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Clinical Study Of HBA1C And Diabetic Retinopathy In Type 2 Diabetes Mellitus Patients In A Tertiary Care Centre

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Abstract
Background: *Diabetic retinopathy (DR) is a vascular condition that affects the retina's microvasculature causing visual impairment. Glycosylated haemoglobin (HbA1C) gives the glucose control over 3 months. Thus diabetic retinopathy if identified early, the progression can be avoided and complications can be treated, preventing visual impairment.*
Objectives: *To study the HbA1c values and different grades of Diabetic Retinopathy and to find out other factors like age, sex, duration of disease, blood sugar levels; affecting the grades of diabetic retinopathy in patients with Type 2 diabetes mellitus.*
Methods: *Cross sectional study was conducted over the period of 24 months in 66 adult patients with type 2 diabetes mellitus coming to the ophthalmology out patient department in the tertiary care Centre. Detailed history was taken. Systemic, and ocular examination was performed and diabetic retinopathy was graded. HbA1c levels and blood sugar levels were checked and correlated to the grade of diabetic retinopathy.*
Results: *Majority of the study subjects belonged to the age group of 51 to 60 years (46.97%), followed by 61 to 70 years (27.27%) with duration between 5 to 10 years (59.09%), followed by 10 to 15 years (24.24%). Mild NPDR was reported in 18.18% study subjects, Moderate NPDR in 40.91%, Severe NPDR in 10.61%, PDR in 21.21%, Advanced DR in 9.09% study subjects. Majority of the subjects with HbA1C levels more than 8 had severe forms of diabetic retinopathy. Mean FBS and PPBS levels were significantly higher in PDR and advanced PDR as compared to mild and moderate diabetic retinopathy.*
Conclusion: *As the duration of diabetes mellitus increased, HbA1C levels increased, and also severity of diabetic retinopathy increased. There was a positive and statistically significant correlation between duration of diabetes mellitus with HbA1C levels, and severity of diabetic retinopathy. Hence routine retinal screening should be carried out and glycemic control should be monitored in all diabetic patients.*
Keywords: *Hba1c, diabetes, diabetic retinopathy.*

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I. Introduction

Diabetes mellitus affects 4% of the world's population, with over half of those affected experiencing some kind of diabetic retinopathy at any one moment[1]. Diabetic retinopathy affects an estimated 5.5 million adult diabetic people[2].Diabetic retinopathy is a major cause of visual impairment in India. The quality of life and eyesight may be maintained if addressed in a timely manner.

Diabetic retinopathy is a diabetic microvascular condition that worsens over time. Proliferative Diabetic Retinopathy is characterised by microaneurysms, cotton wool spots (CWS), haemorrhages, venous calibre abnormalities, intraretinal microvascular abnormalities (IRMAs), neovascularization of the disc (NVD), and neovascularization elsewhere (NVE) on fundoscopy. Uncontrolled glycaemic status causes advanced diabetic retinopathy (ADED), which is characterised by non-resolving vitreous haemorrhage, fibrovascular growth, tractional retinal detachment, rubeosis iridis, and eventually leads to permanent blindness[3].

Microvascular problems in diabetic retinopathy are known to be caused by advanced glycation end products (including glycosylated haemoglobin, HbA1c). The intensity and duration of poor glycaemic control have been linked to an elevated risk of retinopathy progression from non-proliferative to proliferative diabetic retinopathy[4]. Glycosylated haemoglobin measurement is a technique for measuring hyperglycaemia over a two-three months period. [5-6]

The purpose of this study is to determine the relationship between various HbA1c levels and the severity of diabetic retinopathy. So, by regulating blood sugar levels, we can reduce or stop the development of diabetic retinopathy and improve visual outcomes in diabetic patients.

II. Materials And Methods

Cross sectional study with systematic random sampling was conducted over the period of 24 months. 66 adult patients (>18 yrs), both genders, with type 2 diabetes mellitus at least one year duration, on treatment with oral hypoglycaemic agents / Insulin; coming to the ophthalmology out patient department in the tertiary care Centre were included in the study. Exclusion criteria: Patients with pre-existing non diabetic maculopathy (like that due to Central Serous Retinopathy, Age Related Macular Degeneration, Drug Induced and other Macular degeneration), myopic degeneration and other retinal degeneration, patients who have undergone laser photo-coagulation therapy, Sickle cell disease, Hypertensive patients, Patients with severe anaemia.

