Coronary artery disease risk factors distribution in cities versus urban and rural population of Karnataka

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Abstract

Objectives
To analyze the risk factors in patients with established coronary artery disease (CAD) in the setting of cities versus urban and rural population.

Methodology
This cross-sectional study included all CAD patients visiting a tertiary cardiac center in Karnataka, from cities, urban, and rural areas. The patients who presented with known or suspected CAD with chest pain suggestive of CAD; previously diagnosed / documented CAD; documented history of previous revascularization; ST-T changes or Q waves in two or more contiguous leads on electrocardiography (ECG) suggestive of CAD; positive stress test/echo; and regional wall motion abnormality (RWMA) by echo were screened. After the screening, patients undergoing coronary angiogram were included in the study.

Results
In total, 487 patients underwent coronary angiogram, of which 400 had evidence of CAD and were included in the study. Mean age of the study population was 57 years. Male patients comprised 75.3%.

Risk factors for coronary heart disease (CHD), such as obesity (BMI ≥ 25 kg/m²) and sedentary life style, were more prevalent in the city population than in the rural population, while smoking and alcohol consumption were more common among the rural population. Other risk factors were equally prevalent among the city, urban, and rural population.

Conclusions
Primordial and primary prevention should focus on modifying risk factors such as sedentary lifestyle, obesity, smoking, and alcohol consumption.

Keywords
• Coronary artery disease
• City
• Urban
• Rural area
• Risk factors

Introduction
Coronary artery disease (CAD) is the leading cause of death worldwide. In 2001, CAD accounted for 7.1 million deaths globally¹, 5.7 million (80%) of which were in low-income countries.² Between 1990 and 2020, these diseases are expected to increase by 120% for women and
137% for men in developing countries, compared with 30–60% in developed countries. South Asians have a high prevalence of risk factors, and have CAD at an earlier age than people in developed countries. In 2003, according to population-based cross-sectional surveys, the prevalence of CAD in India was estimated to be 3–4% in rural areas and 8–10% in urban areas with a total of 29.8 million affected. The relatively low levels of conventional risk factors in the rural population presents a window of opportunity for primordial and primary prevention. Re-emphasizing the importance of a balanced vegetarian diet, increasing the levels of physical activity, and cessation of smoking would be crucial in containing the rise of risk factors and CAD prevalence induced by urbanization and industrialization. A recent study has shown that approximately three-fifths of the acute coronary syndrome patients lived in urban areas and fewer than a fifth lived in rural areas.

Objective

To analyze the risk factors in patients with established CAD in the setting of cities versus urban and rural population.

Materials and methods

A cross-sectional study was performed on all patients coming to a cardiac care center in south India or its peripheral centers from cities, urban, and rural areas over two years.

Patients presenting with known or suspected CAD with chest pain suggestive of CAD, previously diagnosed /documented CAD, documented history of previous revascularization, ST-T changes or Q waves in two or more contiguous leads on ECG suggestive of CAD, positive stress test/echo, regional wall motion abnormality (RWMA) by echo were screened and those undergoing coronary angiogram were included in the study.

Definition of study population

1. City, urban, and rural population were defined according to the Census of India 2001 data.
2. CAD was defined as per World Health Organization (WHO) cardiovascular survey methods criteria.
3. Hypertension was defined as per seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure (JNC VII).
4. Diabetes mellitus was defined as per WHO criteria for type 2 diabetes mellitus (t2DM).
5. Body mass index (BMI) was calculated as weight in kg divided by square of height in metres and overweight and obesity defined as BMI ≥ 25kg/m².
6. Dyslipidemia was defined according to NCEP ATP III guidelines.
7. According to the Indian consensus group, a person is considered to have a sedentary behavior if he walks less than 14.5 km a week, climbs fewer than 20 flights of stairs a week, or performs no moderate physical activity (300 Kcal/day) on five days a week.
8. 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.
9. Alcohol consumers: Individuals who took alcohol more than once a month were placed in this category.
10. Family history of CAD: Patients whose first-degree relatives had documented CAD at age <65 years were considered to have a family history of CAD.

Inclusion criteria

All patients with coronary angiogram confirmative of CAD were included.

Exclusion criteria

Patients with coronary angiogram not confirmative of CAD were excluded.

Methodology

Patients with suspected CAD, at the time of screening underwent clinical evaluation, biochemical testing, ECG, and echocardiogram, and thereafter, as per clinical indications, those who underwent coronary angiogram with due consent were considered eligible for the study. Biochemical tests, such as those for blood sugar, haemoglobin, creatinine, and fasting lipid profile, were performed as per validated methods. Echocardiographic study was directed toward left ventricular RWMA, left ventricular ejection fraction, and any other relevant findings.

