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Correlation between HbA1c and carotid artery intima-media thickening(cIMT) in diabetic patients

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***Abstract*---**Introduction: Correlation between carotid artery intima-media thickening and HbA1c levels in diabetic patients as a non invasive marker of progressive atherosclerosis. Objectives: The aim of this study is to study the role of two non invasive markers, carotid intima media thickening and HbA1c in diabetic patients and establish the usefulness of both the parameters in evaluating early risk factor assessment. Material and methods: 100 patients meeting the required criteria were taken coming to OPD/IPD bases to Dhiraj hospital in the age group of 35-70 years.HbA1c levels were used according to American diabetes association. Carotid intima media thickening was measures on B mode ultrasonography in radiology department. Results: among the 100 patients, 68 patients were female and 32 patients were male. The mean of HbA1c values were 8.0 ± 2.2%. The mean cIMT values were 0.78 ± 0.3 cm. Conclusion: HbA1c and carotid

artery intimal thickness is useful as a diagnostic marker and early risk factor analysis for atherosclerotic changes in diabetic patients.

***Keywords*---**carotid artery intimal thickness, diabetic patients, HbA1c levels.

Introduction

Vascular complications in diabetic patients are major cause of morbidity and mortality. Vascular complications are the major outcome of type 2 Diabetes Mellitus progression, which reduces quality of life and cause economic burden to the health care system and increases diabetic mortality. Cardiovascular disease is the major cause of mortality and morbidity worldwide. It has been suggested that cardiovascular risk estimation by common risk factors (blood pressure, glucose, cholesterol) and circulating biomarkers may fail to adequately predict the risk of cardiovascular events. Imaging markers of vascular damage might integrate the long lasting cumulative effects of all traditional and non-identified cardio-vascular risk factors and can be detected as target organ damage before clinical events occur at a stage when interventions are effective. Both macro and micro vascular diabetic complications are associated with atherosclerotic changes. Carotid intima-media thickness (cIMT) is a non invasive marker of subclinical atherosclerosis that is measured by B-mode ultrasonography and the association between cIMT and atherosclerosis has been showed in many studies. HbA1c is an important glycemic control marker which demonstrate average three month blood glucose prediction. cIMT is a helpful tool in assessing the risk factor for atherosclerosis and other coronary artery disease, early evaluation of which can identify the people at higher risk without symptomatic progression. In this present study we tried to investigate whether or not, HbA1c values are associated with cIMT which is a non invasive indicator of subclinical atherosclerosis in type 2 diabetic patients.

Materials and Methods

This was a non-interventional, cross sectional study of 100 diabetic patients who were asymptomatic with their level of HbA1c and B-mode evaluation of carotid intima media thickness in Dhiraj hospital.

Inclusion criteria

- Only patients who were willing to participate in the study were included.
- Diagnosed cases of diabetes mellitus type 2 without symptoms of vascular complications.

Exclusion criteria

- Patients who gave negative consent for the study.
- Uncooperative patients for the procedure.
- To ensure only asymptomatic patients are included in the study, all the patients with other risk factors like smokers, patients with previous history of

cardiovascular events, renal disease, hypertension, peripheral vascular diseases, etc were excluded from the study.

Description of tools

- GQ LOGIQ P9 USG MACHINE.
- HbA1c reports from pathology department of Dhiraj hospital

Results

A total of 100 patients were studied, of whom 68% were female and 32% were male. The baseline characteristic of the patients are depicted in the table 1. The observed HbA1C range was 6.1- 13.2% (mean =10.2% ± 2.4). The cIMT measured was within the range 0.035 to 0.8 cm (mean=0.4 ± 0.03 cm). Bivariate correlation analyses showed that the correlation between HbA1C with cIMT was significant ($P < 0.05$) with $r = 0.546$; There was no difference in the CIMT or HbA1c levels when compared with age ($P > 0.05$). Multiple variable linear regression with CIMT as dependent and HbA1c, Age, SBP, DBP, Diet, and Sex as variables shows that the model is significant. HbA1c significantly positively correlates with Carotid intima-media thickness ($P < 0.05$). Age, SBP and DBP found to have a positive independent correlation with cIMT, although it was not significant ($P > 0.05$). Diet and sex had no correlation with cIMT. On the paired sample t-test conducted, there was a very significant correlation ($P < 0.001$) between cIMT and HbA1c ($t=17.075$).

Table 1
Baseline characteristic

	Minimum	Maximum	Mean with SD
Age(in years)	35	70	55 ± 6.2
Hb1c levels(%)	6.1	13.2	10.2 ± 2.4
cIMT (in cm)	0.035	0.8	0.4 ± 0.3
Systolic BP(in mm of Hg)	100	140	125 ± 18
Diastolic BP(in mm of Hg)	60	100	78 ± 2

Image 1. depicts carotid intimal thickening.

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LAB REPORT

Name : MANGILAL JAYRAM BHEEL
Age/Gender : 45 Y / MALE
Ref By : PRAMOD JHA
Dept. : GENERAL MEDICINE

Case No. : 2205310448
Lab No. : 6092
Sample Receive Date : 31/05/2022
Report Date & Time : 31/05/2022@17:59

BIOCHEMISTRY PROFILE

TEST DESCRIPTION	RESULT	UNIT	REFERENCE INTERVAL
HBA1C	10.1	%	4-6 % NON DIABETIC
Cardiac Profile*			
Troponin I*	NEGATIVE		

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The parameter marked with * are not recognised by NABL.
Approved By

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Image 2. HbA1c report of same patient

Discussion

HbA1c, shows presumed blood sugar levels for the last 3 months which is used worldwide as a parameter that determines the level of glycemic control. Complications of diabetes mellitus generally occurs after a latent period of 10-20 years. Thus, while complications occur we can see HbA1c values in normal range and that establishes instant HbA1c value is not related with subclinical atherosclerosis. cIMT is accepted as non invasive marker of atherosclerosis in recent times. An important condition to use cIMT to predict cardiovascular events is to demonstrate that it is associated with both prevalence and incidence of clinical vascular events. In a study done on patients with diabetes mellitus by Brohall G et al. They found significant increase in cIMT values in patients with diabetes mellitus compared to healthy subjects. In the studies conducted on patients with diabetes mellitus by Mukai N et al Huang Y et al Venkataraman et al and Ma X et al they found significant correlation between high HbA1c and increased cIMT.

This implies that cIMT variations can be detected in the early stages of type 2 Diabetes and also cIMT correlated strongly with HbA1c values. We also found a positive correlation between age and blood pressure, although not very significant. Our study had more females than males (68% females vs. 32% males), however It does not reflect the frequency or incidence of diabetes in the area

because our criteria of excluding smokers and drinkers led to rejection of more men than women. In order to select only asymptomatic patients, smokers, patients with previous history of cardiovascular diseases, peripheral vascular diseases, hypertension, renal diseases, patients on drugs that modify cIMT(statins, aspirin, ACE inhibitors,Angiotensin Receptor Blockers, Clopidogrel etc) were excluded because of its association with known cardiovascular risk factors. Carotid intima-media thickness reflects atherosclerotic progression. In this study, we found out that changes of cIMT in diagnosed diabetics correlated with their HbA1c levels from the onset of diabetes and hence cIMT estimation is useful as tool for early detection of risk factors.

Conclusions

There is significant correlation between HbA1c and carotid artery intima media thickening on b mode ultrasound. Both of these parameters are relatively cost effective way of diagnosing high risk asymptomatic patients for further progression of vascular complications. Thus, these both parameters are safe and non invasive examination to alert the related field experts ealy enough to intervene to prevent major cardiovascular complications.

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