



EVALUATION OF MICROVASCULAR AND MACROVASCULAR COMPLICATIONS IN DIABETESMELLITUS

General Medicine

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ABSTRACT

Diabetes Mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia. Several distinct types of DM are caused by a complex interaction of genetics and environmental factors. Diabetes related complications affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. The present study was done on the patients with age more than 18 years affected with Type 1 and Type 2DM attending the inpatient department at Our Tertiary care centre with an aim to evaluate the microvascular and macrovascular complications in them. It was a Prospective observational study with sample size of 50. The present study reveals significant correlation of Increased blood glucose and HbA1c levels with severity and number of microvascular and macrovascular complications.

KEYWORDS

Diabetes Mellitus, Microvascular Complications, Macrovascular Complications

INTRODUCTION

Diabetes Mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia. Several distinct types of DM are caused by a complex interaction of genetics and environmental factors. Depending on the etiology of the DM, factors contributing to hyperglycemia include: i) Reduced insulin secretion ii) Decreased glucose utilization and iii) Increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiological changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system. Direct health expenditures due to diabetes are already close to one trillion USD and will exceed this figure by 2030.¹ As per IDF 2021 data, Epidemiological data in India shows that 74 million people are suffering from Diabetes Mellitus and it was responsible for nearly 6.7 million deaths worldwide, accounting for 12.2% of global deaths in adults aged 20-79 years. Diabetes related complications affect many organ systems and are responsible for the majority of morbidity and mortality associated with the disease. The vascular complication of DM are further subdivided into :a] Micro-vascular complications: • Retinopathy • Neuropathy • Nephropathy and b] Macro-vascular complications: • Coronary Heart Disease [CHD] • Peripheral Arterial Disease [PAD] • Cerebrovascular disease [CVD]. These complications vary in prevalence in different populations depending on various factors such as genetic predisposition, ethnicity, type of diabetes, associated predisposing factors and even definition of the respective complications.² In view of the non-availability of such data in our local population, the presence of these complications need to be assessed among diabetic patients. Hence this study is taken up to know the complication of diabetes so that timely prevention, diagnosis and management can be done to prevent their progression thereby reducing morbidities and mortalities associated with them. The present study was done on the patients with age more than 18 years affected with Type 1 and Type 2DM attending the inpatient department at Our Tertiary care centre.

AIMS AND OBJECTIVES-1]

To evaluate the microvascular and macrovascular complications of diabetes mellitus in patients admitted within our tertiary care centre. 2] To study the correlation of blood sugar level and HbA1c level with complications of diabetes mellitus. Study design : Prospective observational study Sample size : 50 Inclusion Criteria-1. Diabetic Patients with age more than 18 years. 2 Diabetic patients having microvascular and macrovascular complications. Exclusion Criteria-1. Patients with age less than 18 years. 2 Diabetic patients having complications due to other causes.

DISCUSSION- Risk Factors: The United Kingdom Prospective Diabetes Study (UKPDS) demonstrates that controlling lipids and blood pressure may be significantly more effective in preventing CVD than is controlling hyperglycemia.³⁴ Thus, in individuals with

diabetes, the management of lipid disorders, as well as total risk-factor management, is of paramount importance. Hypertension -The prevalence of Hypertension [HTN] in present study is 34% which coincides with Ghimire et al study which showed that 34% participants had HTN.⁴ The studies done by Banerjee et al (2001)⁵ found 50% with hypertension. CDC's National Diabetes Surveillance System 2005, USA 7 shows 62.5% of patients have HTN in diabetes. In type 2 diabetes, HTN usually clusters with the other components of the cardiometabolic syndrome, such as microalbuminuria, central obesity, insulin resistance, dyslipidemia, hypercoagulation, increased inflammation, left ventricular hypertrophy (LVH), and hyperuricemia. In type 1 diabetes, hypertension is usually a manifestation of diabetic nephropathy, and hypertension and nephropathy appear to exacerbate each other. Hypercholesterolemia - In present study,¹⁸ [36%] patients show hypercholesterolemia. Study done by S. Shafiq et al (2001)⁸ showed hypercholesterolemia in 78% patients. CDC - National Diabetes Surveillance System, 2005, USA 7 showed hypercholesterolemia in 60% patients.

