

A Study on Correlation between Microalbuminuria and Ultrasonographically Measured Carotid Artery Intima Media Thickness In Type 2 Diabetes Mellitus Subjects.

¹Subrata Halder , ²Avijit Saha , ³Amrita Biswas.

¹Associate Professor, Department of General Medicine, Raiganj Govt. Medical College, Raiganj, WB, India.

²Assistant Professor, Department of General Medicine , Malda Medical College, Malda ,WB, India.

³Specialist Physician, Department of General Medicine , Egra Super Speciality Hospital, Purba Medinipur, WB, India.

Corresponding Author: Dr Avijit Saha, Assistant Professor, Department of General Medicine, Malda Medical College, Malda, WB, India.

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Abstract

Background: This study was done to find out the correlation between micro albuminuria and carotid artery intima media thickness, an early marker of atherosclerosis in type 2 diabetic subjects.

Methods: 100 patients including male and female with age more than 40 years type 2 DM having microalbuminuria or not were included in this study based upon the inclusion & exclusion criteria. Detailed history physical examinations & relevant systemic examinations & routine investigations were done as per structured proforma & data were analyzed with appropriate statistical tests and methods to determine the significance and power of study.

Results : In this study statistically significant correlation was not found between age and CAIMT ($p=0.3690$). Significant increase in carotid artery intima media thickness was found in patients having microalbuminuria. Among microalbuminuric patients 35 patients (74.5%) having CAIMT ≥ 1 mm & 15(28.3%) patients having

CAIMT ≤ 1 mm. Among normoalbuminuric pts only 12 pts(25.5%) having CAIMT ≥ 1 mm. The value of Pearson's correlation coefficient was $r=0.4245$, which is significant ($p<0.05$). It was found that statistically significant association was found between HbA1C & CAIMT ($P=0.0424$).

Conclusion: Carotid artery intima media thickness evaluated by the high resolution ultrasonography reflects an early index of cardiovascular disease. The present study reveals statistically significant correlation is found between Microalbuminuria & Carotid artery intima media thickness ($p<0.0001$). Routine screening of carotid artery IMT by B-mode USG in type 2 diabetic patients with microalbuminuria is necessary. It helps us not only to detect early atherosclerosis but to prevent further development of diabetic nephropathy and cardiovascular events by applying more intensive therapy.

Keywords: Carotid artery intima media thickness (CAIMT), Atherosclerosis, Microalbuminuria, type 2 diabetics.

Introduction

Microalbuminuria is associated with increase cardiovascular mortality in type 2 diabetes mellitus. Little is known about the relationship between microalbuminuria and atherosclerotic vascular disease in diabetic subjects. Atherosclerosis, a progressive process, is a type of arteriosclerosis or hardening of the arteries that affects only the inner lining of an artery. It is characterized by plaque deposits that block the flow of blood. It predisposes to coronary artery disease, stroke & chronic renal failure in diabetic patients. Carotid artery intima-media thickness (CAIMT) is a surrogate marker of atherosclerosis and imparts prognostic information independent of traditional cardiovascular risk factors. Carotid artery intima media thicknes may be conveniently measured in type 2 diabetic patients by non-invasive B-mode ultrasonography. Normal carotid artery intima media thickness is 0.8 – 1 m.m. It is common practice to call a CAIMT >1.0mm as being abnormal, and >1.2mm as being high risk for developing atherosclerosis. So this study was performed to find out the correlation between microalbuminuria and ultrasonographically measured carotid artery intima media thickness.

Material & Methods

100 patients of type 2 D.M. aged above 40 years who attended Medicine OPD were included in this study after considering inclusion & exclusion criteria over a period of one year. Valid `consent was taken from patients. Detailed history, physical examinations & relevant systemic examinations& routine investigations, urinary ACR, lipid profile ,blood sugar,HbA1c and carotid Doppler study were done as per structured proforma & data were analyzed with appropriate statistical tests and methods to determine the significance and power of study.

Inclusion Criteria: Type 2 diabetic mellitus patients above 40yrs of age.

Exclusion Criteria

- Patient of type 1 diabetes mellitus.
- Present or past history of Coronary Artery Disease, Acute Myocardial Infarction, Congestive Heart Failure.
- Patient with urinary tract infection.
- Patient on Statin Therapy for last one year.
- Associated Collagen vascular disease which may involve the kidney like SLE.

