Comparison of Carotid Intima-Media Thickness in Patients With Stable Angina Pectoris Versus Patients With Acute Coronary Syndrome

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In this study, we found that carotid intima-media thickness (IMT) was significantly increased and carotid artery atherosclerotic plaques were detected more frequently in patients who had early-onset coronary artery disease compared with control subjects (0.73 ± 0.10 vs 0.60 ± 0.10 mm, p <0.001, and 40% vs 11%, p <0.001, respectively). Further, patients who had coronary artery disease and presented with an acute coronary syndrome were found to have significantly increased carotid IMT compared with patients who had stable angina pectoris (0.76 ± 0.10 vs 0.70 ± 0.10 mm, p <0.05). The IMT was greater in the patients who had acute coronary syndrome than in those who had stable angina pectoris. **(Am J Cardiol 2005;96:643–644)**

High-resolution B-mode ultrasound can measure the intima-media thickness (IMT) of the walls of the carotid arteries and the IMT correlates rather well to the presence of atherosclerotic narrowing of coronary arteries.[1] This report describes carotid IMT in patients who presented with acute coronary syndrome (ACS) and in those who presented with stable angina pectoris (SAP).

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We studied 146 patients who were <45 years old and categorized them into 3 groups. The first group consisted of 41 patients who had ACS and whose initial presentation was ST- or non–ST-segment elevation myocardial infarction or Braunwald's class IIIB unstable angina pectoris. The second group consisted of 32 patients who had chronic SAP. The remaining 73 subjects were included in the control group. Patients who had a history of myocardial infarction, unstable angina, percutaneous coronary intervention, carotid surgery, coronary bypass, chronic kidney disease, chronic inflammatory disease, or statin use were excluded from the study. Control subjects were chosen among those who had atypical chest pain, no history of coronary heart disease, and a negative result from stress testing.

A high-resolution ultrasound system equipped with a 13-MHz transducer (Vivid 7, General Electric Vingmed Ultrasound, Horten, Norway) was used for longitudinal scans of the far wall of the distal 2.0 cm of the 2 common carotid arteries, immediately proximal to the origin of the bifurcation, for assessing IMT. Three measurements of IMT were performed in the right and left carotid arteries and were averaged to determine the mean IMT for each side and for the 2 sides combined. IMT was measured offline with computer software (M'ATH, Argenteuil, France), which can automatically define the IMT to within 0.001 mm. Carotid plaques were defined as a focal widening of the vessel wall relative to the adjacent wall that protruded into the lumen. For analysis, plaques were defined as simple or complex depending on their extension, echogenic composition, and surface characteristics as proposed by Lombardo et al.[2] The distance from the interface between the lumina and intima of the near wall to that of the far wall was defined as the lumen diameter. These procedures were performed within the first week of initial presentation to the hospital.

All patients who presented with ACS or SAP underwent coronary angiography. Significant coronary stenosis was defined by visual assessment as ≥70% luminal narrowing in

Table 1
Baseline characteristics of study population

	ACS (n = 41)	SAP (n = 32)	Controls (n = 73)
Age (yrs)	41.2 ± 3.7	41.7 ± 2.8	41.8 ± 3.7
Men	36 (88%)	30 (93%)	66 (90%)
Hypertension	11 (27%)*	3 (9%)	22 (30%)
Diabetes mellitus	14 (34%)*†	3 (9%)	3 (4%)
Smoker	24 (58%)	10 (31%)	18 (25%)
Dyslipidemia‡	15 (37%)	7 (22%)	26 (36%)
No. of coronary arteries narrowed			
1	21 (54%)	25 (78%)	—
2	9 (23%)*	3 (9%)	—
3	9 (23%)*	4 (12%)	—
Body mass index (kg/m^2)	27 ± 3	28 ± 4	28 ± 4
C-reactive protein (mg/L)	9 ± 7*†	4 ± 2	3 ± 1

* p <0.05 compared with patients who had SAP.
† p <0.05 compared with control group.
‡ Plasma total cholesterol level >200 mg/dl or triglyceride level >200 mg/dl.

