Original Research Article

A Correlational Study of HbA1C with Diabetic Retinopathy in Patients with type 2 Diabetes Mellitus

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Abstract

Objectives: This present study was to evaluate the correlation of Glycated Haemoglobin with diabetic retinopathy in various age group of type 2 diabetes mellitus patients. **Methods:** A detailed assessment like ocular symptoms, duration of diabetes, history of use of oral anti hyperglycaemic drugs or insulin and any other history like hypertension or any heart disease were performed. Local and systemic examination were done along with ocular examination. Visual acuity was done by using Snellen's chart. Best corrected visual acuity was also recorded. Anterior segment evaluation was done with slit lamp. Funduscopy was done and funduscopic photography was taken with the help of Topcon Maestro fundus camera. **Results:** Data was analysed by using simple statistical methods with the help of MS-office software. All data was tabulated and percentage was calculated. **Conclusions:** Retinopathy was commonly seen in middle age group diabetic patients. Males were more ponderance than females. Majority of the patients had suffered severe non-proliferative diabetic retinopathy from the duration of 20-40 years. And HbA1C level > 14 mmol/L was seen in most of the diabetic retinopathy patients. Thus, HbA1C level and diseases duration was significantly associated with diabetic retinopathy patients. Hence, now a day, diabetic patients are being referred to ophthalmologists according to the type, onset and duration of diabetes. This humane attitude between the family physicians or general practitioners and ophthalmologists bears cardinal position in diabetes education programs.

Key Words: type 2 diabetes mellitus, retinopathy, HbA1C, age group.

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Introduction

Diabetes mellitus (DM) nothing but the disorder of glucose homeostasis, has been known to mankind from the time immemorial. Worldwide about 415 million people are suffering from DM, which is expected to increase to 642 million by 2040 [1].

HbA1c also called glycated haemoglobin is considered as the best available biochemical parameter to assess the long-term metabolic control in patients with DM. 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 diabeticcomplications. It provides information about overall control of glucose in the previous 6-8 weeks [2].

The strong relationship between the reduction of the HbA1c level and the beneficial effects on DR has obscured the necessity of performing clinical trials addressed to investigatethe specific effect of hypoglycemic drugs on DR per se, independently of their effectiveness in lowering blood glucose levels. The reported pleiotropic actions of GLP-1RA in experimental models of DR, apart from their capacity in lowering blood glucose levels, confer on these drugs a potential extra value in preventing the development or arresting the progression of DR [3].Objectives of our study was to correlate the level of HbA1C with diabetic retinopathy of type 2 diabetes mellitus patients.

Materials & Methods

This present study was conducted in the Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar with collaboration of the Department of Ophthalmology, PMCH, Patna, Bihar, India during a period from February 2019 to December 2019. All the subjects were signed an informed consent. Data was collected with irrespective of age and sex.

Patients with type 2 diabetes mellitus with complains of visual loss were enrolled in this study.

Diabetic cataract. gestational diabetes patients, type 1 diabetes mellitus patient, acute and chronic renal failure.congestive heart failure patients and patients with hazy media due to dense cataract or anycorneal opacity patients were excluded from this study.

Methods

A total of 100 patients of type 2 diabetes mellitus with age group 20 years to 80 years, who were referredfrom endocrinology department for funduscopic examination who had complain of vision loss were enrolled in this study.

A detailed medicalhistory like ocular symptoms, duration of diabetes, history ofuse oforal anti hyperglycaemic drugs or insulin and anyother history like hypertension or any heart disease weretaken. Local and systemic examination were performed along with ocular examination. Visual acuity was done by using Snellen's chart. Best corrected visual acuity was also recorded. Anterior segment evaluation was done with slit lamp. Funduscopy was done and funduscopic photography was taken with the help of Topcon Maestro fundus camera. All patients underwent blood test like complete blood count, FBS, PPBS, HbA1c test,renal function test, lipid profile test was performed. Patients were followed up to 3 months. Grading of diabetes was done as per Early Treatment Diabetic Retinopathy Study (ETDRS).

