Original Article

Analysis of risk factors in angiographically proven coronary artery disease in rural and urban Indian population. Prospective observational multicentre study: Kashmir Heart Survey

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Abstract

Background: The global burden of cardiovascular diseases is increasing rapidly, and changing trends in epidemiological risk factors are identified among diverse Indian population. There has been a significant increase in heart attack deaths over the past 3 years after the COVID-19 pandemic. Are we missing a link? There is an urgent need for studies to confirm any epidemiological shift in coronary artery disease (CAD) risk factors. **Aims and Objectives:** To analyse the risk factors in patients with established CAD in rural and urban Indian Kashmiri populations in the post-COVID period. **Material and Methods:** A prospective observational study of all patients with angiographically proven CAD who have undergone revascularisation or have a clinical suspicion of CAD on the basis of symptoms or positive stress test and later proven to have CAD on coronary angiograms, coming from rural and urban areas of Jammu and Kashmir were enrolled for the study and screened for various modifiable and non-modifiable CAD risk factors. Data was compiled and analysed to know the pattern of various CAD risk factors in our population. **Results:** The study included total 600 patients (rural and urban 300 each), mean age was 59.13 ± 11.62 years. Male patients were 65.50% with a mean age of 57.53 ± 14.17 years and female patients were 34.50% with a mean age of 62.16 ± 10.02 years. In rural subgroup of 300 patients mean age was 60.99 ± 16.86 years and in the urban population we found a mean age of 57.26 ± 16.21 years. The most common risk factor was smoking in 76% rural and 67% urban. Diabetes (39% rural, 43% urban), dyslipidaemia (47.33%, 48.66% urban), hypertension (61% rural, 66% urban), obesity (23% rural, 29.33% urban) and physical inactivity (33.66% rural, 37.33% urban. **Conclusion:** CAD manifests earlier in males and urban populations. Smoking is the most common risk factor for CAD in the Kashmiri Indian population and is more common in the rural population. Coronary artery disease risk factors, such as physical inactivity, diabetes, smoking, hypertension, obesity and dyslipidaemia, are more common in the urban population. Preventive strategies should focus on modifying the risk factors to decrease the prevalence of CAD in communities.

Keywords: CAD Risk factors, cardiovascular disease (CVD), coronary artery disease, Kashmir heart survey, rural CAD, urban CAD

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Introduction

There is significant increase in heart attack deaths over the past three years after the coronavirus disease (COVID-19) pandemic. National Crime Record Bureau (NCRB) report reveals a 12.5%

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rise in heart attack cases in 2022 alone. A report by the NCRB indicated that 32,457 individuals succumbed to heart attacks in 2022, a notable increase from the 28,413 deaths recorded in 2021.[1] Reports suggest that there is an alarming rise of sudden deaths across globe in post COVID-19 period. Patients with COVID-19 were at increased risk of a broad range of cardiovascular disorders including cerebrovascular disorders, dysrhythmias, ischemic and non-ischemic heart disease, pericarditis, myocarditis, heart failure, and thromboembolic disease. Studies indicate different pathophysiological factors responsible for rising incidences of sudden deaths like COVID-19 related autoimmunity, inflammation, subclinical myocarditis and COVID vaccine related adverse effects.[2,3] We intend to analyze and study coronary artery disease (CAD) risk factors in angiographically proven CAD patients in rural and urban subset of north Indian population to see if there is any epidemiological shift in CAD risk factors over the past three years after COVID-19 pandemic. As the global burden of cardiovascular diseases (CVDs) continues to increase and CVDs continue to remain the leading cause of mortality worldwide, this study may help primary care physicians to stress up on modifying the CAD risk factors so that prevalence of CAD can be decreased by applying the measures aimed at primordial and primary prevention of CAD.[4-6]