When in spot urine sample albumin level between 30 to 300 mg/gm of creatinine we considered as microalbuminuria. present.Normal carotid artery intima media thickness is 0.8 – 1m.m.Carotid artery intima medial thickness (CAIMT) >1.0mm was considered as abnormal, and >1.2mm indicates high risk for developing atherosclerosis. Data were analyzed with appropriate statistical tests and methods to determine the significance and power of study.

Results & Analysis

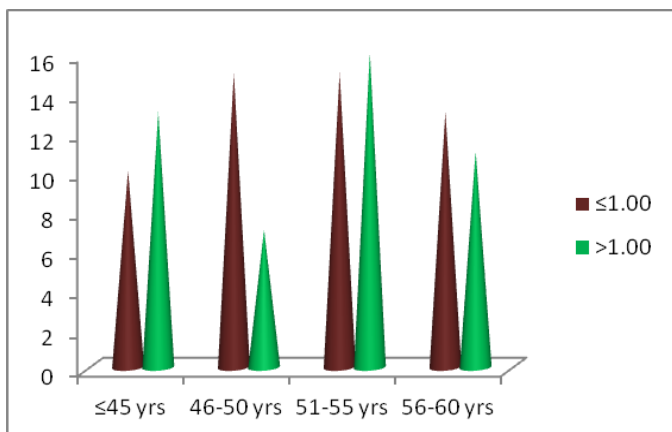
In our study highest proportion of patients 31% were in the age group between 51-55 & percentage of male 56.6% were higher than female 43.4%.

We found that more than 50% patients of 51-55age group had CAIMT>1.00(table-1)

Table1: Correlation between age and CAIMT in all patients

| CAIMT -CC | | | |
|--------------|-------|-------|-------|
| Age (yrs) | ≤1.00 | >1.00 | TOTAL |
| ≤45 | 10 | 13 | 23 |
| 46-50 | 15 | 7 | 22 |
| 51-55 | 15 | 16 | 31 |
| 56-60 | 13 | 11 | 24 |
| TOTAL | 53 | 47 | 100 |

In this study, statistically significant correlation was not found between age and CAIMT ($p=0.3690$).

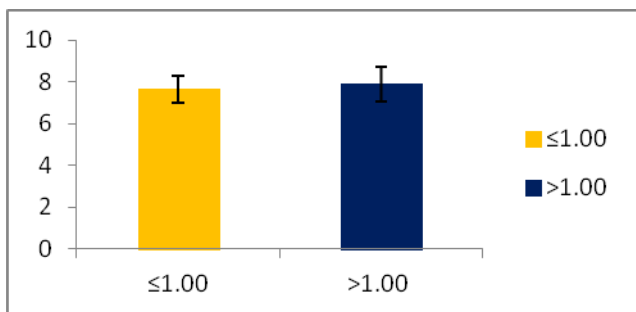


We found higher HbA1C among elevated CAIMT patients. Mean value of HbA1C was 7.9062 between patients of more than 1mm thick carotid intima media and among less than 1mm thick carotid intima media patients mean of HbA1C was 7.6534 (table-2)

Table 2: Association between HbA1C & CAIMT in all patients

| Group | Number | Mean | SD | Minimum | Maximum | Median | p-value |
|-------|--------|--------|-------|---------|---------|--------|---------|
| ≤1.00 | 53 | 7.6534 | .6615 | 6.6800 | 9.2400 | 7.3600 | 0.0424 |
| >1.00 | 47 | 7.9062 | .8244 | 6.6500 | 9.2800 | 7.8000 | |

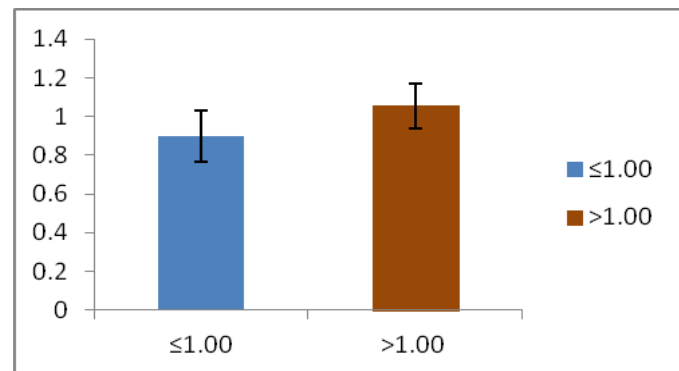
It was found that statistically significant association was found between HbA1C & CAIMT ($P=0.0424$).