Detailed history was taken including age, gender of the patient, duration of diabetes and treatment. HbA1c levels, blood sugar levels and hemoglobulin levels were checked. Systemic and thorough ocular examination with fundus examination was performed. According to the levels of HbA1c, patients were grouped into very good control group (HbA1c<6), good control group (HbA1c between 6 and8) and poor control group (HbA1c>8). Based on the fundus findings, the diabetic retinopathy was graded. Hba1c levels and blood sugar levels were correlated with the grade of retinopathy.

The data was entered using MS Excel software. The data was analysed using SPSS version 22 software. 43. Descriptive Statistical Analysis was done. Spearman's Rank Correlation was used to Correlate and find strength of association between HbA1c levels & Grade of Retinopathy.

III. Results

Table 1: Distribution of subjects according to age

AGE (years)	Number of subjects	Percentage
Less than 40	3	4.55
41-50	10	15.15
51-60	31	46.97
61-70	18	27.27
>70	4	6.06
Total	66	100.0

In the present study we assessed the Age distribution among the study subjects. We observed that majority of the study subjects belonged to the age group of 51 to 60 years (46.97%), followed by 61 to 70 years (27.27%), and 15.15% belonged to 41 to 50 years age group.

Table 2: Gender wise distribution

Gender	Number of subjects	Percentage
Male	43	65.15
Female	23	34.85
Total	66	100.00

In the present study majority of the subjects were males (65.15%), while 34.85% were females. The male: female ratio in the current study was 1.86:1

Table 3: Duration of diabetes mellitus (in years)

Duration (in years)	Number of subjects	Percentage
<5	4	6.06
5 to 10	39	59.09
10 to 15	16	24.24
15-20	4	6.06
>20	3	4.55
Total	66	100.00

Majority of the study subjects had duration between 5 to 10 years (59.09%), followed by 10 to 15 years (24.24%).

Table 3: HbA1c levels

HbA1c level	Number of subjects	Percentage
<6	5	7.58
6 to 8	13	19.70
More than 8	48	72.73
Total	66	100.00

In present study, HbA1c level <6 was reported among 7.58% study subjects, 6 to 8 was reported among 19.70% study subjects, more than 8 was reported among 72.73% study subjects.

Table 4: Severity of Diabetic Retinopathy

Grade of DR	Number of subjects	Percentage
Mild NPDR	12	18.18
Moderate NPDR	27	40.91
Severe NPDR	7	10.61
PDR	14	21.21
Advanced DR	6	9.09
Total	66	100.00

Figure 1: Comparison between severity of diabetic retinopathy and HbA1C levels

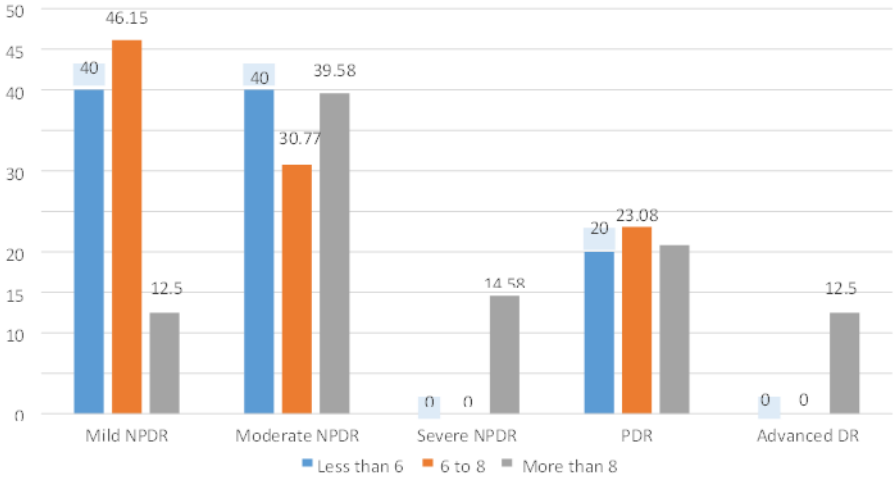
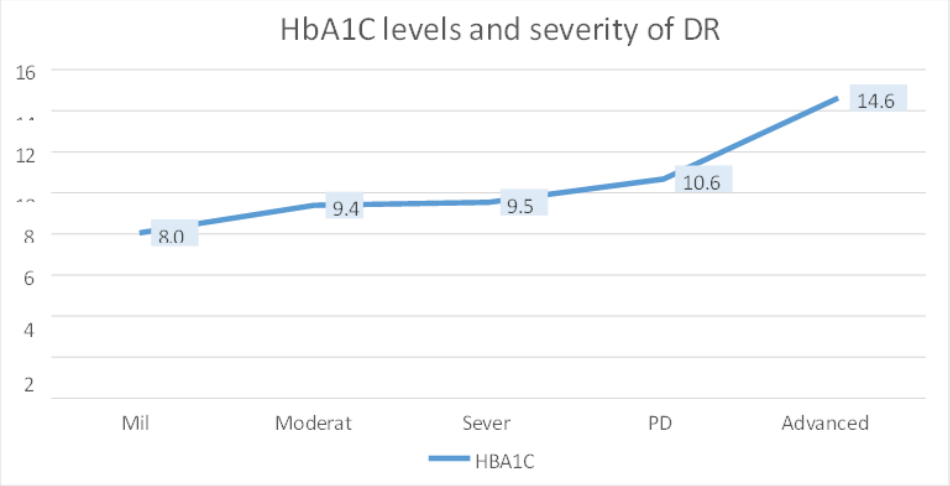


