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## Macrovascular Complications and their risk factors in Type 2 Diabetic Patients in Hyderabad, Pakistan.

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### Abstract:

**Introduction:** Diabetes mellitus (DM), is the universally occurring non-communicable disease as well as exemplary health problem affecting people worldwide.<sup>1</sup> The number of cases of DM are rising at an enormous pace irrespective of any age, gender, economic status or ethnicity around the globe.

**Objective:** To evaluate the macro-vascular complications and its correlation with different risk factors among type-2 diabetic patients.

**Methodology:** This cross-sectional study was conducted at Red Crescent General Hospital Latifabad Hyderabad from October 2018 to October 2020. Type 2 diabetics of either gender, between age 20 and 70 years, on diabetic medication visited during the study duration were included in the study. Data related to socio-demographic details and clinical features was collected from the participants using a written questionnaire. Collected data was analyzed using SPSS ver. 22.

**Results:** Significant association ( $p < 0.05$ ) was demonstrated between Coronary artery diseases and the risk factors like; age of patient, the duration of diabetes mellitus, diastolic as well as systolic blood pressures, body mass index and serum triglycerides levels. While the statistically significant association ( $p < 0.05$ ) of peripheral vascular diseases with the duration of diabetes mellitus, systolic blood pressure and serum triglyceride levels. Whereas, cerebrovascular disease was associated ( $p < 0.05$ ) with age, systolic and diastolic BP.

**Conclusion:** The coronary artery disease seems to be most frequent macro-vascular complication among the type 2 diabetic patients. Whereas the risk factors including; advancing age, duration of diabetes mellitus, hypertension, BMI as well as serum triglycerides levels are the most significant factors for these complications.

**Key Words:** Coronary artery disease, Cerebrovascular Disease, Diabetes Mellitus Type 2, Peripheral vascular diseases.

### Introduction:

Diabetes mellitus (DM), is the universally occurring non-communicable disease as well as exemplary health problem affecting people worldwide.<sup>1</sup> The number of cases of DM are rising at an enormous pace irre-

spective of any age, gender, economic status or ethnicity around the globe.<sup>2</sup> This rise in number of cases of DM and its related degenerative effects as well as complications poses an enormous social and economic burden to population.<sup>2</sup> According to the international

diabetes federation (IDF), approximately 463 million people between age 20 and 79 years are living with DM while this toll is expected to rise up to 700 million by 2045. Over two third of DM cases are residing in low- and middle-income countries.<sup>3</sup>

Type 2 diabetes mellitus (DMT2) is the most common type of DM that accounts for around 90% of DM cases throughout the globe. The number of DMT2 cases are increasing in most of the countries.<sup>4</sup> Approximately, 374 million people are already at risk of developing type 2 diabetes worldwide.<sup>1</sup> Various micro and macro-vascular complications are associated with DMT2 that may have which correspondingly have severe individual and social consequences.<sup>5</sup> Long term macro-vascular complications of DM like peripheral vascular disease (PVD), coronary artery diseases (CAD) and cerebrovascular diseases like stroke are rapidly growing and strongly associated with the DMT2 and 2-4 folds more common in DMT2 patient-comparison with those without diabetes.<sup>6</sup> According to the world health organization (WHO), the prevalence of CAD only in Eastern Mediterranean region (EMRO) is 54% while these deaths may vary from 13% to 49% depends on the country that also accounts for considerable number of deaths in the region.<sup>7</sup>

Pakistan is amongst the low-middle income country where the overall 70% of global burden of diabetics is present.<sup>8</sup> During 2019, IDF reported 6.8% prevalence of DM among 20–79 years' age adults in Pakistan. This surge in diabetes cases is attributed to distorted lifestyle and rapid urbanization in the country.<sup>9</sup> Despite this rise in prevalence, very limited studies have reported the burden of DM complications and the risk factors linked with the complications of disease in the country.<sup>8</sup> The studies conducted in past highlighted the high incidence of the co-morbidities among diabetics in Pakistan which stresses on the strict presentational measures and early detection of disease.<sup>10</sup>