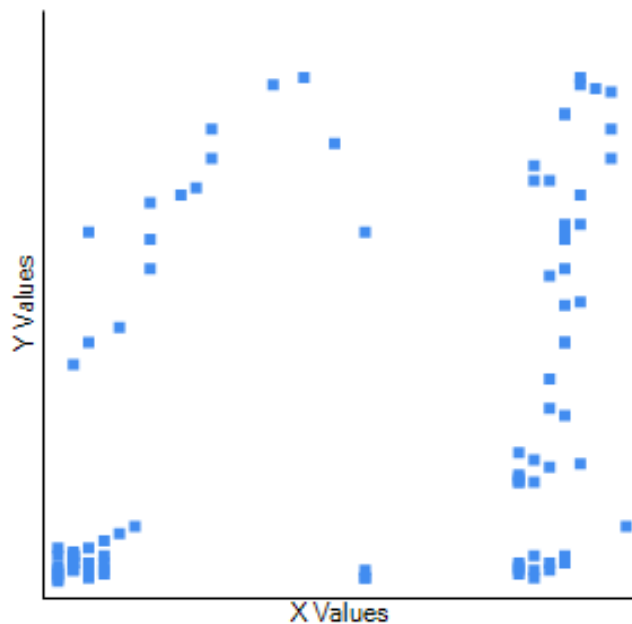
It was found that mean of CAIMT was 0.8994 among normoalbuminuric patients. And microalbuminuric patients mean of CAIMT was 1.0552. In present study significant statistical correlation was noted ($p<0.0001$). (table-3)

Table 3: Mean of CAIMT according to ACR in all patients.

| Urine albumin | Number | Mean | SD | Minimum | Maximum | Median | p-value |
|---------------|--------|--------|--------|---------|---------|--------|---------|
| ≤30mg | 50 | 0.8994 | 0.1316 | 0.8000 | 1.1700 | 0.8200 | <0.0001 |
| >30mg | 50 | 1.0552 | 0.1159 | 0.8100 | 1.1600 | 1.1200 | |



Pearson Correlation Coefficient test



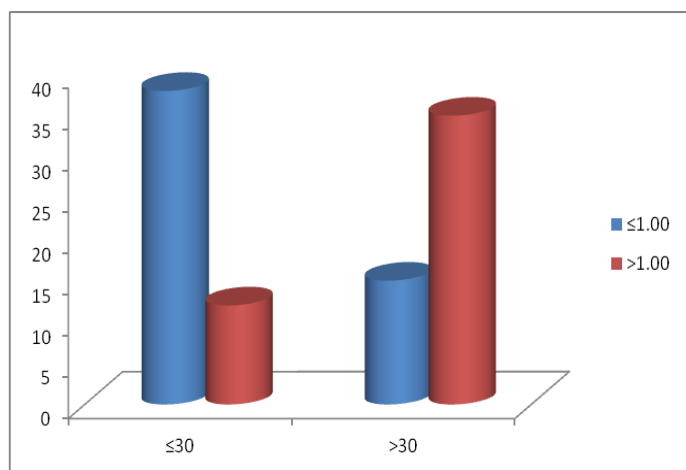
The value of R is 0.4245. The result is significant at $p < 0.05$. Correlation between CAIMT and ACR was statistically significant.

Out of 100 patients 53(53%) had carotid intima media thickness $<1.00\text{mm}$ & 47(47%) had $>1.00\text{mm}$. Among this 47 patients 35(74.5%) had microalbuminuric range proteinuria in their urine & 12(25.5%) pts had normal protein level in their urine. It was found that statistically

significant association was found between CAIMT & ACR ($p < 0.0001$). (table-4)

Table 4: Association between CAIMT & ACR in all patients

| ACR | | | |
|--------------|-------------|-------------|-------------|
| CAIMT -CC | ≤30 | >30 | TOTAL |
| ≤1.00 | 38 71.7% | 15 28.3% | 53 100% |
| >1.00 | 12 25.5% | 35 74.5% | 47 100% |
| TOTAL | 50 50% | 50 50% | 100 100% |



