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A STUDY OF CORRELATION BEETWEEN CAROTID INTIMA MEDIAL THICKNESS AND MACRO-VASCULAR COMPLICATIONS IN TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract

Diabetes mellitus is a metabolic cum vascular syndrome of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin action or insulin secretion or combined, that causes atherosclerotic cardiovascular diseases. Carotid intima media thickness (CIMT) is used as a marker of atherosclerosis that is considered to be an important pathogenic mechanism of macrovascular diseases. CIMT is measured by B mode ultrasound,This study was carried out in 100 type 2 diabetes mellitus patients.In this study we can observe that macrovascular disease are more common in age group of 61 to 70 years. 21 DM patients were having macrovascular complications in this age group.This study showed values of CIMT is raised in type 2 DM patients with macro-vascular complications than Diabetic patients without complications. Risk factors like age, raised BMI, dyslipidemia, duration of uncontrolled DM, raised Hba1c, and raised BMI actually have a correlation with increased value of CIMT and promotes the disease process and contributing for macro-vascular complications like CVA, CAD and PVD.

INTRODUCTION

Diabetes mellitus is a metabolic cum vascular syndrome of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin action or insulin secretion or combined, that causes atherosclerotic cardiovascular diseases.[1] Macrovascular Complications occurs due to atherosclerosis. Macrovascular complications are cerebrovascular diseases, coronary artery disease and peripheral vascular disease.[2] Carotid intima media thickness (CIMT) is used as a marker of atherosclerosis that is considered to be an important pathogenic mechanism of macrovascular diseases.[3] CIMT is measured by B mode ultrasound, It is simple reproducible and non-invasive test for vascular disease. Recent study shows CIMT is early marker of atherosclerosis.[4] Findings of B mode ultrasound well corresponds to histology of carotid intima media thickness.

Carotid arteries are narrowed by a plaque wich is made up of fat, triglycerides and other cholesterols, calcium and other substances.[5] Early diagnosis and intervention can decrease the risk of complications. Carotid arteries are located on each side of neck delivering blood from heart to brain, compromised blood flow can cause stroke or transient ischemic attack.

Indications are: Diabetes, dyslipidemia, hypertension, family history of stroke, receant attack of TIA, coronary artery disease, abnormal carotid bruit on auscultation.

Carotid arteries are examined by ultra sound Doppler in the neck bilaterally in the area of common carotid artery which 1 cm proximal to the dilatation of the carotid bulb. And at Carotid bifurcation which is located 1 cm to the flow divider and internal carotid which is 1 cm distal to flow divider on left and right sides respectively.[6] Ultra-sonographic scanning of carotid is performed by high res B mode ultrasound colour Doppler imaging and with the help of electrical linear transducer.

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doppler of carotids in neck is bilaterally according to evading edge of second echogenic lines. First line is lumen intimal and the second line is collagen containing upper tunic adventitia. So, at each longitudinal projections 3 determination of IMT measured. At the site of thickness,1 cm above and 1 cm below. than those values are averaged.

Chronic dislipidemia causes generation of reactive oxygen species and stress in local shear. This process causes formation of LDL which is oxidized in nature. Macrophages causes endocytosis of oxidized LDL with the help of scavenger receptors.[7] Than macrophages causes release of inflammatory cytokines like TNF – alpha, IL-1, and TGF- beta. These causes fibrofatty streak and causes inflammation and causes thrombus and plaque formation. Fatty streaks are composed of foam cells which are lipid filled in nature. Central obesity, insulin resistance and type 2 diabetes causes dysmetabolism hyperglycemia and hyperlipidemia. Oxidative stress occurs because of these reasons and causes coagulation activation, inflammation activation and endothelial disfunctions. This whole process can cause postprandial dysmetabolism and lead to macro vascular complications.[8]

Aim of the study
- To analyse the carotid intima media thickness in type 2 diabetics with macrovasccular diseases like CAD/CVA/PVD.
- To establish the usefulness of carotid intima media thickness as a early marker of macro vascular complications in type 2 DM.

