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Comparative Study of Correlation between Severity of Diabetic Retinopathy and Serum Glycosylated Haemoglobin (Hba1c) Levels

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Abstract

Aim/Background: Diabetic retinopathy is a medical condition in which damage occurs to the retina due to diabetes mellitus. The role of 'longer term' glucose stability in terms of HbA1c variability, and the occurrence and progression of diabetic complications among type 1 and type 2 diabetic patients remains elusive. This study aims to study the correlation of serum glycosylated haemoglobin (HbA1C) with severity of diabetic retinopathy in patients with type 1 and type 2 diabetes mellitus. *Patients and Methods:* A descriptive correlative study was conducted with 200 patients and were investigated for diabetic retinopathy and HBA1c levels using laboratory investigations and detailed ocular examination. *Results:* Diabetic retinopathy was the most commonly observed in >10 yrs of duration of diabetes (61.76%) followed by 5 -10 yrs (27.45%) and < 5 years (10.78%). Diabetic retinopathy was most commonly observed in HBA1C levels of more than 10 gm (55.88%) followed by 7-10 gm (27.45%) and 7 gm (6.86%). There was statistically significant difference between duration of diabetes, HBA1C levels and diabetic retinopathy amongst study population (p value < 0.05). *Conclusion:* Patients with Diabetic Retinopathy were found to have significantly raised serum glycosylated haemoglobin levels (HbA1c). The severity of Diabetic Retinopathy increased with raised levels of HbA1c noted mostly in patients with HbA1c levels more than 10 mg/dl. There was a significant correlation between Diabetic Retinopathy and duration of Diabetes Mellitus.

Keywords: Diabetes Mellitus; HbA1c Levels; Diabetic Retinopathy

Introduction

Diabetes mellitus is a complex metabolic disorder, characterised by deficiency and ineffective utilization of insulin that leads to persistent hyperglycemia which in turn leads to microangiopathy and end organ damage.

Diabetes mellitus currently affects more than 170 million persons worldwide [1]. According to WHO, 31.7 million people were affected by diabetes in India in the year 2000. This figure is estimated to rise to 79.4 million by year 2030, the largest number in any nation in the world [2]. The eye is most commonly affected organ by diabetes leading to diabetic retinopathy. More than 75% patients who have diabetes mellitus for more than 20 years will have some form of diabetic retinopathy. Diabetic retinopathy is an important cause of blindness. After 15 years of diabetes mellitus, approximately 2% people become blind and about 10% develop severe visual impairment [3]. Timely treatment can prevent vision loss from diabetic retinopathy.

The severity and the duration of the inadequate glycemic control have been seen to be correlated with a higher risk of increased severity of retinopathy, from non-proliferative to proliferative diabetic retinopathy [4]. All previous studies have explored the association of fasting and post prandial sugars with the occurrence of the different stages of non-proliferative DR (NPDR) and proliferative DR (PDR) [5]. But the causal relationship between HbA1c and the occurrence of visual loss, which includes severe NPDR or PDR or diabetic macular oedema (an important cause of visual impairment

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in subjects with type II diabetes), has not been done in population-based studies.

Methodology

This study was carried out in Tertiary care hospital with 200 patients who fulfilled the inclusion and exclusion criteria and who gave a written informed consent. The ethics clearance was obtained from the appropriate authority appointed by the institution (ethics committee). A written informed consent was obtained for participation in the study.

A detailed history was obtained from each patient including the duration of diabetes followed by a complete ocular examination including determination of visual acuity, intraocular pressure, fundus examination done by direct and indirect ophthalmoscopy. Multiple laboratory tests were performed at base line that included blood sugar levels, HbA1c, lipid profile, at The Central Laboratory, MGM Medical College and Hospital, Kamothe. Direct and indirect ophthalmoscopy was done after pupillary dilatation by tropicamide 1% eye drops and 10% phenylephrine eye drops, where required.