Prevalence studies on the complications of DMT2 give noticeable and significant information that play a pivotal role in the policy and practice. But still the scantiness of information related to the risk factors for the co-morbidities in DMT2 patients in Pakistan specially in Sindh and its cities demand a need for attention, screening and interventional program to estimate the prevalence and correlation of risk factors of different co-morbidities of DM in Sindh. For this reason, the present study was designed with an aim to evaluate the macro vascular complications and its relationship with

different risk factors among type-2 diabetic patients in at tertiary care hospital of Hyderabad, Sindh, Pakistan.

#### **Methodology:**

A cross-sectional study was conducted at Red Crescent General Hospital Latifabad Hyderabad from October 2018 to October 2020. All patients visited the outpatient department or admitted in the hospital with positive history of DMT2, taking any medication (insulin or oral hypoglycemic drugs or both), between age of 20 and 70, either gender, socioeconomic status or religion, given consent of participation were included in the study. Patients with type I DM, not willing to participate, mentally compromised or unconscious were excluded from the study.

Informed consent was obtained from all the participants individually prior to the commencement of the interviews. Sample size of 435 was calculated using Rao-soft<sup>11</sup> online sampling calculator while non-random consecutive sampling technique was applied for selection of participants. A pre-designed and pre-tested written questionnaire was used to collect information of all the study participants. The questionnaire comprises of questions regarding socio-demographic variables like; age, sex, economic status, education status, information of Body Mass Index (BMI), duration of disease, medication history, family history of diabetes and smoking history and the details of laboratory diagnosis as well as any comorbidities on examination. The Body weight was calculated wearing least amount of clothing and height was measured without wearing the shoes. BMI measured using formula;  $BMI = \frac{kg}{m^2}$  where kg is a person's weight in kilograms and  $m^2$  is their height in meters square. BMI between 18.5 and 24.9 was labelled as healthy while BMI <18.5 (Underweight), 25.0-29.9 (overweight) and  $\geq 30.0$  was considered as obese<sup>11</sup>.

Serum glucose (Random and Fasting) levels, Glycated hemoglobin (HbA1c), total lipid profile including; serum cholesterol, serum High density lipoprotein (HDL), serum low density lipoprotein (LDL) and serum very low-density lipoprotein (VLDL) were measured.

Blood pressure was measured by trained nursing staff using mercury sphygmomanometer to evaluate the hypertension (HTN) status of the patients using the WHO standard definition for HTN. Statistical analysis was performed using SPSS ver. 22. Demographic variables and co-morbidities were demonstrated by descriptive statistics. Mean and standard deviation (SD) were deter-

mined for quantitative data. Student t-test was performed for determining the association amongst macro-vascular complications and its risk factors. Level of significance was set at  $P < 0.05$ .

#### Results:

Out of total 435 participants, most of the participants were female. Most (70.87%) participants were 40 years of age or above, while 29.13% were younger than 40 years of age. The age ranges between 27 and 71 years, with a mean age of  $48.7 \pm 10.8$  years. The mean BMI was  $24.21 \pm 4.08$  kg/m<sup>2</sup>.

The mean duration of DM was  $8.7 \pm 4.6$  years (range 3-31 years). The mean BMI among the study participants was  $24.21 \pm 4.08$  kg/m<sup>2</sup>. Table I shows the gender wise distribution of socio-demographic details, along with laboratory and clinical findings of study participants. Table II is demonstrating the relationship between different macro vascular complications among study participants with different risk factors. Table II is demonstrating the relationship between different macro vascular complications among study participants with different risk factors.

