

## Original Article

# Correlation of Carotid Intima-Media Thickness with Atherosclerosis in Diabetes

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**Abstract :** B-mode ultrasound of Common Carotid artery at its bifurcation for measure of the Carotid intima-media thickness (CIMT), offers a valid non-invasive quantifying test for macro-vascular complications like atherosclerosis.

**Material and Methods:** 50 cases of type 2 Diabetes and 30 age and sex matched Non-diabetics controls were taken for present study and subjected to Ultra-sonographic scanning of the carotid arteries using B-mode color Doppler imaging to calculate CIMT. **Observation:** In the study group, the relationship between CIMT with triglycerides, LDL-C and total cholesterol are positively correlated ( $p < 0.01$ ) which is statistically significant, whereas with CIMT and HDL-C the relation is negatively correlated, which is statistically significant ( $p < 0.01$ ). **Conclusion:** This study focuses on the importance of CIMT as a simple, non-invasive, safe and cheap screening test for assessing the risk of macro-vascular complications like atherosclerosis as evidenced by strong correlation between CIMT and Lipid Abnormalities in type 2 Diabetes Mellitus patients.

**Key Words :** B-Mode USG, CIMT, Atherosclerosis

**Introduction :** The most important change in early subclinical period of atherosclerotic disease are endothelial dysfunction and increase in intima-media thickness observed in all arterial beds. Thickening of arterial wall of the common carotid artery and plaque formation at the carotid bifurcation are observed in preclinical atherosclerosis as macro-vascular complications<sup>1</sup>.

The intima-media thickness (IMT) of the carotid artery is highly correlated with cardiovascular events in Type 2 Diabetes Mellitus (T2DM)<sup>2</sup>. CIMT has been shown to be independently associated with CAD in Indian subjects and is a well standardized surrogate marker for assessing cardiovascular risk<sup>3</sup>. Thus B-mode ultrasound of common carotid artery at its bifurcation to measure for intima-media thickness offers a valid non-invasive quantifying test for atherosclerosis and is a better alternative to carotid angiography for detection of atherosclerosis and its progression<sup>4</sup>. Hence it is rapidly becoming an acceptable method to detect generalized atherosclerosis<sup>5</sup>. CIMT have been successfully used as a “window” or indicator for generalized and coronary atherosclerosis<sup>6,7</sup>.

**Materials and Methods :** 50 cases of T2DM with duration of more than 2 years, with age more than 35 years, of

either sex, receiving oral hypoglycaemic agents or insulin or both, out-patients or in-patients under the department of Medicine, Maharajah’s Institute of medical sciences, Nellimarla, during the period of November 2011 to October 2013 were included. 30 age and sex matched non-diabetics constituted the controls of the present study. Patients with systemic hypertension, with history of smoking, on ACE/ARB’s, Type 1 DM and secondary diabetes were excluded. All patients included in the study underwent detailed clinical history analysis, physical examination and necessary investigations like HbA1C and Lipid profile. Routine tests for infection like DC, TLC, Urine, Chest X-ray, ESR were carried out. Ocular fundus examination and estimation of Microalbuminuria by Micral test were done. Both Common Carotid arteries were examined. Ultrasonographic scanning of the carotid arteries was performed using a high resolution B-mode colour Doppler imaging and an electrical linear transducer was used. Scanning of extra cranial common carotid or internal carotid arteries in neck was performed bilaterally according to evading edge of second echogenic line.

**Results :** In the study group comparison of total cholesterol with CIMT showed statistically positive correlation (correlation coefficient ‘ $r$ ’=0.606,  $p < 0.01$ ) and also in control group, significant positive correlation was found between total cholesterol and CIMT (correlation coefficient ‘ $r$ ’=0.676,  $p < 0.01$ ). The present study group

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which showed significant positive correlation ( $p < 0.01$ ) between LDL-C and CIMT is very much comparable to previous studies. In the present study group a positive correlation is found between triglycerides and progression of CIMT (correlation coefficient ' $r$ '=0.838) which was statistically significant ( $p < 0.01$ ). The values in control

group were very much similar to study group (correlation coefficient ' $r$ '=0.698,  $p < 0.01$  statistically significant). But in the study group, progression of CIMT had negative correlation with HDL-C (correlation coefficient ' $r$ '= -0.689,  $p < 0.01$ ) which is statistically significant.

Table-1 : Comparing different factors in study and control groups

Factors	Study group Mean± SD	Control Group Mean± SD	t-test	p-value	Significance
CIMT	1.196± 0.301	0.97± 0.29	3.22	<0.01	HS
Age	60.44± 10.26	57.37± 7.85	1.53	>0.05	NS
BMI	25.41± 4.73	23.17± 2.69	2.69	<0.01	HS
W/ H/ ratio	0.939± 0.112	0.96± 0.044	0.84	>0.05	NS
FBS	154.6± 55.1	124.33± 14.8	3.69	<0.001	VHS
PPBS	216.1± 73.01	167.43± 23.41	4.35	<0.001	VHS
TG	199.96± 63.1	139.46± 51.1	4.72	<0.001	VHS
LDL-C	137.9± 35.1	120.17± 48.98	2.08	<0.05	S
HDL-C	38.64± 2.85	38.9± 5.95	0.22	>0.05	NS
Total-C	192.92± 37.7	168.1± 45.5	2.54	<0.01	HS

**Discussion :** CIMT is a well established index of atherosclerosis that correlates with prevalent and incident coronary artery disease<sup>6</sup>. Studies have shown a relationship between atherosclerosis in the carotid and coronary arteries. Furthermore statistically significant correlations (range 0.3-0.5) between CIMT and coronary atherosclerosis the latter based on a coronary angiogram, coronary calcium studies, or intravascular ultrasound have been noted<sup>7</sup>.

The progression of CIMT is influenced by cardiovascular risk factors and is directly related to the risk of future cardiovascular events.

The prospective, community-based Framingham Heart Study provided rigorous support for the concept that hypercholesterolemia, hypertension, and other factors correlate with cardiovascular risk. Abnormalities in plasma lipoproteins and derangements in lipid metabolism (increased LDL, TG, Cholesterol and Decreased HDL) rank among the most firmly established and best understood risk factors for atherosclerosis. As this study clearly establishes Positive correlation between CIMT and LDL, TG, Cholesterol and Negative Correlation

between CIMT and HDL in a statistically significant manner, it implies a strong evidence of correlation between CIMT and Coronary as well as Generalised Atherosclerosis. As patients with type 2 diabetes mellitus suffer unduly from premature and severe atherosclerosis affecting coronary, cerebral and carotid arteries, ultrasonographic assessment of easily accessible arteries like carotid arteries have been advocated as a surrogate marker over less accessible vessels such as coronary and cerebral arterial systems in diabetic populations.<sup>1</sup>

**Summary :** In the study group the relationship between CIMT with triglycerides, LDL-C and total cholesterol are positively correlated ( $p < 0.01$ ) which is statistically significant whereas CIMT and HDL-C the relation is negative correlation which is statistically significant ( $p < 0.01$ ). Hence this study focuses on the importance of CIMT as a simple, non-invasive, safe and cheap screening test for assessing the risk of macrovascular complications in type 2 DM patients and hence the risk of CAD a common cause of mortality in Diabetic population.

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