

The Association of Diabetic Retinopathy with Fasting, Postprandial Blood Sugar Levels and HbA1C in Diabetes Mellitus Patients

Dr Uddhav Khaire¹, Dr Anupam Pal², Dr Rahul Rathod³, Dr Sayed Ammaruddin Chishty⁴

¹Associate professor, Govt. Medical College, Aurangabad, India
uddhavkhair[at]gmail.com

²Junior resident Govt Medical College Aurangabad
anupampal68[at]gmail.com

³Lecturer, Govt medical college Aurangabad
drrnrathod[at]gmail.com

⁴Junior resident Govt Medical college Aurangabad
saedammaruddinchishty[at]gmail.com

Abstract: Diabetic retinopathy (DR) is a microvascular complication of DM and can cause blindness or visual impairment (VI). Although cataract remains a principal cause of blindness in India, other retinal causes (especially DR) are emerging as priority diseases for national programme for control of blindness (NPCB) as well as vision 2020 India. It is of prime importance to examine diabetic patients regularly before the vision drops, so that timely intervention can be done before the condition becomes beyond the scope of treatment. A Cross sectional descriptive study of 130 samples, selected by non-probability convenience sampling method and who met the designed set of criteria, was conducted. In this study, as per funduscopy & Early Treatment Diabetic Retinopathy Scale retinopathy was observed & HbA1C assessed as per ICMR 2018 guidelines. In 94.61% of cases HbA1C was uncontrolled & Controlled in 5.39%. Among all cases 59.23% had moderate degree of retinopathy, 35.38% had mild retinopathy. Further significant correlation was found between level of HbA1C and diabetic retinopathy ($p < 0.05$).

Keywords: DM, NPCB, HbA1C

1. Introduction

Diabetes Mellitus (DM) is an important health issue today. According to World Health Organization (WHO), the number of people with diabetes has increased from 177 million in 2010 to 326.5 million in 2017, in the age group of 20-64 years. It is expected that the number will be around 438 million by the year 2040. India contributes 49% of the world's diabetes burden; with around 72 million in 2017. The data show that the number is expected to increase to 134 million by 2025¹.

Diabetic retinopathy (DR) is a microvascular complication of DM and can cause blindness or visual impairment (VI). Although cataract remains a principal cause of blindness in India, other retinal causes (especially DR) are emerging as priority diseases for national programme for control of blindness (NPCB) as well as vision 2020 India. Prevalence of DR among diabetics has been reported to be 9.6%–21.7% in various studies conducted across India over the last decade.²

Diabetic retinopathy is classified into early stage, nonproliferative diabetic retinopathy (NPDR), and more advanced stage, proliferative diabetic retinopathy (PDR). Retinopathy was evaluated according to the classification of ETDRS (early treatment of diabetic retinopathy study)³. Blindness happens primarily as a result of advanced retinopathy⁴. The prevalence of retinopathy in diabetic population increases with age and duration of diabetes⁴.

Approximately 60-90% of patients in both types of diabetes have diabetic retinopathy over 20 years⁵.

The level of glycosylated haemoglobin appears to be an index of the levels of the blood sugar for a period of several weeks prior to the time of sampling. It has therefore been suggested that the measurement of haemoglobin glycosylation would be a more reliable indicator of the adequacy of control of diabetic state than occasional measurement of blood and urine glucose.⁶

Once diffuse maculae edema (DME) develops, it is difficult to bring back the full vision and treatment is mainly aimed to stabilize the pretreatment vision and also vision improvement occur in few cases. Thus it is of prime importance to examine diabetic patients regularly before the vision drops, so that timely intervention can be done before the condition becomes beyond the scope of treatment.⁷

2. Material and Methodology

A Cross sectional descriptive study conducted in the department of Medicine in tertiary care hospital from 2017-2019. The study was conducted after formal approval of institutional ethical committee. Total 130 samples were selected and who met the designed set of criteria. Informed written consent was taken from patients and their families.

Inclusion criteria:

- 1) Patient having type 1 or type 2 DM diagnosed according to ADA guideline criteria.
- 2) Patient of either sex.
- 3) Patient having age more than or equal to 18 years.
- 4) Patient diagnosed to have diabetic retinopathy.

Exclusion criteria:

- 1) Patient having age less than 18 years.
- 2) Diabetes patient not having diabetic retinopathy.
- 3) Patient having retinopathy due to any other cause
- 4) Patient with pre-existing non diabetic maculopathy.
- 5) Patient who have undergone laser photocoagulation therapy.
- 6) Patient not willing to participate

Clinical grounds for inclusion:

Patients of diabetic retinopathy will be diagnosed by funduscopy. Fundus examination was done as per ophthalmology procedure manual of CDC and findings were noted and categorised as per early treatment diabetic retinopathy scale and classified as early stage, non-proliferative diabetic retinopathy (NPDR), more advanced stage, Proliferative diabetic retinopathy (PDR).

