

Cardiovascular risk factors, socioeconomic determinants and angiographic severity of coronary artery disease in patients awaiting coronary artery bypass graft in a provincial hospital Sri Lanka

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ABSTRACT

Introduction: The age-standardized death rate of coronary heart disease has shown a downward trend in many developed countries while an upward trend has been seen in developing countries with demographic changes, urbanization, and lifestyle changes. The aims of our study were to study the prevalence of cardiovascular risk factors (CVRFs), socioeconomic determinants and explore the relationship between CVRFs and angiographic severity of coronary artery disease (CAD) in a cohort of patients awaiting coronary artery bypass graft (CABG).

Methods: It was a cross-sectional descriptive study. One hundred and forty one consecutive male patients with angiographically diagnosed CAD were selected. We examined the relationship between traditional CVRFs and atherosclerotic burden assessed by different vessel scores.

Results: Mean (SD) age of the subjects was 56 (8) years. The prevalence of CVRFs was high in the study group. Majority of them were in the lower socioeconomic status (SES). The analysis indicated that there were no significant correlations or a significant predictive value of CVRFs with the severity of CAD.

Conclusions: Severity of coronary artery disease estimated by angiographic scores appears to correlate poorly with established traditional cardiovascular risk factors.

Key words: Cardiovascular risk factors, Socioeconomic determinants, Angiographic severity of coronary artery disease.

Introduction

The age-standardized death rate of coronary heart disease has shown a downward trend in many developed countries while an upward trend has been seen in developing countries such as Sri Lanka with demographic changes, urbanization, and lifestyle changes (1,2). Coronary artery disease (CAD) is one of the leading causes of mortality in men. Traditional cardiovascular risk factors (CVRFs) such as advancing age, diabetes mellitus, hypertension, dyslipidaemia, smoking, obesity, and family history

of CAD are well recognized for their association as risk factors with CAD (3). However, the correlation between CVRFs and atherosclerotic burden, assessed angiographically is not as well established, reporting variable and inconsistent results (4-11).

The aims of our study were to characterize socioeconomic determinants, CVRFs and explore the relationship between CVRFs and angiographic severity of CAD in a cohort of patients awaiting coronary artery bypass graft.

Methods

This cross sectional descriptive study investigated 141 consecutive male patients (age 35-76 years) with angiographically diagnosed CAD, awaiting CABG in the Cardiothoracic Unit, Teaching Hospital Karapitiya, Sri Lanka.

An interviewer-administered questionnaire was used in the collection of data. The following information was gathered during the interview and examination: socio-demographic data, presence of traditional cardiovascular risk factors. The socioeconomic status (SES) was defined by occupational position, education and income according to the Barker & Hall guidelines (12).

All baseline anthropometric measurements were estimated by the same investigator, using same instruments. Height was measured following standard technique by a portable stadiometer (IUCHI, Yamato Scientific, Japan) with the precision of ± 0.1 cm and readability up to 200 cm. Weight was measured using a portable beam balance (Bauman, Germany) with the precision of ± 0.1 kg and readability up to 100 kg. Waist circumference was measured to the nearest 0.1 cm according to the standard technique using a non-stretchable measuring tape. Mean of the two readings (three times if difference between readings was ≥ 0.5 cm) was taken as the final measurement. Body mass index (BMI) was calculated.

The interpretation and grades of luminal narrowing were determined according to the consensus opinion of two separately read angiography reports by interventional cardiologists who were blinded for the characteristics of the patients. Three methods were employed in the assessment of the severity of the CAD; Gensini score (13), Leaman score (14), vessel score (15).

This clinical protocol was approved by the Ethical Review Committee of Faculty of Medicine, University of Ruhuna, Galle, Sri Lanka and conducted according to the ethical guidelines outlined in the Declaration of Helsinki. Permission from the respective hospital authorities was obtained. Informed written consent was given by all the participants.

Data were analyzed using Minitab version 15. Results were expressed as mean (standard deviation), percentages or frequencies. Statistical significance was defined when P value was < 0.05 . Coronary vessel score was divided into four groups

as zero, one, two and three-vessel disease. Gensini and Leaman scores were categorized into four categories according to the quartiles ranges. Ordinal logistic regression analysis was performed to determine the predictors of the extent of CAD (on the scale three scores used).