Diabetic retinopathy was diagnosed on the basis of the ETDRS (Early Treatment Diabetic Retinopathy Study) classification. Based on the ETDRS criteria patients was graded according to their severity of retinopathy to corresponding Hba1c levels. Patients suspected of having CSME was confirmed by doing Fundus Fluorescien Angiography (FFA)/ Optical Coherence Tomography (OCT)

HbA1c levels will be determined in all patients with immunoinhibition technique.

Ophthalmic Instruments:

- Snellens chart for testing visual acuity
- Appasamy slit lamp for detailed anterior segment examination of lids, conjunctival surface, cornea and anterior chamber depth.
- Heine ophthalmoscope for direct ophthalmoscopy
- Heine indirect ophthalmoscope for indirect ophthalmoscopy
- Volk 20D and 90D lenses
- Tropicamide 1% and phenylephrine 10% eyedrops for dilated fundus examination.

Statistical Analysis

All the collected data was entered in Microsoft Excel sheet and then transferred to SPSS software ver. 17 for analysis. Qualitative data was presented as frequency and percentages and analysed using chi-square test. Quantitative data was presented as mean and SD. P value < 0.05 was taken as level of significance.

Observations

As seen in the Table 1, Diabetic retinopathy was observed in 51% of study population (Table 1).

As seen in the Table 2, the mean age was 59.07 ±9.569. Mean HBA1C levels were found to be 7.98± 0.730. Other parameters such as Hb (gm%), Fasting Blood sugar levels, Post prandial Blood sugar levels, HDL-C, LDL-C, RBC (/cumm) and PCV (%) were found out to be 10.39±1.445, 146.97±39.60, 208.15±42.26, 41.58±8.9, 93.45±25.60, 3.66±1.072, 30.47±5.019 (Table 2).

Chi square value- 48.4789.df-2, p-value is < 0.00001. As seen in the above table, Diabetic retinopathy was the most commonly observed in >10yrs of duration of diabetes (76.82%) followed by 5 -10 yrs (53.84%) and < 5 years (16.67%). There was statistically significant difference between duration of diabetes and amongst study population (p value < 0.05) (Table 3).

As seen in the above Table 4, Diabetic retinopathy was present in 9.46% of population with HbA1c levels less than 7, 62.22% in patients with HbA1C between 7-10 and 80.28% in patients with HbA1C more than 10 (Table 4).

As seen in the Table 5, Diabetic retinopathy observed in HBA1Clevels less than 7 gm/dl was present in 9.45% of the study population. There was statistically less difference between Diabetic retinopathy and HbA1c amongst study population (p value – < 0.05) (Table 5).

Diabetic retinopathy HBA1C 7 - 10 gm/dl was present in 62.22% of the study population. There was statistically negligible difference between Diabetic retinopathy and HbA1c amongst study population (p value – 0.101)(Table 6).

As seen in the Table 7, Diabetic retinopathy observed in HBA1C levels more than 10 gm/dl was present in 80.28% of the study population. There was statistically significant difference between Diabetic retinopathy and HbA1c amongst study population (p value – 0.0.05) (Table 7).

Table 1: Diabetic retinopathy amongst study population

Diabetic retinopathy		Frequency	Percent
Valid	Absent	98	49.0
	Present	102	51.0
	Total	200	100.0

Table 2: Various parameters amongst study population

	Mean	Std. Deviation
Age	59.07	9.567
HBA1C	7.98	.730
Hb (gm%)	10.39	1.445
BSL- F	146.97	39.608
BSL- PP	208.15	42.268
HDL-C	41.58	8.981
LDL-C	93.45	25.603
RBC (/cumm)	3.66	1.072
PCV (%)	30.47	5.019

Table 3: Comparison of Diabetic retinopathy with Duration of DM amongst study population

			DR		Total
Duration of DM			Absent	Present	
	<5 yrs	No. of patients (%)	55 (83.33%)	11 (16.67%)	66
	5-10 yrs	No. of patients (%)	24 (46.15%)	28 (53.84%)	52
	>10 yrs	No. of patients (%)	19 (23.17%)	63 (76.82%)	82