**Table I: Gender wise distribution of demographic, clinical and laboratory findings (n=435)**

SOCIO-DEMOGRAPHIC & CLINICAL FEATURES	Male		Female		Total	
	210(48.27)		225(51.71)		435	
	n	%	n	%	n	%
<b>Family history of DM</b>						
Positive	112	53.33	95	42.22	207	47.58
Negative	98	46.66	130	57.77	228	52.41
<b>Duration of DM T2</b>						
Up to 5 years	53	25.23	87	38.66	140	32.18
Over 5 years	157	74.76	138	61.33	295	67.81
<b>Hypertension (mmHg)</b>						
Systolic HTN	71	33.80	79	35.11	157	36.09
Diastolic HTN	47	22.38	50	22.22	97	22.29
<b>BMI (kg/m<sup>2</sup>)</b>						
Normal	140	66.66	108	48.00	248	57.02
Overweight	53	25.23	95	42.22	148	34.02
Obese	17	8.09	22	9.77	39	8.96
<b>Smoker</b>						
Yes	143	68.09	28	12.44	166	38.16
No	67	15.40	197	87.55	269	61.83
<b>LABORATORY FINDINGS</b>	<b>Mean</b>	<b>±SD</b>	<b>Mean</b>	<b>±SD</b>	<b>Mean</b>	<b>±SD</b>
<b>Glycemic status</b>						
FBS (mg/dL)	203.5	81.3	206.4	92.1	210.1	87.5
2 hours ppbg* (mg/dL)	301.7	100.3	309.6	115.2	309.4	112.9
HbA1c (%)	8.81	2.4	9.4	2.7	9.6	2.5
<b>Lipid profile (mg/dL)</b>						
Serum total cholesterol level	186.2	47.7	188.8	47.9	188.2	48.1
Serum HDL level	43.5	26.7	42.6	25.4	42.1	28.7
Serum LDL level	140.3	42.6	143.5	45.3	141.2	43.7
Serum Triglyceride	231.1	126.9	213.1	103.4	221.5	115.4

\* ppbg: Post prandial blood glucose

\* HTN: Hypertension

**Table II: Macro-vascular complications and their relation with different risk factors (n=435)**

<b>PERIPHERAL VASCULAR DISEASE</b>					
	<b>Yes</b> 23 (5.29)		<b>No</b> 412 (94.71)		<b>p value</b>
	<b>Mean</b>	<b>±S.D</b>	<b>Mean</b>	<b>±S.D</b>	
Age (years)	54.6	8.4	53.9	9.6	0.731
Duration of DMT2 (years)	10.9	7.7	6.1	5.8	0.002*
Systolic BP (mmHg)	144.5	22.7	134.4	21.1	0.02*
Diastolic BP (mmHg)	88.5	13.7	84.9	11.5	0.14
HbA1C (%)	8.6	2.1	9.3	2.7	0.22
BMI (kg/m <sup>2</sup> )	22.7	3.4	23.8	3.9	0.18
Serum Cholesterol (mg/dL)	182.6	56.3	188.4	43.3	0.53
Serum HDL (mg/dL)	41.5	27.8	43.3	26.5	0.75
Serum Triglyceride (mg/dL)	285.5	113.7	237.3	112.6	0.04*
Serum LDL (mg/dL)	135.8	47.2	144.6	41.7	0.32
<b>CORONARY ARTERY DISEASE</b>					
	<b>Yes</b> 73 (16.78)		<b>No</b> 362 (83.22)		<b>P-value</b>
	<b>Mean</b>	<b>±S.D</b>	<b>Mean</b>	<b>±S.D</b>	
Age (years)	58.4	10.4	51.7	10.7	0.00*
Duration of DMT2 (years)	10.7	6.7	6.3	5.9	0.01*
Systolic BP (mmHg)	148.3	27.8	135.3	26.5	0.00*
Diastolic BP (mmHg)	89.3	15.8	83.5	13.8	0.00*
HbA1C (%)	9.4	2.3	9.2	2.1	0.46
BMI (kg/m <sup>2</sup> )	24.4	3.6	22.3	4.1	0.01*
Serum Cholesterol (mg/dL)	185.4	51.3	189.3	47.4	0.52
Serum HDL (mg/dL)	45.7	42.4	40.1	19.3	0.07
Serum Triglyceride (mg/dL)	240.2	151.5	211.3	100.8	0.04*
Serum LDL (mg/dL)	140.9	44.8	141.2	43.6	0.95
<b>CEREBROVASCULAR DISEASE</b>					
	<b>Yes</b> 28 (6.43)		<b>No</b> 407 (93.56)		<b>P-value</b>
	<b>Mean</b>	<b>±S.D</b>	<b>Mean</b>	<b>±S.D</b>	
Age (years)	59.6	11.2	50.6	11.3	<0.001*
Duration of DMT2 (years)	9.4	5.2	7.4	5.4	0.058
Systolic BP (mmHg)	150.3	26.8	135.7	25.4	0.003*
Diastolic BP (mmHg)	90.5	13.3	82.6	12.3	0.001*
HbA1C (%)	9.2	2.4	9.6	2.7	0.44
BMI (kg/m <sup>2</sup> )	23.8	5.1	24.1	3.9	0.72
Serum Cholesterol (mg/dL)	191.6	49.0	186.9	49.7	0.62
Serum HDL (mg/dL)	43.2	18.5	41.7	23.2	0.73
Serum Triglyceride (mg/dL)	253.5	167.0	219.6	112.8	0.13
Serum LDL (mg/dL)	138.6	44.1	140.2	42.4	0.84