MICROVASCULAR COMPLICATIONS -Retinopathy: In present study, the most prevalent microvascular disorder is diabetic retinopathy seen in 34% of the cases, out of which 76% of the patients with had non-proliferative type of retinopathy. This research coincides with Darivemula S et al, 9 study of Urban South Indian population which showed Retinopathy in 34% of the study sample. And in North Indian study by Barman et al¹⁰ Observed Retinopathy in 29% of the study sample. Diabetic retinopathy is a highly specific vascular complication of both type 1 and type 2 diabetes, with prevalence strongly related to both the duration of diabetes and the level of glycemic control.²⁹ **Nephropathy:** Nephropathy in the present study is found in 28 % of research subjects, Klein et al in their study found that frequency of microalbuminuria was 29.2%.¹¹ A lower prevalence of proteinuria (19.7%) was found in the study conducted by Ramchandran et al in south Indian diabetes subjects.¹² Gupta et al reported prevalence of microalbuminuria in 26%.¹³ Significant associations of duration of diabetes and nephropathy was also observed by Mohan et al (2000) and Verghese et al (2001). **Neuropathy :** The incidence of neuropathy in present study was 14% which coincides with study by Knuiman et al²⁸ in which prevalence of neuropathy was 14%. Prevalence found by Ramchandran et al in southern India was 27.5%.¹² While Shobhana et al reported the prevalence of neuropathy as much as 7%.¹⁴ Study done by G.Premalatha, V.Mohan et al (2002)¹⁵ had 19.1% patients with Neuropathy.

MACROVASCULAR COMPLICATION

Coronary Heart Disease [CHD] : The incidence CHD in present study is 38%. Liu et al, found 30.1% prevalence of IHD [Ischemic Heart Disease] among diabetics.¹⁶ Haffner and colleagues¹⁷ demonstrated that diabetic patients without previous MI have as high a risk for a first MI as do nondiabetic patients with a history of MI for having a second infarction.

Peripheral Arterial Disease [PAD] :In the present study PAD was present in 6% of patients .This coincides with the study by G.Premalatha, V.Mohan et al (2002) which showed 4% prevalence.¹⁵ In a study conducted by Ramachandran et al prevalence of PAD was 4% in South Indian diabetic subjects.¹² Al Kafrawy et al., 2014¹⁹ concluded that peripheral neuropathy, duration of diabetes, peripheral vascular disease, and poor glycemic control were significant predictors of Diabetic Foot Ulcers. Foot ulcerations and amputations are common complications associated with diabetes. These may be the consequences of several factors, including peripheral neuropathy, peripheral arterial disease (PAD), and foot deformities. They represent major causes of morbidity and mortality in people with diabetes. Early recognition of at-risk feet, pre-ulcerative lesions, and prompt treatment of ulcerations and other lower-extremity complications can delay or prevent adverse outcomes.

Cerebrovascular Disease[CVD]: 11% of the present study patients have cerebrovascular accidents. This is in line with the 2005 CDC-National Diabetes Surveillance System (US) international study which showed a prevalence of 9 percent of strokes in patients with T2DM.⁷

Correlation Between Fasting Blood Sugar Levels And Complications

In present study 50 % patients have poor glycemic control. Present study shows the correlation between FBS Levels and microvascular complications was significant at the 0.01 level (2-tailed).($p < 0.01$) Present study shows that correlation between FBS Levels and Macrovascular Complications is significant at the 0.01 level (2-tailed).These results revealed that there is a moderate correlation between deranged FBS Levels and Macrovascular Complications. ($P < 0.01$) According to the American Diabetes Association (ADA) Standards of Medical Care in Diabetes 2017, FBS measurement can be used for glycemic control assessment and individuals having FBS ≥ 152 mg/dL are said to have poor glycemic control.²⁰ A hospital-based study done in North Kerala found that 28.3% of persons to have adequate glycemic control.²¹

Correlation of HbA1c and complications-The present study showed uncontrolled HbA1c is highly correlated with all microvascular complications and were found statistically significant at 0.01 level. ($p < 0.01$) Present study shows significant association correlation between deranged HbA1c levels and Macrovascular complications. Significant at 0.01 level ($p < 0.05$) Ray et al²⁴ enrolled 3304 patients and compared the effects of standard treatment to intensive one on the cardiovascular events and mortality in DM patients. Average HbA1c was 0.9% lower and the number of cardiovascular events was with 15% and MI with 17% lower in intensive treated patients.²⁴Diabetic retinopathy and neuropathy was significantly linked to poor glycemic control (high HbA1c) as found by present study. Gaede et al and Klein et al reported similar findings.^{25,26}Kamran M. Hassan et al.²⁷in 2016 observed a strong association between HbA1c and neuropathy.

CONCLUSION

The present study reveals significant correlation of Increased fasting glucose and HbA1c levels with Microvascular and macrovascular complications of diabetes mellitus. The number and severity of complications are directly proportional to glycemic status .Therefore early diagnosis and prompt treatment of Diabetes is important to prevent occurrence and progression of complications. This research emphasizes the need for early diagnosis, monitoring, and awareness programmes in order to reduce the burden of complication management. Effective blood glucose regulation decreases microvascular disorder and should be enforced early and sustained for a sufficient amount of time. In order to avoid macrovascular disease in addition to glycemic regulation, proper blood pressure management and dyslipidemia management are highly necessary. Diabetes complications can be prevented or delayed by maintaining blood glucose, blood pressure and cholesterol levels as close to normal. There are a high proportion of patients with poor glycemic control among T2DM patients. This underscores the need to build awareness regarding glycemic control so that they are protected from the effects of the potentially avoidable glycemic burden.