Table 4: Distribution of Diabetic retinopathy with HBA1c levels amongst study population

			DR		Total
HBA1C			Absent	Present	
	Less than 7	No. of patients (%)	67	07	74
	7-10	No. of patients (%)	17	28	45
	More than 10	No. of patients (%)	14	57	71

Table 5: Comparison of Diabetic retinopathy with HbA1c levels less than 7 among the study population

			DR			
			Absent	Present	Chi square value	P value
HBA1C	Less than 7	% with DR	90.54%	9.45%	48.649	0.0000 (<0.05)

Table 6: Comparison of Diabetic retinopathy with HbA1c levels between 7 and 10 among the study population

			DR			
			Absent	Present	Chi square value	P value
HBA1C	7-10	% with DR	37.78%	62.22%	2.689	0.101

Table 7: Comparison of Diabetic retinopathy with HbA1c levels more than 10 among the study population

			DR			
			Absent	Present	Chi square value	P value
HBA1C	More than 10	% with DR	19.71%	80.28%	26.042	0.000 (<0.05)

Results

Diabetic retinopathy was observed in 51 of the study population

Diabetic retinopathy was the most commonly observed in >10 yrs of duration of diabetes (76.82%) followed by 5 -10 yrs (53.84%) and < 5 years (16.67%).

Diabetic retinopathy with HBA1C between 7-10 gm/dl was present in 62.22% of the study population.

Diabetic retinopathy observed in HBA1C levels more than 10 gm/dl was present in 80.28% of the study population.

There was no significant correlation between Diabetic retinopathy with AGE, BSL F, BSL PP amongst study population.

Discussion

In the present study, Diabetic retinopathy was the most commonly observed in > 10 yrs of duration of diabetes (76.82%) followed by 5 -10 yrs (53.84%) and < 5 years (16.67%). There was a significant correlation between Diabetic Retinopathy and duration of Diabetes Mellitus. (p value <0.0)

Our study also showed that incidence of diabetic retinopathy was increasing significantly with duration of DM ≥ 10 years. Tapp et al in 2003 concluded that duration of diabetes was the risk factor of DR [5]. It was also proved by UK Prospective Diabetes Study Group [4]. In the CURES Eye study 41.8% had diabetic retinopathy after 15 years of diabetes and severity of diabetic retinopathy proportionally increased with longer duration of diabetes. In addition it has been demonstrated that for every five years increase in duration of diabetes, the risk of diabetic retinopathy increases by 1.89 times [5].

In the present study, Diabetic retinopathy was the most commonly observed in HBA1C levels of more than 10 gm/dl (80.28 %) followed by 7 - 10 gm/dl (62.22%) and 7 gm/dl (9.45%). There was statistically significant difference between duration of diabetes and amongst study population (p value < 0.05). The higher levels of HbA1c indicate risk for development of microangiopathy in diabetics. HbA1c has special affinity for oxygen and thereby causes tissue anoxia and plays a role in causation of micro and macroangiopathy. Decrease in HbA1c concentrations by 1% leads to an estimated reduction of 30% in the risk of microvascular complications. Boucher et al who documented that levels of HbA1c above 12.6% indicate a risk for development of micro-angiopathy [6].

In the present study, the mean age related to development of diabetic retinopathy was 59.07±9.5 of the study population. The mean HBA1c related to development of Diabetic retinopathy was 7.98±0.730 in the study population. Thus the findings of our study are in accordance with various studies conducted on this subject.

Conclusions

The conclusions of this study were:

Patients with Diabetic Retinopathy were found to have significantly raised serum glycosylated haemoglobin levels (HbA1c). The severity of Diabetic Retinopathy increased with raised levels of HbA1c noted mostly in patients with HbA1c levels more than 10 mg/dl. There was a significant correlation between Diabetic Retinopathy and duration of Diabetes Mellitus.

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