



CORRELATION OF GLYCOSYLATED HEMOGLOBIN AND SEVERITY OF DIABETIC RETINOPATHY IN INDIAN ADULTS WITH TYPE II DIABETES MELLITUS

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ABSTRACT

Type II diabetes mellitus (DM) is the most prevalent endocrine disease. It is expected to double over the next two decades. Changes in lifestyle, increase in weight caused by overeating and lethargy play an important role for increasing of type II diabetes. By the time the patients are diagnosed with type II DM, most of them have already developed macro and microvascular complications such as Diabetic Retinopathy (DR). According to a report by the ADA the most frequent cause of blindness among adults aged 20-75 years is DR. Appropriate diet, regular exercise and early detection can reduce the risk of DR. Duration of diabetes, level of glycemic control, hypertension, deranged lipid profile, obesity, proteinuria, pregnancy and socioeconomic status play important role for development of DR, out of which duration of diabetes and inadequate level of glycemic control are the most important. The gold standard to assess average blood glucose concentration over three months is HbA1c levels. The normal value of HbA1c, that is in non-diabetic individuals is below 6.4%. The aim of the present study was to assess the relationship between HbA1c levels, duration of diabetes, BMI and DR in the patients with type II diabetes mellitus.

KEYWORDS : Diabetes mellitus, Macular edema, Retinopathy

INTRODUCTION

Diabetes mellitus (DM) is the disorder of glucose homeostasis. It has been known to mankind from the time immemorial. HbA1c also called glycosylated haemoglobin is considered as the best available biochemical parameter to assess the long-term metabolic control in patients with DM.^{1,2} HbA1c levels are closely associated with the response to treatment and the risk of developing complications and hence it provides the evidence based marker with which we can assess the chances of developing diabetic complications. It provides information about overall control of glucose in the previous 6-8 weeks. Important burden of the DM is due to the development of complications. Many studies like Brussels study and Wisconsin study have shown robust relationship with levels of HbA1c and duration of DM and the development of complication.^{3,4}

Diabetic retinopathy (DR) is one of the most frequent causes of blindness in the west which occurs due to the disturbances in retinal blood flow. Present study is undertaken to determine the correlation of severity diabetic retinopathy with raised HbA1c levels.⁵

METHODS :

The study was carried out on a randomly selected sample population of 142 Indian adults (i.e. Indian adults who have completed 18 years of age) who were diagnosed with Type II Diabetes Mellitus in the past, using clinical records (which have made the diagnosis based on HbA1c concentration) as a measure to ascertain diagnosis.

Patients with HbA1c levels of more than or equal to 6.5% would be termed as diabetics. The requisite informed consent would be obtained. General parameters such as height, weight and blood pressure would be taken and the BMI would be calculated.

The glycosylated hemoglobin concentration of the most recent laboratory report would be taken and the subject would undergo fundoscopic examination to ascertain the presence or absence of Diabetic Retinopathy and if present the severity of Diabetic Retinopathy would also be ascertained using the Early Treatment Of Diabetic Retinopathy Study (ETDRS) Classification.^{6,7}

Criteria For Diagnosis And Severity Of Diabetic Retinopathy

| Disease Severity Level | Findings Observable upon Dilated Ophthalmoscopy |
|--|---|
| Mild non proliferative retinopathy | <ul style="list-style-type: none"> At least one microaneurysm or intraretinal hemorrhage. Hard/soft exudates may or may not be present. |
| Moderate non proliferative retinopathy | <ul style="list-style-type: none"> Moderate microaneurysm/ intraretinal hemorrhage. Early mild intraretinal microvascular abnormalities (IRMA) Hard/soft exudates may or may not be present. |
| Severe non proliferative retinopathy | <ul style="list-style-type: none"> Four quadrants of severe microaneurysms/ intraretinal hemorrhage. Two quadrants of venous bleeding. One quadrant of IRMA changes. |
| Early proliferative retinopathy | <ul style="list-style-type: none"> New vessels; and definition not met for high-risk proliferative retinopathy |
| High-risk proliferative retinopathy | <ul style="list-style-type: none"> New vessels with the following high risk characteristics: <ol style="list-style-type: none"> Neo vascularization at optic disc (NVD) ¼ to 1/3 of disc area with or without vitreous hemorrhage (VH) or pre retinal hemorrhage (PRH) NVD < ¼ disc area with VH or PRH Neovascularization elsewhere > ½ disc area with VH or PRH. |

Inclusion Criteria:

Patients with Type 2 diabetes mellitus

Exclusion Criteria:

- Individuals with type I Diabetes Mellitus or gestational diabetes
- Media opacities or other ocular manifestation that interfere with visualisation of fundus and classification of diabetic retinopathy
- Uncooperative patients
- Patients unwilling to give consent

Statistical Analysis:

Using the ANOVA test it shall be determined whether a correlation exists between glycosylated hemoglobin concentration and the severity of Diabetic Retinopathy.

