Original Article

ASSOCIATION OF TYPE 2 DIABETES MELLITUS AND MACROVASCULAR COMPLICATIONS IN A TERTIARY CARE CENTER – A CROSS SECTIONAL STUDY

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Abstract

Diabetes is a group of chronic diseases characterized by high blood sugar. Modern medicine utilizes a wide range of lifestyle and pharmaceutical interventions aimed at preventing and controlling hyperglycemia. In addition to ensuring proper delivery of glucose to the body's tissues, diabetes treatment aims to reduce the potential for high blood sugar to damage body tissues.

Protecting the body from high blood sugar. The importance of this cannot be overemphasized. Direct and indirect effects on the human vascular system are major causes of morbidity and mortality in type 2 diabetes. In general, the adverse effects of hyperglycemia are divided into macrovascular complications (coronary artery disease, peripheral artery disease, and stroke). In this study we are aimed at studying the development of Macrovascular complication among the diabetic and pre diabetic patients visiting a Tertiary care hospital over a period of 1 year as a cross sectional study from the initial date of assessment at 6 months interval.

Keywords: Diabetes Mellitus, Prediabetic Populations, T2DM.

INTRODUCTION

Diabetes is recognized as a global epidemic, with the number of adults with diabetes reaching 22 million in 2021, with an estimated prevalence of 8.5% worldwide [1]. However, the prevalence of diabetes is heterogeneous and varies from country to country. In Arab countries such as Qatar, the prevalence is estimated at 20.2%, while in the United States the prevalence is approximately 12.3% [2, 3], indicating a greater public health burden and a more urgent problem.

Diabetes is a major cause of microvascular complications such as nephropathy and retinopathy. It is also associated with accelerated atherosclerosis, and type 2 diabetes mellitus (T2DM) is usually recognized late in cardiovascular disease (CVD). Therefore, many patients experience complications at or shortly after diagnosis. A strong association between diabetes and CVD has been observed in several studies, apart from other traditional

cardiovascular risk factors [4]. As the leading cause of death in diabetic patients, CVD mortality accounts for 52% of her type 2 diabetes deaths and 40% of type 1 diabetes (type 1 diabetes) [5]. Recently, prediabetic conditions characterized by impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) have been shown to be associated with cardiovascular morbidity and mortality [6]. Therefore, it is important to better understand the pathophysiology in order to identify new approaches to early resolve or prevent the development of macrovascular complications. This article attempts to review current understanding of the epidemiology, etiology, and implications of increased CVD risk in diabetic and prediabetic populations. Cardiovascular risk factors [7]. As the leading cause of death in people with diabetes, CVD accounts for 52% of deaths in type 2 diabetes and 12% in type 1 diabetes [8].

MATERIALS AND METHOD

The aim of the study is to find the association between diabetes and development of macrovascular complication among the patient visiting a Tertiary care center during the course of follow up from Department of Department of General Medicine, Chettinad Institute of Medical Research.

Study Period: January 2022-December 2022

Sample Size: From a study by Prakash Ajmera at el.[1]

The macrovascular complications were about 35% in the diabetic patients in his study, based on which, having

Precision = 5.00 %

Prevalence = 35.00 %

Population size = infinite

95% Confidence Interval specified limits [30% -- 40%]

(these limits equal prevalence plus or minus precision)

Estimated sample size:

n = 350

All 350 patients diagnosed as Diabetic on the assessment on January 2022 were taken up using Consecutive sampling Technique (Every subject meeting the criteria of the inclusion is taken up for the study until the adequate sample size is attained.) and were followed up for a period of 1 year to study the Macrovascular complications.

Materials and Method

After getting approval from the Department of institutional ethics committee, patients who attended Medicine OPD for Diabetes screening on First week of January were recruited for the study. Consecutive sampling Technique is used. The newly diagnosed and patients with the History and Laboratory diagnosis of Diabetes were taken up for the study. The patients were followed at 6 months interval over a period of 1 year with their Medical records. The data was collected using a Semi- Structured pretested, Predesigned, validated questionnaire. The values were entered in Excel sheet. History, Clinical findings, Laboratory tests, CT- Brain, MRI- Brain, USG of Peripheral vessels, ECG and ECHO were taken up as parameters for the patients during the follow up for the patients with confirmed diagnosis of Diabetes. Association between Diabetes and Macrovascular complications

like Coronary Artery Disease, Stroke and Peripheral Vascular Disease were studied using appropriate statistical analysis.