Objectives
- Prevalance of macrovascular complications in patients with raised value of CIMT compared to normal value of CIMT.
- Prevalance of raised value of CIMT in type 2 DM patients with macrovascular complications compared to type 2 DM patients without macrovascular complications.
- To find out association between risk factors like uncontrolled DM, dyslipidemia, and raised BMI and development of macro-vascular complications.

MATERIALS AND METHODS

The present study was done in patients admitted to Civil hospital Ahmedabad, Gujarat over a period of 1 year. CIMT measured by B mode ultrasound Doppler.

Selection criteria and Target population: Patient aged 35 to 75 years with type 2 diabetes mellitus.

Investigations: macrovascular complications like CAD/CVD/PVD diagnosed through medical history, clinical examination and investigations like echocardiogram, doppler and computed tomography scan. Weight and height for BMI measurement, HBA1C for status of DM and lipid profile to diagnose dislipidemia.

Sampling Method: 100 patients selected by Simple random sampling methods.

RESULTS

This study was carried out in 100 type 2 diabetes mellitus patients admitted in medicine department of civil hospital Ahmedabad, between january to December 2021. they were devided in patinent with macro-vascular complications and without macrovascular complications.

Table 1: Age distribution of case and control group

Age group	Type 2 DM with macrovascular diseases.	Type 2 DM without macrovascular diseases.
UP TO 50 YRS	10	18
51 TO 60 YRS	13	19
61 TO 70 YRS	21	5
ABOVE 70 YRS	6	8
TOTAL	50	50

In this study we can observe that macrovascular disease are more common in age group of 61 to 70 years. 21 DM patients were having macrovascular complications in this age group.

Table 2: prevalance of macrovascular complications in type 2 DM patients

CIMT in mm	Present Study		Shamugavadivas et al[9]		K.J.R.et al,[10]	
	With complications	Without complications	With complications	Without complications	With complications	Without complications
>0.8mm	35(a)	11(b)	47(a)	22(b)	34(a)	17(b)
<0.8mm	15(c)	37(d)	3(c)	28(d)	16(c)	33(d)

CIMT= Common Carotid Intimal Medial Thickness. P= 0.0001 stastistically significant.
CIMT mean in DM patients with complication is 0.99 and standard deviation (+/-) is 0.359 and in without complications is 0.76 with standard deviation is(+/-)0.283.
Prevalance of macrovascular complications in patients with raised value of CIMT compared to normal value of CIMT. a/a+b=0.76 VS c/c+d=0.28
so, 76 % patients have macrovascular complications who have raised value of CIMT compared to normal CIMT which is 28 %.

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Prevalance of raised value of CIMT in type 2 DM patients with macrovascular complications compared to type 2 DM patients without macrovascular complications. a/a+c=0.70 VS b/b+d =0.22, so, 70 % patients with macrovascular diseases have raised value of CIMT as compared to type 2 DM without macrovascular diseases which is 22 %.

Table 3: Hba1c value in DM patients

	Hba1c mean value % DCCT units	Standard deviation (+/-)
Type 2 DM with macrovascular diseases.	7.4	0.4
Type 2 DM without macrovascular diseases.	6.4	0.5

P= 0.00290, p is statistically significant.
As [Table 3] shows patient with macrovascular complications are having hba1c mean value is 7.4(+/-0.4) higher than the patient without complication 6.4(+/-0.5). so, higher Hba1c value and uncontrolled DM for a longer time triggers atherosclerosis causing macrovascular complications.

