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ANALYSIS OF GLYCEMIC CONTROL AND MICRO-VASCULAR COMPLICATIONS IN TYPE 2 DIABETES AND CONTROL OF GLUCOSE

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Abstract:
Introduction: *Diabetes Mellitus (DM) is a chronic disorder characterized by impaired metabolism of glucose and other energy yielding fuels as well as by the late development of vascular and neuropathic complications.* ***Objectives of the study:*** *The main objective of this study is to analyze the role of glycemic control and micro-vascular complications in Type 2 diabetes and control of glucose.* ***Methodology of the study:*** *This study was conducted at Rafique Anwer Memorial Trust Hospital, Gujranwala. This study was conducted with the permission of ethical committee of hospital. This is a retrospective observational study done through 2007 and comprises a study group of 200 patients who were subjected to detailed history, physical investigations and laboratory investigations.* ***Results:*** *Diabetic Retinopathy, Neuropathy and Nephropathy all were associated with poor glycemic control. 190/210 (90%) patients of Diabetic Retinopathy, 175/190 (92%) patients of Diabetic Neuropathy and all 175 patients of Diabetic Nephropathy had associated hypertension. 85/210 (40%) patients of Diabetic Retinopathy had duration between 10-15 years, 115/210 (55%) patients of Diabetic Retinopathy had a duration of >15 years, 70/190 (37%) patients of Diabetic Neuropathy had duration of DM 10-15 years and 70/190 (37%) patients had duration of DM >15years.* ***Conclusion:*** *Microvascular complications tend to occur in those diabetic patients who have long duration of the disease, hypertension and poor glycemic control.*

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INTRODUCTION:

Diabetes Mellitus (DM) is a chronic disorder characterized by impaired metabolism of glucose and other energy yielding fuels as well as by the late development of vascular and neuropathic complications [1]. Diabetes comprises of a group of disorders involving distinct pathogenic mechanisms, for which hyperglycemia is a common denominator. Both types of diabetes are preceded by a phase of abnormal glucose hemostasis as the pathogenic processes progress. Type I diabetes is the result of complete or near total insulin deficiency. Type II DM is a heterogeneous group of disorder characterized by variable degree of insulin resistance, impaired insulin secretion and increased glucose production [2]. Diabetes is etiologically classified as Type I, Type II, other specific types as genetic defects, disease of exocrine pancreas, endocrinopathies, drug induced, infections, uncommon forms of immune-mediated diabetes and gestational diabetes [3].

Type I DM is the result of interactions of genetic environment and immunological factors that ultimately lead to the destruction of the pancreatic beta cells and insulin deficiency. Type II DM is characterized by insulin resistance, impaired insulin secretion and increased hepatic glucose production [4]. Complication of diabetes are acute like diabetic ketoacidosis and hyperglycemic hyperosmolar state and chronic like microvascular complications-retinopathy, neuropathy and nephropathy and macrovascular complications. The importance of tight glycemic control for protection against microvascular and cardiovascular disease (CVD) in diabetes was established in the Diabetes Control and Complications Trial (DCCT)/Epidemiology of Diabetes Interventions and Complications (EDIC) study for type 1 diabetes. Although the role of glycemic control on microvascular disease in type 2 diabetes was documented in the United Kingdom Prospective Diabetes Study (UKPDS), its role in reducing cardiovascular risk has not been established as clearly for type 2 diabetes [5-7].

Background of the study

Hyperglycemia is an important risk factor for the development of microvascular disease in patients with type 2 diabetes, as it is in patients with type 1 diabetes. This has been shown in several observational studies. In addition, improving glycemic control improves microvascular outcomes, as illustrated by the findings of a meta-analysis of randomized trials [8]. There was a reduction in the risk of microvascular complications (a composite outcome including progression of nephropathy, manifestation and progression of retinopathy, and retinal photocoagulation) in the intensive compared with standard glycemic control group (relative risk [RR] 0.88, 95% CI 0.82-0.95). There were significant reductions in risk for each of the individual components [9].

Objectives of the study

The main objective of this study is to analyze the role of glycemic control and micro-vascular complications in Type 2 diabetes and control of glucose.

METHODOLOGY OF THE STUDY:

This study was conducted at Rafique Anwer Memorial Trust Hospital, Gujranwala. This study was conducted with the permission of ethical committee of hospital. This is a retrospective observational study done through 2007 and comprises a study group of 200 patients who were subjected to detailed history, physical investigations and laboratory investigations.

