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A Cross Sectional Study of Evaluation of Micro and Macro Vascular Complications in Type 2 Diabetes in a Teaching Hospital

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Abstract
Introduction: *Diabetes mellitus (DM) has routinely been described as a metabolic disorder characterized by hyperglycemia that develops as a consequence of defects in insulin secretion, insulin action, or both. Type 2 diabetes encompasses individuals who have insulin resistance (IR) and usually relative (rather than absolute) insulin deficiency. The pathologic hallmark of DM involves the vasculature leading to both microvascular and macrovascular complications. Chronicity of hyperglycemia is associated with long-term damage and failure of various organ systems mainly affecting the eyes, nerves, kidneys, and the heart.*
Materials and Methods: *This study was conducted in patients attending or enrolled in the Department of General Medicine, Maheswara Medical College from January 2018 to December 2018. A total of 500 type-2 diabetic patients were seen at the centre during this period. All diabetic patients registered at diabetic clinic were screened for diabetes and its complications. The present study was conducted on 456 patients as 44 patients showed their unwillingness to give informed consent. Each subject underwent detailed history and complete clinical examination.*
Results: *Out of the 456 patients who fulfilled the inclusion criteria, 456 patients had completed the medical records and satisfied all the inclusion criteria. A total of 53 (5%) patients were removed due to incomplete data. Female participants were 304 while 152 were males. Of the 456, 244 (53.50%) were age 60 years and above with a mean age of 58.6. Most participants were obese, 381 (64.3%) had a BMI of greater than 30, while only 9.6% had normal BMI of less than 25.*
Conclusion: *Advancement in age was found to be a main culprit of micro vascular complication. Duration of diabetes and BMI was directly proportional to these complications. Family history of diabetes were also influence the micro vascular complications, prevalence was found significantly higher in patients whose both parents and sibling are suffering from diabetes. Retinopathy and neuropathy were the most prevalent microvascular complication in type 2 diabetic population of Ajmer city. Screening with some simple test such as ECG, fundoscopy, biothesiometer and biochemical tests namely, lipid, protein and fat profile for all cases of diabetes is essential to identify the complications at an early age.*
Key Words: *Diabetes mellitus, Microvascular, ECG, fundoscopy, biothesiometer*

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I. Introduction

Diabetes mellitus (DM) has routinely been described as a metabolic disorder characterized by hyperglycemia that develops as a consequence of defects in insulin secretion, insulin action, or both. Type 2 diabetes encompasses individuals who have insulin resistance (IR) and usually relative (rather than absolute) insulin deficiency.[1]The pathologic hallmark of DM involves the vasculature leading to both microvascular and macrovascular complications. Chronicity of hyperglycemia is associated with long-term damage and failure of various organ systems mainly affecting the eyes, nerves, kidneys, and the heart.[2]

According to diabetes atlas (7th edition), the global prevalence of diabetes is estimated at 415 million (8.8%), which is predicted to rise to 642 million in next 25 years.[3] In India, there are about 69.2 million people with diabetes and are expected to cross 123.5 million by 2040. Moreover, worldwide approximately 193 million diabetics remain undiagnosed predisposing them to the development of several long-term complications of untreated chronic hyperglycemia. Although intensive glycemic control lowers the incidence and progression of microvascular complications, the morbidity associated with these complications is still increasing. Several landmark studies such as the United Kingdom Prospective Diabetes Study (UKPDS) have demonstrated that strict glycemic control does limit microvascular disease while attempts to improve macrovascular outcomes through glucose-lowering interventions still remain shrouded with controversy.[3] A relative risk (RR) reduction

in myocardial infarction (MI) (P = 0.052) has been observed in the 10 years of posttrial follow-up of UKPDS. Similarly, the risk of cardiovascular mortality, nonfatal MI and stroke reduced with pioglitazone in the Prospective Pioglitazone Clinical Trial in Macrovascular Events as compared to placebo group. The action in diabetes and vascular disease: Preterax and Diamicron MR Controlled Evaluation and the Veterans Affairs Diabetes Trial failed to show any significant improvement in cardiovascular risk with the intensification of diabetes therapy. To further complicate matters, in Action to Control Cardiovascular Risk in Diabetes trial the use of intensive therapy for 3.5 years increased mortality but did not significantly reduce major cardiovascular events.[4]

