

Microvascular complications of diabetes mellitus

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ABSTRACT:

INTRODUCTION:

Diabetes is a metabolic disease characterized by hyperglycemia, with high morbidity and mortality worldwide. The micro-vascular complications of Diabetes Mellitus, are considered as an important part of hyperglycemia limitations, caused by the increased endothelial permeability and can progress to severe impairments in several organ systems.

AIM:

To analyse correlation of microvascular complication with period of diabetes mellitus, glycemic control and hypertension.

METHOD:

A study of 100 patients with DM were included with age ranging from 20 to 80 years.

CONCLUSION:

Diabetic retinopathy was the most common late complication observed in the study. Diabetic retinopathy, neuropathy and nephropathy all are associated with poor glycemic control. Long duration of DM, with poor glycemic control and the associated hypertension all increase the chances of micro-vascular complications in DM.

KEYWORDS:

Diabetes mellitus (DM), microvascular complications, hyperglycemia.

INTRODUCTION: -

Diabetes mellitus (DM) is described as a metabolic disorder characterized by hyperglycemia that develops as a consequence of defects in insulin action, insulin secretion or both. Type 2 DM includes individuals who are insulin resistant (IR) and usually relative (rather than absolute) insulin insufficiency. The pathological hallmark of Diabetes mellitus involves the vasculature leading to both microvascular and macrovascular complications. Persistence of hyperglycemia is associated with long-term damage and failure of multiple organs mainly affecting the eyes, cardiovascular, kidneys and nerves.

In the 9th edition of IDF Diabetes Atlas, the prevalence of diabetes is estimated for the year 2019 and projected to the years 2030 and 2045. The diabetes estimates are for adults aged 20–79 years, and include both type 1 and type 2 diabetes, diagnosed and undiagnosed. Approximately 463.0 million adults aged 20–79 years worldwide (9.3% of all adults in this age group) have diabetes. It is estimated that 79.4% live in low- and middle-income countries. Based on the estimates of year 2019, by the year 2030 an estimated 578.4 million, and by the year 2045, 700.2 million adults between 20-79 years of age, will be having diabetes. Although intensive glycemic control lowers the incidence and progression of microvascular complications the morbidity associated with the complications is still rising.

The Patients having DM and the associated microvascular complications appear at a higher risk of accelerated atherosclerosis which ultimately concludes in cerebrovascular and cardio-vascular events and early death. Micro-vessels are the basic functional unit of the cardio-vascular system comprising of arterioles, venules and capillaries. They are different from the Macro-vessels in both cellular components and architecture. In contrast to macro-vessels distributing blood to different organ systems, micro-vessels play important role in maintaining BP (blood pressure) and proper delivery of nutrients. [2] The microcirculation also plays an important role in regulatory systems controlling vascular permeability and the myogenic responses that adapt to blood flow according to the metabolic requirements. Alteration in the micro-vascular function may arise even before uncontrolled hyperglycemia and the vascular pathologies manifest. DM causes pathognomonic alterations in the micro-vasculature, affecting the capillary basement membrane (BM) including arterioles in the retina, glomeruli, skin, muscle and myocardium, by increasing its thickness, leading to the development of **DIABETIC MICROANGIOPATHY**. The thickening is ultimately leading to the abnormality in vessel function, comprising of the numerous clinical abnormalities i.e., tissue hypoxia, delayed wound healing and hypertension.

Micro-vascular complication is the Major outcome in patients with type 2 diabetes mellitus. They are the rising cause for morbidity and mortality. Further, they inflict a substantial burden on economy and the health care system.

The micro-vascular complications are classified into: -

- **DIABETIC RETINOPATHY**
- **DIABETIC NEPHROPATHY**
- **DIABETIC NEUROPATHY**

Diabetic Retinopathy: -Diabetic retinopathy results in numerous degrees of visual impairment and is a leading cause of blindness across the globe.

Diabetic Nephropathy: - Diabetic nephropathy is the leading cause for END STAGE RENAL DISEASE(ESRD) requiring maintenance Hemodialysis. It establishes as im paired glomerular filtration rate or albuminuria. Though, microalbuminuria is usually used as an indicator for predicting renal dysfunction in diabetics, it does not always precede the declining renal function. Thus, The United Kingdom's Prospective Diabetes Study (UKPDS) required to identify the other risk factors linked to the impairment of renal function among type 2 DM. Elevated **SBP** (systolic blood pressure), Female sex, reduced waist-circumference and Asian-Indian ethnicity were identified as the risk factors. The study projected that 38% of individuals with type 2 DM had albuminuria and 29% had dysfunction after follow up for 15 years.

Diabetic Neuropathy: - Diabetic neuropathy affects approximately half of the population suffering from DM. It has a noteworthy impact on patients' functional ability and day to day activities. It has been subdivided into autonomic and peripheral neuropathy.

MATERIAL AND METHODS:

This prospective observational study was carried out in VSGH Hospital in Ahmedabad from December 2018 to December 2019. The 100 patients of diabetes mellitus were included in the study ranging from 20-80 years of age with median age group 55.02 years Detailed history and careful clinical examination was performed on each

patient. Laboratory investigations done were RBS/FBS/PP2BS, HBA1C, S. creatinine, UACR, S. lipids, USG for kidney size and CMD, fundus, ECG, 2DECHO, CXR PA, EMG AND NCV.

RESULTS:

A total of 100 patients who reported between Dec 2018 and Dec 2019 were studied and analysed.

