Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 12, 2023

Original research article

A Study on relation of Carotid Intima Media Thickness (CIMT) to various micro & macro-vascular complications of diabetes

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Abstract

CIMT has been proposed as a risk factor that may be included in the algorithms for cardiovascular risk assessment 10. In CIMT measurement, common carotid and internal carotid arteries are usually taken into consideration. Considering this relative risk of MI is reported more with increasing internal CIMT compared with common CIMT, but the opposite is reported for stroke risk. This single centre, prospective, observational study was carried out in Diabetes unit of tertiary care hospital in patients of type 2 Diabetes Mellitus (T2DM). Patients were screened with following inclusion and exclusion criteria and total 100 patients were enrolled in the study. Among macrovascular complications, coronary artery disease, cerebrovascular accident and peripheral vascular disease were present in 13.00%, 7.00% and 16.00% of the patients. In microvascular complications, most common encountered complication was retinopathy (33.00%) followed by nephropathy and neuropathy in 32.00% and 19.00% patients respectively.

Keywords: Carotid intima media thickness, micro & macro-vascular complications, diabetes

Introduction

According to the Indian Council of Medical Research‐ Indian Diabetes study (ICMR‐ INDIAB), a national Diabetes study, India currently has 62.4 million people with Diabetes. This is set to increase to over 100 million by 2030. The majority of people with diabetes (90%) have Type 2 diabetes (T2DM). While T2DM predominantly affects older individuals in developed countries, in developing nations like India, it affects the younger population in the prime of their working lives and thus poses an even greater threat to the health of these individuals. This epidemic of Diabetes is unfortunately paralleled by a corresponding increase in the prevalence of its complications, both microvascular and macrovascular, which account for much of the premature morbidity and mortality due to Diabetes in India [1, 2].

Given the rapid escalation of the Diabetes epidemic, all levels of prevention (primary, secondary and tertiary Diabetes prevention) need to be put into action simultaneously. Unfortunately, more than 50% of people with T2DM remain undiagnosed. Thus the priority is to screen, diagnose and treat as many people with T2DM as possible. In a hugely populated country like India with over 1.2 billion people with diverse cultures, the screening and diagnosing methods for Diabetes should be simple, cost‐ effective and less time‐ consuming and should also take into consideration the unique risk factors for and increased susceptibility to, T2DM that the Asian Indians have. The latter is referred to as the "Asian Indian Phenotype" [3].

CIMT has been proposed as a risk factor that may be included in the algorithms for cardiovascular risk assessment. In CIMT measurement, common carotid and internal carotid arteries are usually taken into consideration. Considering this relative risk of MI is reported more with increasing internal CIMT compared with common CIMT, but the opposite is reported for stroke risk [4].

The risk of complications in a person varies with severity of CIMT. It has been reported that increased hazard ratios of the asymptomatic presence of increased CIMT have significantly increased hazard ratios for clinical end points like MI, stroke and CV death. Beside this, considering other complications of Diabetes like retinopathy, peripheral arterial disease, good amount of evidence suggests strong association between CIMT and risk of complications [5].

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 12, 2023

Given the huge number of Diabetic population in our country, assessing CV risk in a Diabetic person becomes important. Correlation of CIMT with incident complications of Diabetes makes CIMT a useful screening test to be used clinically. This method provides cheap and safe alternative to other invasive and non-invasive tests [6].

Methodology

This single centre, prospective, observational study was carried out in Diabetes unit of tertiary care hospital in patients of type 2 Diabetes Mellitus (T2DM). Patients were screened with following inclusion and exclusion criteria and total 100 patients were enrolled in the study.

Inclusion Criteria

- Age ≥ 18 years.
- Either gender.
- Diagnosed type 2 Diabetes Mellitus (T2DM).
- Willing to participate in the study.

Exclusion Criteria

- Patients with type I DM
- Secondary Diabetes
- Overt renal failure
- Congestive cardiac failure
- Urinary tract infection
- Recent inter current illness
- Pregnant Females

Not Willing to Give Informed Consent

After initial screening, demographic details of the patient like patient identifier, age, gender, height, weight, smoking history, alcoholism history were recorded in case record form (CRF). Other relevant history like history of coronary artery disease (CAD), history of stroke or transient ischemic attacks (TIAs), history of peripheral arterial disease, autonomic neuropathy, retinopathy and renal disease was also noted in CRF.

Results

Table 1: Complications of Diabetes encountered in study

Complications	N	Percentage
Coronary Artery Disease	13	13.00%
Cerebrovascular Accident	7	07.00%
Peripheral Vascular Disease	16	16.00%
Retinopathy	33	33.00%
Neuropathy	19	19.00%
Nephropathy	32	32.00%

Among macrovascular complications, coronary artery disease, cerebrovascular accident and peripheral vascular disease were present in 13.00%, 7.00% and 16.00% of the patients. In microvascular complications, most common encountered complication was retinopathy (33.00%) followed by nephropathy and neuropathy in 32.00% and 19.00% patients respectively.

Table 2: Relationship between CIMT and complications of Diabetes

Complication	Increased CIMT	Normal CIMT	P value
Coronary Artery Disease	12	1	0.069
Cerebrovascular Accident	6	1	0.670
Peripheral Vascular Disease	15	1	0.034*
Retinopathy	28	5	0.032*
Neuropathy	16	3	0.159
Nephropathy	26	6	0.121

*P<0.05, Chi Square test (Fischer exact test)

Though all complications were common in patients with increased CIMT compare to normal patients, retinopathy (28 vs. 5, p=0.032) and peripheral vascular disease (15 vs. 1, p=0.034) were significantly more common with increased CIMT group of patients. Coronary heart disease (12 vs. 1, p=0.069), cerebrovascular disease (6 vs. 1, p=670), neuropathy (16 vs. 3, p=0.159) and nephropathy (26 vs. 6, p=0.121) were non-significantly more in patients with increase CIMT as compared to normal

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 12, 2023

counterparts.