COVID-19 and Heart Attacks: SARS-2019, (CODV19), caused by coronavirus 2, is a pandemic that has led to considerable morbidity and death across the world. While the virus mainly affects the respiratory system, it also causes acute myopericarditis, acute coronary syndrome, congestive heart failure, cardiogenic shock, and cardiac arrhythmias. The COVID-19 pandemic has created havoc around the globe by claiming more than one and a half million lives and infecting more than 76 million people by the end of year 2022. The impact of COVID-19 in terms of case numbers and deaths is devastating as the pandemic is considered the biggest challenge the world is facing since World War-II and also an important turning point in the history of humanity. The increase in heart attacks due to COVID-19 is a complex and evolving topic. While the primary concern with COVID-19 has been its respiratory impact, as the emerging evidence suggests, its influence on cardiovascular health is significant. Several factors contribute to the potential link between COVID-19 and increased heart attacks. The virus can cause inflammation of the heart muscle and coronary vessels, known as myocarditis and vasculitis respectively, leading to rhythm disturbances and abnormal cardiac function. This condition increases the risk of heart attacks, especially in individuals with pre-existing co-morbidities and high-risk lifestyles.[7] While the exact nature and cause of these sudden deaths can be ascertained only by autopsy studies, there is enough evidence to suggest a direct link between COVID-19 infections and sudden cardiac arrests. The COVID-19 pandemic lockdown-related physical inactivity, virus-related myocarditis, vaccine-induced inflammation and immune dysregulation and the amount of stress posed by the pandemic itself could all be possible aetiologies behind the rising trend in heart attacks in the post-COVID era. The fact that many of these cases lacked the conventional coronary artery disease risk factors further supports the hypothesis that these deaths are more related to virus and vaccine-induced inflammation, structural, functional, and vascular abnormalities leading to possible electrical abnormalities resulting in fatal arrhythmia in apparently healthy individuals.[7-10]

CAD in Kashmir Valley: In the union territory of Jammu and kashmir, the population like any other developing community, is undergoing lifestyle changes but the unusual stress and strain for the last three decades has contributed to increase the prevalence of CAD. The overall prevalence of CAD in the population studied by all diagnostic measures was 7.54%. The overall rural prevalence was 6.70% and urban prevalence was 8.37%.[11] Union territory of Jammu and Kashmir, especially the Kashmir Valley being no exception to national and global data also witnessed surge in sudden deaths especially in young people in last three years. Surprisingly, majority of these cases were young and apparently healthy individuals. Many people who suffered sudden cardiac arrests had no significant family or personal history and most of these cases were reported from play fields, deceased involved in cricket or other sports-related activities. Although exact cause of these deaths can be obtained from autopsy studies, fatal arrythmias due to plaque rupture, myocarditis and hypertrophic cardiomyopathies (HOCM) remains the leading cause of sudden cardiac deaths across globe in all age groups.[12-14]

A study carried out by the Global Health Research Institute suggests that J&K has recorded 29.6% deaths due to heart-related ailments. The study further reports that 25% of deaths occur in the age group of 25-69 years. Out of these, 32.8% of deaths occur in urban areas and 22.9% in rural areas. These percentages shoot up in winters as compared to summers owing to the extreme weather conditions limiting regular exercising and outdoor activities as sedentary lifestyle leads to increased chances of heart attacks. The ischemic heart disease, which contributed 4.3% to total deaths in 1990, has now increased to 8.7% in 2016, reveals a recent study, by the Indian Council of Medical Research (ICMR), on disease burden trends across the country. At least 3,256 people out of 1 lakh died in 2016 due to heart disease in J&K reveals the study, which attributes smoking and stress as major causes for it.[14,15]

Differences in CAD Risk Factors: Kashmir Valley remains under a thick snow blanket for at least 4 months during harsh winters when the minimum temperature drops to minus 10 degrees centigrade in urban and up to minus 25 degrees centigrade in rural remote villages. These extreme weather conditions force people to remain indoor and physically inactive every year for a significant period of time, which contributes to obesity, dyslipidaemia and poor control of diabetes and hypertension thereby increasing the risk of heart attacks in the valley during winters. As per the National Health Survey (NHS), J&K is sixth highest in the country after North Eastern States – Manipur, Arunachal Pradesh, Tripura, Meghalaya and Mizoram – in terms of tobacco consumption. As per the NHS figures, the prevalence of tobacco in Kashmir includes Kupwara 56.6%, Shopian 52%, Anantnag and Bandipora 49%, Budgam 48%, Pulwama 44%,

