Study of risk factors for increased carotid intima media thickness in subjects with and without diabetes mellitus at a tertiary hospital

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Abstract
Background: Sonographic evaluation of the carotid artery intima–media thickness is a simple, noninvasive and reproducible imaging parameter to evaluate atherosclerosis and atherosclerotic vascular diseases. Present study was aimed to measure carotid intima media thickness in subjects with and without diabetes mellitus and correlation of CIMT with risk factors like age, hypertension, smoking, dyslipidemia. **Material and Methods:** Present study was cross sectional hospital based study conducted in patients aged more than 30 years with type 2 diabetes mellitus and hypertension as cases and controls were selected from healthy relatives attending OPD with patient. **Results:** In present study, 100 patients were selected with 50 patients each in diabetic and non-diabetic groups. Majority of cases were from age group 61-70 years, there are 27 cases and 27 controls which corresponds to 54%. In cases, 74% were males and 26% were females. In controls, 74% were males and 26% were females. In males difference of CIMT between cases and controls was statistically significant. 46 patients had CIMT between 0.06 – 0.20 cm (92%) and Out of 50 controls,45 had CIMT between 0.06 – 0.20 cm (90%). Mean CIMT in cases is 0.121 ± 0.015 cm and in controls, it is 0.07 ± 0.02 cm, difference was statistically significant ($p = 0.035$). We noted a statistically significant difference for various lipid profile values (Total cholesterol, LDL, HDL, Triglyceride) and difference was statistically significant ($p < 0.001$). The mean CIMT is increased in DM+HTN+SMOKING group (0.16 ± 0.25) which indicates risk factors contributes in the development of atherosclerosis. **Conclusion:** Measurement of carotid intima media thickness by ultrasound Doppler is reliable and helps in early medical intervention to take care of risk factors and life style modification.
Keywords: carotid intima media thickness (CIMT), diabetes mellites, hypertension, ultrasound study

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INTRODUCTION

Sonographic evaluation of the carotid artery intima–media thickness is a simple, noninvasive and reproducible imaging parameter to evaluate atherosclerosis and atherosclerotic vascular diseases. Recently, considerable attention has been directed at the wall thickness of the carotid arteries as an early marker of atherosclerotic disease and as a means of showing the effectiveness of medical therapies in treating atherosclerosis.[1,2] Ultrasound imaging of carotid vessels can provide information on Carotid Intima Medial Thickness (CIMT), plaque presence and type, calcification, and wall diameter, offers the ability to examine pre-symptomatic lesions, assess atherosclerotic burden and hence the risk of cardiovascular and cerebrovascular events.[1,2,3] There is also evidence for an excess prevalence of intimal thickening and atherosclerotic lesions in patients suffering from definite hypertension compared with normotensive controls.[4,5,6] Measurement of carotid intimal thickness using high resolution B mode ultrasonography which is noninvasive well validated method is used to assess early manifestations of

atherosclerosis such as early cardiovascular disease, T1A, stroke in asymptomatic as well as high risk patients such as dyslipidemia, DM, HTN and cigarette smoking.[5,6] Present study was aimed to measure carotid intima media thickness in subjects with and without diabetes mellitus and correlation of CIMT with risk factors like age, hypertension, smoking, dyslipidemia.

MATERIAL AND METHODS

Present study was cross sectional hospital based study conducted in department of general medicine with help of Department of General Medicine, BGS Global Institute of Medical Sciences Kengeri, India. Study duration was of 1 year (January 2020 to December 2020). Study was approved by institutional ethical committee.

Inclusion criteria: Patients aged more than 30 years with type 2 diabetes mellitus and hypertension

Exclusion criteria: Patients with ischemic heart disease (acute coronary syndrome, stable angina, prior history of coronary artery bypass graft, per cutaneous coronary angioplasty)

- Patients with congestive heart failure
- Patients with renal disease both acute and chronic
- Patients with stroke
- Patients with type 1 DM

Study was explained and consent was taken for participation. Controls were selected from healthy relatives attending OPD with patient. A total of 100 patients were selected with 50 patients each in diabetic and non-diabetic groups.

Patients were subjected to history taking (demographic details, past medical history), examination, followed by for carotid Doppler examination to measure carotid intima media thickness. Blood investigations such as blood sugar levels, HbA1c, lipid profile were done.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, 100 patients were selected with 50 patients each in diabetic and non-diabetic groups. Majority of cases were from age group 61-70 years, there are 27 cases and 27 controls which corresponds to 54%. In cases, 74% were males and 26% were females. In controls, 74% were males and 26% were females.

