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## Evaluation of Correlation Between Carotid Artery Intima Media Wall Thickness and Coronary Artery Stenosis in Sari, North of Iran

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**Abstract:** The purpose of this study was to investigate role of predictive value of carotid artery ultrasonography on the basis of intima-media thickness in coronary artery disease. Ultrasonography and quantitative coronary angiography were achieved for assessment carotid and coronary artery diseases in 80 consecutive patients (mean age 57.37 years) with chest pain that referred for cardiac catheterization. Mean values of parameters were recognized that carotid artery atherosclerosis to be equally involved between left and right carotid arteries. Fifty nine (73.8%) of patients had coronary artery atherosclerosis. Degree of involvement in coronary arteries regarding the 0-vessel, 1-vessel, 2-vessel, 3- vessel and LMS-CAD were 26, 30, 21, 15 and 8%. The most of patients have 1-VD involvement. There is a significant association between mean IMT of carotid and CAD. The 80% of patients had increased IMT ( $\geq 0.8$  mm). None of patients with normal coronary angiography have IMT most of 1.2 mm. Carotid disease has a acceptable sensitivity (87%), Specificity (43%), negative predictive value (54%) and positive predictive value (81%) for presence of CAD. In patients that assessment for chest pain, increased IMT of carotid artery in ultrasonography ( $\geq 1.2$  mm) has significantly related to presence of CAD. Patients with mean IMT over 1.2 mm, 87% likelihood of presence of coronary artery stenosis in our region that must be evaluated, treatment and followed. Therefor, measurement of carotid IMT seem to be a predictive parameter for presence and severity of CAD. This is a useful, noninvasive peripheral marker for assessment presence of coronary artery disease.

**Key words:** Carotid ultrasonography, intima media thickness, coronary angiography, cardiac artery disease

### INTRODUCTION

Atherosclerosis is a longstanding, progressive and generalized process that involves entire of circularity system such as cranial vascular system and coronary arteries. For this reason that, athroma of cardiac and coronary arteries may be existence (Brandwald, 2005; Kallikuzaros *et al.*, 1999; O'leary *et al.*, 1999; Tonari *et al.*, 2003; Hallerstam *et al.*, 2004). This relationship between carotid artery disease and coronary artery disease is best evaluated by increased myocardial infarction after carotid manipulation and the cerebrovascular attack following Coronary Artery Bypass Graft Surgery (CABA) (Hallerstam *et al.*, 2004). Multiple risk factors play a crucial role in the development of coronary artery disease (Hallerstam *et al.*, 2004; Hertzner *et al.*, 1985; Jones *et al.*, 1984; Heyman *et al.*, 1980). The evaluation of endothelial function is important in detection of early atherosclerosis (Tonaris *et al.*, 2003). Endothelial dysfunction plays an crucial role in atherosclerosis and may precede the development of clinically overt vascular diseases (Tonaris *et al.*, 2003). A peripheral artery disease that may associated with coronary artery disease is carotid atherosclerosis (Kallikuzaros *et al.*, 1999; Tonaris *et al.*,

2003). However, invasive methods are required to assess coronary endothelial dysfunction (for example, cardiac angiography). Noninvasive measurements of peripheral circulation could be a valuable alternative (for example, carotid ultrasound) Multiple noninvasive markers of arterial wall involvement are recommended that a simple and sensitive route is measurements of carotid artery intima-media wall thickness (Tonari *et al.*, 2003).

Also, this association between the extent of coronary artery disease and carotid IMT has not been completely demonstrated. The purpose of this study was to investigate role of predictive value of carotid artery ultrasonography on the basis of intima-media thickness in coronary artery disease.

### MATERIALS AND METHODS

Eighty consecutive patients aged years (range, 33 to 78 years), who had been referred to our Mazandaran heart center for evaluation of chest pain were studied. Exclusion criteria were unstable angina, previous myocardial infarction, cerebrovascular disease, cardiomyopathy, angiographically documented CAD, congenital heart disease, valvular heart disease,

congestive heart failure and any coronary artery bypass graft, percutaneous transluminal coronary angioplasty, or carotid endarterectomy. After careful history and examination was taken, data also was written in informed consent such as blood pressure, blood sugar and hyperlipidemia. Approval for the study had been given by the local ethics committee.