TABLE 1: AGE AND SEX CHARACTERISTICS

Age Group (Years)	No. of Cases		Total	Percentage (%)
	Male	Female		
20-39	07	11	18	18
40-59	20	14	34	34
60-79	25	23	48	48
total	52	48	100	100

Male to female ratio is 1.08:1. Above table shows maximum incidence between 60-79 years (48%). Mean age 55.02 years

TABLE 2: DURATION OF DM

DURATION (Years)	NO. OF PATIENTS	PERCENTAGE (%)
<1 YEAR	2	2%
1-5	19	19%
6-10	25	25%
11-15	32	32%
16-20	18	18%
>20	4	4%
TOTAL	100	100%

Mostly patients with DM had duration of 11-15 years of DM i.e., 32% in this study.

TABLE 3: MICROVASCULAR COMPLICATIONS

MICROVASCULAR COMPLICATIONS	Total Patients	Percentage (%)
Present	77	77%
Absent	23	23%

Total	100	100%	
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Out of total 100 patients 77 developed some microvascular complications in the form of diabetic retinopathy, neuropathy and/or nephropathy in this study.

TABLE 4: - TYPE OF MICROVASCULAR COMPLICATIONS.

	Diabetic retinopathy		Diabetic neuropathy		Diabetic nephropathy	
	present	absent	present	absent	present	absent
No. of patients	42	58	35	65	38	62
Percentage (%)	42%	58%	35%	65%	38%	62%

Retinopathy is the mc microvascular complication, f/b nephropathy f/b neuropathy.

TABLE 5: - CORRELATION OF DURATION OF DM WITH MICROVASCULAR COMPLICATIONS.

Duration In years	No complications	Diabetic retinopathy	Diabetic nephropathy	Diabetic neuropathy
<1	2	-	-	-
1-2	14	-	-	5
6-10	7	2	10	7
11-15	-	17	14	4
16-20	-	19	10	15
>20	-	4	4	4
total	23	42	38	35

Among 23 patients who had no microvascular complications of DM, 16 patients had duration of DM <5 years. Among 42 patients with retinopathy 17 patients had duration of DM 10-15 years while 55% had duration >15 years. Among 38 patients with nephropathy, 14 patients had duration of DM b/w 10-15 years while 14 patients had duration >15 years. Among 35 patients with neuropathy 19 patients had duration of DM >15 years.

TABLE 6: - CORRELATION OF GLYCEMIC CONTROL WITH MICROVASCULAR COMPLICATIONS.

HBA1C	NO MICROVASCULAR COMPLICATIONS	DIABETIC RETINOPATHY	DIABETIC NEPHROPATHY	DIABETIC NEUROPATHY
<7.0	19	00	1	00
7.1-8	4	12	17	14
8.1-9	00	17	12	12
>9.1	00	13	08	09
TOTAL	23	42	38	35

Among 23 patients who had no microvascular complications of diabetes, 19 (83%) patients had HBA1C <7.0%. among 42 patients with retinopathy and 35 with neuropathy all had HBA1C >7.0% while 37 patients out of 38 (97%) with nephropathy had HBA1C >7.0%.

TABLE 7: -CORRELATION OF HYPERTENSION WITH MICROVASCULAR COMPLICATIONS: -

HYPERTENSION BP	NO MICROVASCULAR COMPLICATIONS	DIABETIC RETINOPATHY	DIABETIC NEPHROPATHY	DIABETIC NEUROPATHY
<130/80 mmHg	16	04	00	03
>= 130/80 mmHg	07	38	38	32

total	23	42	38	35
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DISCUSSION: -

DIABETIC RETINOPATHY: Caird et al found 36.8% prevalence rate of non-proliferative retinopathy in a survey involving 4076 diabetic patients with over 10 years duration of diabetes. In the present study 40% of diabetic retinopathy had diabetes duration 10-15 years while 55% had duration over 15 years which is almost similar to above study. Among 42% prevalence of diabetic retinopathy in the present study, all patients had HbA1C >7.0 which implies poor glycemic control which is similar to DCCT, UKPDS and Kumamoto study. In this study 90% of diabetic retinopathy is associated with HTN.

DIABETIC NEPHROPATHY: The level of glycemic control seems to be the strongest factor influencing the onset of nephropathy which has been demonstrated in various studies. All patients with diabetic nephropathy had associated HTN which has also been reported as predisposing factor in several studies.

DIABETIC NEUROPATHY: - In Rochester diabetic project the prevalence of neuropathy increases from 4% of diabetes of short duration <5 years to 15% after 20 years of DM. In the present study the prevalence of neuropathy is 10.5% after 20 years of DM which is almost similar to above study. In the present study 97% patients with diabetic neuropathy had poor glycemic control and 92% of diabetic neuropathy patients had associated HTN which correlates with the landmark study of DCCT, UKPDS.

CONCLUSION: -

100 patients of DM were included in the study ranging from 20 to 80 years with median age group 55.02 years. Diabetic retinopathy was the most common late complication observed in the present study with prevalence 42% for diabetic nephropathy in 38% and diabetic neuropathy in 35%. All complications were associated with poor glycemic control. 90% of diabetic retinopathy, 92% of diabetic neuropathy and all the patients with diabetic nephropathy in the present study had associated hypertension. 70% patients with no microvascular complications had duration of diabetes <5 years. 55% patients with diabetic retinopathy had duration of DM >15 years, 37% with diabetic neuropathy had duration of diabetes between 10-15 years and 37% had duration of DM >15 years. 54% patients with diabetic nephropathy had duration of diabetes >15 years. Therefore, the long duration of DM, poor glycemic control and the associated HTN all have increased the chances of micro-vascular complications in DM.

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Conflict of Interest:

Nil

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