Inclusion Criteria: Patients with Diagnosis of Type 2 Diabetes between the age group of 25- 50 years at the time of initial assessment.

Exclusion Criteria: Patient with Diabetes and known history of Chronic illness like hypertension, Hyperlipidemia, Coronary Artery Disease, Stroke, Peripheral Vascular disease, Systemic diseases were excluded, Patient with Diabetes and known history of Chronic illness.

Biological Material Required: Nil.

Statistical Method

Tools Used: Patients with the confirmed diagnosis of Diabetes will be taken up for the study. Using a pretested, validated questionnaire for the patients with confirmed diagnosis of Diabetes with no other Chronic illness were followed with their Medical records at 6 months interval. Development of Macrovascular complication is assessed. Association between Diabetes and Macrovascular complications like Coronary Artery Disease, Stroke and Peripheral Vascular Disease were studied using appropriate statistical analysis, Chi- square and Paired T test using SPSS Version 26.0.

Pathogenesis of CVD in Diabetes Mellitus

Hyperglycemia and insulin resistance, among various other factors, are believed to significantly contribute to the pathogenesis of atherosclerotic alterations and macrovascular complications in diabetes. Both are common in diabetics, but insulin resistance usually occurs years before hyperglycemia becomes clinically significant.

Insulin Resistance

Obesity plays an important role in the pathogenesis of insulin resistance, which is common in patients with type 2 diabetes. By releasing free fatty acids (FFAs) and inflammatory mediators, adipose tissue alters lipid metabolism, increases reactive oxygen species (ROS) production, and enhances systemic inflammation [9]. Insulin resistance is associated with abnormal function of glucose transporter type.

(GLUT-1), an insulin-mediated glucose transporter found primarily in adipocytes and muscle cells.

The blockade of NF-κB in a mice model resulted in decrease in systemic oxidative markers, adhesion molecule gene expression, and macrophage infiltration, processes that contribute to atherosclerosis [10], suggesting an important upregulation role of NF-κB in CVD development.

Parallel to atherosclerotic changes, thrombosis also plays an important role in the development of macrovascular complications in diabetes. In physiological setting, insulin inhibits thrombosis and increases fibrinolysis, and insulin resistance creates a prothrombotic state [11]. Lack of insulin also results in calcium accumulation in platelets, which enhances platelets aggregation [12], further contributing to CVD development.

Hyperglycemia

Hyperglycemia is also involved in the pathogenesis of cardiovascular complication of diabetes. It increases the production of ROS, which inactivates NO [13], leading subsequently to endothelial dysfunction. On the other hand, increased ROS production contributes to CVD by triggering the activation of protein kinase C (PKC). Acting as a group of enzymes that can affect the function of other cellular proteins, PKC has been shown to have

an effect on vascular cell growth and apoptosis, permeability, extracellular matrix synthesis, and cytokine production [14]. Activation of PKC results in alteration of vascular homeostasis and predisposition to vascular complications. PKC in turn induces ROS production in vascular cells [15], perpetuating the vicious cycle.

Risk of Stroke among Diabetics

In addition to CHD, diabetes also increases the risk of stroke. The INTERSTROKE study, a case-control study that recruited patients with acute stroke and patients with no history of stroke in 22 countries, showed a 35% increased risk of stroke in patients with a self-reported history of diabetes. [16]. A meta-analysis of 102 prospective studies found that diabetics had a 2.3-fold higher risk of ischemic stroke and a 1.6-fold higher risk of hemorrhagic stroke than non-diabetics [17].

Diabetes is also associated with poor prognosis and increased disability after stroke. In patients hospitalized with acute stroke, diabetes was associated with a higher risk of death or functional dependence (characterized by a modified Rankin scale of 3–6) [18]. The Australian Stroke Unit Registry showed that diabetic patients 3 months after acute stroke had poorer functional outcomes compared to those without [19]. Patients with impaired fasting glucose also showed lower functional outcomes and lower hospital discharge rates after acute stroke [3].

