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Hba1c Levels an Indicator of Glycemic Control in Diabetics With and Without Retinopathy

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ABSTRACT

Introduction: Diabetic retinopathy is a main cause of vision impairment and blindness due to uncontrolled diabetes. In Pakistan uncontrolled iabetes is on rise and one of the leading causes of preventable blindness.
Aims &Objectives: To determine HbA1c levels as an indicator of glycemic control in diabetics with and without retinopathy.
Place and duration of study: Department of Ophthalmology, Shaikh Zayed Hospital Lahore from -1st March 2020 to 30th April 2021.
Material &Methods: It is a comparative cross-sectional design in which one hundred and sixty diabetic retinopathy patients (group A) were compared with one hundred and sixty patients with no diabetic retinopathy (group B). Both groups were conveniently enrolled and their complete demographic, clinical, biochemical land fundoscopic data was documented on self -constructed, structured pro-form and analyzed on SPSS version 24, P-value<0.05 was taken as significant.
Results: The mean age in diabetic retinopathy group (group A) was 52±5.6 SD years with 50% (80/160) females. In no diabetic retinopathy group (group B) the mean age was 43±3.7 SD with 50.60% females (81/160). Age-wise difference between both groups was significant with p-value <0.05. There were equal number of patients from both genders. Majority of diabetic retinopathy patients belonged to age >55 years (Table -1).
In group A inadequate glycemic control (HbA1c=7.1-9) was found in 37.5% (60/160) while poor glycemic control (HbA1C >9) was found in 56.8% (91/160). In group B inadequate glycemic control was found in 23.75% (38/160) and poor glycemic control was found in 39.3% (63/160). There is a significant difference (p<0.05) in glycemic control among diabetics with and without retinopathy.
Conclusion: Deranged HbAIc Levels representative of overall fasting and post prandial poor glycemic control over 3 months were found to be significantly high in diabetic retinopathy patients as compared to diabetics without retinopathy enabling the physician to label these patients at high risk of retinopathy

Keywords: Diabetic retinopathy, HbA1c, poor glycemic control, inadequate glycemic control

INTRODUCTION

Diabetic retinopathy has been identified as a main cause of blindness. Blindness that results from cataract, corneal infections or glaucoma is related to uncontrolled diabetes. With ascent in cases of diabetes the related complications with this disease are also on acceleration. Literature supports an increase up to twice fold of diabetic cases presented in developing countries by the year 2030. A study from year 2010 reported 285 million people globally with diabetes mellitus. Among them almost 33% were suffering from diabetic retinopathy[1,4].
Diabetic patients develop eye infections and diabetic retinopathy a result of uncontrolled sugar levels. The onset of diabetic retinopathy is slow and progressive. The initial stages are milder as non proliferative which includes presentation of minimal one micro-aneurysm[5,6]. The moderate non proliferative diabetic retinopathy causes hemorrhage in addition to micro-aneurysm and hard exudates. In severe cases micro-aneurysm spreads to 4 quadrants with hemorrhages and venous beading in at least 2 quadrants as well as intra-retinal microvascular anomaly is at least one of the quadrants. Proliferative diabetic retinopathy is featured by factors as neo-vascularization, macular edema, tractional bands, retinal detachments, preretinal hemorrhages as well as hemorrhage inside vitreous[7]. (Fig-1)[25].
Risk factors for diabetic retinopathy majorly include diabetes duration, age, glycemic values, obesity, neuropathy and nephropathy. Adults with high glycemic values and obesity are highly prone towards diabetic retinopathy[8,10].
Even though Pakistan has a major load of uncontrolled diabetes and diabetic retinopathy, still there has been no mutual consensus by health

administrators to combat its consequences. The frequency of patients having diabetes mellitus is difficult to ascertain because of differing standards of diagnosis but various studies have reported that prevalence of diabetes mellitus in Pakistan is around 5-7%. In Pakistan the prevalence of diabetic retinopathy (DR) in diabetic patients is 12% whereas others have reported the rates to be as high as 15% to 19.9%[11,12]. HbA1c and fasting blood glucose values can be considered as predictors for the future development of Diabetic retinopathy. This study aimed to determine the prevalence and severity of Diabetic retinopathy among diabetic patients and to assess its relationship with HbA1c levels[13].

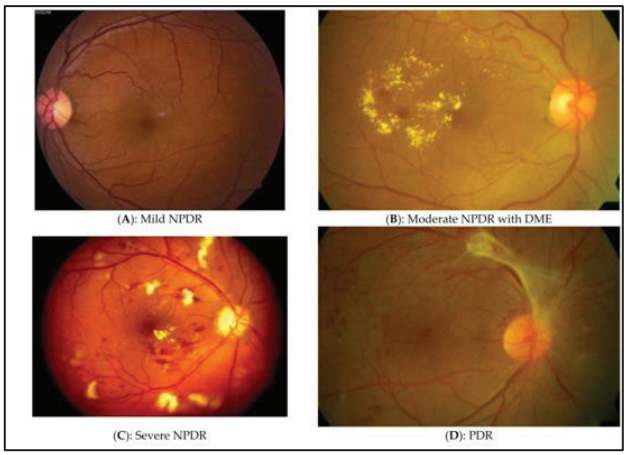

Fig-1: Severity of Diabetic Retinopathy[25]

Most previous studies of subjects with type2 diabetes used fasting plasma glucose (FPG) variability as an indicator of glycemic variability However; it has a limitation in that it does not reflect postprandial glucose levels, which has recently been considered important in terms of diabetes control. HbA1c can be a better indicator in that it reflects both fasting plasma glucose and postprandial glucose levels.[23].