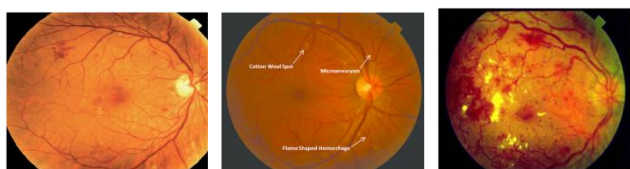


Figure 1: Mild, Moderate & Severe diabetic retinopathy (DR)

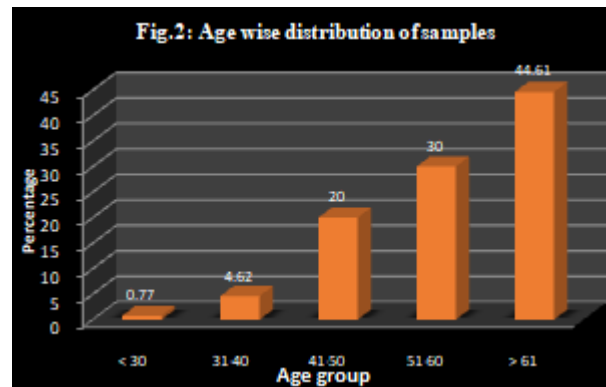
Routine investigations, BSL Fasting and PP were done from central laboratory of institute. HbA1C was done from NABL accredited laboratory and an MOU for a concessional rate was done for the study population.

Once patient was enrolled after taking necessary consent, the patient was thoroughly interviewed, examined and investigated by the investigator. Detailed history of illness and thorough general and systemic examination findings were recorded.

On analysis of data, observations were noted and results were formulated. Quantitative data presented in the forms of frequency and percentage.

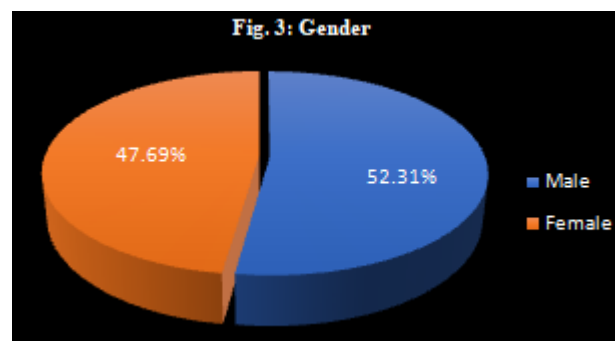
3. Results and Discussion

A total 130 cases in the study period were analyzed. In study it was found that most cases 58 (44.61%) were in the age group of above 61 years. The mean age was found to be 58.32 ± 10.60 .



Study shows 68 (52.31%) patients were male cases. Male to female ratio was approximately 1: 1.09. Also most of patient having hypertension 71 (54.62%) followed by obesity 37 (28.46%) ischemic heart disease in 21 (16.15%) and the remaining were cerebrovascular accident 15 cases (11.54%). Furthermore data also reveals that patients having single or multiple comorbid illness along with diabetic retinopathy. as comorbidity.

In the study most of 94 (72.31%) patients were on injection insulin and 25 (19.23%) on oral hypoglycaemic agents.

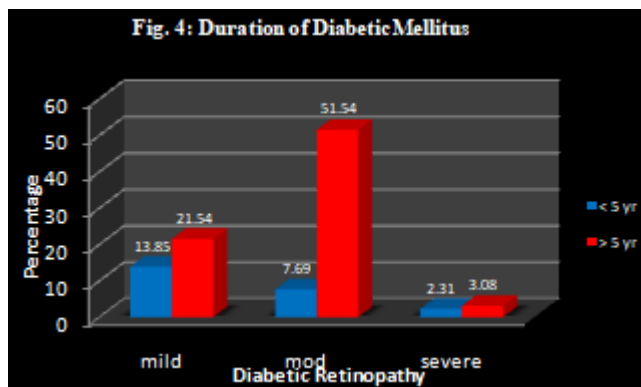


Further it was found in present study that most of patient 59 (45.39%) were having BMI in the range of 25-29.9 (overweight), 37 (28.46%) patients were having BMI in the >30 (obese) and 34 (26.15%) patients were BMI in the range of 18.5-24.9 (normal).

Table 1: Body Mass Index (BMI) of study population

BMI	Frequency	Percentage	Mean \pm SD
< 18.5	0	0	28.21 \pm 4.25
18.5-24.9	34	26.15	
25-29.9	59	45.39	
>30	37	28.46	

In the study most of cases 99 out of 130 (76.15%) had diabetes for more than 5 years. Out of 99 (76.15%) patients with duration of DM more than 5 years maximum number of patients 67 (51.54%) patients had moderate diabetic retinopathy.



In the present study it was observed that in the most 105 (80.77%) had (uncontrolled) unsatisfactory level of HbA1C and maximum number 71 (54.62%) of these patient had moderate diabetic retinopathy.

