IS COMMON CAROTID INTIMA MEDIA THICKNESS AN INDEPENDENT PREDICTOR FOR CORONARY ARTERY DISEASE?

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ABSTRACT

Introduction: Non-invasive measurement of carotid intima media thickness (IMT) has been noted as a marker for atherosclerosis and can serve as a predictor of cardiovascular events. This study investigates the relationship between carotid IMT and coronary artery disease (CAD).

Method: This is a descriptive, analytical cross-sectional study of 300 individuals referring to Isfahan Cardiovascular Research Center (ICRC). Following history taking, clinical examinations, and measurement of body weight and height, the subjects' lipid profile and fasting blood sugar (FBS) were evaluated. The subjects were divided into two groups according to CAD risk factors. The two groups were adjusted based on coronary disease risk factors. Maximum common carotid IMT was measured via B-mode ultrasonography in all subjects. Those with atherosclerotic plaques were excluded from the study. Collected data were statistically analyzed by SPSS[10].

Results: 65% of the subjects were male and 35% were female. They had a mean age of 50.72 years. 130 subjects (43%) were placed in the CAD group and 170 (56.7%) in the non-CAD group. There was no significant difference between the two groups in respect of risk factors such as age, total cholesterol, cigarette smoking, body mass index (BMI), hypertension, HDL-C, and LDL-C. Common carotid IMT was evaluated in the two groups. Mean IMT of the CAD group was found to be 0.8 millimeters more than that of the non-CAD group (P<0.05).

Discussion: Different studies have shown varying relationships between carotid IMT and CAD. Based on the results of this study and in view of the safety and simplicity of ultrasonographic carotid IMT measurement, IMT can be used as a predictor of atherosclerosis in coronary arteries.

Keywords: Intima-media, Carotid, Coronary Artery Disease (CAD), Ultrasonography

INTRODUCTION

Much attention has been focused today on common carotid Intima Media Thickness (IMT) as a marker of atherosclerotic diseases and a tool for gauging the effectiveness of atherosclerosis treatment [1]. Non-invasive techniques such as B-mode ultrasonography can directly evaluate carotid IMT Increased IMT in carotid arteries is suggestive of a histological IMT [2, 3].

Increased IMT in carotid arteries is suggestive of a generalized increase in IMT, or local atherosclerotic changes (plaque formation), which maybe due to aging [4, 5].

Various studies have shown that IMT increases mm/year in known cases of cardiovascular disease (CVD) [6]. Hence IMT increase can be regarded as a marker of generalized atherosclerosis and atherosclerosis of coronary arteries [7, 8]. On the other hand, IMT is related to coronary risk factors such as age, smoking, hypertension, and LDL-C [9-11]. In a number of recent studies, cholesterol lowering medications led to decrease in IMT [12-15].

These studies suggest that IMT is of high value as a marker of atherosclerosis. There have also been studies on the relationship between CAD and ultrasonographic variables with mixed results on how carotid IMT relates to CAD [16-19].

In a study of extracranial carotid in 280 people, it was found that progression of atherosclerosis in the carotid is more marked in people with higher risk of

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CVD, [20] although other observational studies and clinical trials have not shown a clear relationship between carotid IMT and CAD [20,21].

Individuals with atherosclerotic coronary arteries remain symptom-free for decades and the first manifestation of disease may be overwhelming, if not fatal, hence non-invasive ultrasonographic measurement of IMT can be of great value in screening for patients. Preventing atherosclerosis and its progression remains a central goal in medicine [22].

In view of the high prevalence of CVD in the society and the fact that simple methods such as IMT measurement may detect atherosclerosis in its nascence and help prevent fatal events; this study was designed to assess the value of carotid IMT in predicting the risk of CAD. The objective of this study is to evaluate coronary atherosclerosis in subjects and measure their common carotid IMT, and to assess the relationship between the two parameters.

MATERIALS

This descriptive, analytical, cross-sectional study involved 300 patients referring to Isfahan Cardio-vascular Research Center (ICRC). The objectives of the study were explained to the patients and their written consent was obtained before including them in the study. All of the patients underwent clinical examinations, including blood pressure measurement with the standard method, cardiovascular examinations, and measurement of height and weight. Biochemical tests including FBS, total cholesterol, triglyceride, high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) were performed for the patients. The subjects were divided into two groups: with CAD (herein referred to as the CAD group), and without CAD (herein referred to as the non- CAD group).

By definition, CAD patients were those who had Suffered from AMI during the last six months and had a positive coronary artery angiography (>75% narrowing of at least one coronary artery) or had undergone coronary artery bypass graft surgery (CABG) or coronary angioplasty.

Subjects with no clinical evidence of coronary artery involvement (i.e. showing no signs of ischemia in exercise test or in their electrocardiogram, or having normal angiograms) were entered in the non-CAD group.

All of the subjects underwent carotid ultrasonography using a *Wing Med* device and 7.5 MHz probe. The procedure was performed by a cardiologist, with the subjects in supine position and neck extension (where carotid arteries are superficial).

Initially, common carotid cross-sections on the two sides were examined from the lower end of the neck to the mandibular angle using real time imaging. Subjects with atherosclerotic plaques or marked lesions were excluded, and those with no marked plaques were included in the study.