RESULTS:

In this study majority of the patients were in the age group of 61-70years which accounted for 36% followed by in the age group of 51-60years in which 28% of patients of type 2 diabetes mellitus were seen. 55% were males and 45% were females. Mean duration of diabetes mellitus was 9.61years. 100% patients were on oral hypoglycaemic agents. In the present study 48.5% had HbA1C less than 8, 28.8% had HbA1C 8.0-9.9, 22.5% had HbA1c equal to or more than 10.0.

Totally 68.3 % of patients had DR of varying severity.

Table 1: Incidence of diabetic retinopathy based on severity.

| Diabetic retinopathy severity | Number of patients | Percentage |
|-------------------------------|--------------------|------------|
| Mild NPDR | 22 | 15.5 % |
| Moderate NPDR | 19 | 13.3 % |
| Severe NPDR | 23 | 16.1% |
| Early PDR | 15 | 10.7% |
| High risk PDR | 18 | 12.6% |
| Normal | 45 | 31.6% |

Table 1 shows that majority of them had severe non proliferative diabetic retinopathy accounting for 16.1% followed by mild non proliferative diabetic retinopathy in 15.5%. 13.3% of the patients had moderate non proliferative diabetic retinopathy, 12.6% patients had high risk proliferative diabetic retinopathy and 10.7% patients had early proliferative diabetic retinopathy.

Table 2: Correlation of severity of diabetic retinopathy with the levels of HbA1c.

| DR | NO OF PATIENTS | AVERAGE HBA1C | STANDARD DEVIATION | P value |
|---------------|----------------|---------------|--------------------|---------|
| MILD NPDR | 22 | 7.95 | 1.67 | 0.023 |
| MODERATE NPDR | 19 | 8.37 | 1.97 | |
| SEVERE NPDR | 23 | 9.64 | 1.92 | |
| EARLY PDR | 15 | 9.03 | 1.81 | |
| HIGH RISK PDR | 18 | 9.23 | 1.73 | |
| TOTAL | 97 | 8.84 | 1.90 | |

Table 2 shows Severity of diabetic retinopathy in relation to value of HbA1. In this study, data shows that severe form of DR (including severe NPDR, PDR) are more commonly distributed among the patients with higher HbA1c as compared to lower HbA1c group. However milder form of DR (including mild and moderate NPDR) are more in patients with lower HbA1c. P value is 0.023 therefore the findings are significant.

DISCUSSION

The exponential rise in the prevalence of diabetes and hence its complications has been a cause of great concern to health care providers worldwide. Prevalence of diabetic retinopathy varies widely among different ethnicity. It ranges from 29% seen in Blue mountain eye study to 50.3% in the Winconsin epidemiologic study of diabetic retinopathy.

Among the Indian studies Chennai urban Rural Epidemiological study (CURES) showed an overall prevalence of diabetic retinopathy of 17.6%. Present study showed overall prevalence of 64% which is almost more than 3 times compared to CURES study. This may be due to the selection of diabetic patients who already had blurring of eyes.^{8,9,10} Many landmark trials like diabetic control and complication trial (DCCT) have showed strong relationship

between HbA1c and the development and progression of DR.^{11,12,13} A study done by Leske et al, in Barbodose eye study, they found that every 1% increase in HbA1C from baseline was associated with a >2-fold risk of DR, up to 4 years of follow up which was correlating with the present study in telling the linear relationship of HbA1c levels with the development of DR.^{14,15,16} Many other epidemiological studies also confirm that uncontrolled sugars which is assessed by HbA1c is important risk factor for DR

In the present study majority of the patient who developed DR were males accounting for 53.3% and 46.6% were females.^{17,18}

CONCLUSION

From this study authors conclude that, as the HbA1c levels increases severity of diabetic retinopathy also increases. Hence it is advisable to include HbA1c as the screening tool in the evaluation of diabetes mellitus, so that we can predict the development of diabetic retinopathy and treat them in early stages. Results were found to be statistically significant.

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