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Original Research Article

Comparison of clinical profile of urban vs. rural Indian youth with premature coronary artery disease (PCAD): a sub-study of the PCAD registry

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ABSTRACT

Background: We aimed to compare clinical profile of premature coronary artery disease (PCAD) in urban vs. rural Indian populations.
Methods: This was a prospective cross-sectional observational multi-centre study. This study is a sub-study of the ongoing PCAD registry. Between the period April 2017 and April 2018, a total of 1061 patients <40 years with PCAD were studied. Urban (n=583) and rural (n=478) populations were statistically compared.
Results: Mean age of the urban and rural populations were 34.50±4.15 years and 33.99±4.46 years, respectively. All cardiovascular risk factors (smoking, diabetes, hypertension, dyslipidemia, obesity, diet and family history), except for alcoholism were more prevalent in urban subjects compared to rural subjects. However, higher prevalence of only hypertension (p=0.05) was statistically significant. Religion was significant between the two populations (p<0.001). Window period was also significant between the two populations (p<0.001). Very low density lipoprotein cholesterol (VLDL) (p=0.037) was significantly different between both populations.
Conclusions: All conventional risk factors were more prevalent among urban populations than rural populations, however none of these differences except for hypertension was statistically significant.

Keywords: India, Premature coronary artery disease, Rural, Urban, Youth

INTRODUCTION

Coronary artery disease (CAD) is considered an alarming health concern worldwide.[1] Despite the global curb on this epidemic, it is still a significant health concern for urban and rural Indians, as well as Asian Indians living abroad.[2,3] CAD although predominantly encountered in older populations, has now been observed at an early onset in Indian youth aged less than 40 years as compared to other ethnicities.[1,4] This early onset of CAD is referred to as premature coronary artery disease (PCAD). It has been shown that Asian Indians are genetically prone to develop CAD at a much younger age.[5] Approximately 50% of first heart attacks occur before 55 years and 25% occur before 40 years age.[3]

Several studies have proven higher prevalence of CAD in urban populations compared to their rural counterparts.[5,6] This observation may be justified by the occurrence of multifaceted transitions, such as the nutritional, demographic, epidemiological and socioeconomic transitions.[7] However, there are currently limited studies assessing PCAD in India comparing urban subjects with rural subjects. In this regard, we conducted this

observational cross-sectional study to compare clinical profiles of PCAD in urban vs. rural Indian populations.

METHODS

This was a prospective cross-sectional observational multi-centre study. This study is a sub-study of the PCAD registry (CTRI/2018/03/012544). Between the period April 2017 and April 2018, a total of 1380 patients with PCAD were recruited in the PCAD registry. The inclusion criteria for present sub-study were: (i) age ≤40 years and (ii) patients admitted for ischemic heart disease proven by documented acute coronary disease (ACS) or chronic stable angina with documented evidence of coronary artery disease (CAD). Exclusion criteria were (i) myocarditis/cardiomyopathies/pulmonary embolism; (ii) previous diagnosis of CAD; and (iii) ongoing medications such as antiplatelet or statins. Accordingly, 1061 patients fulfilled the inclusion criteria for this sub-study and were examined. Of the 1061 patients, 583 (54.9%) and 478 (45.0%) were urban and rural area residents, respectively. All patients gave their written informed consent prior to the start of the study. All study procedures were approved by the local Institutional Ethics Committee.

Study procedure and data collection

Details of the patient's clinical, laboratory and angiographic profile were documented on admission to the tertiary-care centre. Patients were managed according to their diagnosis, preference and availability of health insurance. Treatment was decided in accordance to the current American College of Cardiology/American Heart Association (ACC/AHA) guidelines for ACS management. All modalities such as thrombolysis, primary percutaneous coronary intervention (PCI), facilitated PCI and anticoagulation followed by diagnostic elective coronary angiography were available depending on presentation.

Statistical analysis

Continuous variables are expressed as means with standard deviations and categorical variables as counts and percentages. Continuous variables were compared with Student's t- test or Mann-Whitney U test. Categorical variables were compared with Chi-square test or Fisher exact test. A p value of ≤0.05 was considered statistically significant. All statistical analysis was done using R statistical software (R core team, 2018) program, version 3.5.1., released under the GNU General Public License (GPL), version 2 and published by the Free Software Foundation.[8]

RESULTS

A total of 1061 patients were observed. The study comprised of 583 (54.9%) and 478 (45.0%) urban and rural area subjects, respectively. Hence, the ratio of urban to rural patients was 5.5:4.5. The mean age of the study population was comparable for urban (34.50±4.15 years) and rural areas (33.99±4.46 years). The urban and rural residents comprised of 543 (51.2%) and 436 (41.1%) males, respectively. Risk factors such as diabetes (p=0.086) and hypertension (p=0.05) were numerically higher in urban subjects compared to their rural counterparts.