Figure2: Trend of HbA1C levels over increasing severity of diabetic retinopathy



Majority of the subjects with HbA1C levels more than 8 had severe forms of diabetic retinopathy.

Table 5: Trend of Blood sugar levels and HbA1C levels over increasing severity of diabetic retinopathy

Parameters		Severity of Diabetic retinopathy				
		Mild	Moderate	Severe	PDR	Advanced PDR
Blood sugar levels	Fasting blood glucose	145.08	154.96	150.43	217.71	206.50
	Post prandial blood glucose	209.58	236.67	241.00	348.14	304.67
HbA1c levels		8.05	9.40	9.54	10.68	14.63

As the blood sugar levels increase, so does the HbA1C levels increase and the severity and grade of diabetic retinopathy increases as well.

Table 6: Correlation of duration of diabetes mellitus with HbA1C levels and Severity of diabetic retinopathy

Correlation between	Duration (in years)	
	Correlation coefficient	P-value
HbA1c level	$r_s = 0.517$	<0.001
Severity of diabetic retinopathy	$r_s = 0.552$	<0.001

In the present study, we observed that as the duration of diabetes mellitus increased, HbA1C levels increased, and also severity of diabetic retinopathy increased.

IV. 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 Wisconsin epidemiologic study of diabetic retinopathy[7]. Among the Indian studies Chennai urban Rural Epidemiological study[8] (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. Many landmark trials like diabetic control and complication trial (DCCT)[9] have showed strong relationship between hba1c and the development and progression of diabetic retinopathy. Hence the present study was conducted to assess the hba1c values and different grades of Diabetic Retinopathy in patients with Type 2 Diabetes Mellitus in tertiary care hospital. And to find out other factors like age, sex, duration of disease, blood sugar levels; affecting the grades of diabetic retinopathy in patients with Type 2 diabetes mellitus.

In the present study:

- Majority of the study subjects belonged to the age group of 51 to 60 years (46.97%), followed by 61 to 70 years (27.27%), and 15.15% belonged to 41 to 50 years age group. The male: female ratio in the current study was 1.86:1.
- Majority of the study subjects had duration between 5 to 10 years (59.09%), followed by 10 to 15 years (24.24%).
- Majority of the subjects with hba1c levels more than 8 had severe forms of diabetic retinopathy. As the mean hba1c levels increased, the severity of diabetic retinopathy increased.

We observed that as the duration of diabetes mellitus increased, hba1c levels increased, and also the severity of diabetic retinopathy increased**.**

Our findings align with Anitha et al.[5] who also found an association of advanced glycation index (AGI) with the severity of DR, Lubna Ahmad et al[4] -results indicate that poor glycemic control (which can be seen by high HbA1c values) increases the risk for development of Diabetic retinopathy, Leske et al[10] study , they found that every 1% increase in HbA1C from baseline was associated with a >2-fold risk of DR, and The Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR)[11] which showed that the relative risk of developing Proliferative Diabetic Retinopathy increases to 2.64 times when the HbA1c is between 12.1 to 19.5% and chances of developing Macular Edema is 3.37 times.

V. Conclusion

It has been seen that compared to the measurement of glucose levels, HbA1c assay is equally good in defining the level of hyperglycaemia at which the prevalence of Diabetic retinopathy increases.

HbA1C levels can predict the extent of retinal involvement in diabetic patients. Hence routine retinal screening should be carried out and glycaemic control should be monitored in all diabetic patients on every follow up visit.

Regular ophthalmoscopic fundus examinations are essential in detecting the progression of retinopathy and development of disease characteristics which indicate a need for treatment.

Conflict of Interest: There is no conflict of interest.
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