Prevalence of coronary artery calcium among asymptomatic men and women in a developing country: Comparison with the USA data

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Abstract

Background: Coronary artery calcium score (CACS) correlates with atherosclerotic burden and predicts cardiac events. Most of the published data have been derived from the USA population.
Objective: To study the prevalence of coronary calcium in an asymptomatic population from the eastern Mediterranean region and compare it to data obtained from a large population study in the USA.
Results: A total of 1154 asymptomatic men and women from Lebanon underwent EBCT screening because of the presence of one or more CAD risk factors. Mean CACS as well as the percentile cut-points increased consistently with increasing age and, except for those above 74 years of age, were higher in men than women in each age stratum. Age, hypercholesterolemia, diabetes and smoking showed significant associations with CACS in men, while only age and hypercholesterolemia were significantly associated with CACS in women. Among men, the 75th and 90th percentile distributions were comparable to what is observed in developed countries such as the USA.
Conclusion: Findings, from this first study in the region, suggest that despite a higher rate of diabetes and smokers in our study population, the CACS distribution in Lebanon is similar to that observed in the USA.
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1. Introduction

Calcium deposition in atherosclerotic coronary plaques has been documented in several pathological studies [1–3]. The extent of coronary artery calcium (CAC), as a marker of coronary atherosclerosis, can be measured using electron beam computed tomography (EBCT) [4–9]. Studies have shown that CAC as measured by EBCT correlates with the burden of atherosclerosis [9] and with the presence of angiographically determined coronary artery disease [8,10].

Other studies have also shown that CAC scores (CACS) can predict coronary obstruction and subsequent cardiac events in asymptomatic and symptomatic patients [11–13]. Consequently, age and gender-specific CACS percentiles derived from large population-based studies are vital in clinical decision making on subsequent referral for further imaging modalities [14].

While there is increasing evidence that the prevalence of CAC is affected by classical coronary artery disease (CAD) risk factors such as age, gender, hypertension, smoking, diabetes and cholesterol [15–17], recent studies suggest that, in spite of the higher CAD mortality rate in blacks, coronary calcium does not vary significantly by race or ethnicity [18,19]. The question remains, however, whether such results

apply to other ethnic groups in settings other than the USA where most of the studies have been conducted. We report in this paper the prevalence of CAC in 1154 asymptomatic men and women in Lebanon, a small country (total population 3.4 million) in the eastern Mediterranean region and we compare our CACS percentiles to data derived from a large population-based cohort of adults in the USA [14].

2. Methods

2.1. Study subjects

Between June 2002 and January 2004, a total of 1154 asymptomatic subjects (938 men and 216 women) underwent EBCT screening because of the presence of one or more CAD risk factors. Prior to the screening, all subjects completed a questionnaire soliciting information regarding demographics, CAD risk factors, medical history and medications taken. CAD risk factors included current use of cigarettes, family history of CAD, diabetes, hypercholesterolemia, hypertriglceridemia, hypertension, and obesity. Family history of CAD was defined as a history of myocardial infarction, angioplasty or stent placement, coronary artery bypass grafting (CABG), or sudden cardiac death in a parent, grandparent or sibling at <65 years of age. Hypercholesterolemia was defined as a high cholesterol level of >200 mg/dl as reported by the patient or by the intake of lipid lowering medications. Subjects were considered hypertriglyceridemic if a triglycerides level >180 mg/dl was reported or if they were on fibrates therapy. Patients reporting high blood pressure readings or the use of antihypertensive medications were classified as hypertensive. All patients were asked about their daily intake of aspirin. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared, and obesity was defined, according to the WHO criteria [20], as BMI $\geq 30\,kg/m^2$.

2.2. Electron beam tomography imaging procedures

EBCT was performed at the Consulting Clinics Beirut, Lebanon, using an Imatron C 300 EBCT scanner (Imatron Inc., California). A total of around 40 transaxial 3-mm thick slices were obtained starting at the level of the carina and proceeding to the level of the diaphragm. Images were acquired with 100 ms scan time and were ECG-triggered at 40% of the R–R interval. Quantitative calcium scores were determined according to the method described by Agatston [21]. All CACS were analyzed by an experienced physician.

2.3. Statistical analysis

Frequencies, means and standard deviation (S.D.) were used to describe the baseline characteristics of the study sample. For comparison with published literature, subjects were divided according to gender and then into nine mutually exclusive age categories (<40, 40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74 and >74 years old). Descriptive statistics were calculated for CACS and results were expressed as mean (±S.D.) and percentiles (25th, 50th, 75th and 90th). Multiple linear stepwise regressions were carried with CACS as the dependent variable and baseline CAD risk factors as independent variables. These included age, hypertriglceridemia, hypercholesterolemia, hypertension, diabetes, smoking, BMI and family history of CAD. To account for the non-normal distribution of the total CACS, transformation was made using a log conversion $[\log_{10}(x+1)]$ [22]. Variables entered and remaining in the model required an alpha value of 0.05 and 0.10, respectively. All analysis was conducted stratified by gender. The Statistical Package for the Social Sciences (SPSS 12.0) was used for all computations (SPSS, Inc.). A *p*-value <0.05 was considered significant.

3. Results

The study population consisted mainly of men (81%) with an age ranging between 26 and 80 years (mean 51.8 years, S.D. 10.6 for men; mean 53.4 years, S.D. 10.8 for women). Baseline CAD risk factors are listed in Table 1 for men and women separately. Compared to women, men were more likely to report hypertriglyceridemia (10.0% versus 3.7%), a higher intake of aspirin (28.8% versus 16.2%), and to suffer more from obesity defined as a BMI > 30 kg/m² (26.8% versus 17.2%). The prevalence of other CAD risk factors did not vary significantly between the two genders. Table 2 provides the size of study population, mean and standard deviation as well as the total CACS cut-off points for the 25th, 50th, 75th and 90th percentiles for each age stratum among men and women, respectively. Mean CACS as well as the percentile cut-points increased consistently with increasing age and, except for those above 74 years of age, were higher in men than women in each age stratum.

Results of the multivariate linear regression analysis are shown in Table 3. Age and cholesterol level were significantly associated with CACS in both men and women (*p* < 0.05).

Table 1
Baseline demographic characteristics of study population

Characteristics	Men ($n = 938$)	Women ($n = 216$)
Mean age ± S.D. (years)	51.8 ± 10.6	53.4 ± 10.8
Hypertriglyceridemia (%)	10.0	3.7
Hypercholesterolemia (%)	45.6	46.3
Hypertension (%)	25.8	28.7
Diabetes mellitus history (%)	9.9	8.3
Smoking (%)	44.1	45.4
Intake of aspirin (%)	28.8	16.2
BMI (>30 kg/m²)	26.8	17.2
Family history of CAD	40.0	49.1