

CAROTID INTIMA-MEDIA THICKNESS AS A MARKER OF ATHEROSCLEROSIS

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Date Received: February 12, 2015

Date Revised: March 14, 2015

Date Accepted: March 30, 2015

Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

All authors declare no conflict of interest.

This article may be cited as: Ali SN, Zubair M, Ahmad N. Carotid intima-media thickness as a marker of atherosclerosis. Pak Heart J 2015;48(4): 206 - 210.

ABSTRACT

Objectives: To determine the use of Carotid arterial intima-media thickness (IMT) as non-invasive surrogate end point to measure progression of atherosclerosis.

Methodology: This descriptive cross-sectional study was conducted at cardiology department of Chaudhry Pervaiz Elahi Institute of Cardiology Multan, from January 2013 to June 2013. Non-probability convenience sampling technique was used. Informed consent was taken from each participant. Intima media thickness was noted in all patients. All relevant baseline data was also recorded in the proforma.

Results: A total of 143 cases of both genders fulfilling inclusion criteria were registered in this study. Increased intima media thickness (≥ 1 mm) was present in 107 (74.8%) while it was < 1 mm in 36 (25.2%) of our study cases. Mean age was 49.28 ± 6.82 . Atheroma was present in 54 (37.7%). Mean IMT value was also calculated and it was 0.78 ± 0.15 on right side and 0.79 ± 0.23 on the left side.

Conclusion: Carotid IMT increases with progressive coronary artery disease and the patients with IMT over 1 mm have a 75% likelihood of having CAD.

Key Words: Intima-Media Thickness, Carotid, Atherosclerosis

INTRODUCTION

Carotid wall intima-media thickness (IMT) is a surrogate measure of atherosclerosis associated with cardiovascular risk factors and cardiovascular outcome.^{1,3-5} The intima-media thickness (IMT) is the distance from the lumen-intima interface to the media-adventitia interface of the artery wall as measured on non-invasively acquired ultrasonographic images of the carotid arteries.

Increased IMT of common carotid artery represents a form of atherosclerosis that is manifested as diffuse arterial wall thickening.⁶ The mean IMT of common carotid artery is more reproducible measure than the IMT of internal carotid artery and is believed to be better suited for cardiovascular risk assessment and intervention studies.^{7,8}

IMT is well measured at far wall of common carotid artery 1-2 cm proximal to bifurcation.⁹ The mean carotid IMT in healthy males between 20-60 years age is 0.573 ± 0.07 mm.¹⁰ Carotid IMT over 1 mm increases the risk of significant coronary artery disease (CAD). It was over 1 mm in 76% of cases with significant CAD.¹¹

Carotid IMT independently predicts future vascular events like myocardial infarction and stroke. Its predictive value is as high in younger subjects as in the older subjects.¹²⁻¹³

The management strategy of combined coronary and asymptomatic carotid disease should be decided case by case, considering the degree of systematic atherosclerosis, cardiac conditions and plaque morphology. It is imperative to shift the focus to the disease prevention rather than palliation. Prevention requires early identification of individuals at risk of developing cardiovascular disease but still clinically asymptomatic so that intensive preventive measures may be instituted to arrest the progression of disease.

The significance of this study was to identify the frequency of increased IMT of carotid artery in patients of significant CAD. As there is no much local data available regarding this and once early identification of young individuals who are at increased risk of CAD and stroke is done, preventive strategies can be applied to prevent CAD and stroke. The results of this study will also be helpful to design future more advanced research studies in future in the targeted population which will ultimately lead to better preventive and management policies.

METHODOLOGY

This descriptive cross-sectional study was conducted at cardiology department of Chaudhary Pervaiz Elahi Institute of Cardiology Multan, from January 2013 to June 2013. The patients between 40 to 60 years of age and of either gender admitted in hospital with significant coronary artery disease (diameter stenosis more than 70%) on the basis of coronary

angiographic findings were included in the study via non-probability, consecutive sampling technique. Patients with previous history of stroke or procedure on carotid artery were excluded from the study. Informed written consent was taken from all patients.

Carotid scanning of the common carotid artery in the neck was performed bilaterally and IMT of the posterior wall 1-2cm proximal to bifurcation was measured. Carotid IMT was considered increased when there was ≥ 1 mm thickness. The outcome variable i.e. increased carotid intima media thickness was noted on the proforma along with demographic profile of the patients. Data was entered and analysed by SPSS version 10.0. The quantitative variable of like age was represented as mean \pm standard deviation and the qualitative variables like gender, carotid intima media thickness, diabetes mellitus and smoking were represented as frequencies and percentages.

Confounding variables like age, gender, diabetes mellitus and smoking were controlled by stratification and effect were seen on outcome through chi-square test. P-value ≤ 0.05 was considered as significant.

RESULTS

Of 143 study cases, 95 (66.4%) were male and 48 (33.6%) were females. Increased intima media thickness (≥ 1 mm) was present in 107 (74.8%) while it was < 1 mm in 36 (25.2%) cases (table 1). Mean age of these study cases was 49.28 ± 6.82 years (minimum age was 40 years while maximum age was 60 years). Of these 143 cases, 84 (58.74%) were from age group 40-50 years and 59 (41.26%) were from 51-60 years, with maximum number of cases i.e. 54 (37.8%) were from age group of 40-50 years.

About 32 (22.37%) were diabetics while 35 (24.5%) were smokers. All of these 35 (100%) smokers were male. Atheroma was present in 54 (37.7%).