Table 4: lipid profile mean values in DM patients

	This study		K.J.R.et al[10]	
	Type 2 DM with macrovascular diseases.	Type 2 DM without macrovascular diseases.	Type 2 DM with macrovascular diseases.	Type 2 DM without macrovascular diseases.
Cholesterol	248 (+/-19)	218 (+/-15)	209	185
Triglyceride	226 (+/15	170 (+/- 12)	214	158
HDL	36 (+/- 4)	46 (+/-3)	36	40
LDL	136 (+/- 12)	109 (+/-13)	126	110

In this study p= <0.01 significant in DM patient with macrovascular complications.
All mean values are in mg/dl and (+/- SD).

As [Table 4] shows serum cholesterol(248 mg/dl), triglyceride(226 mg/dl and LDL(136mg/dl) are significantly raised and good cholesterol HDL(36mg/dl) is reduced in patient with DM with macrovascular disease in our study. And patient without macrovascular disease are having near normal values of cholesterol(218mg/dl), triglyceride(170mg/dl) and LD(109mg/dl)L as compared to with macrovascular complications patients, and normal values of HDL.

Figure 1: number of patient of smoking and macrovascular complications

As shown in [Figure 1] number of smoker in DM with macrovascular complications are 22 and without complications are 19 and and patient who do not smoke and having macrovascular complications are 28 and without macrovascular complications are 31. So, smoking distribution in two groups in this study matched equally to decrease bias of risk factors or to avoid confounding factors.

DISCUSSION

[Table 1] shows 100 diabetic patients were included in this study as per inclusion criteria. CIMT is measured with the help of ultrasound doppler. And macro-vascular complication is more common in age group of 61 to 70 years.

In this study "p" value is 0.0001 [Table 2] so, 0.8 mm considered as mean and statistically significant in DM with complication group and we can say that CIMT raised in patients with CAD, CVA and PVD patients.

In our study Out of 50 35(76%) DM patient with macro-vascular complication had CIMT more than 0.8 mm. and Out of 50 DM patient without macro-vascular complications only 11(28%) had CIMT more than 0.8 mm. p = 0.0001 and it is statistically significant. And this study is comparable to other study. [Table 2].

So, prevalence of macro-vascular complications in patients with raised value of CIMT is 76% and prevalence of complications in normal value of CIMT is 28%. We also observed that prevalence of raised value of CIMT in type 2 DM patients with macro-vascular complications is 70% and prevalence of raised value of CIMT without macro-vascular complications is 22%.

In Shamugavadivas et al study [Table 2] prevalence is 68% patients have macro-vascular complications who have raised value of CIMT compared to normal CIMT which is 9%.

And 94% patients with macro-vascular diseases have raised value of CIMT as compared to type 2 DM without macro-vascular diseases which is 44%.[9] So this study also supports that patient with raised value of CIMT are prone to develop macro-vascular complications.
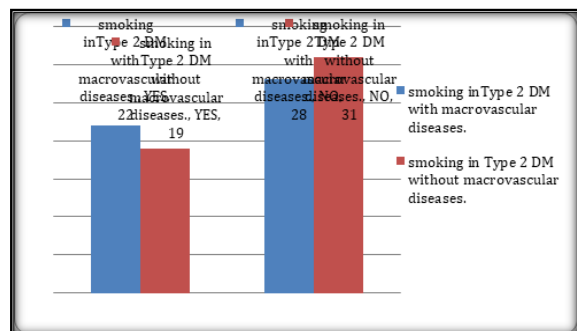
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In K.J.R.et al study [Table 2] prevalence is 67% patients have macro-vascular complications who have raised value of CIMT compared to normal CIMT which is 33% percent. And 68 percent patients with macro-vascular diseases have raised value of CIMT as compared to type 2 DM without macro-vascular diseases which is 34%.[10] this study also supports that patient with raised value of CIMT are prone to develop macro-vascular complications.

High resolution B mode ultrasonography Doppler is non invasive and validated method to assess early markers of atherosclerosis and indicator of CAD/PVD/CVA by measuring carotid intimal thickness in asymptomatic or patients with dislipidemia, DM, and cigarate smoking.[11]

On comparing carotid intima media thickness in both DM patients with and without macro-vascular complications. patients with complications had mean CIMT as 0.99 mm and patient without complications had mean CIMT as 0.76mm. The normal intimal - medial thickness of common carotid artery as evaluated by B mode ultrasound imaging was 0.8 mm approximately.