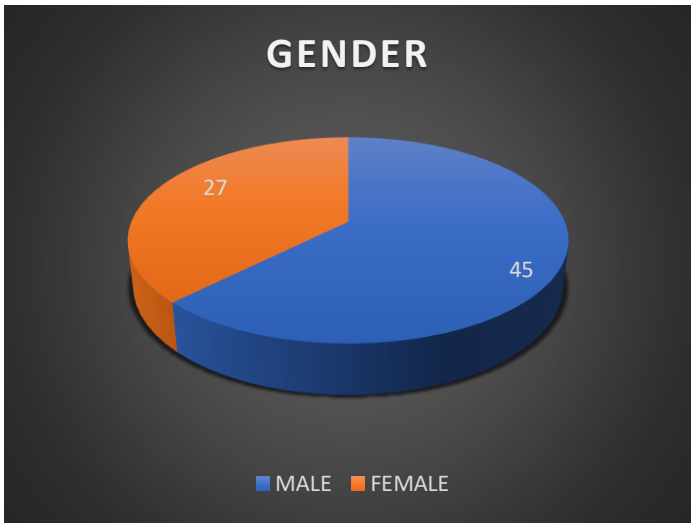
Risk of Peripheral Arterial Disease among Diabetics

Peripheral arterial disease (PAD) is a common macrovascular complication in diabetic patients. A study from the "German Epidemiological Examination on the Ankle-Brachial Index" (GETABI) showed a two-fold higher rate of PAD in diabetic patients over the age of 65 (defined as ABI <0> 1) also indicates PAD [1].

Results

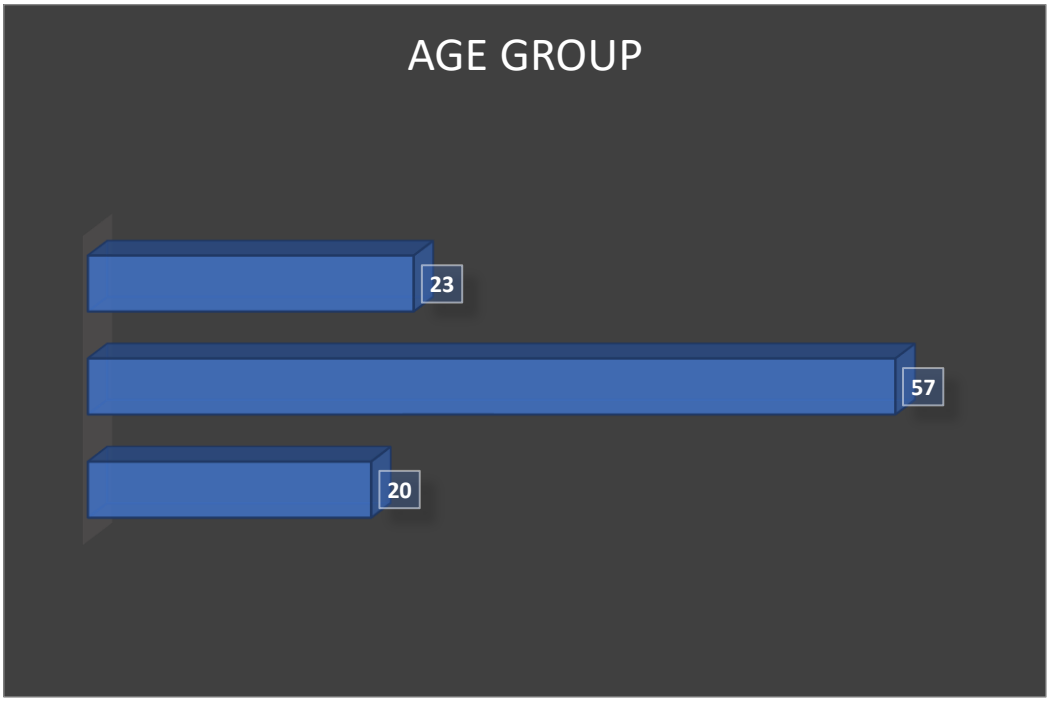
From the patients visiting the Medicine OPD in the first week of January 2022, all visiting OPD were screened for diabetes. Among them 350 patients were diagnosed with Diabetes. 78 were old cases and 262 were newly diagnosed.

