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Prevalence of Diabetic Retinopathy and Correlation with HbA1c in Patients Admitted in Khyber Teaching Hospital Peshawar

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Author`s Contribution	ABSTRACT
[1,2]Concept, idea and design, acquisition of data, literature review, final approval, authored the study, tabulation of data, bibliography and reviewed the study [3,4]Critical review, drafting of manuscript and data analysis, data collection, methodology writing, literature review, drafting and final approval *Funding Source: None* *Conflict of Interest: None* *Received: Dec 18, 2020* *Accepted: May 04, 2021* **Address of Correspondent** *Dr. Shah Muhammad Khan Jadoon* *Associate Professor Pharmacology* *Bacha Khan Medical College, Mardan* *drsmkjadoon@yahoo.com*	**Objective:** To determine the prevalence of diabetic retinopathy in patients admitted in Khyber Teaching Hospital Peshawar and to correlate different stages of diabetic retinopathy with HbA1C levels. **Methodology:** This cross sectional study was conducted at Department of Ophthalmology, Khyber Teaching Hospital, MTI, Peshawar from December 2019 to May 2020. All patients over the age of 15 years who were diagnosed with diabetes mellitus were included in the study while patients with cataract or retinopathy due to other pathologies were excluded. All diabetic patients were admitted through the outpatient department. In the ward, their blood pressures were recorded and HbA1c levels were also measured. Visual acuity (VA) was checked. Screening for diabetic retinopathy was done by a consultant ophthalmologist by Optos Ultrawide Field Imaging of the retina and Optical Coherence Tomography (OCT) of macula to establish stages of diabetic retinopathy and presence of diabetic macular edema respectively. **Results:** A total of 103 diabetic patients were included. Their retina was photographed, viewed and analyzed. Diabetic retinopathy, irrespective of the type, was found in 69 patients with a prevalence of 66.9%. Patients with lower ranges of HbA1c (below 6%) showed no evidence of DR. The clustering of majority of patients with diabetic retinopathy with HbA1c levels of 8 to 12 %, showed a significant relationship between high blood sugar levels and severity. **Conclusion:** In our study the higher frequency of retinopathy is alarming by considering it one of the leading causes of blindness in the working class. It is highly recommended that routine ophthalmologic examination may be carried out along with optimal diabetic control. **Keywords:** Blood Glucose Levels, Diabetes Mellitus, Diabetic Retinopathy, HbA1c, Opthalmoscopy, Visual Acuity

Introduction

Diabetes mellitus is a syndrome with disordered metabolism characterized by hyperglycemia over a prolonged period. It may be due to defect in insulin secretion or insulin action or, more commonly both and its effects include long-term complications, dysfunction and failure of various organs. [1] Complication of DM may be acute or chronic if left uncontrolled. Acute complications include hypoglycemia, hyperglycemia, diabetic ketoacidosis, and non-ketotic hyperosmolar hyperglycemic coma. Chronic complications include both microvascular and macrovascular complications. Microvascular complications include retinopathy, nephropathy, neuropathy and cardiomyopathy. While macrovascular complications are coronary artery disease, cerebrovascular accidents, and diabetic foot ulcers. [2]

HbA1C is the currently acceptable indicator of good glycemic control. According to Zoungas there is 38 % rise in the risk of microvascular abnormalities by 1 % rise in HbA1c levels. [3] Threshold of HbA1c for macro-vascular problems and death is ~ 7 % whereas for microvascular

abnormalities is ~ 6.5 %.[4] For predicting prevalence of development of diabetic retinopathy, HbA1c values has been considered quite specific and sensitive.[5] The prevalence of retinopathy is very low at HbA1c 6.5-6.8% and becomes moderate or severe at 6.9% and above, rendering HbA1c threshold of 6.5% for detecting any retinopathy. [6]

In 2019, over 19 million adults in Pakistan are estimated to be living with diabetes with no plan to combat complications like DR. The risk of developing diabetic retinopathy or other microvascular complications of diabetes depends on both the duration and the severity of hyperglycemia. Retinopathy may begin to develop as early as 7 years before the diagnosis of diabetes in patients with type 2 diabetes and most patients with type 1 diabetes develop evidence of retinopathy within 20 years of diagnosis. [7]

Diabetic retinopathy, a micro-angiopathy, is one of the leading causes of blindness. It is responsible for ~ 10,000 new cases of blindness every year in the United States alone. [7] Pakistan is ranking 4th in the top 10 countries for an absolute increase in diabetes prevalence which is 17.1%.[8] Various classifications of diabetic retinopathy exist. Eva Kohner's classified it into three main types, Background retinopathy, Pre-proliferative retinopathy and Proliferative retinopathy. [9]

The aim of our study is to know the prevalence of diabetic retinopathy and also relate it to HbA1c levels. This study will pave the way for further research, public awareness programs, policy and treatment planning by health authorities. This will reduce the economic burden as well as further vision loss among the masses suffering from diabetes mellitus.