In recent years, much attention has been focused on the management of macrovascular complications such as stroke and acute coronary syndromes. It is well-recognized that vascular complications in a given tissue are often accompanied by evidence of pathology in other vascular territories. A linear relationship between microvascular complications and duration of disease was established by the authors where they documented the presence of microvasculopathy across different age groups in their study in 25–40% of diabetic patients aged >25 years with more than 5 years duration of diabetes. Researchers such as Krentz *et al*[5]. and Al-Wakeel *et al*[6]. have observed that both microvascular and macrovascular complications develop simultaneously in diabetes. On the contrary, Matheus and Gomes described the case report of type 1 DM (T1DM) patient with early and aggressive coronary artery disease (CAD) without evidence of nephropathy, retinopathy, or classical risk factors for CAD. Thus, there is not much clarity over whether microvascular complication precedes macrovascular complications or they progress simultaneously.

II. Materials And Methods

This study was conducted in patients attending or enrolled in the Department of General Medicine, Maheswara Medical College from January 2018 to December 2018. A total of 500 type-2 diabetic patients were seen at the centre during this period. All diabetic patients registered at diabetic clinic were screened for diabetes and its complications. The present study was conducted on 456 patients as 44 patients showed their unwillingness to give informed consent. Each subject underwent detailed history and complete clinical examination. Details regarding age, sex, and socioeconomic status, rural or urban, duration of diabetes and treatment history of diabetes were recorded for all the patients. Blood pressure was recorded in lying down, sitting and standing positions at intervals of five minutes and compared in both arms. Pregnant diabetic cases or gestational diabetics and type-1 diabetics were excluded from the study. Type-2 diabetes was differentiated from type-1 diabetes by age of onset, body habitus and evidence of ketoacidosis. Diabetes was diagnosed according to American Diabetes Association (ADA) revised criteria. Blood glucose level estimation was done by glucose oxidase method in venous blood. Glycosylated haemoglobin (HbA1C) was measured by ion-exchange chromatography method. The selected patients were evaluated for presence of vascular (micro and macro) complications i.e. coronary artery disease, peripheral vascular disease, retinopathy, nephropathy and neuropathy by relevant investigations. Retinopathy was diagnosed by detailed fundus examination and was classified according to diabetes retinopathy study (DRS) and early treatment diabetic retinopathy study (ETDRS). Urine for microalbuminuria (30-300 mg/ 24 hrs) was tested by micral test for incipient nephropathy. Overt nephropathy was confirmed by estimation of level of blood urea, serum creatinine and macroalbuminuria. Neuropathy was diagnosed by history of numbness, paraesthesia, tingling sensation and confirmed by touch sensation with 10 gm monofilament, vibration sense by biothesiometer and ankle reflex. PVD was considered to be present if there is definitive history of intermittent claudication and one or more of peripheral pulses is absent in both feet or ankle brachial index < 0.8 (by Doppler). Coronary artery disease was diagnosed by history of myocardial infarction or angina, documented by previous treatment records or by ECG (Minnesota codes) and chest X-ray to assess cardiac size.

III. Results

Variables	N (Percentage)
Age	
<40	**28 (6.14)**
40-49	**65 (14.25%)**
50-59	**119 (25.219)**
≥60	**244 (53.50%)**
Range	**26-95**
Mean ± SD	**58.6±12.8**
Gender	
Male	**152 (33.33%)**
Female	**304 (66.66%)**
BMI	
<25	**34 (7.4%)**
≥25-29	**124 (27.19%)**

30-35	**153 (33.55%)**
≥35	**145 (31.79%)**
Duration of DM (years)	
<10	**213 (46.71%)**
≥10-19	**150 (32.89%)**
≥20	**93 (20.39%)**
Hemoglobin A1c (HbA1c)	
<7	**54 (11.84%)**
≥7	**190 (41.66%)**
8-10	**212 (46.49%)**
HbA1c Controlled	
No	**305 (66.88%)**
Yes	**151 (33.11%)**
Hypertension Controlled	
No	**167 (36.62%)**
Yes	**289 (63.37%)**