Table 1: Age and gender distribution

	CASES (n=50)		CONTROLS (n=50)		P value
	No. of cases	Percentages	No. of cases	Percentages	
Age in years					0.54
40-50	10	20	11	22	
51-60	13	26	12	24	
61-70	27	54	27	54	
Mean ± SD	60.62 ± 8.66		60.42 ± 8.35		
GENDER					1
Male	37	74		74	
Female	13	26	1	26	

In age group 61-70 years, CIMT in cases was 0.13±0.021, in controls, it was 0.07±0.02 and difference was statistically significant. In cases, Mean CIMT in males is 0.097±0.04 and in females 0.17±0.030. In controls, Mean CIMT in males is 0.07±0.02 and in females 0.07±0.024. In males difference of CIMT between cases and controls was statistically significant.

Table 2: Comparison of CIMT between age and gender distribution

	Cases	controls	P value
Age in years			
40-50	0.08 ± 0.03	0.07 ± 0.01	0.151
51-60	0.11 ± 0.04	0.074 ± 0.01	0.105
61-70	0.13 ± 0.021	0.07 ± 0.02	0.014
GENDER			
Male	0.097 ± 0.04	0.07 ± 0.02	<0.001
Female	0.17 ± 0.030	0.07 ± 0.024	0.217

CIMT between 0.01-0.05 cm group, there are 4 cases and 5 controls. CIMT between 0.06-0.10 cm group, there are 28 cases and 42 controls. CIMT between 0.11-0.15 cm group, there are 14 cases and 3 controls. CIMT between 0.16-0.20 cm group, there are 4 cases. Out of 50 cases, 46 patients had CIMT between 0.06 – 0.20 cm (92%) and Out of 50 controls,45 had CIMT between 0.06 – 0.20 cm (90%). Mean CIMT in cases is 0.121± 0.015 cm and in controls, it is 0.07 ±0.02 cm, difference was statistically significant (p = 0.035).

Table 3: Comparison of Average CIMT in two groups

CIMT	CASES (n=50)		CONTROLS (n=50)	
	No. of cases	Percentages	No. of cases	Percentages
0.01-0.05	4	8	5	10
0.06-0.10	28	56	42	84
0.11-0.15	14	28	3	6
0.16-0.20	4	8	0	
Mean ± SD	0.121 ± 0.015		0.07 ± 0.02	

We noted a statistically significant difference for various lipid profile values (Total cholesterol, LDL, HDL, Triglyceride) and difference was statistically significant ($p < 0.001$). Patients with above the normal values in the profile were defined as risk group and patients with normal and below normal values were defined as non-risk group.

Table 4: Distribution of lipid parameters in two groups

Sugar parameters	CASES (n=50)		CONTROLS (n=50)		P value
	No. of cases	Percentages	No. of cases	Percentages	
Total cholesterol (mg/dl)					< 0.001
≤ 200	18	36	39	78	
>200	32	64	11	22	
LDL (mg/dl)					< 0.001
≤ 130	27	54	40	80	
>130	23	46	10	20	
Triglyceride (mg/dl)					< 0.001
≤ 150	1	2	27	54	
>150	49	98	23	46	
HDL (mg/dl)					< 0.001
≤ 40	34	68	13	26	
>40	16	32	37	74	

Mean CIMT value 1.30±0.23 is highest between 7-10 years duration. There is incremental increase in CIMT value as the duration of DM progress. statistical significance was achieved when duration of DM was compared with CIMT value. Mean CIMT in risk group of DM subjects (HbA1c > 7) was higher than the non-risk group (HbA1c < 7) and P value 0.0004 highly significant.

Table 5: Effect of duration of diabetes on CIMT

	No. of cases	MEAN CIMT	P VALUE
DURATION			
1-3 YEARS	20	0.77+ 0.19	<0.001
4-6 YEARS	15	0.88+ 0.13	
7-10 YEARS	15	1.30+0.23	
HBA1C			0.0004
>7	37	0.09+0.04	
<7	13	0.05+0.03	

The mean CIMT is increased in DM+HTN+SMOKING group (0.16±0.25) which indicates risk factors contributes in the development of atherosclerosis.

