensive out of which 23% were known cases and 30% were newly diagnosed. 68.7% males and one quarter of the females were hypertensive and this difference was highly statistically significant ($p<0.0001$). 28% subjects were diabetic out of which 13% were newly diagnosed and 15% were known cases of DM. More females (52.8%) were diabetic than males (14.1%) and this difference was statistically highly significant ($p<0.0001$).

28% subjects were overweight and 16% were obese. 39% subjects had abdominal obesity. Gender and background difference for overweight was not statistically significant. 30.6% females and 7.8% males were obese and this difference was statistically significant ($p=0.003$). 69.4% females and 21.8% males had abdominal obesity and this difference was highly statistically significant ($p<0.0001$). There was no statistically significant urban rural difference for abdominal obesity. Dyslipidemia, as a single risk factor, was present in 55% subjects. Hypercholesterolemia, hypertriglyceridemia, increased LDL and decreased HDL were present in 35%, 28%, 38% and 34% cases. Gender difference for hypercholesterolemia was statistically significant and for other lipid parameters was not significant. Hypercholesterolemia was more common in females than males (Table 1 &2). The prevalence of obesity and abdominal obesity was higher in diabetics and this difference was statistically significant (Table 3).

94% of the subjects had ≥1 risk factor. 65% of subjects had ≥2 risk factors. Only 6% subjects had none of the risk factors (Figure 1). Dyslipidemia, as a single risk factor, ranked first (55%), closely followed by hypertension (53%) followed by abdominal obesity (39%), increased LDL (38%), hypercholesterolemia (35%) decreased HDL (34%) and diabetes mellitus (28%) (Table 4). More males were hypertensive (68.7%) and alcoholic (50%) as compared to females (25% and 0% respectively). Diabetes mellitus, obesity, central obesity and hypercholesterolemia were more prevalent in females.

Table 1: Distribution of various risk factors according to gender

		MALE	FEMALE	X2	p value	
Dietary habits	Vegetarian	35(54.7)	28(77.8)	5.26	0.022	Significant
	Non vegetarian	29(45.3)	8(22.2)			
Smoking	Smoker	19(29.7)	5(13.9)	3.15	0.07	Not Significant
	Non smoker	45(70.3)	31(86.1)			
Alcohol use	Alcoholic	32(50)	0(0)	23.23	<0.0001	Highly significant
	Non alcoholic	32(50)	36(100)			
Hypertensive	0	44(68.7)	9(25)	17.48	<0.0001	Highly significant
Diabetic		9(14.1)	19(52.8)	20.96	<0.0001	Highly significant
Overweight		18(28.1)	10(27.8)	0.001	0.97	Not significant
Obesity		5(7.8)	11(30.6)	8.8	0.003	Significant
Abdominal obesity		14(21.8)	25(69.4)	21.73	<0.0001	Highly significant
Hypercholesterolemia		16(25.0)	19(52.8)	7.74	0.005	Significant
Hpertriglyceridemia		15(23.4)	13(36.1)	1.82	0.17	Not significant
↑ LDL		22(34.4)	16(44.4)	0.96	0.32	Not significant
↓ HDL		18(28.1)	16(44.4)	2.7	0.1	Not significant

Table 2: Distribution of various risk factors according to background

		URBAN	RURAL	X2	p value	

Dietary habits	Vegetarian	36(57.1)	27(73)	2.5	0.11	Not Significant
	Non vegetarian	27(42.9)	10(27)			
Smoking	Smoker	13(20.6)	11(29.7)	1.05	0.30	Not Significant
	Non smoker	50(79.4)	26(70.3)			
Alcohol use	Alcoholic	17(27)	15(40.5)	1.96	0.16	Not significant
	Non alcoholic	46(73)	22(59.5)			
Hypertensive		31(49.2)	22(59.5)	0.98	0.32	Not
						Significant
Diabetic		17(27)	11(29.7)	0.08	0.16	Not significant
Overweight		15(23.8)	13(35.1)	1.47	0.22	Not significant
Obesity		9(14.3)	7(18.9)	0.36	0.54	Not significant
Abdominal obesity		24(38.1)	15(40.5)	0.056	0.81	Not significant
Hypercholesterolemia		23(36.5)	12(32.4)	0.17	0.67	Not significant
Hypertriglyceridemia		20(31.7)	8(21.6)	1.16	0.27	Not significant
↑ LDL		27(42.9)	11(29.7)	1.7	0.19	Not significant
↓ HDL		25(39.7)	9(24.3)	2.4	0.11	Not significant