Mean IMT value was also calculated and it was 0.78 ± 0.15 on right side while it was 0.79 ± 0.23 on the left side. Increased intima media thickness was stratified with

Table 1: Distribution of Increased Intima Media Thickness among Study Cases. (n=143)

Increased intima media thickness	Frequency	Percentages
($1 \geq$ mm)		
Yes	107	74.8%
No	36	25.2%
Total	143	100%

Table 2: Stratification of Increased Intima Media Thickness with Respect to Age.

Age groups (In Years)	Increased Media thickness		P-value
	Yes (n=107)	No (n=36)	
40-50	60	24	0.000
41-60	47	12	
Total	143		

regards to the age, gender, diabetes mellitus and smoking (p= 0.000, p= 1.00, p=0.00 and p=0.265 respectively). (Table 2-6).

DISCUSSION

Coronary artery disease (CAD) is still the major cause of death in developed nations, despite many prevention programs widely pursued in the Europe, USA and other developed countries. Non-invasive B-mode ultrasonographic measurement of progression of IMT in the distal common carotid artery is a useful surrogated end point for clinical coronary events. The increase in IMT is the significant positive predictor of angiographically proven CAD. Determination of carotid intima-media thickness (carotid IMT) is a usually acceptable research procedure which is used for detection and quantifying the subclinical CVD. This method is based upon the aggregated thickness measurement of tunica intima and tunica media of the carotid artery walls and with the help of B-mode ultrasound. A large number of epidemiological studies have reported that increase in carotid IMT is a strong predictor for the development of any future CVD such as MI, strokes and mortalities from CVD.^{14,15}

As a result of limited sensitivity and specificity of treadmill testing as well as trans-thoracic echocardiography in the

Table 3: Stratification of Increased Intima Media Thickness with Respect to Gender.

Gender	Increased Media thickness		P-value
	Yes (n=107)	No (n=36)	
Male	71	24	1.00
Female	36	12	
Total	143		

Table 4: Stratification of Increased Intima Media Thickness with Respect to Diabetes Mellitus.

Diabetes mellitus	Increased Media thickness		P-value
	Yes (n=107)	No (n=36)	
Diabetic	30	02	0.000
Non-diabetic	77	34	
Total	143		

diagnosis of CAD, other procedures are required.^{16,17}

This implies specifically in the patients having atypical angina or with typical angina along with a negative treadmill test and echocardiographic findings, at the same time it does reflect towards a need to introduce a new complementary method for the diagnosis. With the advent of new Doppler ultrasound machines, with more sophisticated software, and having high resolution transducer facilitates comprehensive analysis of IMT among peripheral vessels such as the carotid arteries and femoral arteries. IMT is generally regarded as the early stage of development of atherosclerosis.

Many researchers have not only reported relationship between risk factors and IMT, but also have reported it between the changes in different risk factors with progression/regression in the thickness of the intima-media complex among carotid arteries.¹⁸ They observed that the thickness of the intima-media complex increases with “age, sex, hypertension, diabetes mellitus, hyperlipidaemia, and many other factors.”¹⁹

Other studies compared intima media thickness with the presence of clinically symptomatic coronary artery diseases as well as the extent of coronary artery disease on

Table 5: Stratification of Increased Intima Media Thickness with Respect to Smoking

Smoking	Increased Media thickness		P-value
	Yes (n=107)	No (n=36)	
Yes	29	6	0.265
No	78	30	
Total	143		

Table 6: Stratification of Increased Intima Media Thickness with Respect to Hypertension.

Smoking	Increased Media thickness		P-value
	Yes (n=107)	No (n=36)	
Yes	48	24	0.033
No	59	12	
Total	143		

angiograms.²⁰ Rather, the results reported by these studies were found to be discrepant.²¹

Sun et al reported mean IMT of the carotid coronary artery 0.66 ± 0.12 mm on the right side and 0.68 ± 0.12 mm on the left side. Age, systolic blood pressure and fasting blood sugar were independent risk factors related to both carotid atherosclerosis and thick IMT.²² The results of Sun et al are close to our study results for mean IMT i.e. 0.78 ± 0.15 on right side and 0.79 ± 0.23 on the left.

In our study, out of 143 study cases 107 (74.8%) had IMT over 1mm while a study reported by Najafian et al reported frequency rates of increased IMT (76%) which is close to our study results.¹¹ Kablak-Ziembicka reported 96% increased IMT among patients of coronary artery disease, which is higher than our study results.¹⁴

Mean age of our study cases was 49.28 ± 6.82 years, while Kablak-Ziembicka reported 58.8 ± 9.2 years which is higher than our study results. The reason for lower mean values in our study cases can be understood in terms of inclusion criteria (40- 60 years) so we excluded those aged more than 60 years. In our study, 66.4 % were males and 33.6% were females. Same has been reported by Christensen et al who reported 68 % male gender in their study.¹⁵

Our study results have indicated 30 (93%) diabetics had increased IMT similar findings have been made by Mitsuhashietal.²³

Our study results are in compliance with many previous studies around the world. Crouse et al reported, in carotid arteries, a positive relationship between coronary artery disease, which was confirmed by coronary angiography and mean IMT.²¹ Similarly, current study results have indicated that mean aggregate of IMT increases along with increasing CAD.

CONCLUSION

Intima media thickness increases with progressing coronary artery disease and the patients with IMT over 1

mm have a 75% likelihood of having CAD. Hence Carotid IMT ≥ 1 mm increases the risks of significant coronary artery disease. Measuring the carotid IMT in the Common Carotid Artery can be achieved with acceptable as well as comparable reproducibility.

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