Catheterization of coronary arteries was performed with the Judkins approach. Selective left and right coronary arteriograms were taken in all patients using GE ADVANTX LC PLUS and GE OEC machines. Multiple views were taken using standard technique to define the severity of the arteriographic disease. Number of vessels diseased was calculated for each lesion.
Number of diseased vessels
The number of diseased vessels is measured according to coronary artery surgery study (CASS) criteria.2

Ethics
Ethical clearance was taken as per the local institutional ethical review board.

Statistical analysis
Data was analyzed using chi-square, t-test, and ANOVA. P value <0.05 was statistically significant. The data was analyzed using SPSS.

Results
In total, 487 patients underwent coronary angiogram, in which 400 had evidence of CAD, and were included in the study; 87 patients had normal coronaries and were excluded. Among the 400 patients with established CAD, 197 patients were from city, 102 patients were from urban area, and 101 patients were from rural areas.

Sex distribution of study population is depicted in Table 1. Age distribution of study population is depicted in Table 2.

Table 1: Sex distribution of the study subjects

<table>
<thead>
<tr>
<th>Sex</th>
<th>City (n = 197)</th>
<th>Urban (n = 102)</th>
<th>Rural (n = 101)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>145 (75.6%)</td>
<td>77 (75.5%)</td>
<td>79 (78.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>52 (26.4%)</td>
<td>25 (24.5%)</td>
<td>22 (21.8%)</td>
</tr>
</tbody>
</table>

Table 2: Age distribution of study subjects

<table>
<thead>
<tr>
<th>Age in years</th>
<th>City (n = 197)</th>
<th>Urban (n = 102)</th>
<th>Rural (n = 101)</th>
<th>Total (n = 400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 years</td>
<td>2 (1%)</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td>3 (0.8%)</td>
</tr>
<tr>
<td>31–40 years</td>
<td>11 (5.6%)</td>
<td>5 (4.9%)</td>
<td>2 (2%)</td>
<td>18 (4.5%)</td>
</tr>
<tr>
<td>41–50 years</td>
<td>37 (18.8%)</td>
<td>20 (19.6%)</td>
<td>20 (19.8%)</td>
<td>77 (19.3%)</td>
</tr>
<tr>
<td>51–60 years</td>
<td>68 (34.5%)</td>
<td>42 (41.2%)</td>
<td>32 (31.7%)</td>
<td>142 (35.5%)</td>
</tr>
<tr>
<td>61–70 years</td>
<td>53 (26.9%)</td>
<td>22 (21.6%)</td>
<td>37 (36.6%)</td>
<td>112 (28.0%)</td>
</tr>
<tr>
<td>71–80 years</td>
<td>23 (11.7%)</td>
<td>12 (11.8%)</td>
<td>9 (8.9%)</td>
<td>44 (11.0%)</td>
</tr>
<tr>
<td>81–90 years</td>
<td>3 (1.5%)</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
<td>4 (1%)</td>
</tr>
</tbody>
</table>

Risk factors
Risk factors of CAD in city, urban, and rural population are depicted in Table 3 and 4.

Among the risk factors, there was no significant difference between the groups in age of presentation (p = 0.744), t2DM (p = 0.673), systemic hypertension (p = 0.163), family history of CAD (p = 0.872), serum total cholesterol (S-C; p = 0.069), serum low density lipoprotein cholesterol (SLDL-C; p = 0.721), serum high density lipoprotein cholesterol (SHDL-C; p = 0.873), and serum triglycerides (p = 0.938).

Smoking was significantly more common in rural patients compared to city and urban patients (p = 0.001).
Sedentary habit was significantly more common in city patients compared to urban and rural patients (p = 0.001).
Alcohol consumption was significantly more common in rural patients compared to city and urban patients (p = 0.001).
BMI was significantly more in city patients compared to urban and rural patients (p = 0.001).