Results

A total of 141 male patients with CAD were included. Mean (SD) age of subjects was 56 (8) years (range: 35-76 years). Table 1 shows the prevalence of cardiovascular risk factors, demographic and socioeconomic characteristics of the patients. Body mass index (BMI) ranged from 17.8 kgm^{-2} to 38 kgm^{-2} and the mean (SD) was $24(3) \text{ kgm}^{-2}$. Majority of patients (66.7%) were within the normal BMI limits and only 31.9% were in the overweight and obesity groups, according to the WHO criteria (16). The prevalence of overweight and obesity (60.2%) was higher with the use of lower cut off values ($\geq 23 \text{ kgm}^{-2}$ as over weight) defined for the Asian populations by International Association for the Study of Obesity (IASO), and the International Obesity Task Force (IOTF) (17).

Table 1: Basic clinical, demographic and socioeconomic characteristics (n=141)

Characteristics	Mean (SD) or n (%)
Age (years)	56 \pm 8
BMI (kgm^{-2})	24 \pm 3
Obesity (BMI $>30 \text{ kgm}^{-2}$)	5 (3.6 %)
Diabetes mellitus	56 (39.7 %)
Dyslipidaemia	50 (35.5 %)
Hypertension	67 (47.5 %)
Smoking	105 (74.5 %)
Alcohol intake	107 (75.9 %)
Statin treatment	136 (96.4 %)
Social classes	
Class 1	10 (7.1 %)
Class 2	36 (25.5 %)
Class 3	37 (26.2 %)
Class 4	41 (29.1 %)
Class 5	17 (12.1 %)

A/L = Advanced level examination. O/L = Ordinary level examination.

Waist circumference varied from 70.2 cm to 115.5 cm with a mean and SD of 87.1 and 7.6 cm. Minority of the patients (17.7%) had a waist circumference above the cut off value defined for males (≥ 94 cm), that indicates the central obesity by the WHO criteria, but when Asian population specific cutoff values for WC (≥ 90 cm) was used it rose to 28.3%.

The vessel score varied from zero to three, Gensini score ranged from zero to 166 and Leaman score varied from zero to 35. Table 2 indicates the severity categories according to the three scores and the percentage of patients in each category. The other tables (Table 3, 4, 5) demonstrate the significant values, odd ratios and the relevant confidence intervals for each predictor variables considered for atherosclerotic burden categories following ordinal logistic regression. The results reflected that the traditional cardiovascular risk factors were not independent predictors of severity of CAD.

Table 2: Angiographic characteristics of the study cohort (n=141)

Angiographic findings	Number (%)
Vessel score categories	
Minor vessel disease (zero)	2 (1.4 %)
One vessel disease	8 (5.7 %)
Two vessel disease	29 (20.6 %)
Three vessel disease	12 (72.3 %)
Gensini score quartiles	
0 - 50	36 (25.5 %)
> 50 - 72	37 (26.2 %)
> 72 - 98.5	33 (23.4 %)
> 98.5 - 166	35 (24.8 %)
Leaman score quartiles	
0 - 9.5	36 (25.5 %)
> 9.5 - 15	36 (25.5 %)
> 15 - 20	37 (26.2 %)
> 20 - 35	32 (22.7 %)

Table 3: Predictors of atherosclerotic burden assessed by Gensini score among patients with CAD (n=141)

	Odd ratio	95 % CI for β	P value
Age (1- year increase)	0.99	0.96 - 1.03	0.666
Obesity (BMI >30 kgm ⁻²)	0.67	0.13 - 3.52	0.637
Diabetes mellitus	1.37	0.74 - 2.54	0.312
Hypertension	0.45	0.24 - 0.84	0.012
Smoking	1.40	0.67 - 2.92	0.369
Alcohol intake	0.90	0.43 - 1.89	0.782
Dyslipidaemia	1.28	0.67 - 2.47	0.451

Results of the ordinal logistic regression analysis are given as odd ratio (OR) and confidence intervals (CI).

Table 4: Predictors of atherosclerotic burden assessed by Leaman score among patients with CAD (n=141)

	Odd ratio	95 % CI for β	P value
Age (1-year increase)	0.98	0.95 - 1.02	0.311
Obesity (BMI >30 kgm ⁻²)	0.37	0.07 - 2.01	0.251
Diabetes mellitus	1.21	0.66 - 2.23	0.541
Hypertension	0.62	0.33 - 1.15	0.126
Smoking	0.98	0.47 - 2.05	0.966
Alcohol intake	0.84	0.40 - 1.77	0.654
Dyslipidaemia	0.93	0.49 - 1.79	0.835

Results of the ordinal logistic regression analysis are given as odd ratio (OR) and confidence intervals.

