



Relationship Between Coronary Artery Lesion and Risk Factors Studied in Two Cardiac Centers in India

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Abstract

Background

Coronary artery disease (CAD) accounts for high morbidity and mortality worldwide. It is important to identify the localisation of coronary atherosclerotic lesions as well as the risk factors in patients with CAD. The present study aimed to identify the pattern of coronary artery lesions and the associated risk factors in patients with suspected or known CAD.

Methodology

Overall, 302 consecutive patients with suspected or known CAD who were referred for coronary angiography between March and May 2012 in two cardiac centers in India was studied. Coronary lesions with 50% stenosis in the coronary arteries were considered as significant lesion. Associated cardiovascular risk factors, namely, hypertension, diabetes mellitus, dyslipidemia, smoking, family history and male sex, were identified.

Result

Of the 302 patients, 235 (77.8%) had at least one coronary lesion, with 224 (95.3%) of them having at least one risk factor. The lesions were significantly more common in males than in

females ($p = 0.026$). Middle-aged patients have higher number of risk factors for CAD as well as coronary lesions than patients belonging to other age groups. Multiple risk factors are significantly associated with multi-vessel lesions ($p = 0.035$). Hypertension, diabetes mellitus and smoking were significantly associated with left anterior descending artery lesion ($p = 0.03, 0.004$ and 0.01 , respectively) and right coronary artery lesion ($p = 0.04, 0.01$ and 0.003 , respectively).

Conclusion

Coronary lesions were significantly more common in males than in females. Multiple risk factors are significantly associated with multi-vessel lesions. Aggressive prevention/control of such risk factors will therefore help to reduce the disease burden.

Keywords

- Coronary angiography
- Coronary lesions
- Risk factors

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■ Introduction

Coronary artery disease (CAD) accounts for high morbidity and mortality worldwide. This scourge has particularly reached an alarming level in India, with a rapidly rising burden of the disease.¹ The surge in the prevalence of CAD has been largely due to the paradigm shift in lifestyle, particularly changes in dietary pattern, increasing prevalence of central obesity, increased tobacco smoking and physical inactivity.^{2,3}

The survey-reported prevalence of CAD in adults in India has increased four-fold over the last 40 years.⁴ Studies indicate that Indians have 3–4 times higher risk of CAD than white Americans, 6 times higher risk than the Chinese and 20 times higher risk than the Japanese.^{5–7}

Localization of coronary atherosclerotic lesions is important as well as the risk factors in patients with CAD. This study aimed to identify the pattern of coronary artery lesions and the associated risk factors in individuals with suspected or known CAD.

■ Methodology

This is a longitudinal, observational study of patients with coronary angiography between March and May 2012 visiting two cardiac centers in India. All patients were administered with a structured questionnaire and had undergone coronary angiographic evaluation for CAD. Coronary lesions with 50% stenosis in the coronary arteries were considered as significant lesion.^{8,9} Associated cardiovascular risk factors, namely, hypertension, diabetes mellitus, dyslipidemia, smoking, family history and male sex were identified. Results were analysed using SPSS statistical analyses package.

■ Result

The study included 302 patients, with 221 (73.2%) males and 81 (26.8%) females. The age range was 25–90 years, with a mean age of 58.82 ± 10.852 years. Summary of frequency distribution of age range of patients is shown in Table 1.

Table 1: Frequency distribution of age range of the patients

Age range (years)	Frequency	Percentage (%)
25–44	27	8.9
45–64	185	61.3
65	90	29.8

Summary of the risk factors and age distribution is shown in Table 2. The risk factors are more common in middle-aged and elderly patients. Overall, 217 (71.8%) patients had hypertension, 159 (52.6%) had diabetes mellitus, 93 (30.8%) had dyslipidemia, 106 (35.1%) had a positive smoking history and 74 (24.5%) had positive family history. A total of 20 (6.6%) patients had no documented risk factor, 67 (22.2%) had single risk factor and 215 (71.2%) had multiple risk factors.