Table 3: Risk factors distribution among study subjects

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>City (n = 197)</th>
<th>Urban (n = 102)</th>
<th>Rural (n = 101)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (&gt;25 kg/m²)</td>
<td>110 (55.8%)</td>
<td>38 (37.2%)</td>
<td>35 (34.6%)</td>
<td>0.001</td>
</tr>
<tr>
<td>t2DM</td>
<td>110 (55.8%)</td>
<td>56 (54.9%)</td>
<td>51 (50.5%)</td>
<td>0.673</td>
</tr>
<tr>
<td>HTN</td>
<td>127 (64.5%)</td>
<td>59 (57.8%)</td>
<td>54 (53.5%)</td>
<td>0.163</td>
</tr>
<tr>
<td>Tobacco consumption</td>
<td>67 (34.0%)</td>
<td>37 (36.3%)</td>
<td>57 (56.4%)</td>
<td>0.001</td>
</tr>
<tr>
<td>F/H/O CAD</td>
<td>32 (16.2%)</td>
<td>19 (18.6%)</td>
<td>17 (16.8%)</td>
<td>0.872</td>
</tr>
<tr>
<td>Sedentary</td>
<td>141 (71.6%)</td>
<td>44 (43.1%)</td>
<td>37 (36.6%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Alcohol</td>
<td>31 (15.7%)</td>
<td>29 (28.4%)</td>
<td>39 (38.6%)</td>
<td>0.001</td>
</tr>
<tr>
<td>S-C (&gt;200 mg/dL)</td>
<td>65 (33.0%)</td>
<td>26 (25.5%)</td>
<td>21 (20.8%)</td>
<td>0.069</td>
</tr>
<tr>
<td>SLDL-C (&gt;130 mg/dL)</td>
<td>71 (36.0%)</td>
<td>37 (36.3%)</td>
<td>32 (31.7%)</td>
<td>0.721</td>
</tr>
<tr>
<td>SHDL-C (&gt;40 mg/dL)</td>
<td>123 (62.4%)</td>
<td>62 (60.8%)</td>
<td>60 (59.4%)</td>
<td>0.873</td>
</tr>
<tr>
<td>STGL (&gt;120 mg/dL)</td>
<td>69 (35.0%)</td>
<td>35 (34.3%)</td>
<td>37 (36.6%)</td>
<td>0.938</td>
</tr>
</tbody>
</table>

Risk factors of CAD in city, urban, and rural population are depicted in Table 3 and 4.

Among the risk factors, there was no significant difference between the groups in age of presentation (p = 0.744), t2DM (p = 0.673), systemic hypertension (p = 0.163), family history of CAD (p = 0.872), serum total cholesterol (S-C; p = 0.069), serum low density lipoprotein cholesterol (SLDL-C; p = 0.721), serum high density lipoprotein cholesterol (SHDL-C; p = 0.873), and serum triglycerides (p = 0.938).

Smoking was significantly more common in rural patients compared to city and urban patients (p = 0.001).
Sedentary habit was significantly more common in city patients compared to urban and rural patients (p = 0.001).
Alcohol consumption was significantly more common in rural patients compared to city and urban patients (p = 0.001).
BMI was significantly more in city patients compared to urban and rural patients (p = 0.001).

Table 4: Lipid profile in different groups

<table>
<thead>
<tr>
<th>Lipid profile</th>
<th>City (n = 197)</th>
<th>Urban (n = 102)</th>
<th>Rural (n = 101)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-C (mg/dL)</td>
<td>185.62 ± 37.93</td>
<td>182.39 ± 42.02</td>
<td>179.32 ± 27.73</td>
<td>0.364</td>
</tr>
<tr>
<td>SLDL-C (mg/dL)</td>
<td>20.39 ± 34.41</td>
<td>11.49 ± 26.16</td>
<td>11.91 ± 25.84</td>
<td>0.147</td>
</tr>
<tr>
<td>SHDL-C (mg/dL)</td>
<td>3.74 ± 7.52</td>
<td>3.67 ± 5.58</td>
<td>3.76 ± 5.45</td>
<td>0.723</td>
</tr>
<tr>
<td>STGL (mg/dL)</td>
<td>148.45 ± 69.07</td>
<td>153.25 ± 46.12</td>
<td>148.79 ± 42.30</td>
<td>0.778</td>
</tr>
</tbody>
</table>

p ≤ 0.05 is significant

S-C, serum total cholesterol; SLDL-C, serum low density lipoprotein cholesterol; SHDL-C, serum high density lipoprotein cholesterol; STGL, serum triglycerides.
Coronary angiogram pattern:

In our patients, right dominance was seen in majority of patients, 342 (85.5%), followed by left dominance in 33 (8.3%), and codominant in 25 (6.3%); there was no significant difference between the groups (p = 0.214; Table 5).

Number of vessels diseased was 1.70 ± .886 in city, 1.63 ± 1.004 in urban, and 1.47 ± .996 in rural patients, with no significant difference between the groups (p = 0.139).