Table 3: Comparison between hypertensive and diabetic patients as regards the prevalence of abnormal lipid profile and anthropometric measures

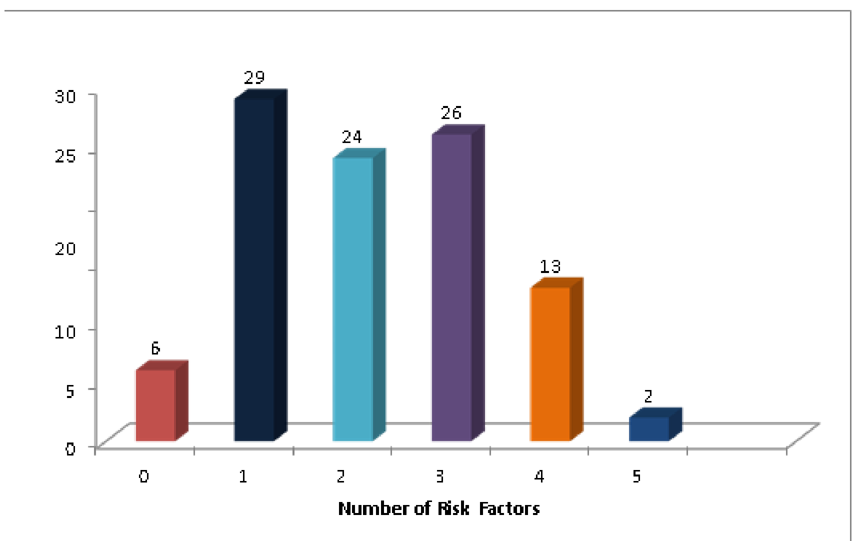
		HYPERTENSIVE	**NORMOTENSIVE**	**p VALUE**	**DIABETICS**	**NONDIABETICS**	**p VALUE**
DYSLIPIDEMIA	YES	25(47.2)	31(66.0)	0.059	18(64.3)	38(52.8)	0.298
	NO	28(52.8)	16(34.0)		10(35.7)	34(47.2)	
OBESITY	YES	6(11.3)	10(21.3)	0.175	8(28.6)	8(11.1)	0.032
	NO	47(88.7)	37(78.7)		20(71.4)	64(88.9)	

ABDOMINAL OBESITY	YES	19(48.7)	20(51.3)	0.49	15(39.5)	23(60.5)	0.045
	NO	34(55.7)	27(44.3)		13(21)	49(79)	

Table 4: Prevalence of risk factors in ACS patients

RISK FACTOR	PERCENTAGE OF PATIENTS
SMOKING	24
HYPERTENSION	53
DIABETES MELLITUS	28
OBESITY	16
ABDOMINAL OBESITY	39
DYSLIPIDEMIA	55
HYPERCHOLESTEROLEMIA	35
HYPERTRIGLYCERIDEMIA	28
INCREASED LDL	38
DECREASED HDL	34

Figure 1: Distribution of subjects according to no. of risk factors



Discussion

There are several well established conventional risk factors for ACS like age, sex, smoking, obesity, hypertension, diabetes and dyslipidemia. Early diagnosis and control of these risk factors is expected to result in a decline in incidence of CAD and hence ACS similar to that was seen in western world.

Our study showed higher prevalence of ACS in males than females as in other studies done by Sharma et al[23] and Kalra et al[24] who reported male: female ratio of 4:1 and 1.6:1 respectively. The mean age in our study was 60.17 ± 9.99 years similar to studies done by Khatri et al[25] and Ralapanawa U et al[26] where mean age was 60 ± 12.90 and 61.3±12.6 years.

Family history of CAD was present in 9% cases in our study. Our findings correlated more with Ahmed E et al[27] and Yadav et al[28] who reported positive family history in 8.6 -13.4 % cases (according to age groups) and 14% cases respectively. Family history of Diabetes Mellitus, hypertension and CVA was present in 10%, 8% and 2% of subjects respectively. In study done by Ralapanawa et al[26], family history of hypertension, diabetes mellitus and stroke were present in 23.4%, 23.4% and 14.3% cases which was slightly higher than in our study. These differences in positive family history may be attributed to ignorance, unawareness, recall bias or retrospective falsification in our subjects. Moreover, there is no scale to conclusively establish this as a risk factor. History of smoking was much lower in our study (24%) in comparison to other studies done by Ralapanawa et al[26], Mirza et al[29] and Khatri et al[25] in which 42.3%, 62% and 39% of the subjects had history of smoking. History of alcohol intake (32%) in our study correlated well with the study done by Ralapanawa et al[26] where 39.3% patients were alcoholic. Higher prevalence of alcoholism in rural areas could be due to the particular customary habit of the population under study and social acceptance to drinking alcohol.