Ganderbal 42%, Baramulla and Kulgam 41% and Srinagar 38. As per the official data, Kupwara has the highest prevalence of tobacco use at 56.6% while Srinagar has the lowest at 38.4%. In addition to these factors, unusual extra stress due to prevailing political turmoil in the last three and a half decades, rising cases of substance abuse among young, unhealthy dietary habits like increased salt intake (pink salt tea), excessive use of mutton, junk and carbohydrate-rich meals add up to increase the incidence of heart attacks especially during winters in Kashmir Valley.[16,17]

We aim to study and analyze the risk factors in angiographically proven coronary artery disease. Patients who have suffered a heart attack in past or those who presented with acute coronary syndrome to central (urban) or peripheral (rural) hospitals across Kashmir Valley were enrolled for study. CAD risk factors were analyzed and compared between rural and urban subgroups. No such study has been carried out earlier in the region. Studying the risk factor profile in rural and urban populations is going to help and plan preventive strategies to tackle rising incidence of heart attacks in Kashmir Valley.

Aims and Objectives

To study and analyse the risk factors in patients with angiographically proven coronary artery disease in rural and urban Kashmiri Indian population.

Material and Methods

A prospective observational study of all patients aged more than 18 years who have a history of manifest CAD in the past or signs and symptoms suggestive of coronary artery disease, angiogram-proven obstructive CAD on evaluation. The study patients were enrolled from central (urban) and peripheral (rural) hospitals of Kashmir Valley. Detailed history, relevant examination and lab parameters were documented from patients enrolled for the study. The study was discussed in Institutional Ethical Committee meeting and was cleared under letter No: SKIMS-IEC-6621.

Inclusion criteria:

- Age more than 18 years.
- Established coronary artery disease; patients with a history of PCI, CABG or thrombolysis with angiographically established CAD.
- Consent for the study.

Exclusion criteria:

- Clinical suspicion of CAD but not undergone angiograms.
- Coronary angiograms not confirmative of CAD.
- Thrombophilia or embolic myocardial infarction.
- Spontaneous coronary artery dissection.
- Pregnancy with Myocardial infarction.

Defining our Study population: Urban and rural populations were defined according to Census of India 2011 data. According to the data released by Census India; Jammu and Kashmir has 72.58% rural and 27.42% urban population. Urban units, also known as towns, include places with a municipality, corporation, cantonment board, notified town area committee, or meet specific criteria defined as Census Towns. Census Towns are places that meet the criteria: minimum population of 5,000. At least 75% of male main workers engaged in non-agricultural pursuits. The density of population of at least 400 per sq. km. Rural areas, on the other hand, encompass all areas that do not fall under the classification of urban units.[18]

Coronary artery disease: Defined as per WHO cardiovascular survey methods criteria.[19] Hypertension: defined as per the 2020 International Society of Hypertension Global Hypertension Practice Guidelines.[20] Diabetes mellitus: According to Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes 2020.[21] Body mass index (BMI): calculated as weight in kg divided by the square of height in metres. Obesity is defined as a BMI ≥25 kg/m.[22]

Dyslipidaemia: 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA guideline on the management of blood cholesterol.[23] Physical inactivity: adults (≥18 years): Not achieving 150 min of moderate-to-vigorous-intensity physical activity per week or 75 min of vigorous-intensity physical activity per week or an equivalent combination of moderate and vigorous-intensity activity.[24] Tobacco consumption: Users of all types of tobacco products and present and past smokers have been included in the smoker category. The diagnostic criteria for tobacco use as well as other coronary risk factors adopted were in accordance with American College of Cardiology clinical data standards.[25]

Family History of CAD: People with one or more close relatives who have or had early coronary artery disease (CAD) are at an increased risk for CAD. For men, early CAD is diagnosed before age 55 years. For women, early CAD is being diagnosed before 65 years. Number of vessels diseased: The number of diseased vessels is measured according to coronary artery surgery study (CASS) criteria.[26]

Statistics: The data were entered into a Microsoft Excel sheet and analysed using the SPSS package.