Table 1: Sociodemographic and disease characters

The sociodemographic and baseline characteristics of the participants are shown in Table 1. Out of the 456 patients who fulfilled the inclusion criteria, 456 patients had completed the medical records and satisfied all the inclusion criteria. A total of 53 (5%) patients were removed due to incomplete data. Female participants were 304 while 152 were males. Of the 456, 244 (53.50%) were age 60 years and above with a mean age of 58.6. Most participants were obese, 381 (33.55.3%) had a BMI of greater than 30, while only 7.4% had normal BMI of less than 25.

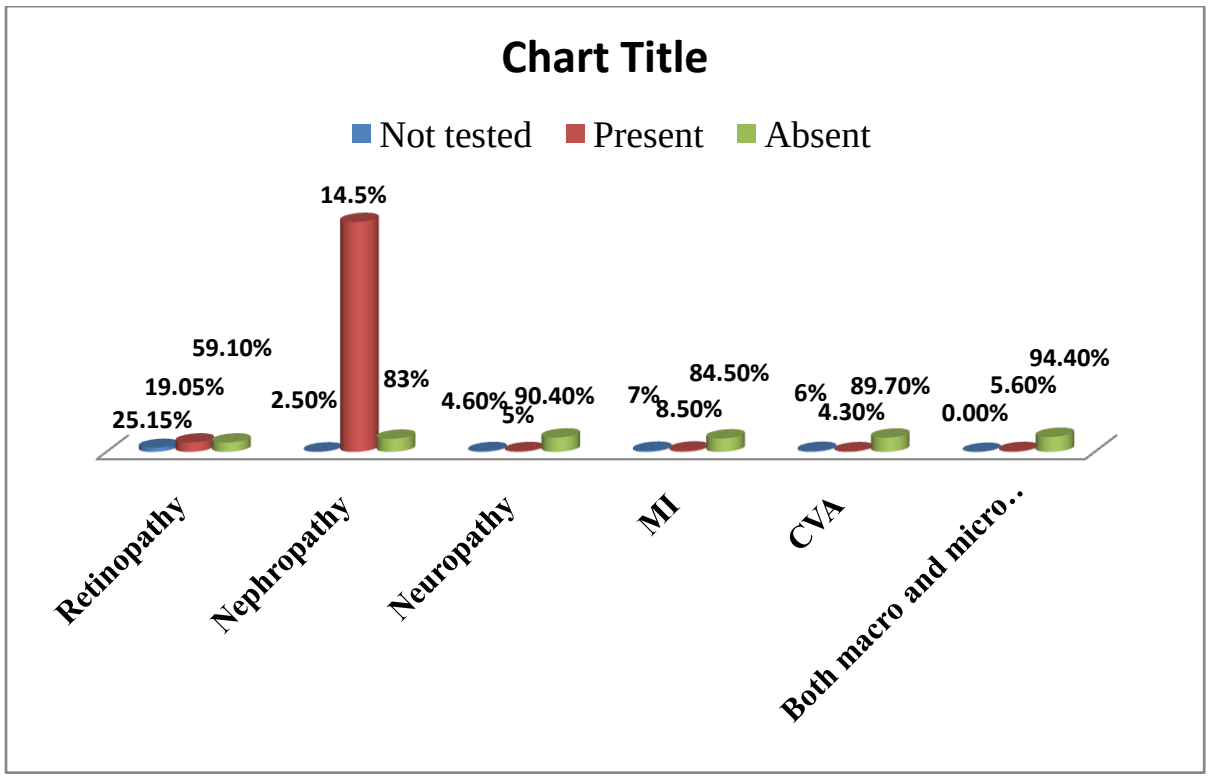

Figure 1: Prevalence of micro vascular and macro vascular complications in type2 diabetes patients (N=456)