Using duplex ultrasonography and B-mode imaging, carotid arteries on the two sides were longitudinally studied and IMT (distance between intimia-lumen interface and media-adventitia interface) was measured on the two sides at 4 different sites. Maximum IMT in the left or right common carotid arteries was entered in data collection forms as the independent variable to be investigated. Detection of plaques or lesion in longitudinal B-mode images of carotid arteries would also exclude the patients from the study. IMT values greater than 0.8 mm were considered abnormal [23]. The Data was analyzed with T student test using SPSS. Odds ratio was calculated in both groups and P.Value less than 0.05 was considered as significant. The results were reported as mean ± standard deviation.

RESULTS

300 individuals volunteering to participate in the study were divided into two groups. Of 130 subjects in the CAD group, 78 (60%) had suffered from myocardial infarction (MI) and 52 (40%) had positive coronary angiographies, or had undergone coronary bypass surgery and angioplasty. The non-CAD group comprised individuals with no history of CAD.

There were 82 men (63%) and 48 women (37%) in the CAD group. There were 111 men (65%) and 59 women (35%) in the non-CAD group. The subjects were aged between 38 and 65 years. Demographic details in two groups were shown in table 1.

Table 1. Comparison of risk factors in the CAD and non-CAD groups

	CAD	Non-CAD
Age (year)	51.8±8.7	49.9±8.5
Hypertension (%)	22	20
Diabetes Mellitus (%)	40	30
BMI (kg/m2)	26.12±2.2	24.8±3.2
FBS (mg/dl)	125.5±32.6	110.3±41.2
Total Cholesterol (mg/dl)	206.3±42.6	198.4±57.1
LDL-C (mg/dl)	128.2±39.1	123.2±43.1
HDL-C (mg/dl)	40.7±8.6	42.8±9.1
Triglyceride (mg/dl)	260.1±89.2	246.6±75.1
Smoking (%)	24	20

Table 2. Relationship between common carotid IMT in the CAD and non-CAD groups

IMT	CAD	Non-CAD
IMT≤0.8	29%	71%
IMT>0.8	64%	36%

Results of ultrasonographic investigations and IMT measurements are shown in Table 2, subjects in the CAD group had increased common carotid IMT compared with those in the non-CAD group, and the difference between the two groups was significant (P<0.05). Odds ratio measured 3.02 in this comparison (95% CI: 1.8- 4.6).

DISCUSSION

In view of the high prevalence of CAD and related mortality and morbidity, numerous attempts have been made to find effective methods for primary prevention of CVD. Carotid ultrasonography is one of the methods recently noted for assessing an individual's risk of developing CAD.

Ultrasonography is an accurate and reliable procedure for non-invasive measurement of IMT in superficial vessels.

The most important finding of this study is the relationship between common carotid IMT and atherosclerosis in coronary arteries.

The difference between carotid IMT in the two groups was clearly significant after maximum adjustment for risk factors. In other words, IMT increase in the CAD group is marked enough to be used as a predicting factor. Other studies have yielded similar results. IMT measurement and detection of peripheral plaques can be useful in screening for CAD patients [24]. In the Rotterdam study of 8000 individuals during 4 years, patients with higher IMT stood a higher chance of stroke and MI [25]. A study by Bots showed that the absolute ten-year risk of coronary disease rose from 13% to 23.4% with increase in IMT, while the risk of mortality increased from 15% to 46% in the same period [25].

It was concluded in a study by Hodis that the relative risk of non-fatal MI and death would increase 2.2 times, and the risk of acute coronary events would increase by 3.1 times with every 0.03 mm increase in carotid IMT, this prediction is regardless of the person's current lipid profile and other CAD risk factors [26].

In 1995, John R Crouse conducted a study of 270 CAD patients to investigate the relationship between the severity of atherosclerosis and IMT increase at different points along the carotids. He found that the mean value of the subtraction of IMT in the common carotid artery and IMT in the carotid bulb related to atherosclerosis of coronary arteries. However, the present study demonstrated a strong correlation between common carotid IMT and coronary atherosclerosis [37]. Alberto Bulbarini measured common carotid IMT in 100 patients with CAD and found that increase in common carotid IMT was correlated with atherosclerotic involvement of the coronary arteries. Moreover, the extent of carotid involvement related to the number of involved coronary arteries [34].

Other studies have shown that common carotid IMT in hypertensive individuals is higher than that of healthy individuals [28, 29]. Jadhav found that coronary involvement is significantly correlated to IMT and this correlation is stronger in hypertensive individuals [23]. Nevertheless, drawing such a conclusion was not possible in this study, because subjects were adjusted according to risk factors such as hypertension.

A study found a significant relationship between severity of coronary artery involvement, and IMT in internal carotid artery and the carotid bulb, however, no such relationship was found in the common carotid artery [30]. The latter study investigated the relationship between the severity of coronary involvement and carotid IMT. In this study, however, this relationship could not be investigated because coronary angiography had not been undertaken for all of the patients. A study by R. Adams Mark concluded that carotid IMT was related to the severity of CAD, but this relationship was weak; this can be attributed to generalized atherosclerosis in the subjects of the study, all of whom were aged above 65 years [31].

A 2001 study found that carotid IMT in normal individuals strongly correlates with risk factors such as Body Mass Index (BMI), systolic blood pressure, physical activity and lipid profile [32]. In the present study, the difference in carotid IMT in the two groups cannot be attributed to differing risk factors, because the subjects were adjusted for risk factors. In light of our findings, we conclude that common carotid artery IMT measurement is a reliable, non-invasive and simple method which can provide a basis for speculating on the presence of coronary atherosclerosis, and thus serve as a marker for predicting coronary events and patient screening.

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