FBS, RBS and PPBS were elevated in DM patients with macro-vascular complications compared to those without complications.[10] Hba1c level elevated in DM patients with macro-vascular complications then without complications. p =0.0290 and it is statistically significant. [Table 3]

Patient having raised values of Hba1c have developed macro vascular complications as compared to controlled values of hba1c.[13] In this study patient having mean value of Hba1c 7.4 developed complications and patient with mean value of 6.4 did not developed macro vascular complications. So it is significant that those who have raised value of Hba1c are more prone to develop macro vascular complications. [Table 3]

Duration of uncontrolled DM is also responsible for development of macro vascular complications,[14] in this study patient having uncontrolled DM for 5.6 years developed macro vascular complications and those who are having uncontrolled DM for 3.3 years did not developed macro vascular complications. So because of this observation, (p=0.014) it is significant that patient having uncontrolled DM for more than 5 years are more prone to develop macro vascular complications. so, study stats that as duration of diabetes increases there is progression of CIMT.

[Table 4] Study of K.J.R et al also shows that patient with complications are having altered lipid profile. So, according to these both studies we can say that dyslipidemia is responsible for atherosclerosis and those patients having dyslipidemia are more prone to develop macro-vascular complications. So, patient having altered lipid profile must go for CIMT and if found abnormal values, they must be treated with statins and lifestyle medication. diabetes also should be treated aggressively.[14]

This study has p value of <0.01 and it is significant that dyslipidemia is a risk factor for macro-vascular complications. [Table 4] and This study has demonstrated the role of traditional risk factors like total cholesterol, LDL Cholesterol and triglycerides in the progression of atherosclerosis.

Patient having raised cholesterol, LDL and triglycerides and decreased HDL are more prone to develop macro vascular complications.[15] And those who are having good amount of HDL do not develop macro-vascular complications despite of having raised values of triglycerides and cholesterol. We also observed that among 50 patients 48% (n=24) patients are suffering from cerebro vascular accidents, 43% (n=21) patient are suffering from coronary artery disease and ischemic heart disease. And only 9% (n=5) patients are suffering from peripheral vascular disease. So according to our study we can say that patient with raised value of CIMT are more prone to develop complications.

Most common macro vascular disease is CVA than second most common is CAD and third most common is PVD in DM patient having raised values of CIMT.

Smoking a confounding factor is equally matched in groups to reduce bias of risk factors. [Figure 1]

In this study we found that patient of type 2 DM having macro-vascular complications are having BMI mean value of 26.2 with satandard deviation(+/- 1.2) and those who do not have macro-vascular complications are having mean value of 24.5 and standard deviation (+/- 1) so, according to this study we can say that raised BMI value is a risk factor to develop macro-vascular complications in type 2 DM patients. So patient with raised BMI value and with DM must go for Doppler evaluation and CIMT and intervention must be done according to CIMT values to prevent macro-vascular complications.[16] p=0.51 BMI is raised in DM patients with complications but it is not significant.

Patient having mean BMI of 26.2 had developed macro vascular complications as compared to mean of 24.5.

CONCLUSION

This study showed values of CIMT is raised in type 2 DM patients with macro-vascular complications than Diabetic patients without complications. age group of 61 to 70 years is more common to develop complications. risk factors like age, raised BMI, dyslipidemia, duration of uncontrolled DM, raised Hba1c, and raised BMI actually have a correlation with increased value of CIMT and promotes the disease process and contributing for macro-vascular complications like CVA, CAD and PVD.[17] So early life style modification in diabetic patient can be very helpfull and prevents dependence on other and prevents restriction in quality of life.[18] Hba1c value must be investigated on a regular interval to monitor DM.[19]

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