Non-Proliferative Diabetic Retinopathy (NPDR)5 was classified as follows:

1. No DR
2. Very mild NPDR- Microaneurysms only.
3. Mild NPDR- Any or all of: microaneurysms, retinalhaemorrhages, exudates, cotton wool spots, up to thelevel of moderate NPDR. No intraretinal microvascularanomalies (IRMA) or significant beading.
4. Moderate NPDR:

Severe retinal haemorrhages (more than ETDRSstandard photograph 2A: about 20 medium–large perquadrant) in 1–3 quadrants or mild IRMA.
Significant venous beading can be present in no morethan 1 quadrant.
Cotton wool spots commonly present.

5. Severe NPDR:

The 4–2–1 rule; one or more of:
Severe haemorrhages in all 4 quadrants.
Significant venous beading in 2 or more quadrants.
Moderate IRMA in 1 or more quadrants.

6. Very Severe NPDR:

Two or more of the criteria for severe NPDR

Proliferative Diabetic Retinopathy was classified as follows:

1. Mild – Moderate PDR:

Newvessels on the disc (NVD) or new vesselselsewhere (NVE), but extentinsufficient to meetthe high-risk.

2. High Risk PDR:

New vessels on the disc (NVD) greater than ETDRS standard photograph 10A (about 1/3 disc area). Any NVD with vitreous haemorrhage.
NVE greater than 1/2 disc area with vitreous haemorrhage.

Statistical Analysis

Data was analysed by using simple statistical methods with the help of MS-office software. All data was tabulated and percentage was calculated.

OBSERVATIONS

In this present study, we were enrolled a total of 100 patients of diabetic retinopathy with age ≥ 20 years. Male and female ratio was 11:9. Majority of the patients 41(41%) were in age group of 41-60 years.

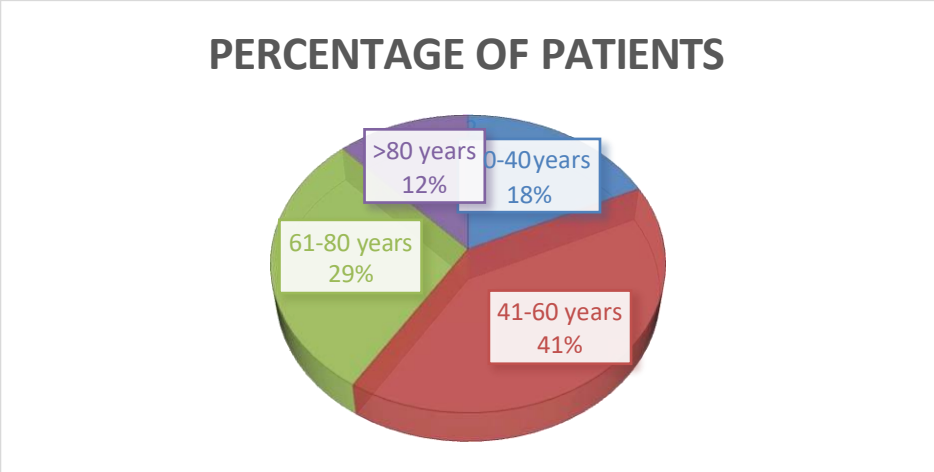

Figure 1: Age wise distribution of patients with diabetic retinopathy

Table 1:Severity of patients with diabetic retinopathy

Prevalence	No. of patients	Percentage
Mild NPDR	16	16%
Moderate NPDR	21	21%
Severe NPDR	44	44%
Early PDR	15	15%
High risk PDR	4	4%

In this study, most of the cases 44(44%) had severe NPDR. And rest of the cases had moderate 21(21%), mild 16(16%), early PDR 15(15%)and high risk PDR 4(4%).