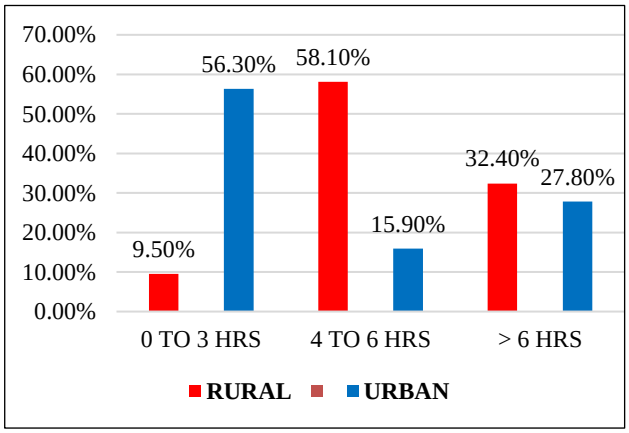

Figure 1: STEMI window period (urban Vs rural).

Table 1: Distribution of qualitative variables among urban and rural subjects.

Characteristics	Urban, n=583	Rural, n=478	p value
Male, n (%)	543 (51.2%)	436 (41.1%)	0.292
Smoker, n (%)	305 (52.3%)	238 (49.8%)	0.385
Diabetes mellitus, n (%)	88 (15.1%)	54 (11.3%)	0.086
Hypertension, n (%)	80 (13.7%)	46 (9.6%)	0.05
Dyslipidemia	74 (12.7%)	48 (10.0%)	0.211
Obesity	62 (10.6%)	37 (7.8%)	0.141
Alcoholism, n (%)			
Chronic	40 (6.9%)	44 (9.2%)	0.213
Occasional	37 (6.3%)	95 (19.9%)	
Diet, n (%)			
Vegetarian	37 (6.3%)	41 (8.6%)	0.205
Non-vegetarian	546 (93.7%)	437 (91.4%)	
Family history, n (%)	89 (15.3%)	58 (12.1%)	0.168
Religion			
Christian, n (%)	12 (2.0%)	2 (0.4%)	<0.001
Hindu, n (%)	462 (79.2%)	431 (90.2%)	
Muslim, n (%)	109(18.7%)	45 (9.4%)	

Other cardiovascular risk factors such as smoking, dyslipidemia, obesity, alcoholism, diet and family history were also not significantly different among the two groups. Religion difference was significant between the two populations (p<0.001). Window period was significant between the two groups (p<0.001). Window period of urban and rural subjects is given in Figure 1. The distribution of qualitative variables among urban and rural subjects is detailed in Table 1.

Age (p=0.045) was significantly different between urban and rural subjects. Mean very low-density lipoprotein cholesterol (VLDL) levels (p=0.037) was significantly higher in urban subjects than in rural subjects. Other quantitative variables such as low-density lipoprotein (LDL), triglycerides (TG), body mass index (BMI), waist/hip ratio, total cholesterol, high density lipoprotein (HDL), HDL-1, non-HDL and cholesterol ratio were not significantly different. Distribution of quantitative variables among urban and rural subjects are demonstrated in Table 2.

Table 2: Distribution of quantitative variables among urban and rural subjects.

Characteristics	Urban, N=582	Rural, N=476	p value
Age, years	34.50±4.15	33.99±4.46	0.045
BMI, kg/m^2	23.68±3.61	23.35±3.21	0.461
Waist/Hip ratio	1.25±5.48	0.92±0.05	0.572
Total cholesterol, mg/dL	175.58±50.68	171.60±51.78	0.109
HDL, mg/dL	35.28±14.39	34.52±9.39	0.85
HDL-1, mg/dL	34.63±14.4	33.74±9.34	0.943
LDL, mg/dL	120.37±106.81	111.5±44.98	0.136
TG, mg/dL	178.5±119.61	165.54±121.37	0.17
Non-HDL, mg/dL	142.0±49.0	137.7±52.32	0.105
VLDL, mg/dL	36.6±25.47	33.11±24.26	0.037
Total cholesterol/HDL cholesterol	13.23±183.43	5.47±2.42	0.246

Values are expressed as Mean±SD. LDL- Low density lipoprotein, HDL- High density lipoprotein, TG- Triglycerides, VLDL- Very low density lipoprotein cholesterol

DISCUSSION

The study subjects were recruited from the ongoing PCAD registry. The PCAD registry is a large ongoing cross-sectional registry designed to enrol an estimated 10,000 subjects between April 2017 and April 2022. The tertiary-care centres enrolled subjects predominantly belonging to the city of Bangalore, India. Subjects from nearby towns, villages, rural areas and the neighbouring state of Andhra Pradesh were also eligible for enrolment in the study. The study aimed to compare clinical profiles of PCAD in urban vs. rural Indian youths.