Table 5: Predictors of atherosclerotic burden assessed by vessel score among patients with CAD (n=141)

	Odd ratio	95 % CI for β	P value
Age (1 year increase)	1.01	0.97 - 1.06	0.598
Obesity (BMI >30 kgm ⁻²)	0.70	0.07 - 7.28	0.765
Diabetes mellitus	0.37	0.16 - 0.86	0.020
Hypertension	0.81	0.37 - 1.78	0.606
Smoking	1.62	0.66 - 3.96	0.289
Alcohol intake	1.70	0.64 - 4.53	0.284
Dyslipidaemia	0.54	0.22 - 1.28	0.161

Results of the ordinal logistic regression analysis are given as odd ratio (OR) and confidence intervals.

Discussion

Our findings suggest that majority of patients with CAD undergoing coronary artery bypass graft in a local provincial hospital belongs to lower socioeconomic classes. Prevalence of traditional risk factors was high among these patients. The anthropometric parameters did not appear to predict the atherosclerotic burden assessed by angiogram based tools. Diabetes mellitus was found to be an independent predictor of the atherosclerotic burden estimated by the vessel score, but OR was less than 1. Hypertension seemed to be an independent predictor of the severity of CAD assessed by the Gensini score with a low odds ratio. Therefore none of the traditional risk factors emerged as a meaningful independent predictor of atherosclerotic burden. The associations of CVRFs with coronary atherosclerotic burden have been variable and inconsistencies exist. Few have shown positive associations, while others have reported equivocal or even negative associations (4-11, 18).

Wang *et al.* found that the total amount of lifetime smoking and total cholesterol/ HDL-cholesterol was associated with the severity of coronary artery disease (4). Phillips *et al.*, showed that in men selected for coronary arteriography; age and HDL-cholesterol might be stronger predictors of the degree of CAD than were blood pressure, cholesterol, diabetes, smoking, and BMI (5). Vlietstra *et al.* concluded that some risk factors were associated with the presence of disease and also with

the extent of the CAD, but other factors appeared to influence only to the onset of the disease (6). Anderson *et al.* also showed a variable relationship between cardiovascular risk factors and the extent of coronary artery disease (7). According to Hasin *et al.* the most important contributory factors to the severity of atherosclerosis were the duration of clinical history, number of previous myocardial infarctions, and male sex, but more specifically elevation of serum cholesterol and diabetes mellitus. Cigarette smoking, obesity, hypertension, a family history of atherosclerosis, and elevated serum triglycerides had a positive influence, but this was not statistically significant (8). Krishna Swami *et al.*, revealed that although strong associations exist between risk factors and the occurrence of CAD, the small quantitative association detected between the presence of risk factors and the severity of disease was weak (9). Opherk *et al.*, found a significant correlation between the degree of atherosclerotic lesions and hypertriglyceridaemia, hypercholesterolaemia as well as smoking habits. No correlation between other risk factors, such as hypertension, diabetes mellitus, hyperuricaemia, obesity, and the coronary score was observed (10). Guo *et al.*, demonstrated high low-density lipoprotein as a prominent predictor of the extent and severity of angiographic CAD (11). Nicholls *et al.* showed male gender, diabetes mellitus, and a history of prior revascularization were as strong independent predictors of atherosclerotic burden in coronary disease patients. However many risk

factors did not predict angiographic disease severity, suggesting different mechanisms drive stenosis development and atheroma accumulation (19).

Similarly, in a study involving younger patients (mean age 56 years) to determine the relationship between CVRFs and the extent of CAD, only a few risk factors (diabetes and male sex) correlated with intravascular ultrasonography (IVUS) measured coronary atheroma burden; none of these risk factors correlated with "luminal" severity assessed through coronary angiography, suggesting that different mechanisms drive stenosis development and atheroma accumulation (18).

Hypercholesterolaemia has been reported as an independent risk factor for severity of coronary artery disease (8,10). In the present study, a trend of dyslipidaemia and higher prevalence of statin use were observed, but dyslipidemia was not a predictor of the extent of obstructive CAD burden. Similarly, a lack of association between lipids and atheroma burden, as estimated by IVUS in a recent study, prompted the speculation of other factors such as inflammation and genetic susceptibility may predict cardiovascular outcomes in the setting of dyslipidaemia (18).

In conclusion, the patients who were admitted for coronary artery bypass graft in a state local provincial hospital were mainly in the lower socioeconomic status. The conventional cardiovascular risk factors were not able to predict the severity of coronary artery disease estimated by coronary angiography based scores, although they were considerably prevalent.

The limitations we encountered were the missing of patients who were being treated at the private sector hospitals who may be included in the higher SES. The study was confined to men and need to be expanded to women.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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