Table 2: Risk factors and age distribution

Risk factors	20–44 years N (%)	45–64 years N (%)	65 years N (%)	Total
Hypertension	17 (7.8)	125 (57.6)	75 (34.6)	217
Diabetes mellitus	7 (4.4)	98 (61.6)	54 (34.4)	159
Dyslipidemia	10 (10.8)	60 (64.5)	23 (24.7)	93
Smoking	17 (16.0)	65 (61.3)	24 (22.7)	106
Family history	8 (10.8)	50 (67.6)	16 (21.6)	74

Values are N (% within risk factors)

Of the 302 patients, 67 (22.2%) had normal coronary angiography, 75 (24.8%) had single vessel disease (SVD), 80 (26.5%) had double vessel disease (DVD) and 80 (26.5%) had triple vessel disease (TVD). Table 3 shows the pattern of coronary vessel disease and age distribution. SVD, DVD and TVD are more common in middle-aged patients than in the young and elderly.

Table 3: Pattern of vessel disease and age distribution

Pattern of vessel disease	20–44 years (%)	45–64 years (%)	65 years (%)	Total
SVD	6 (8)	48 (64)	21 (28.0)	75
DVD	3 (3.8)	48 (60.0)	29 (32.2)	80
TVD	4 (5.0)	52 (65.0)	24 (30.0)	80
Total	13	148	74	235 (100%)

Values are N (% within pattern of vessel); SVD, single vessel disease; DVD, double vessel disease; TVD, triple vessel disease

Left main CAD was found in 17 (5.6%) patients, left anterior descending artery (LAD) lesion in 193 (63.9%), left circumflex artery lesion in 120 (39.7%) and right coronary artery lesion in 153 (50.7%).

Of the patients with LAD lesion, 123 (63.7%) had proximal LAD lesion, 65 (21.5%) had mid LAD lesion and 5 (1.7%) had distal lesion. Sex distribution of patients with CAD is summarised in Table 4. The burden and distribution of vessel diseases are significantly higher in men than in women.

Table 4: Pattern of vessel disease and sex

Pattern of vessel disease	Men N (%)	Women N (%)	Total
SVD	50 (66.7)	25 (33.3)	75
DVD	65 (81.2)	15 (18.8)	80
TVD	67 (83.8)	13 (16.2)	80
Total	182	53	235

Values are N (% within pattern of vessel). $p = 0.026$ [Sig(2-Tailed)]; SVD, single vessel disease; DVD, double vessel disease; TVD, triple vessel disease

Table 5 shows the relationship between risk factors and the pattern of vessel diseases in the patients. Multiple risk factors predispose to the development of coronary artery lesions. Table 6 shows the relationship between risk factors and LAD lesions.

Table 5: Correlation between pattern of vessel disease and risk factors

Pattern of vessel disease	No risk factors N (%)	Single risk factor N (%)	Multiple risk factors N (%)	Total
SVD	6 (8)	17 (22.7)	52 (69.3)	75
DVD	5 (6.2)	17 (21.2)	58 (72.5)	80
TVD	0 (0)	12 (15)	68 (85)	80
Total	11	46	178	235

Values are N (% within pattern of vessel). $p = 0.035$; SVD, single vessel disease; DVD, double vessel disease; TVD, triple vessel disease

Table 6: Risk factors and LAD lesion distribution

Risk factors	Proximal LAD N (%)	Mid LAD	Distal LAD	Total	Sig 1-sided
Hypertension	98 (67.1)	46 (31.5)	2 (1.4)	146	0.04
Diabetes mellitus	71 (62.8)	40 (35.4)	2 (1.8)	113	0.03
Dyslipidemia	42 (73.7)	15 (21.0)	2 (5.3)	59	0.06
Smoking	43 (58.9)	30 (41.1)	0 (0)	39	0.03
Family history	24 (54.5)	18 (40.9)	2 (4.5)	44	0.13

Values are N (% within risk factors)

■ Discussion

The study population shows a very high prevalence of multiple risk factors for CAD, with a corresponding high prevalence of multi-vessel CAD, which is consistent with the global trend.^{8,10}

There is an alarming increase in the risk factors for CAD in India.¹² This increase is largely driven by rapid urbanisation and drastic lifestyle change, particularly in dietary pattern favoring increased consumption of salty meal, simple carbohydrate and saturated fats as well as increased tobacco smoking (including increased passive smoking) and physical inactivity. These factors result in

increasing prevalence of central obesity, dyslipidemia, diabetes mellitus and hypertension.^{4,5,11 12}

Our findings are consistent with those of the INTERHEART study, which show a very close relationship between conventional risk factors and CAD globally, irrespective of the sex and age of patients.¹³ Risk factors are major drivers of CAD, and each increase in the number of risk factors has a multiplier rather than additive effect on patients' morbidity profile.^{6,14} This trend is vividly evident in our study, where multiple risk factors were shown to be significantly associated with DVD and TVD. Aggressive prevention/control of such risk factors will aid in reducing the disease burden.