The present study is designed to determine HbA1c levels as an indicator of glycemic control in diabetics with and without retinopathy attending the Ophthalmology department of a tertiary care hospital in Lahore.

MATERIAL AND METHODS

This study was conducted at Department of Ophthalmology, Shaikh Zayed Hospital Lahore from -1st March 2020 to 30th April 2021.The present study enrolled 320 participants.160diabetic retinopathy patients who were compared with 160 diabetic cases with no retinopathy. An informed consent was taken from each participant after gaining an ethical approval for the study. Each patient's complete history including age, gender, BMI (body mass index), blood pressure systolic and diastolic values, diabetic status, HbA1c analysis, presence/absence of complications related to microvascular system including retinopathy, nephropathy or neuropathy, fundoscopic results and other screening performed by ophthalmologist were documented. A 5cc blood was used for analyzing above mentioned biochemical analytes through calorimetric as well as analyzer-based methods. A well-structured proforma was adopted for entering the details of stated variables and relevant clinical information. HbA1c level 5.6-7.0% was considered well controlled, 7.1-9 % as inadequately controlled while a value above 9% was considered poorly controlled. Glomerular Filtration Rate (GFR) was calculated by Modification of Diet in Renal Disease (MDRD) formula with <60 as an indication of nephropathy. Patients with normal range values were categorized as controlled diabetic while those having highly deviated levels were further analyzed for uncontrolled diabetic status. Data was analyzed by independent t test, mean, standard deviations and chi square using SPSS-24, P-value <0.05 was considered as significant.

RESULTS

The mean age in group A was 52±5.6 SD years with 50% (80/160) females. In group B the mean age was 43±3.7 SD with 50.60% females (81/160). Age-wise difference between both groups was significant with p-value <0.05. There were equal number of patients from both genders in diabetic retinopathy patients while 50.6% women were recorded in no retinopathy group. Majority of diabetic retinopathy patients belonged to age >55 years (Table -1).The study recorded patients suffering from diabetic retinopathy to be having either poorly controlled (56.8%) or inadequately controlled (37.5%) HbA1c levels in comparison to no diabetic retinopathy patients having either poorly controlled (39.3%) or inadequately controlled (23.75%) HbA1c levels. The variance between group A and group B was significant. The frequency of diabetic retinopathy calculated from this data is 56.8% among poorly controlled and 37.5% in inadequately controlled diabetic population (Table-2). Within controlled and uncontrolled diabetic patients, it was noticed that 58.9% had mild non proliferative diabetic retinopathy while 9.9% were even those who suffered from proliferative diabetic retinopathy. The total number of uncontrolled diabetic patients was estimated by combining inadequately controlled and poorly controlled diabetic cases (Table-3).

Variable	Group A (n=160)	Group B (n=160)	P-value
Age (years)			
41-45	27(16.9%)	131(81.8%)	<0.05
46-55	62(38.75%)	18(11.3%)	
>55	71(44.4%)	11(6.8%)	
Gender			
Men	80 (50%)	79 (49.3%)	0.667
Women	80 (50%)	81 (50.6%)	

Table-1: Distribution of age and gender between diabetic retinopathy and no diabetic retinopathy patients (n=320)

Variable	Group A	Group B	P-value
HbA1c/Glycemic control			
Controlled	9 (5.6%)	59 (36.9%)	<0.05
Inadequate Glycemic Control	60 (37.5%)	38 (23.75%)	
Poor glycemic control	91 (56.8%)	63 (39.3%)	
Blood Pressure			
Normotensive	127 (79.4%)	80 (50%)	<0.05
Hypertensive	33 (20.6%)	80 (50%)	
Neuropathy Present	82 (51.3%)	66 (41.3%)	<0.05
Neuropathy Absent	78(48.7 %)	94(58.7)	
Nephropathy Present	72 (45%)	11 (6.9%)	<0.05
Nephropathy Absent	88(55%)	149(93.1%)	
Obesity Present	85 (53.1%)	41 (25.6%)	<0.05
Obesity Absent	75(46.9 %)	119(74.4%)	

Table-2: Comparison of HbA1c status between diabetic retinopathy and no diabetic retinopathy patients.