With blind manner in all patients, IMT of both, right left common carotid and internal carotid arteries (RCCA/LCCA) were evaluated by ultrasonography with megas commercially, available machine with 7.5 MHz imaging linear array transducer. The carotid artery was divided into two segments on the basis of arterial anatomy and geometry (i.e., distal CCA) and the carotid bifurcation (bulb).

The IMT was defined as the distance between the leading edge of the lumen-intima echo and the leading edge of the media-adventitia echo in the far wall.

IMT values were measured with in 15 mm proximal and 10 mm distal to the dilatation of the carotid bulb in subjects at supine position in longitudinal manner. Plaque was defined as localized increased in IMT of 1.10 mm (Zwiebel, 2002; Sutton, 2003).

Normally this parameter is less than 0.8 mm, but Hangan Ansert (2002) and Strandness (2002) has shown that this increases (atheroma) in other areas, such as the coronary arteries.

Selective coronary angiographies were performed by Judkins technique. The percentage of diameter stenosis was calculated by quantitative coronary angiography with a commercially available automated coronary analysis system.

According to the number of diseased vessels, our patients were classified into 5 following groups:

- Group 1:** No vessel disease
- Group 2:** 1 vessel disease
- Group 3:** 2 vessel disease
- Group 4:** 3 vessel disease
- Group 5:** LMS-CAD with or without other vessel diseases

Groups 4, 5 were defined as severe (Kallikuzaros *et al.*, 1999).

All measurements in ultrasonography were performed by a attend that blind to all other data. Cardiac angiography were performed by several specialized attends.

## RESULTS AND DISCUSSION

Eighty patients (50 men, 30 women; mean age 57.34 years; range, 33 to 78 years) were studied.

The clinical and demographic of the entire study subjects are shown in Table 1.

The data were analyzed using SPSS12 software. Independent t-test were used to detect statistical significant between IMT of carotid vessel and normal/abnormal coronary arteries.

A value of  $p < 0.05$  was considered statistically significant. Sensitivity, specificity and predictive values were calculated by usage of reliable manner. Carotid disease has a acceptable sensitivity (87%), specificity (43%), negative predictive value (54%) and positive predictive value (81%) for presence of CAD.

Sixty four (80%) of patients had increased IMT (>0.8 mm) of carotid artery. Sixteen (20%) of patients were normal in carotid ultrasonography. Measurements of IMT in entire study subjects are shown in Table 2.

Mean values of parameters were recognized that carotid artery atherosclerosis to be equally involved between left and right carotid arteries. Fifty nine (73.8%) of patients had coronary artery atherosclerosis. Degree of involvement in coronary arteries regarding the 0-vessel, 1-vessel, 2-vessel, 3-vessel and LMS-CAD were 26, 30, 21, 15 and 7.5%, respectively, that is listed in Fig. 1. The most of patients have 1-VD involvement. In this study a significant correlation demonstrated between coronary and carotid arteries atherosclerosis that shown in Fig. 1 and 2.

This study evaluated the correlation between carotid artery disease and coronary artery disease in patients that presented with chest pain.

In this study, a peripheral marker (Intima-media thickness) was evaluated in patients with probability of coronary artery disease. The important finding of this research was that the carotid disease has significantly correlation to the presence of coronary artery disease. Endothelial dysfunction may be an important, marker of

**Table 1: Clinical characteristics of the 80 study subjects**

| Characteristic              | Mean±SD   |
|-----------------------------|-----------|
| Age (year)                  | 57.34±9.6 |
| Sex (M/F)                   | 50/30     |
| Hypertension (%)            | 25        |
| Positive family history (%) | 20        |
| Diabetics (%)               | 25        |