Table 2:Durations of type 2 mellitus with severity of diabetic retinopathy

Duration	Mild NPDR	Moderate NPDR	Severe NPDR	Early PDR	High risk PDR	Total
<10 years	3(18.75%)	3(18.75%)	7(43.75%)	2(12.5%)	1(6.25%)	16(16%)
10-20 years	4(16%)	4(16%)	12(48%)	3(12%)	2(8%)	25(25%)
20-40 years	10(16.95%)	12(20.34%)	25(42.37%)	9(15.25%)	3(5.08%)	59(59%)

In this present study, most of the patients 59(59%) had suffered from diabetic retinopathy from the duration of 20-40 years. Among them 25(42.37%) severe PDR, 12(20.34%) moderate PDR, 10(16.95%) mild NPDR, 9(15.25%) early PDR and 3(5.08%) high risk PDR cases were seen. 25(25%) cases had disease duration between 10-20 years. Among them, 12(48%) severe NPDR, 4(16%) moderate and mild NPDR, 3(12%) early PDR and 2(8%) high risk PDR were seen. 16(16%) cases had suffered with diabetic retinopathy from less than 10 years. Among them 7(43.75%) severe NPDR, 3(18.75%) mild and moderate NPDR, 2(12.5%) early PDR and 1(6.25%) high risk PDR were seen.

Table 3: Level of HbA1c in patients with diabetic retinopathy

HbA1c	Mild NPDR	Moderate NPDR	Severe NPDR	Early PDR	High Risk PDR	Total
7-8.5	1(25%)	1(25%)	1(25%)	1(25%)	0	4(4%)
8.6-10.5	2(18.18%)	2(18.18%)	4(36.36%)	2(18.18%)	1(9.09%)	11(11%)
10.6-12.5	4(22.22%)	2(11.11%)	7(38.89%)	4(22.22%)	1(5.56%)	18(18%)
12.6-14.5	4(16.67%)	6(25%)	10(41.67%)	3(12.5%)	1(4.17%)	24(24%)
>14.5	4(9.30%)	7(16.28%)	25(58.13%)	5(11.63%)	2(4.65%)	43(43%)
Total	15(15%)	18(18%)	47(47%)	15(15%)	5(5%)	100(100%)

In this present study, majority of cases 43(43%) had HbA1c levels >14.5 mmol/L. Among them, 25(58.13%) severe NPDR, 7(16.28%) moderate NPDR, 5(11.63%) early PDR, 4(9.30%) mild NPDR and 2(4.65%) high risk PDR. 24(24%) cases had HbA1C level between 12.6-14.5 mmol/L HbA1c level. Among them 10(41.67%) severe PDR, 6(25%) moderate NPDR, 4(16.67%) mild NPDR, 3(12.5%) early PDR and 1(4.17%) high risk PDR.18(18%) diabetic retinopathy cases had HbA1C level between 10.6-12.5.Among them 7(38.89%) severe NPDR, 4(22.22%) mild NPDR and early PDR, 2(11.11%) moderate NPDR and 1(5.56%) high risk PDR. 11(11%) diabetic retinopathy patients had HbA1C level between 8.6-10.5 mmol/L. Among

them 4(36.36%) severe NPDR, 2(18.18%) mild NPDR, moderate NPDR, early PDR and 1(9.09%) high risk PDR. 4(4%) patients had HbA1C level between 7-8.5 mmol/L. Among them1(25%) cases had mild NPDR, moderate NPDR, severe NPDR and early PDR.

Discussion

Type 2 diabetes is now a common and serious global health problem, which, for most countries, has evolved in association with rapid cultural and social changes, ageing populations, increasing urbanisation, dietary changes, reduced physical activity and other unhealthy lifestyle and behavioural patterns. The risk of developing diabetic retinopathy or other microvascular complications of diabetes depends on both the duration and severity of hyperglycemia [4].

In this present study, most of the diabetic retinopathy patients were belonged in age group of 41-60 years. Males were more ponderance than females.