Figure 1: Gender of study participants (N=350)



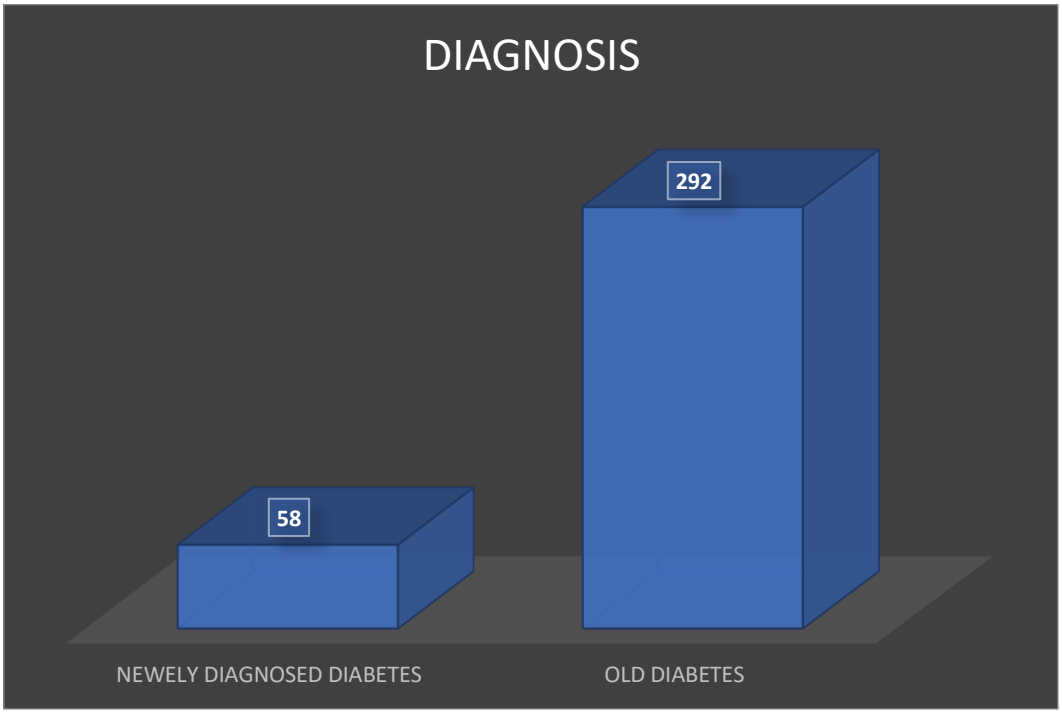
Among the study participants, 45% were females and 55% were male.

Figure 2: Age group of study participants (N=350)