**Table 2: Measurement of IMT in study population**

| Parameters                               | No. | Minimum | Maximum | Mean±SD        |
|--|-----|---------|---------|----------------|
| IMT of right common carotid in Doppler   | 80  | 0.50    | 2.9     | 1.2530±0.5994  |
| IMT of left common carotid in Doppler    | 80  | 0.40    | 2.7     | 1.3150±0.5685  |
| Mean IMT of common carotid in Doppler    | 80  | 0.45    | 2.4     | 1.2837±0.50489 |
| IMT of right internal carotid in Doppler | 80  | 0.60    | 2.6     | 1.2010±0.4887  |
| IMT of left internal carotid in Doppler  | 80  | 0.50    | 2.6     | 1.2100±0.5058  |
| Mean IMT of internal carotid in Doppler  | 80  | 0.60    | 2.4     | 1.2056±0.43092 |
| Valid N (listwise)                       | 80  |         |         |                |

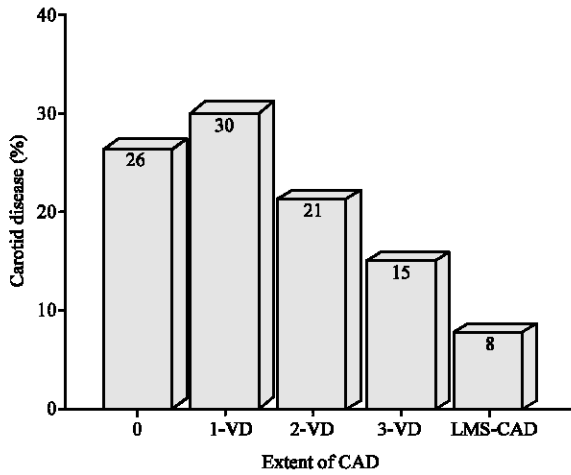


Fig. 1: Percentage of carotid disease according to the improvement of CAD in this study

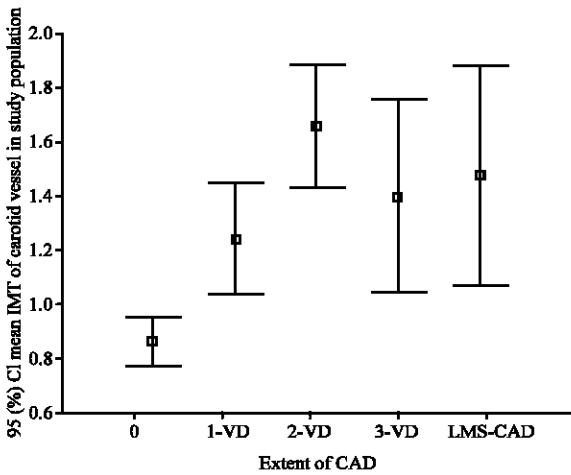


Fig. 2: Comparison of mean IMT of carotid vessel with extent of coronary artery disease

early atherosclerosis and can be used to detect persons at high risk for future cardiovascular attack (Tonari *et al.*, 2003; Hagen Ansert, 2001; Strandness, 2002; Craven *et al.*, 1990). Tonari *et al.* (2003) suggested that the this parameter (IMT) can detect clinically dormant individuals who are at high risk for coronary artery disease. Carotid atherosclerosis is important in view of its relationship to cerebrovascular ischemic disease and coronary atherosclerosis. Autopsy studies also are noted a strong correlation between two diseases (Strandness, 2002; Kablak Zienbicka, 2004; Takiuchi *et al.*, 2004). Our patients had greater IMT compared with normal subjects. Thus, carotid intima-media thickness has been suggested as a surrogate marker for coronary atherosclerosis for use in clinical screening and trails. In this study, the

prevalence of coronary disease increased from 13% in the patients without presence of IM thickening in the carotid arteries to 87% in patients with IMT over of 1.2 mm. Carotid ultrasonography is a technique that could even indicate the presence of severe coronary artery disease, in patients that have previous myocardial infarction. This study has shown that the intima-media thickness is a strong predictor of ischemic heart disease, but it may be a useful tool in the evaluation of patients with athermatous changes in order to measure both the prevalence of disease and the progression, or regression, of disease over a period of time, depending on the regimens employed.

Carotid ultrasonography can be also a clinical screening tool for patients at risk of cerebrovascular attacks, during and after coronary artery bypass graft surgery. The study has shown that ultrasonography is a reliable, valid, simple, safe, non invasive and acceptable modality for the detection of concomitant carotid athermanous in the patients with coronary artery disease. This is a useful, noninvasive peripheral marker for assessment presence of coronary artery disease.

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