The prevalence of hypertension in studies done by Shakya et al[30] and Reda AA et al[31] were similar to our study i.e. 50.6% and 54.5% respectively. At the same time, the Indian CREATE registry study[32] shows the prevalence of 37.7% in comparison to our study (53%). Sharma R et al,[23] Cheema et al,[33] Shakya et al[30] and Reda AA et al[31] reported a slightly higher prevalence of diabetes mellitus in ACS patients that was reported to be 37%, 31.33%, 34.4% and 38% respectively. Our results were comparable to study done by Ralapanawa et al[26] who reported Diabetes mellitus in 29.3% subjects. The findings in our study are consistent with those of CREATE registry.[32] A similar percentage of patients were diabetic in our study (28% versus 30.4%). More females (52.8%) were diabetic compared to males (14.1%) in our study and this difference was highly statistically significant ($p<0.0001$). In a study done by Ranjith et al[34] prevalence of diabetes was 65% in females as compared to 37% males.

A total of 44% subjects were overweight and obese in our study ie. BMI $\geq 25 kg/m^2$. International studies by Mirza et al[29] and Ceponiene et al[35] showed much higher prevalence of overweight and obesity i.e. 86% and 78.6%. In an Indian study done by Babu AS et al,[36] the prevalence of obesity was 16.2% which correlated well with our results. 21.8% males had waist circumference

>102 cm and 69.4% females had waist circumference >88 cm and this difference was highly statistically significant ($p<0.0001$). In contrast, in a study done by Reda AA et al,[31] males had mean waist circumference of 99.30±3.55 and females had mean waist circumference of 85.83±4.06 and this difference was statistically significant ($p=0.001$).

Hypercholesterolemia, increased triglycerides, increased LDL and decreased HDL were present in 35%, 28%, 38% and 34% subjects respectively. In a study done by Krishnan et al,[37] hypercholesterolemia and decreased HDL was present in 52% and 39% subjects respectively. Increased triglycerides were found in 22.1% subjects and increased LDL was present in 49.3% subjects in a study done by Yagi et al.[38] Dyslipidemia as a single risk factor, was present in 55% patients which was close to studies done by Alhassan et al (59%)[39] and Khatri et al (62%).[25] Gender differences were significant only for hypercholesterolemia in which 52.8% females and 25% males had hypercholesterolemia.

When the individual risk factors were compared with each other, no correlation was found between hypertension and dyslipidemia, obesity and central obesity. The prevalence of obesity and central obesity was higher in diabetics and this difference was statistically significant ($p<0.05$). In a study done by Reda A et al,[31] prevalence of obesity and central obesity was higher in diabetics but this difference was not statistically significant. 65% of the subjects had ≥ 3 risk factors. 91% subjects had more than one risk factor. Kalra S et al[24] found that approximately one third of the subjects had more than one risk factor

In our study, dyslipidemia, as a single risk factor, ranked first (55%), closely followed by hypertension (53%), abdominal obesity (39%), increased LDL (38%), hypercholesterolemia (35%), decreased HDL (34%) and diabetes mellitus (28%). In a study done by Cheema et al,[33] hypertension ranked first (46.3%) followed by smoking (41.9%), family history of CAD (32.7%) and diabetes mellitus (31.33%). In a study done by Krishnan et al,[37] percentage of risk factors was- overweight or obese- 59%, abdominal obesity- 57%, hypertension-28%, diabetes mellitus-15%, high cholesterol-52%, decreased HDL-39% and smoking- 28%. Yagi et al,[38] compared risk factors in ACS patients and patients of stable angina pectoris and found smoking as an independent risk factor for ACS. Other risk factors were not statistically significant.

Limitations of our study were lack of a matched control group and non temporal nature of study. Nevertheless, our results were qualitatively similar for most risk factors in all regions of world.

To conclude, there are definite attributable risk factors for ACS, indicating a possible domain of health promotion and intervention to reduce morbidity and mortality. Most of the risk factors are modifiable. There is propensity for multiple risk factors (>3 or more), this indicates that targeting individual risk factor yields a cumulative advantage in controlling incidence of ACS. Infact, many risk factors are interrelated and one intervention can even impact multitude of the risk factors. More intervention based studies are needed to see the temporal impact of health promotion and prevention outcomes in relation to individual risk factor reduction. Newer emerging non traditional risk factors like stressful, sedentary lifestyle, lack of physical exercise, socioeconomic status need to be studied.

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