Results

Table 1 shows the number of cases enrolled in rural and urban centres in Kashmir Valley. Table 2 presents the area (district)-wise break up of patients enrolled for the study. A majority (35%) of patients are from the Srinagar district of central Kashmir, followed by Budgam (14.66%) and District Ganderbal (12.5%). Table 3 shows the age and gender distribution of patients in our study. Majority of our patients were in the age group of 51-80 years of age. We observed male predominance in patients with CAD. We selected an equal proportion of patients from rural and urban areas. Table 4

shows the percentage prevalence of CAD risk factors in rural and urban Indian populations. We observed a mean age of 60.99 vs 57.26 in the rural and urban subsets of patients. CAD tends to manifest at an earlier age in the urban population. Smoking is the most common risk factor found in both study groups (76% rural vs 67% urban). All other risk factors studied were more common in the urban population.

Discussion

Our study comprised of 600 patients. Mean age was 59.13 ± 11.62 years. Male patients were 65.50% with mean age of 57.53 ± 14.17 years and female patients were 34.50% with a mean age of 62.16 ± 10.02 years [Table 3]. In rural subgroup of 300 patients mean age was 60.99 ± 16.86 years and in urban population we found mean age of 57.26 ± 16.21 years. The data showed uniform presentation of CAD in both groups in terms of age and gender distribution. Urban population tend to have lower mean age (57.26 vs 60.99) of onset of CAD when compared with rural population. Xavier D *et al.* in their study found mean age of 57 years which is comparable to our study. Most of our patients were in the age group of 51-70 years (58.33%) comparable to that shown by Xavier D *et al.* (56.7%).[27] We found 44 patients (n = 600) 7.33% [Table 3] were younger than 40 years of age who presented with symptoms of acute coronary syndrome with elevated biomarkers and ECG evidence of myocardial ischemia.

Table 1: Centre-wise enrolment of patients

Study Centre	No. of cases	Males	Females	Rural	Urban
SKIMS	440	288	152	185	255
District Hospital	108	69	39	75	33
Sub-District Hospital	52	36	16	40	12
Total	600	393	207	300	300

Table 2: Area (district)-wise distribution of patients

Area (District)	Males	Females	Rural	Urban
Srinagar	147	63	8	202
Budgam	51	37	28	60
Ganderbal	54	21	60	15
Baramulla	44	22	54	12
Anantnag	33	23	45	11
Kulgam	22	15	37	-
Pulwama	17	12	29	-
Kupwara	18	8	26	-
Shopian	7	6	13	-
Total	393	207	300	300

The most common risk factor we found was smoking in 72% of patients (76% rural and 67% urban) as shown in Table 4. Santosh Kumar Sinha *et al.*[28] studied; acute myocardial infarction in young 1,116 consecutive patients and found mean age of the patients was 26.3 years and 78.5% were smokers. Our study showed women tend to manifest CAD later when compared with men (62.16 vs 57.53 mean age of onset) as depicted in Table 3. Women with clinically manifest CHD are in general older than men, with a higher expression of cardiovascular risk factors.[29,30] Although women and men share most classic risk factors, the significance and the relative weighting of these factors are different. At younger ages (<50 years) smoking is more deleterious in women than in men, with a larger negative impact on the total number of cigarettes smoked per day.[31,32] Smoking increases the risk of a first acute myocardial infarction (AMI) relatively more in females than in men. Women with diabetes are at greater risk for cardiovascular complications than their male counterparts. In a meta-analysis of 37 prospective cohort studies, the risk of fatal CHD is 50% higher in women with diabetes compared with male diabetics.[33] The reason for this higher mortality is multifactorial and related to a heavier risk factor burden, more involvement of inflammatory factors, smaller vessel size of the coronary arteries and often less aggressive treatment of diabetes in women.