Discussion

Carotid artery intima-media thickness (CAIMT) is a surrogate marker of atherosclerosis. Carotid artery intima media thickness (CAIMT) is now commonly used as a screening tool for detection of the presence of atherosclerosis. Normal carotid artery intima media thickness is 0.8 – 1 mm. It is common practice to call a CAIMT >1.0mm as being abnormal, and >1.2mm as

being high risk for developing atherosclerosis [1]. First described by Pignoli in 1986, IMT is defined as the measured distance between the luminal-intimal interface and the media-adventitial interface of the common carotid artery. [2] More specifically, IMT is the double-line pattern visualized by B-mode vascular ultrasound formed by the two parallel lines of: 1) the junction of the vessel lumen with the intima and 2) the junction of the media with the adventitia. [3]

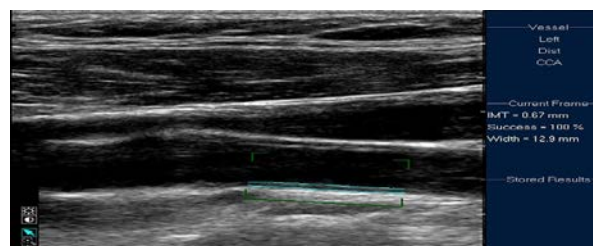


Figure Shown is an example of measuring CIMT with a normal measurement, in this case 0.67 mm.

Cross-sectional studies have reported apparent age related increases in common CAIMT of about 0.010 mm (10 mm) per year in seemingly healthy men and about 0.014 mm (14 mm) per year in seemingly healthy women, whereas in the ICA it is 10 mm for both sexes. [4] Patients with known CAD, however, exhibit a tripling of CIMT progression rates over patients without known CAD, some 30 mm/yr versus 10 mm/year, respectively. [5] There have been numerous investigations of the correlation of increased CAIMT to the risk of CVD. A typical example is the Kuopio Ischemic Heart Disease Risk Factor Study. This study quantified an increased MI risk of 11% for each 0.1-mm increase in CIMT. [6] Recently, the Multi-Ethnic Study of Atherosclerosis (MESA Study), [7] The Tromso Study, [8] and The Northern Manhattan Study [9] all confirmed the increased hazard ratios of the asymptomatic presence of increased CAIMT and/or carotid plaque (defined as focal thickening .1.5 mm) as giving significantly increased hazard ratios for clinical end points.

The largest of these, the Atherosclerosis Risk in Communities (ARIC) study, demonstrated strong correlation of CAIMT and cardiovascular events in greater than 10,000 individuals, both male and female, with a mean follow up of 5.2 years. The age-adjusted risk of coronary heart disease increased with increasing CAIMT and remained statistically significant despite adjustment for other risk factors. For a 0.19-mm increase in common CAIMT, the relative risk for cardiac events was 1.36 (95% CI 1.23 to 1.51) in men and 1.69 (95% CI 1.50 to 1.90) in women, thus increasing the risk for coronary heart disease (CHD) 32% and 92%, respectively. [10]

Our results are comparable to those of Mykannen Leena et al^[11] who reported that subjects with microalbuminuria had greater carotid artery IMT than those without microalbuminuria. Similar results were demonstrated by Gilles F.H Diercks et al^[12] whose study showed that microalbuminuria is strongly related to subclinical atherosclerosis (assessed by CAIMT) in type 2 diabetic patients ($r=0.40$, $p<0.001$).

Our results are comparable to those of Temelkova et al^[13] who observed that CAIMT correlated strongly with HbA1c values. According to Yokoyama^[14], a study also done on type 2 diabetics, which showed a significant positive correlation ($r=0.26$; $p<0.0001$) between urinary albumin-to-creatinine ratio (ACR) and intima-media thickness of carotid arteries (CAIMT). Type 2 diabetic patients with microalbuminuria had a significantly higher value of IMT.

Conclusion

Microalbuminuria is associated with increase cardiovascular mortality in type 2 diabetes mellitus. Carotid artery intima media thickness evaluated by the high resolution ultrasonography reflects an early index of cardiovascular disease. The present study reveals that

statistically significant correlation is found between Microalbuminuria (urinary ACR) & Carotid artery intima media thickness (CAIMT) ($p<0.0001$). Routine screening of carotid artery IMT by B-mode USG in type 2 diabetic patients with microalbuminuria is necessary. It helps us not only to detect early atherosclerosis but to prevent further development of diabetic nephropathy and cardiovascular events by applying more intensive therapy. However, larger and further studies are needed to confirm our results.

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