Controlled HbA1clevels<5.6%-7%
Inadequately controlled HbA1c levels 7.1%-9%
Poorly controlled HbA1c levels>9%

Diabetic Retinopathy	Inadequately Controlled	Poorly Controlled
Mild Non-Proliferative DR	9 (100%)	89 (58.9%)
Moderate Non-Proliferative DR	-	42 (27.8%)
Severe Non-Proliferative DR	-	5 (3.3%)
Proliferative DR	-	15 (9.9%)

Table-3: Types of diabetic retinopathy in inadequately and poorly controlled diabetic patients.

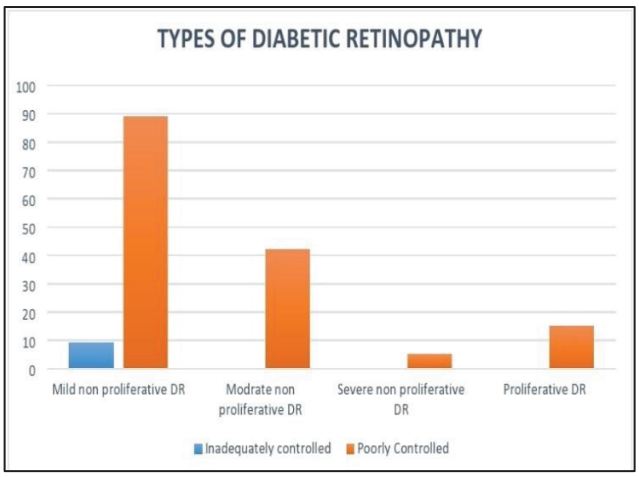

Fig-1-: Types of diabetic retinopathy in inadequately and poorly controlled diabetic patients.

DISCUSSION

Diabetes mellitus has surged within years in Pakistan as well as other parts of the world. According to world health organization survey Pakistan is number eight in diabetic cases on global unit in 90s tenure while it is ranked at fourth highest country with diabetic cases in recent years[14].

The mean age of diabetic patients having diabetic retinopathy is around 52 years. Diabetes mellitus being leading cause of blindness and visual impairments in western as well as Asian region is reported to be maximum in patients below age of 60 years[15]. Hyperglycemia is considered to play an important role in the pathogenesis of retinal microvascular damage. Multiple metabolic pathways have been implicated in hyperglycemia-induced vascular damage. The earliest responses of the retinal blood vessels to hyperglycemia are dilatation of blood vessels and blood flow changes[16]. Obesity is seen to be significantly higher in diabetic retinopathy cases which has been reported as a risk factor in literature[7,9].

The current study enrolled same number of men and women who were suffering from diabetic retinopathy as well as uncontrolled diabetes. This elaborates the fact that there was no significant variance seen among diabetic retinopathy cases in women or men. Although many studies have reported similar findings especially from the Middle East areas which report no significant difference among diabetic retinopathy cases and gender distribution[17,20].

Wisconsin Epidemiologic Study of Diabetic Retinopathy (WESDR) showed that there is a three-fold higher risk of retinopathy if the patient has an HbA1c level of ≥12%. It is demonstrated that good and sustained glycemic control as measured by

HbA1c levels is important in preventing the onset of DR[21].

There is a steady increase in the prevalence of diabetic retinopathy. The findings of this study showed that there is no significant association of diabetic retinopathy and known risk factors including sex, type of diabetes mellitus (DM), obesity, and smoking. On the other hand, the duration of DM, HbA1c level, uncontrolled diabetes, hypertension, dyslipidemia, nephropathy, insulin treatment, and age are identified as strong predictors of DR among diabetics in this study[22]. Consequently, the frequency of diabetic retinopathy in uncontrolled diabetes is around 59.9%. A study reported that majority of uncontrolled diabetic patients are under threat of developing diabetic retinopathy[23]. A systematic review on Pakistani population stated that prevalence of diabetic retinopathy is around 28.78% with a variation of 10.6%-91.3% in literature. The similar study also described that most of the reviews from Pakistan found prevalence of diabetic retinopathy around 28.2%(variation of 4-46.3%)depending upon what type of diabetic population was under research[1].

Several studies have compared the sensitivity of FPG (fasting plasma glucose) and HbA1c in diabetic retinopathy detection. Many cross-sectional studies conducted in China, Iran, Korea, the US, Pima peoples, etc., have reported that HbA1c was able to detect diabetic retinopathy more sensitively than FPG[24].

Current study highlighted the importance of HbA1c levels in determining the glycaemic/diabetic control status particularly in the context of early detection and prevention of retinopathy. The poorly controlled glycemic levels are significantly different in retinopathy and no retinopathy group. This study has limitations of the design which is cross-sectional. Further studies with cohort design can be conducted with different glycemic control levels and also by including fasting and random sugar levels.

CONCLUSION

Current study found a statistically significant difference in glycemic control determined by HbA1c levels among diabetics with and without retinopathy. HbA1c levels are significant in depicting the glycemic control of past 3 months thus can enable the physician to label these patients at a high risk of retinopathy.

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