In our study risk factors for coronary artery disease (CAD), physical inactivity (35.50%), diabetes (41%), dyslipidaemia (48%), hypertension (63.5%) and obesity (26.16%) were more prevalent in the urban population than rural study group. Singh RB *et al.*[34] studied the prevalence of coronary artery disease and coronary risk factors in rural and urban populations of north India and found coronary risk factors were two- or three-fold more common among urban subjects compared to the rural population in both sexes. Central obesity was four times more common in the urban population compared to the rural in both sexes. There was a significant association between coronary disease and age, hypercholesterolaemia, hypertension and central obesity in both sexes.

Our study analysed the risk factors in angiographically documented CAD in the rural and urban subsets of the north

Table 3: Age and gender distribution of patients

Age group (years)	No. of cases (n=600)	Males	Females	Rural	Urban
20-30	4	4	-	1	3
31-40	40	37	3	14	26
41-50	94	74	20	46	48
51-60	170	98	72	64	106
61-70	180	120	60	108	72
71-80	112	60	52	67	45
Mean age (SD)	59.13±11.62	57.53±14.17	62.16±10.02	60.99±16.86)	57.26±16.21
Total (%)	600	393 (65.50)	207 (34.50)	300 (50)	300 (50)

Table 4: Risk factor analysis in rural and urban populations

Risk factor	Rural (%) (*n*=300)	Urban (%) (*n*=300)	Total (%) (*n*=600)
Mean age±SD	60.99±16.86	57.26±16.21	59.13±11.62
Smoking	230 (76%)	202 (67%)	432 (72%)
Hypertension	183 (61%)	198 (66%)	381 (63.50%)
Diabetes	117 (39%)	129 (43%)	246 (41%)
Obesity (BMI ≥25)	69 (23%)	88 (29.33%)	157 (26.16%)
Dyslipidaemia	142 (47.33%)	146 (48.66%)	288 (48%)
Family history of CAD	25 (8.33%)	29 (9.66%)	54 (9%)
Physical inactivity	101 (33.66%)	112 (37.33%)	213 (35.50%)

Indian population. We found smoking is the commonest risk factor followed by diabetes and hypertension. As the burden of CVDs continues to increase, we need to emphasize the importance of adopting a healthy lifestyle at the primary care level so that the rising incidence of heart attacks in Kashmir Valley can be addressed. Primary care physicians have an important role to organise health education and screening camps at gross root level in communities to detect and treat CAD risk factors at the earliest. A national tobacco control programme needs to be implemented and people should be educated about the hazards of all forms of tobacco.

Conclusion

Coronary artery disease manifests earlier in males and urban populations. Smoking is the most common risk factor for CAD in Kashmiri Indian population. Coronary artery disease risk factors, such as physical inactivity, diabetes, smoking, hypertension, obesity and dyslipidaemia, are more common in the urban population. Family History of CAD is equally prevalent between urban and rural populations. Preventive strategies should focus on modifying these risk factors to decrease the incidence of acute coronary syndrome and sudden cardiac deaths in rural and urban areas.

Future Directions: Autopsy studies are needed to elucidate the cause of rising sudden cardiac arrests in Kashmir Valley. Family screening for inherited structural heart disease or channelopathies has an important role to play. The role of persistent markers of inflammation in studying the post-COVID immune dysregulation, coronary vasculitis and myocarditis is to be evaluated. Health education programmes are the need of the hour to reduce the burden of coronary artery risk factors which are on a rising trend in the region. Basic Life support training is to be imparted to people involved in organising sports activities, police personnel involved in rescue operations, railway station and airport staff, public offices, schools and college staff.

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Conflicts of interest

There are no conflicts of interest.

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