The prevalence of micro and macro vascular complications in patients with type 2 DM are presented in Figure 1. Out of the 456 participants, 86(19.05%) had retinopathy, 64 (14.5%) had nephropathy, and 22 (5%) had neuropathy. Approximately 63 (8.50%) had myocardial infarction (MI), 38 (4.30%) had cerebrovascular accident (CVA). The prevalence of both micro and macro vascular changes in the same patient were 25 (5.6%). Microvascular complications and risk factor modeling with the best-fitted model are shown in Table 2. The variables that formed the model are: age (years), duration of DM (years), the HbAIc level and controlled hypertension level. Assuming all the variables remain the same, each increment in age by one year increases the odds of developing microvascular complications by 4%. Each additional year in duration of DM increases the odds of developing microvascular complications by 5%. Each high level of HbAI2 increases the odds by 40%.

Patients with controlled hypertension show a protective effect on microvascular complications with the odds decreasing by 57%.

IV. Discussion

Diabetes mellitus is growing faster and becoming a serious medical problem associated with higher morbidity and mortality in the KSA. The prevalence of microvascular complications such as retinopathy is as high as 19.05% in the WHC; this prevalence could even be much higher nearby private centers with less established diabetic control services. The most recent study in KSA conducted in 2000 by Khan et al[7] conducted in Al-Hasa area estimated the prevalence of retinopathy by 13.6%. Our study was conducted in the capital city of Riyadh, which has a diverse population from across KSA. Globally, nephropathy prevalence among type 2 diabetic patients in different studies is much higher when compared with our result.[8] A 2005 study conducted in South Korea estimated the prevalence of nephropathy in 267 type 2 diabetic patients to be 27%. The prevalence of nephropathy in this study is lower by approximately 12-13% than the 2 studies conducted in KSA, and by approximately 9-11% than studies carried out in different countries. Such difference could be related to the nature of the center as primary healthcare center. More advanced cases are referred to the endocrinology and nephrology departments in Prince Sultan Military Medical City (PSMMC).[9]

The prevalence of macrovascular complications were found to be high, but lower when compared with the prevalence of microvascular complications. Our findings revealed the prevalence of MI was 8.4%, which was lower than other international studies such as the United Kingdom Prospective Diabetes Study (UKPDS) study (15.3%). However, an Italian cohort study found the prevalence of MI to be 2.2% in a cohort of 11,644 patients. The difference in the UKPDS and Italian studies can be attributed to the differences in diet habits. This issue can be extended to the results in our study where the consumption of fat is high, similar to North Europe, lower than Mediterranean area, and slightly higher than some regional countries like Iran. Cerebrovascular accident prevalence was 3.7% in our sample. In the UKPDS study, the prevalence of fatal and non-fatal CVA was 3.7% over the follow-up period. Peripheral VD prevalence in our study was 1.2%. The UKPDS study reported 1.4% peripheral VD in the participants without adjustment to hypertension control. This percentage dropped to 1% when hypertension control is considered. All macrovascular changes (MI, CVA, and peripheral VD) presence was 12% in our study. The UKPDS reported 22.9% macrovascular changes comparatively for the same complications.[10]

The prevalence of neuropathy was found to be 9.6%. The prevalence is lower than other studies as the criteria used to define neuropathy cases are stricter in our study than studies with questionnaire-based assessments. Neuropathy is tested in our center using the modified Toronto Clinical Neuropathy Score (mTCN) in diabetic patients to assess the neuropathy presence and severity.

V. Conclusion

Advancement in age was found to be a main culprit of micro vascular complication. Duration of diabetes and BMI was directly proportional to these complications. Family history of diabetes were also influence the micro vascular complications, prevalence was found significantly higher in patients whose both parents and sibling are suffering from diabetes. Retinopathy and neuropathy were the most prevalent microvascular complication in type 2 diabetic population of Ajmer city. Screening with some simple test such as ECG, fundoscopy, biothesiometer and biochemical tests namely, lipid, protein and fat profile for all cases of diabetes is essential to identify the complications at an early age. These complications were delayed or controlled by biochemical parameters within normal range. No such studies in the past have been done in this region, through which comparisons could be made. Further studies are required to justify the conclusion of risk and complications in Hyderabad, Telangana (India)

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