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Table 2
Ultrasonic properties of carotid arteries of the study population

	ACS (n = 41)	SAP (n = 32)	Controls (n = 73)	p Value‡
Mean carotid IMT (mm)	0.76 ± 0.10*†	0.70 ± 0.10†	0.60 ± 0.09	<0.001
Left carotid IMT (mm)	0.80 ± 0.13*†	0.70 ± 0.10†	0.62 ± 0.10	<0.001
Right carotid IMT (mm)	0.72 ± 0.12†	0.71 ± 0.14†	0.58 ± 0.09	<0.001
Left lumen diameter (mm)	5.99 ± 0.80†	5.89 ± 0.78†	5.56 ± 0.86	<0.001
Right lumen diameter (mm)	6.11 ± 0.89†	5.70 ± 0.72†	5.54 ± 0.88	<0.001
Left carotid flow velocity (cm/s)	107 ± 23	102 ± 24	112 ± 14	NS
Right carotid flow velocity (cm/s)	105 ± 22	101 ± 30	107 ± 16	NS
Carotid plaque occurence	23 (57%)*†	6 (19%)†	8 (11%)	
Simple plaques	8 (20%)†	5 (16%)	7 (10%)	
Complex plaques	15 (37%)*†	1 (3%)	1 (1%)	

* p <0.05 compared with patients who had SAP.
† p <0.05 compared with control group.
‡ Analysis of variance.

any of the 3 major coronary branches or ≥50% luminal narrowing of the left main coronary artery.

Statistical analysis was performed with SPSS 9.0 for Windows (SPSS, Inc., Chicago, Illinois). Continuous variables are presented as mean ± SD, and categorical variables as percentage. Chi-square or Fischer's exact test was used for categorical variables. One-way analysis of variance with Dunnett's test or unpaired *t* test for pairwise comparisons was used for analysis of continuous variables. A multivariate logistic regression model in which age, gender, hypertension, diabetes, current smoking, dyslipidemia, and ischemic family history represented the independent variables was used to determine the increased carotid IMT. The IMT values within highest quartile were accepted as increased IMT. All p values <0.05 were accepted as statistically significant.

Baseline characteristics of the study population are presented in Table 1. There were 27 patients who had ST-segment elevation myocardial infarction, 7 who had non–ST-segment elevation myocardial infarction, and 7 patients who had unstable angina pectoris. Patients who had ACS were more likely to have positive family history for coronary artery disease, diabetes mellitus, and multivessel disease than were patients who had SAP or controls. Ultrasonic properties of carotid arteries of the study population are presented in Table 2. Prevalence of complex carotid artery atherosclerotic plaques was higher in patients who had ACS than in those who had SAP. Carotid IMT was significantly increased in patients who had ACS and SAP compared with controls. The IMTs of patients who had ACS were significantly increased compared with those of patients who had SAP. Logistic regression analysis showed that diabetes mellitus is the independent predictor of increased carotid IMT (odds ratio 6.04, 95% confidence interval 1.24 to 29.29, p = 0.025).

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This is the first study to show that patients who had an ACS were much more likely to have complex carotid plaques and greater IMT than were patients who had chronic SAP.

In the Atherosclerosis Risk In Communities (ARIC)[3] study, mean carotid IMT was consistently greater in those who had prevalent clinical cardiovascular disease than in those who did not have disease. A previous observational study demonstrated a significantly increased carotid IMT in patients who were 30 to 50 years of age and had survived a myocardial infarction compared with control subjects.[4] Our study extended this finding and demonstrated increased carotid IMT in patients who had ACS and those who had SAP. Our findings also showed significantly increased carotid IMT in patients who had ACS compared with those who had SAP.

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