Table 3: Mean CIMT in patients with or without complications

Complications	CIMT (Mean ± SD)		P value
	Patient with Complications	Patient Without Complications	
CAD	0.93 ± 0.04	0.91 ± 0.06	0.341
CVA	0.92 ± 0.03	0.91 ± 0.06	0.691
PVD	0.93 ± 0.02	0.91 ± 0.06	0.225
Retinopathy	0.95 ± 0.07	0.89 ± 0.05	0.0001
Neuropathy	0.92 ± 0.04	0.91 ± 0.06	0.691
Nephropathy	0.94 ± 0.07	0.90 ± 0.05	0.001

Mean values of CIMT in patients with and without macrovascular complications were non-significant for CAD [0.93 ± 0.04 vs. 0.91 ± 0.06 (p=0.341)], CVA [0.92 ± 0.03 vs. 0.91 ± 0.06 (p=0.691)], and PVD [0.93 ± 0.02 vs. 0.91 ± 0.06 (p=0.225)] respectively. For microvascular complications, significant difference for retinopathy [0.95 ± 0.07 vs. 0.89 ± 0.05 (0.0001)] and nephropathy [0.94 ± 0.07 vs. 0.90 ± 0.05, (p=0.001)] but not for neuropathy [0.92 ± 0.04 vs. 0.91 ± 0.06, (p=0.691)] was observed respectively in patients with or without that complication.

Table 4: Relationship between magnitude of glycemia and duration of Diabetes with coronary artery disease

Glycemic parameter	CAD		P value
	Yes (n=13)	No (n=87)	
Duration of DM	12.46 ± 5.99	10.97 ± 5.58	0.374
FBS	136.85 ± 32.47	126.93 ± 25.01	0.203
PPBS	175.62 ± 40.80	172.40 ± 36.58	0.772
HbA1c	8.60 ± 1.07	8.32 ± 0.88	0.381

Discussion

Diabetes Mellitus is one of major growing pandemic of the century. Today, there are 382 million people living with Diabetes. A further 316 million with impaired glucose tolerance are at high risk from the disease-an alarming number that is set to reach 471 million by 2035. Diabetes is on the rise all over the world and countries are struggling to keep pace. A staggering 80% of people with Diabetes live in low and middle income countries and the socially disadvantaged in any country are the most vulnerable to the disease. Today's emerging Diabetes hotspots include countries in the Middle East, Western Pacific, sub-Saharan Africa and South-East Asia where economic development has transformed lifestyles. These rapid transitions are bringing previously unheard of rates of obesity and Diabetes. Developing countries are facing a firestorm of ill health with inadequate resources to protect their population. Without concerted action to prevent Diabetes in less than 25 years time there will be 592 million people living with the disease. Diabetes is now become prominent global health agenda with specific targets for access to essential medicines and for halting the growth of obesity and Diabetes [7].

Diabetes is associated with a number of complications. Acute metabolic complications associated with mortality include Diabetic ketoacidosis, hyperosmolar coma. But arguably the most devastating consequence of Diabetes are its long term vascular complications. These complications are wide ranging and are due at least in part to chronic elevation of blood glucose levels which leads to damage of blood vessels and the resulting complications are grouped under "Microvascular disease" and "Macrovascular disease" [8].

Cardiovascular disorders in Diabetes include premature atherosclerosis, manifest as myocardial infarction and stroke as well as impaired cardiac function, predominantly diastolic dysfunction. Diabetes Mellitus is also one of the major risk factor for peripheral arterial disease especially important in the development of Lower Extremity Artery Disease (LEAD). This is certainly true for severe disease notably gangrene and ulceration but for intermittent claudication the strength of the association with Diabetes may be comparable with that for coronary heart disease. The association of Diabetes with LEAD is inconsistent on multivariable analysis which includes other risk factors but it appears that the duration and severity of Diabetes affect the level of risk [9].

Diabetic nephropathy represents the major cause of end-stage renal failure. Diabetic retinopathy is characterized by a spectrum of lesions within the retina and is the leading cause of blindness among adults aged 20-74 years. More than half of all individuals with Diabetes eventually develop neuropathy with a lifetime risk of one or more lower extremity amputations estimated in some populations to be up to 15%.

Asian Indians are known to have very high rates of Diabetes and premature coronary artery disease. For assessment of macro-vascular complications Carotid Intima-Media Thickness (CIMT) is a well standardized surrogate marker for assessing cardiovascular risk and it is well accepted as a parameter of subclinical atherosclerosis. CIMT is a strong predictor of future cardiovascular events and is associated

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 12, 2023

with conventional markers of cardiovascular risk such as age, hypertension and dyslipidemia.
Earlier studies have documented a significant role of CIMT in cardiovascular disease prediction in both non-Diabetic and Diabetic populations. Studies have shown that in Asian Indians there is an association between increased CIMT and type 2 Diabetes. CIMT significantly higher in Diabetic patients than in non-Diabetic subjects and also demonstrated that subclinical atherosclerosis increases with increasing degrees of glucose intolerance. Thus CIMT assessment in relation to complications of Diabetes becomes necessary [10].

Conclusion

- Complications observed in Diabetic patients were retinopathy was the most followed by nephropathy, neuropathy, PVD, CAD and CVA.
- Retinopathy and PVD were significantly associated with increased CIMT.
- Significant difference in mean CIMT was observed in retinopathy and nephropathy patients.

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