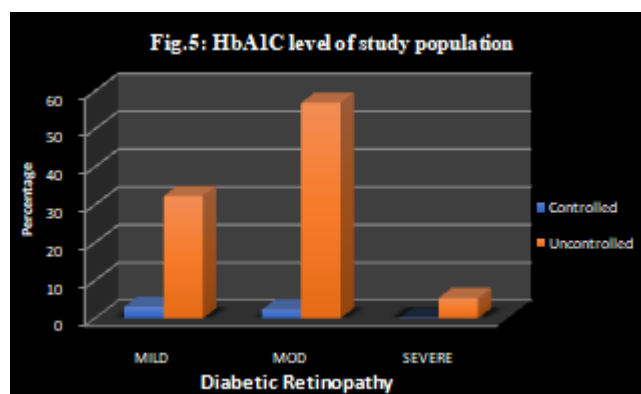
Table 2: HbA1C level of study population

HbA1C	Diabetic retinopathy			Total	F value	p value
	Mild	Moderate	Severe			
5.6-7%	4 (3.08%)	3 (2.31%)	00	07 (5.39%)	23.084	0.00001
7-10%	34 (26.15%)	71 (54.62%)	00	105 (80.77%)		
>10 %	8 (6.15%)	3 (2.31%)	7 (5.39%)	18 (13.85%)		
TOTAL	46 (35.38%)	77 (59.23%)	07 (05.39%)	130		

As observed in table no.1 only 7 (5.39%) of the study population had HbA1C in control range and 18 (13.85%) of patients had very high HbA1C > 10%.

On applying one way ANOVA correlation was found between level of HbA1C and diabetic retinopathy.

In multivariate analysis a significant association was found between diabetic retinopathy with duration of more than 5 years DM and uncontrolled HbA1c with Diabetic retinopathy as $p < 0.05$. For the remaining variable data has not found significant as $p > 0.05$.



4. Discussion

Diabetes Mellitus is an important health problem affecting the whole world. Its impact is on the increase for the past many years, with 326.5 million people suffering from it as per the 2017 records. Diabetic Macular Edema forms the

leading cause of blindness among the patients with diabetic retinopathy. There have been many studies correlating the severity of diabetic retinopathy and the various risk factors, including level of fasting/Postprandial and HbA1C¹⁰⁶.

Analysis of the age distribution of patients showed that most people were in the 5th and 6th decade where male accounting for 52.31% while female were 47.69% and also that of age and sex preponderance analysis did not show any statistical significance in the current study. This was correlating to study done by Niveditha H et al.8, Ahmed RA et. al.9 and Tariq N. et. al.1⁰.

In the previously published studies, it was observed that the diabetic retinopathy increases with duration of diabetes. In our study also diabetic retinopathy increased with the number of years the patients had DM. Most number of cases (76.15%) in the study having more than 5 years duration of DM with mean duration of 10.12 years. The significance of duration of diabetes is well evident from its correlation to diabetic retinopathy development ($p=0.01$). This results correlate with studies done by M Tanaka¹¹, Niveditha H et al.8, Ahmed RA et. al.9 and ThasniM. et al.1².

According Early Treatment Diabetic Retinopathy Scale classification most number of patient 77 (59.23%) had moderate diabetic retinopathy and only 7 (5.39%) had severe diabetic retinopathy. Findings were consistent with other studies such as M Tanaka¹¹, Niveditha H et al.8, Ahmed RA et. al. 9 and Thasni M. et al.1². Variability of findings observed due to different cohort, size of samples and different settings.

HbA1c can be used for predicting the complications of diabetes. It shows a direct & linear correlation with the diabetic retinopathy as seen in present study ($p = 0.00001$). It is very safe to say that HbA1C is the better parameter than FBS & 2 hour PPBS level in diagnosing & predicting complications of diabetic retinopathy. Among several studies reported that there is a positive correlation between HbA1/C and the duration of diabetic mellitus and it is a strong predictor of risk for diabetes complications¹³.

5. Conclusion

It can be concluded from this study that the momentary risk of retinopathy increases dramatically with time although HbA1c is constant and the predictive ability is greater than earlier recognized. Patients with current good control can develop retinopathy due to earlier poor. HbA1c is undoubtedly a user friendly and stable test with very minimal biological variability and which is not affected by factors which otherwise has considerable impact on glucose measurement. glycaemic control.

6. Future Scope

HbA1c is for the moment an expensive test, but considering the load of diabetes in the country and its resultant economic burden early diagnosis and regular monitoring in order to curtail any resultant complication is a necessity. When such is the case the resultant cost of HbA1c testing can be very much justified. Moreover properregulation regarding

standardization of the methods for HbA1c should be implemented and research evaluating the diagnostic and monitoring HbA1c levels in India should be conducted, so that a countrywide range for HbA1c could be established. A wide and proper use of HbA1c is also likely to decrease the cost factor and HbA1c could become an affordable routine test in the long run.

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