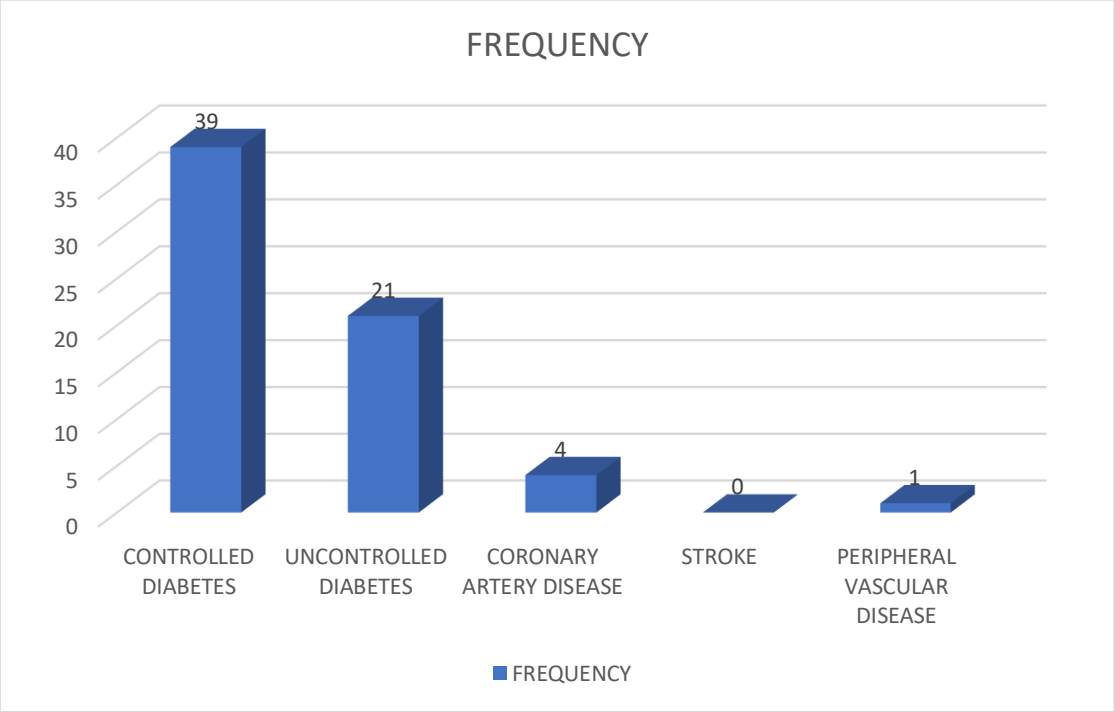
Among the study participants, 23% were between 45-50 years, 57% between 35-44 years and 20% were between 25-34 years of age.

Figure 3: Diagnosis of Diabetes (N=60)



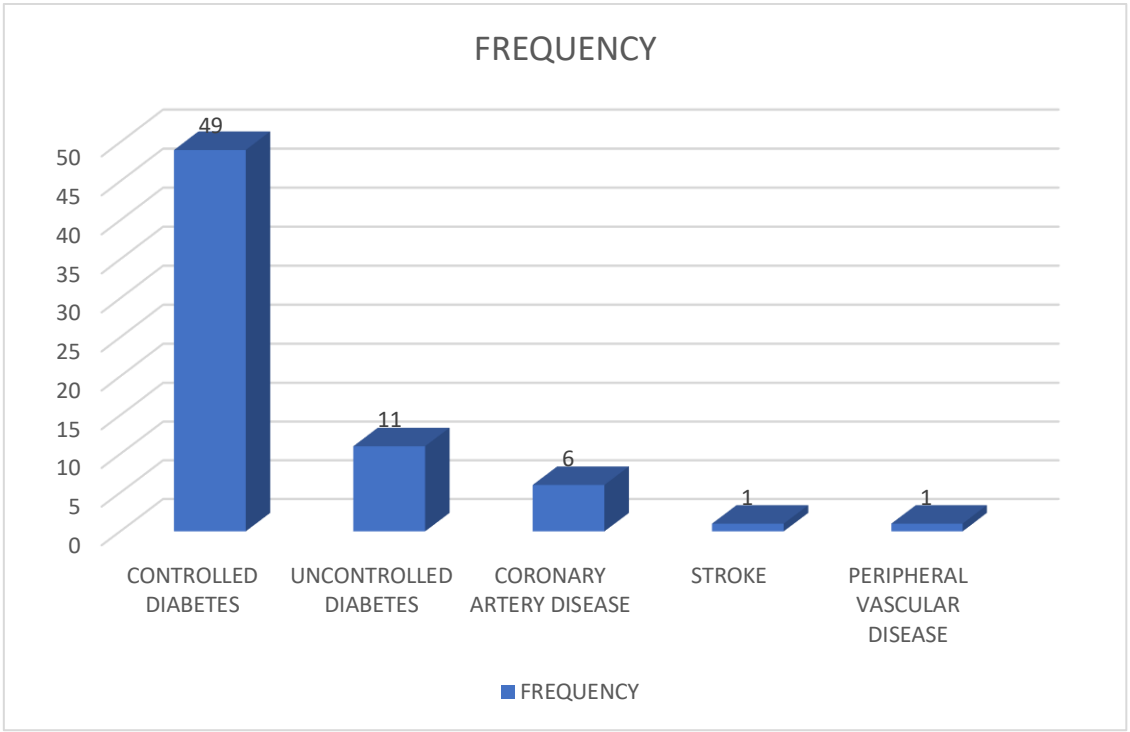
At initial diagnosis 21% had newly diagnosed Diabetes and 79% had old diagnosis of Type 2 Diabetes.