Table 6: Comparison of CIMT in both diabetic and non-diabetic with risk factors

NO	MEAN CIMT
DM+HTN	0.12± 0.25
DM+SMOKING	0.08±0.04
DM+HTN+SMOKING	0.16±0.25
NON DM+HTN	0.08±0.2
NON DM+SMOKING	0.06±0.01
NON DM+HTN+SMOKING	0.08±0.01

DISCUSSION

Atherosclerosis typically occurs over a period of many years, usually many decades. After a generally prolonged "silent" period, atherosclerosis may become clinically manifest. Evaluation of intimal medial thickness is considered as surrogate marker of Atherosclerosis. B mode ultrasound was found to be a suitable noninvasive method to visualize the arterial walls and to monitor the early stages of the atherosclerotic process. Ultrasound imaging of carotid vessels can provide information on Carotid

Intima Medial Thickness (CIMT), plaque presence and type, calcification, and wall diameter, offers the ability to examine pre-symptomatic lesions, assess atherosclerotic burden and hence the risk of cardiovascular and cerebrovascular events. In present study cases and controls in age groups of 40 – 50 , 51-60 and 61-70 years, mean age being 60 years and more no of patients are in age group 61-70 years[27 cases] .As the age increases, Mean CIMT in cases has increased compared to controls that is Mean CIMT in cases in age group 41-50 is 0.08 cm , 51-60 is 0.11 cm and 61-70 years is 0.13 cm. In cases, mean CIMT is 0.121 cm (range 0.04 – 0.019 cm) and in controls, mean CIMT is 0.07 cm (range 0.04 – 0.15 cm). Rathnakar Sahoo et al.[8], Salonen R et al.[9], Howard G et al.[10], Allan PL et al.[11], showed a positive correlation between age and CIMT. In the study by Ratnakar Sahoo et al.,[8] differences in mean CIMT between males and females in cases were not significant; however the difference was significant in both the genders when compared to controls with P < 0.001. Similar findings were noted in present study. In this study, in cases, mean CIMT is 0.121 cm (range 0.04 – 0.19 cm) and in controls, mean CIMT is 0.07 cm (range 0.04 – 0.15 cm). Mean CIMT is significantly more in cases when compared to controls with P-0.0001. Similar findings were noted in study done by Ratnakar Sahoo et al.,[8] mean CIMT in cases was 0.0782 cm (range 0.05 – 0.15 cm) and in controls it was 0.059cm (range 0.04 -0.09 cm) with P<0.0001, and also in the study done by Mohan et al.[11], Pujia et al.[12]. In this study mean CIMT of hypertensive and non-hypertensive patients in study group were 0.12±0.25 and 0.09±0.03. Mean CIMT of hypertensive and non-hypertensive patients in control group were 0.08±0.02 and 0.06±0.01 (p=0.04) Similar findings were noted by Daniel H O'Leary et al.[13], A K Agarwal. et al.[14] In this study 10% of study group are smokers with mean CIMT of 0.09±0.04 and nonsmokers with mean CIMT of 0.08±0.04 (p=0.63). In control group mean CIMT of smokers 0.06±0.01 and nonsmokers 0.06±0.01 (p=1.0). In this study there was no significant difference in CIMT between smokers and nonsmokers. Due to a smaller number of patients and duration of smoking was not considered in this study hence this study failed to achieve statistical significance on effect of smoking on CIMT. In this study there was positive correlation between duration of DM with CIMT value (p=0.001) This study is correlating with the study Ratnakar Sahoo et al.[8],Mohan et al.[11], Pujia et al.[12]. In this study there was a positive correlation between HbA1C level with CIMT (p=0.0004) on comparing risk and non-risk group in DM subjects. This study is correlating with the study by Yokoyama Hiroki et al.[15], Yamasaki Yoshimitsu et al.[16] showed HbA1C had statistically significant positive correlation with CIMT.

Limitations of present study were cross sectional study, small sample size. Diabetes, duration of diabetes, age, gender and hypertension are the most important risk factors associated with increased intimal medial thickness. Diabetic subjects have higher intimal medial thickness values than non-diabetic subjects. Diabetes, duration of diabetes, age, gender and hypertension are the most important risk factors associated with increased intimal medial thickness. Ultrasound guided CIMT measurement is noninvasive, reproducible method for detecting of early arterial structural changes associated with various risk factor for atherosclerosis. By using noninvasive USG guided measurement of CIMT it is possible to detect atherosclerosis in risk groups at the earliest during asymptomatic period and to prevent related complications.

CONCLUSION

The present study showed increased values of CIMT in DM patients. Along with this risk factors like age, HTN, BMI, duration of DM, may actually have a correlation with CIMT either directly or indirectly influencing the disease process itself and contributing for atherosclerosis. Measurement of carotid intima media thickness by ultrasound Doppler is reliable and helps in early medical intervention to take care of risk factors and life style modification.

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