A study done by Leske et al, [4] in Barbodose eye study, they found that every 1% increase in HbA1C from baseline was associated with a >2-fold risk of DR, upto 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 [4]. Many other epidemiological studies also confirm that uncontrolled sugars which is assessed by HbA1c is important risk factor for DR [5,6].

In this study, most of the cases 44(44%) had severe NPDR. And rest of the cases had moderate 21(21%) cases had moderate NPDR. 59(59%) patients had suffered from diabetic retinopathy from the duration of 20-40 years. Among them 25(42.37%) had severe PDR, 12(20.34%) moderate PDR, 10(16.95%) mild NPDR, 9(15.25%) early PDR and 3(5.08%) high risk PDR cases were seen. 25(25%) cases had suffered from10-20 years.

A study was done by Yun [7] in 2010 on the association between DR and HbA1c concluded that DR was significantly more in patients having higher levels of HbA1c (odds ratio=3.46). Elevated HbA1c have been seento be associated with increased severity of DR, i.e., from Non-Proliferative Diabetic Retinopathy (NPDR) to PDR [8]. Complication of diabetes such as DR can be detectedat the time of the first diagnosis of diabetes [9]. Therelationship between DR and HbA1c values have beenstudied by many authors, and almost all the studies werein accord and pointed out that elevated HbA1c level issignificantly associated with the development of DR [10,11].

In our study, majority of cases 43(43%) had HbA1c levels >14.5 mmol/L. Among them, 25(58.13%) severe NPDR, 7(16.28%) moderate NPDR, 5(11.63%) early PDR, 4(9.30%) mild NPDR and 2(4.65%) high risk PDR. 24(24%) cases had HbA1C level between 12.6-14.5 mmol/L HbA1c level. Among them 10(41.67%) severe PDR, 6(25%) moderate NPDR, 4(16.67%) mild NPDR, 3(12.5%) early PDR and 1(4.17%) high risk PDR. 18(18%) diabetic retinopathy cases had HbA1C level between 10.6-12.5. Among them 7(38.89%) severe NPDR, 4(22.22%) mild NPDR and early PDR, 2(11.11%) moderate NPDR and 1(5.56%) high risk PDR. 11(11%) diabetic retinopathy patients had HbA1C level between 8.6-10.5 mmol/L. Among them 4(36.36%) severe NPDR, 2(18.18%) mild NPDR, moderate NPDR, early PDR and 1(9.09%) high risk PDR. 4(4%) patients had HbA1C level between 7-8.5 mmol/L. Among them1(25%) cases had mild NPDR, moderate NPDR, severe NPDR and early PDR.

Lokesh S et al. [12] were studied on severity of diabetic retinopathy in relation to value of HbA1. In their study, data shows that severe form of DR (including severe NPDR, PDR and CME) 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 HbA1c <10.0 compared to the patients with HbA1c >10.0 32% of patient had fasting blood sugars more than 200, 48% of patients had fasting blood sugars in the range of 126-199 and 20% had Fasting blood sugars less than 126. 80% of patients had PPBS more than 200 [12].

Conclusion

This present study concluded that retinopathy complication was commonly seen in middle age group diabetic patients. Males were more ponderance than females. Majority of the patients had suffered severe non-proliferative diabetic retinopathy from the duration of 20-40 years and HbA1C level > 14 mmol/L was seen in most of the diabetic retinopathy patients.Thus, HbA1C level and diseases duration was significantly associated with diabetic retinopathy. Hence, now a day, diabetic patients are being referred to ophthalmologists according to the type, onset and duration of diabetes. As evidence of strong link between DR and HbA1c is rising, it is time to consider HbA1c level as one of the proposed factors that may influence the referral. The

treating doctor should persuade the patientsto undergo screening for retinopathy whether needed or not. This humane attitude between the family physiciansor general practitioners and ophthalmologists bears cardinal position in diabetes education programs.

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