The diagnosis and classification of diabetes as Type I and Type II is based on ADA guidelines 2007. The patients' history, laboratory investigations and physical examination was obtained by retrospective chart review and medical record review. All 200 patients apart from being subjected to detailed history and physical examination had undergone detailed laboratory investigations in form of random blood sugar, fasting and postprandial blood sugar, HbA1c, s. creatinine, urine for protein and microalbuminuria, ultrasound for kidney size, fundus examination, vibration and perception test.

Ethical consideration

Permission from the Head of department will be taken. Also, consent from the patient will be taken verbally.

Statistical analysis

The data of respiratory function were compared between the smoker and non-smoker groups using the independent t-test for normally distributed data or the Mann-Whitney U test for other distributions. Differences were considered statistically significant at $p<0.05$.

RESULTS:

In all, 200 participants were found to be currently diabetic, giving an overall prevalence of current condition to be 24.6% (95% CI 21.90 - 27.49) in the study population. History of disease was reported by 31.5% participants ($P < 0.001$).

Table 01: Distribution of participants according to disease

Status	Total (%)	P-value
Diabetic	24.6	<0.001
Type-2	32	<0.001
Non diabetic	68.5	<0.001

In our study, microvascular complications were present in 385 (77%) patients (Table 2).

Table 02: Characterizes the microvascular complications in Diabetes.

HbA1c	Patients	Percentage
<7.0%	95	83
>7.0%	20	17
Total	115	100

95 (83%) patients of the 115 patients without microvascular complications of had HbA1c < 7.0 (Table 5). 80 (70%) patients of the115 patients without microvascular complications had duration < 5 years (table 03).

Table 03. Differentiates patients based on HbA1c (hemoglobin A1c). Patients without microvascular complications.

Duration of Diabetes	No. of Patients	Percentage
< 5 years	80	70
> 5 years	35	30
Total	115	100

DISCUSSION:

The most important pathogenesis leading to microvascular damage is that hyperglycemia damages capillary endothelial cells in the retina, mesangial cells in the renal glomeruli and Schwan cells of the peripheral[10]. Due to hyperglycemia, there is excess glucose transport in these endothelial cells which leads to damage of these cells. Thus, a microvascular complication arises as a result of damage inside these endothelial cells.

Current evidence does support direct relationship between hypertension and poor glycemic control with microvascular complications as also seen in our study [11]. These are termed as independent risk factors for microvascular disease progression. Age, glycated hemoglobin, duration of diabetes, and serum triglycerides are other risk factors as well as smoking, obesity, physical inactivity [12].

The most common cause of blindness in patient with diabetes is diabetic retinopathy. It is estimated to affect up to 3 million people in the United States alone, by 2050. The main screening method is annual dilated eye examination to detect diabetic retinopathy. Hyperglycaemia and hypertension are the main risk factors of developing retinopathy in patients with diabetes as also seen with our study [13]. Vascular Diabetic Complications in Southeast Sweden (VISS) study reported similar findings. The VISS study a longitudinal observational study of 451 patients with diabetes who were followed for up to 24 years found that keeping HBA1c below 7.6% was beneficial in preventing retinopathy and persistent microalbuminuria for up to 20 years [14]. Intensive blood pressure control in patients with type 2 diabetes reduced the incidence and progressions of diabetic neuropathy over 4–5 years follow up similar to the results in our study [15].

Diabetic neuropathy most commonly manifests as distal, symmetrical sensorimotor neuropathy. Patient can have negative symptoms in the form of numbness or positive symptoms like tingling, and/or burning pain. It is mainly diagnosed clinically. The tests that can be used include vibration studies and ultrasound [16]. Management should be prompt as delay can have deleterious effects resulting in gangrene and amputations. It is known that diabetic nephropathy occurs in up to 40% of all of patients with diabetes, almost similar to our study in which 35% patients had diabetic nephropathy [17]. Poor glycemic control and hypertension damage the glomeruli. Tight glycemic control is very prudent in primary prevention of micro-albuminuria as seen in various studies [18]

Limitations

The limitation of our study is that it is retrospective observational study but it does validate the findings of those few studies that are available in the literature, which have shown poor glycemic control and hypertension to be associated with microvascular complications of diabetes.

CONCLUSION:

Microvascular complications tend to occur in those diabetic patients who have long duration of the disease, hypertension and poor glycemic control.

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