OBSERVATION AND RESULTS:

Table No. 1 Hypertension And DM

	Total (n=50)	Percentage (%)
Hypertensives	17	34%
Non- Hypertensives	33	66%

Table 2 : DM and hypercholesterolemia

serum total cholesterol	Total patients	%
< 200 (mg/dl)	5	10.0
201 - 239	27	54.0
240 & Above	18	36.0
Total	50	100.0

Table 3 -Fasting blood sugar level

FBSL	No. of Patients	%
< 126 (mg/dl)	20	40.0
>126 – 200 (mg/dl)	7	14.0
201 - 300 (mg/dl)	16	32.0
> 300 (mg/dl)	7	14.0
Total	50	100

Table 4:HbA1c Levels

HbA1C levels	Total	
	No. of Patients	%
>6.5%-8%	27	54.0
8% – 10%	17	34.0
> 10%	6	12.0
Total	50	100.0

Table 5 : Microvascular And Macrovascular Complications

Type of Diabetic Complication	No. of Patients (N=50)	%
Retinopathy	17	34.0
Nephropathy	14	28.0
Neuropathy	7	14.0
Cerebrovascular Disease (CVD)	6	12.0
Coronary Heart Disease (CHD)	19	38.0
Peripheral Arterial Disease (PAD)	3	6.0

Table 6 : P Value Of Correlation Between FBSL And Microvascular Complications

	Retino pathy	Nephro pathy	Neuro pathy
Pearson Correlation	0.786**	0.790**	0.784**
Sig. (2-tailed)	0.000	0.000	0.000
N	50	50	50

Table 7 : HbA1c levels and complications

Complications	HbA1C level			
	> 6.5%-8% (n=27)	8% - 10% (n= 17)	>10% (n=6)	Total (n=50)
Retinopathy	3 (11%)	8 (47%)	6 (100%)	17
Nephropathy	1 (3.7%)	7 (41%)	6 (100%)	14
Neuropathy	0	1 (6%)	6 (100%)	7
CVD	1 (3.7%)	2 (12%)	3(50%)	6
CHD	6 (22%)	8 (47%)	5 (83%)	19
PAD	0	2 (12%)	1 (17%)	3

Table 8 : Age And Sex Distribution

Age [in years]	Gender					
	Male		Female		Total	
	No. of Patients	%	No. of Patients	%	No. of Patients	%
18- 30 Years	2	8.7	1	3.7	3	6.0
31 - 40 Years	4	17.4	1	3.7	5	10.0
41 - 50 Years	3	13.0	6	22.2	9	18.0
51 - 60 Years	6	26.1	12	44.4	18	36.0
> 60 Years	8	34.8	7	25.9	15	30.0
Total	23	100.0	27	100.0	50	100.0
Mean Age	54.13 $\pm$ 17.93		57.07 $\pm$ 11.96		55.72 $\pm$ 14.91	

Table 9 : P Value Of Correlation Between HbA1c Levels And Microvascular Complications

HbA1C		Retino pathy	Nephro pathy	Neuro pathy
Pearson Correlation		0.635**	0.707**	0.882**
Sig. (2-tailed)		0.000	0.000	0.000
N		50	50	50

Table 10: P value of correlation between HbA1C levels and

macrovascular compliance

statement by the American Diabetes Association. Diabetes Care 2017;40:412–418

		CVD	CHD	PAD
HbA1C	Pearson Correlation	0.472**	0.411**	0.313*
	Sig. (2-tailed)	0.001	0.003	0.027
	N	50	50	50

Table 11: Fasting Blood Sugar Levels And Complications

Complications	Fasting Blood Sugar level				
	< 126 (mg/dl) (n=20)	126 -200 (mg/dl) (n= 7)	201 - 300 (mg/dl) (n=16)	> 300 (mg/dl) (n=7)	Total (N=50)
Retinopathy	0	2 (28.5%)	8 (50%)	7 (100%)	17
Nephropathy	0	2 (28.5%)	5 (31%)	7 (100%)	14
Neuropathy	0	0	1 (6%)	6 (86%)	7
CVD	0	1 (50%)	2 (12%)	3 (43%)	6
CHD	0	4 (57%)	10 (62.5%)	5 (71%)	19
PAD	0	0	2 (12%)	1 (14%)	3

Table 12: P Value Of Correlation Between Fasting Blood Sugar Levels And Macrovascular Complications.

	CVD	CHD	PAD
Pearson Correlation	0.472**	0.482**	0.365**
Sig. (2-tailed)	0.001	0.000	0.009
N	50	50	50

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