**Discussion:**

DM is the growing metabolic disorder and a serious medical problem providing the patients and health care system with great deal of burden in the form of comorbidities<sup>12</sup> while complications related to DM further imposing economic burden on the families and the country. The findings of this study provided a potential insight for prevalence of complications and their risk factors in the DMT2 patients of Sindh. Our study findings strongly suggest that there is an association between DMT2 and chronic macro-vascular complications. The prevalence of macro-vascular complications amongst our study population with type 2 DM was 28.5%. The rising trends in the prevalence of the complications was observed as compared to the previous studies. A study conducted in Punjab, Pakistan by Gillani et al.<sup>13</sup> reported the prevalence of macro vascular complication in their study was 21.7%. While a study by Al-Khawlani et al<sup>14</sup> reported that 25.4% of their participants with DMT2 were having macro vascular complication. A study from Saudi Arabia reported 12.1% of total macro vascular diseases among their diabetic participants that is quite lower than our study.<sup>15</sup> In the present study, among the patients with macro vascular complications of DMT2, 16.78% had CADs, 6.43% had CVD and 5.29% had PVD. Several studies also reported similar trend of macro vascular complications as demonstrated in this study. Alaboud et al. reported the consistent findings of macro vascular complications in their study participants.<sup>15</sup> Another study by Gedebjerg et al<sup>16</sup> also reported higher prevalence (15%) of CADs in their patients followed by 5% CVDs and 2% PVDs in their study. Moreover, Uddin et al<sup>17</sup> reported prevalence of 8.5% CADs, 2.0% CVD and 2.2% PVD in their newly diagnosed DMT2 patients.

The risk factors analysis in the present study demonstrated that duration of DMT2 was the main risk factor for CAD and PVD while systolic hypertension was the common risk factor in CAD, PVD and CVD. Al-Khawlani et al<sup>14</sup> also reported the findings consistent with current study. Moreover, age and diastolic blood pressure were significantly associated with CAD and CVD. A study from Pakistan<sup>13</sup> reported the strong association between age and CAD that is consistent with the findings of present study. Serum triglycerides was a common significantly associated factor of CAD and PVD in this study, a finding consistent with published studies.<sup>18,19</sup> This may be due to fact that high serum triglycer-

ides may lead to increase chances of thrombus formation within the vessels and lead to blockage of blood circulation in the vessels. With strengths, there are many limitations in the study. Foremost, limited duration and resources only one center was included in the study. Furthermore, only macro vascular complications were studied in the present study while many risk factors like economic status, treatment etc. are not included for the study.

**Conclusion:**

The coronary artery disease seems to be most frequent macro-vascular complication among the type 2 diabetic patients. Whereas the risk factors including; advancing age, duration of diabetes mellitus, hypertension, BMI as well as serum triglycerides levels are the most significant factors for these complications.

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