Our study revealed that conventional risk factors not only predispose to multi-vessel disease but also tend to cause a more devastating disease when LAD is involved, affecting the proximal portion of the artery more than the distal. The area of necrosis is thus wider in patients with traditional risk factors. Proximal LAD occlusion leads to a high morbidity and mortality rate.¹⁴ This may explain why near-fatal cases occur when these risk factors are present in lesions involving LAD.

It must, however, be mentioned that a few of the patients in our study did not have any risk factor. Eight (8%) and six (6.2%) patients with SVD and DVD, respectively, did not have any of the risk factors assessed in our study. This may be due to the impact of newer, non-traditional risk factors in these patients. Non-traditional risk factors, such as elevated C-reactive protein levels, homocysteinemia, chronic inflammation, influenza virus infection, periodontitis, elevated lipoprotein(a) levels and environmental pollutions, may contribute to the development of CAD.¹⁰ Indeed, comparative studies on newer risk factors show that Indians have higher C-reactive protein, plasminogen activator inhibitor-1 and homocysteine levels.¹⁵ However, all patients with TVD had at least one traditional risk factor.

CAD was significantly more common in men than in women in this study, which is consistent with the global trend.^{16,17} This may be due to multifactorial reasons. Cardiovascular disease develops 7–10 years later in women than in men.¹⁶ One of the reasons for this is the effect of oestrogen before menopause. There is a strong assumption that high levels of endogenous oestrogens before menopause delays the manifestation of atherosclerotic disease in women, and this is corroborated by the Women's Ischemia Syndrome Evaluation (WISE) study, which revealed that young women with endogenous oestrogen deficiency have a more than seven-fold increase in coronary artery risk.¹⁸ Oestrogens have a regulating effect on several factors, such as lipids, inflammatory markers, vascular reactivity, insulin sensitivity and the

coagulation system.^{19,20} Another reason is that unhealthy habits, such as smoking, heavy alcohol consumption, increased red meat intake with little or no fruits and vegetables, are more likely acceptable in men than in women, thereby increasing the risk of CAD in men.¹⁷

Furthermore, our study reveals that middle-aged patients have more risk factors for CAD and more coronary lesions than those of other age groups. Similar findings have been reported by other investigators.^{6,12,13} This should be a cause of concern because they form the bulk of the workforce and they are in their most productive age. The sad reality is that the most productive ages of the patient's life are lost fighting the disease instead of contributing to the growth of the country. The ripple effect is the burden and distraction this confers on the immediate family as they take out time and energy to care for a loved one affected by the disease. The result is that not only is the affected individual unproductive or sub-optimally productive, family members and those actively or remotely caring for the patient are also sub-optimally productive. The socioeconomic impact of such trend can only be devastating, with loss of manpower, productive hours and ultimately financial retrogression.

The World Health Organization has estimated that India lost 9 billion USD in national income from premature deaths due to heart disease, stroke and diabetes in the year 2005 alone.²¹ Many studies have highlighted the grave socioeconomic losses associated with CAD, and these are expected to cumulatively increase over the years.²²⁻²⁴ They highlight the need for aggressive strategies for the prevention and control of CAD globally, including India, as this will help block leakages from this ravaging scourge. Furthermore, this should be a wake-up call for healthcare providers and policy makers in the country because the conventional risk factors for CAD are potentially modifiable and are good starting point for its prevention.^{10,25}

A major limitation of the study is that this is a hospital-based study; therefore, it may not be a true representation of the trend in the community. However, many community studies point to this trend,^{11,12,26} so the study may just be a reflection of what entails in the community. Additionally, we did not look at obesity as a risk factor, which is quite rampant in India, because some of the patients were too ill to have their body mass index assessed.

■ Conclusion

Multiple risk factors are significantly associated with multi-vessel lesions. Patient as well as population-based multifactorial interventions requiring combined educational, behavioral, medical and policy approaches are needed to reduce the disease burden because the conventional risk factors for CAD are potentially modifiable and are good starting points for its prevention.

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