Indians are more susceptible to an early onset of CAD.[9] This has been proven by the INTERHEART study which revealed South Asians had one of the highest percentage (8.9%) of cases of acute myocardial infarction ≤40 years as compared to other ethnic groups (Western Europe: 2.7% and Central and eastern Europe 2.9%).[10] This trend of early burden of CAD was also observed in a US study, in which South Asians residing abroad demonstrated the highest risk of PCAD prevalence (50%) as compared to other ethnic groups (Hispanic: 20% and black: 30%).[11]

A study by Mohammad et al, compared prevalence of PCAD with mature coronary artery disease (MCAD).[1] The study observed a higher prevalence in risk factors such as hypertension, smoking, obesity, hyperlipidaemia and family history. Only diabetes was higher in MCAD group. They also found male sex, smoking, hypertension, hyperlipidaemia and family history were independent risk factors for PCAD. Further studies have affirmed that patients with PCAD have a different clinical presentation and associated CAD risk factors as compared with MCAD.

In the present study, all cardiovascular risk factors were found to be higher in urban subjects compared to rural subjects (smoking 52.3 vs. 49%, diabetes 15.1 vs. 11.3%, hypertension 13.7 vs. 9.6%, dyslipidemia 12.7% vs. 10.0%, obesity 10.6 vs. 7.8% and family history 15.3 vs. 12.1%). This trend has been observed in several other studies comparing urban vs. rural cardiovascular risk factors.[5,7,12]

It is likely that the disparity in the cardio-metabolic profile of the two populations are due to different dietary preferences and lifestyles. Urban residents consume more packaged and processed foods with high percentages of animal fats, salt and sugar whilst rural residents adhere to less processed traditional foods since their foods are locally obtained.[7]

The twenty first century has witnessed an emergence of lifestyle-related and CAD risk factors in rural areas depending upon availability and use of technologies in these areas.[13] The study conducted by De Auley et al included 38 (44.7%) and 31 (37.4%) urban and rural women, respectively. Our study included 40 (3.8%) and 42 (4.0%) urban and rural and women, respectively.[5] These similar statistics are evidence that indeed CAD is becoming equally prevalent in both populations.

High blood pressure, a critical cardiovascular risk factor, is the third highest risk factor contributing to disease in South Asia. Overall prevalence of hypertension in India

was found to be 29.8% with one-third Indians being hypertensive. Significant differences in hypertension prevalence between urban (33.8%) and rural (27.6%) were noted.[14] This could be explained by differences in socioeconomic conditions, other risk factors and higher rates of salty food consumption. A two fold increase in hypertension was observed among Indians when they smoked, had tobacco habits, consumed excess salt or alcohol or had a sedentary life. Gupta et al, stated that due to changes associated with menopause the risk of hypertension increases with age in becoming more prevalent than in men.[2]

It is well known that the urban population are more inactive than rural subjects. A recent study by Anjana et al, of 142777 Indian patients has revealed alarming statistics.[15] These are: (i) 392 million individuals in India are inactive, (ii) <10% people engage in recreational physical activity, (iii) majority of the time spent in moderate to vigorous intensity activity and was at the workplace and, (iv) those who are physically active carry out only <20 minutes of moderate/vigorous physical activity. Presence of available and affordable transportation systems, sedentary jobs, remote-controlled and automatic appliances have paved the way for the decline in physical activity in the urban lifestyle. This lifestyle pattern is in contrast to rural residents who walk long distances and carry out vigorous activities such as farming and other manual occupations.[7]

Studies have reported CAD prevalence to be 2.5 times higher in urban India compared to rural India.[5] As urban and rural Indians belong to the same genepool this statistic suggests a powerful impact of environmental and lifestyle factors superimposing upon genetic susceptibility.

Another aspect which is most relevant while comparing urban to rural, is availability of healthcare facilities. This study observed that among the cases of ST elevation MI where either emergency thrombolysis, or primary percutaneous coronary intervention is indicated 56.3% of urban and only 9.5% of rural patients reached the tertiary care centre within 3hours of chest pain. This has a significant impact on the outcome of the entire treatment.

Due to the devastating impact of PCAD has a devastating impact on the patient's life. Since it affects the younger working population it results in loss of productive and profitable years of the patient. Therefore, this group of individuals require more attention. Lower cut-offs and stricter goals for individual risk factors such as those followed in the Western populations should be implemented.

This study is limited by the fact that the socioeconomic status and degree of exercise were not outlined among the groups. The second limitation is that subjects were confined to the city of Bangalore and its nearby surrounding areas, thus these findings are subjective to regional variation. Hence, there is a need to study prevalence of multiple CAD risk factors in different regions of India using a uniform protocol.

CONCLUSION

This study concludes that cardiovascular risk factors namely smoking, diabetes, hypertension, dyslipidemia, obesity, alcohol abuse, diet, family history and lipid profile are more prevalent in urban than in rural areas. These risk factors commonly found in the adult population are now becoming more commonly found in the Indian youth.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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