Table 5: Coronary angiogram pattern among study subjects

<table>
<thead>
<tr>
<th>Angiogram pattern</th>
<th>City (n = 197)</th>
<th>Urban (n = 102)</th>
<th>Rural (n = 101)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right dominant</td>
<td>168 (85.3%)</td>
<td>93 (91.2%)</td>
<td>81 (80.2%)</td>
<td>0.214</td>
</tr>
<tr>
<td>Left dominant</td>
<td>18 (9.1%)</td>
<td>5 (4.9%)</td>
<td>10 (9.9%)</td>
<td>0.214</td>
</tr>
<tr>
<td>Codominant</td>
<td>11 (5.6%)</td>
<td>4 (3.9%)</td>
<td>10 (9.9%)</td>
<td>0.214</td>
</tr>
</tbody>
</table>

Number of diseased vessels

<table>
<thead>
<tr>
<th></th>
<th>0 (n = 45)</th>
<th>1 (n = 109)</th>
<th>2 (n = 119)</th>
<th>3 (n = 87)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>13 (6.5%)</td>
<td>77 (39.0%)</td>
<td>68 (34.5%)</td>
<td>43 (21.8%)</td>
</tr>
<tr>
<td>Urban</td>
<td>14 (13.7%)</td>
<td>35 (34.3%)</td>
<td>24 (23.5%)</td>
<td>25 (24.5%)</td>
</tr>
<tr>
<td>Rural</td>
<td>18 (17.8%)</td>
<td>37 (36.6%)</td>
<td>27 (26.7%)</td>
<td>19 (18.8%)</td>
</tr>
</tbody>
</table>

p ≈ 0.05 is significant

Discussion

In this study, the mean age of our patients (57 years) was comparable to that reported by Xavier D et al. Majority of our patients were in 51–70 years age group (63.5%), which was comparable to that observed by Xavier D et al (56.7%). Male patients in our study comprised 75.3%, comparable to that reported by Xavier D et al (76.4%).

The presence of risk factors for CHD, such as obesity (indicated by BMI ≥ 25 kg/m²) and sedentary lifestyle, was more in the city population than in the rural population, whereas smoking and alcohol beverage consumption was more common among the rural population. Other risk factors like DM, hypertension, family history of CAD, S-C ≥ 200 mg/dL, SLDL-C ≥ 130 mg/dL, HDL-C <40 mg/dL, and triglycerides ≥ 150 mg/dL was equally prevalent among the city, urban, and rural populations.

These variations may be partially explained by differences in lifestyle. Rural men and women work in agriculture, which involves heavy physical activity, whereas most urban men and women have sedentary habits.

Urban–rural epidemiological survey of CHD was conducted by Gupta and Malhotra in ethnic groups similar to those of the present study. The prevalence of the disease was almost 2.5 times more common in both sexes in the urban than in rural areas. A lesser degree of physical activity, body weight on the higher side of normal, and higher prevalence of hypertension and DM in the urban population are some of the important risk factors responsible for these differences.

Another study by Kumar R et al showed a clear gradient of increasing prevalence of CHD and the risk factors from the rural to the semi-urban to the urban population, confirming the growth of an epidemiological trend in northern India. Most of the risk factors for CHD, i.e., high blood pressure, diabetes, obesity, physical inactivity, the quantity of food consumed, and lipid parameters were significantly higher in the urban population than the rural population. However, smoking was less common in the urban areas, whereas drinking was equally prevalent among the urban and rural communities.

Socio-cultural factors that can be considered to constitute an “urban way of life” are probably playing a significant role in CHD. According to Marmot & Syme, acculturation plays an important role in causing CHD.

In England, the rates of CHD were found to be higher among the more “westernized” Indians than those with a more “traditional” approach, even after controlling for the effects of the conventional risk factors for CHD.

The presence of CHD risk factors (except for smoking and alcohol drinking) were found to be quite low in the villages. A recent review of Indian studies has concluded that the rates of CHD, hypertension, diabetes, and obesity are very low among the rural population of India, and high in many of the metropolitan cities. The lifestyle in the villages is still very traditional. For one, a vegetarian diet is the norm and not much fried food is consumed. Further, agricultural work demands strenuous physical activity, leaving little room for obesity.

Despite the fact that smoking is very common in the villages, the prevalence of CHD is lower than in the urban population. The major risk factor for CHD in the urban population is the lack of physical work and consumption of more food, both of which have resulted in a much higher level of obesity in the urban than in the rural areas. The levels of cholesterol were also significantly higher in urban areas. Obesity leads to insulin resistance and makes a person more prone to diabetes, glucose intolerance, and hypertension. Insulin resistance has been demonstrated among overweight individuals even in rural areas. The risk factors for hypertension, such as obesity, as well as its prevalence, have nearly doubled among the urban population of Chandigarh in the last 30 years.

Diet and activity patterns are more involved than smoking in the etiology of the higher prevalence of CHD among the urban population of northern India. It appears that the urban lifestyle is conducive to the manifestation of the metabolic syndrome in Indians, as reported by McKeigue among South Asians living in London. Hence, retaining the traditional way of life is advisable in order to prevent the emergence of a CHD epidemic in the developing countries.
Coronary artery disease risk factors like sedentary lifestyle and obesity are more common in city population, whereas smoking and alcohol beverage consumption is more common in rural population. Primordial and primary prevention should focus on modifying these risk factors.

References

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