Figure 4: Diagnosis at 6 months follow up



At 6 months follow up, 39 had control in Blood sugar levels, 21 had poor glycemic control. 4 had diagnosis of Coronary Artery Disease among the uncontrolled Diabetes patients. None had stroke and 1 had diagnosis of PVD among the patient with uncontrolled diabetes among the study participants.

Figure 5: Diagnosis at 1 year follow up



At 1 year follow up, 49 had controlled diabetes, 11 had uncontrolled diabetes, 6 had Coronary Artery Disease, 1 had stroke and 1 had Peripheral Vascular Disease. All the patients with macrovascular complication had Uncontrolled Diabetes.

Table 1,2: Chi- Square test t**o** assess the association between Diagnosis and Glycemic control of Diabetes

		CONTROLLED/ UNCONTROLLED DIABETIS		Total
		1.00	2.00	
DIAGNOSIS	Newley diagnosed	6	52	58
	Old case	225	67	292
Total		231	119	350

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.614[a]	1	.057		
Continuity Correction[b]	2.616	1	.106		
Likelihood Ratio	3.821	1	.051		
Fisher's Exact Test				.088	.051
Linear-by-Linear Association	3.554	1	.059		
N of Valid Cases	350				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.35.					
b. Computed only for a 2x2 table					

The chi- square test showed a significant association between old/ new cases of Diabetes and the control of glycemic level among the study participants.

Table 3: Correlation between Uncontrolled diabetes and Macrovascular complication at 6 months and 1 year interval

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
	CAD at 6 months	.0667	350	.25155	.03247
	CAD at 1 year	.1000	350	.30253	.03906
	STROKE at 6 months	.0000	350	.00000	.00000
	STROKE at 1 year	.0167	350	.12910	.01667

	PVD at 6 months	.0167[a]	350	.12910	.01667
	PVD at 1 year	.0167[a]	350	.12910	.01667
a. The correlation and t cannot be computed because the standard error of the difference is 0.					

Paired Samples Correlations				
		N	Correlation	Sig.
	Diabetes Control and CAD	350	.046	.726
	Diabetes Control and Stroke	350	.802	.000
	Diabetes control and PVD	350	.	.

Paired sample T test was done to find the correlation between the Glycemic control and Macrovascular complication among the study participants at 6 months and 1 year interval. It was seen that there was a significant correlation between Glycemic control and Coronary Artery disease and Stroke among the study participants. The patients with Uncontrolled diabetes and higher risk of developing the disease among the study participants in this study. Thus it is seen that there is a significant association between diabetic status and the Macrovascular complication in cases with uncontrolled diabetes in this study. Which is of significant importance.

CONCLUSION

In summary, both diabetes and prediabetes predispose to the development of macrovascular complications of diabetes through complex molecular pathways involving hyperglycemia and insulin resistance. Although intensive glycemic control alone may not reduce mortality or major cardiovascular events, there are global implications for lifestyle modification, reduction of hyperglycemia, and management of cardiovascular risk factors associated with diabetes. A novel approach is beneficial for the cardiovascular risk profile of these patients. Therefore, glycemic control goals should be tailored to the individual patient. In recent years, new classes of antidiabetic drugs, such as SGLT-2 inhibitors and GLP-1 receptor agonists, have given rise to renewed hope of reducing mortality in patients with type 2 diabetes without increasing the risk of hypoglycemia.

LIMITATIONS AND RECOMMENDATION

Done in a small group of patients within a short span of time. A long period of study from Multicenter at different Ethic groups will prove the significant contribution of Diabetes as a risk factor for Macrovascular complication when left uncontrolled.

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