Methodology

This cross sectional study was conducted at the Department of Ophthalmology, Khyber Teaching Hospital, MTI, Peshawar from December 2019 to May 2020. All patients over the age of 15 years who were diagnosed with diabetes mellitus, mobile and well oriented were included in the study. Patients who had cataract or retinopathy due to other diseases were excluded. Sample size was calculated by using WHO sample size calculator and convenient non-probability sampling technique was adopted for this study. Approval from hospital ethical committee was obtained. Written informed consent was taken from all patients after explaining them the purpose of study. All diabetic patients were admitted through outpatient department. In the ward their blood pressures were recorded and HbA1c levels were also measured. Visual acuity (VA) was checked. Screening for diabetic retinopathy was done by a consultant ophthalmologist by Optos Ultrawide Field Imaging of the retina and Optical Coherence Tomography (OCT) of the macula to establish stages of diabetic retinopathy and presence of diabetic macular edema respectively. Diabetic retinopathy was classified as non proliferative (mild, moderate or severe) and proliferative diabetic retinopathy. Those with hazy views were classified as proliferative diabetic retinopathy because of vitreous hemorrhages from neo vascularization. Data was collected and analyzed by software SPSS version 20.0. Quantitative variables like age, blood pressure, HbA1c levels is calculated as mean ± SD. Qualitative variables like gender, previous retinal interventions were presented in the form of frequencies and percentages. Presence of Diabetic Retinopathy was stratified among age, gender, HbA1c levels and blood pressure. Post stratification data was calculated through chi square test. Level of significance (P value) with Odds Ratio (OR) for all the exposure and outcome variables was considered with a significance level of 0.05 with a confidence level of 95%. All the data is presented in the forms of tables and graphs.

Results

We examined a total of 103 diabetic patients during the study period. Their retina was photographed, viewed and analyzed. Male to Female patient's distribution ratio was 47:56 (45.64%:54.36%) respectively. Majority of patients lied between 30-70 years with mean age of 54.59 with ± 8.987SD (Table I). Diabetic retinopathy was found in 69 patients with a prevalence of 66.9%. Non-proliferative diabetic retinopathy (NPDR) was seen in 35 patients (50.7%) while proliferative diabetic retinopathy (PRD) was present in 34 (49.3%) patients. No view was seen in 13 (12.6%) patients and was attributed to vitreous hemorrhages with or without tractional retinal detachment (TRD). Rest of the patients i.e. 21(20.4%) had no diabetic retinopathy. Patients having HbA1c below 6% showed no evidence of DR. The presence of PDR was seen at almost all ranges of HbA1c compared to NPDR. Most cases of PDR and NPDR were seen in patients having HbA1c ranges between 8 to 11% (Table II).

Discussion

The primary aim of this research was to determine the prevalence of diabetic retinopathy. The total number of diabetics whose retina was photographed, viewed and

Table I: Diabetic Retinopathy distribution by Type, Gender and Age

		Type Of Retinopathy						
		No DR	PDR	Mild NPDR	Moderate NPDR	Severe NPDR	No View	Total
Type		21	34	24	10	1	13	103
Gender	Male	7	17	12	5	1	5	47
	Female	14	17	12	5	0	8	56
Age	30-40	3	0	0	1	0	0	5
	41-50	5	16	16	6	0	1	36
	51-60	7	14	14	3	1	6	39
	61-70	6	4	4	0	0	3	20
	70 & Above	0	0	0	0	0	3	3
	Total	21	34	34	10	1	13	103

Table II: HBA1c and Types of Diabetic Retinopathy

HBA1c	Type of Retinopathy						Total
	No DR	PDR	Mild NPDR	Moderate NPDR	Severe NPDR	No View	
Below 6.00	4	1	1	0	0	0	6
6.01-7.00	1	6	5	3	0	2	17
7.01-8.00	2	4	2	1	0	1	10
8.01-9.00	2	5	4	2	1	1	15
9.01-10.00	3	7	4	1	0	1	16
10.01-11.00	1	10	6	3	0	1	21
11.01-12.00	4	1	3	2	0	4	14
12.01-13.00	2	2	0	0	0	0	4
Total	19	36	25	12	1	10	103

analyzed were 103. Diabetic retinopathy, irrespective of the type, was found in 69% patients with a prevalence of 66.9 %. Pooled prevalence of DR, in the literature was found to be 11064 (28.78%) (With 95% confidence interval [C.I] 29.55 – 47.73) having a huge variation of 91.3% to 10.6%.[10] This finding is quite alarming because when interpreted for the entire population, it points to a huge burden of disease. When previous studies are compared with this prevalence, it is much greater.

In rural Alberta, Canada, the prevalence of diabetic retinopathy was 27.2% in a study in 2005.[11] Similar study in Victoria, Australia also showed the prevalence of diabetic retinopathy around 29.1%. [12] Antonio Rodriguez-Poncelas et all carried out retrospective, cross-sectional, population based study of T2DM patients and screened them with retinal photography in Catalonia, Spain, the prevalence of untreated, vision threatening retinopathy was 2.8%.[13] The All India Ophthalmologic Society carried a study in 2014 and found the prevalence of DR in India

was 21.7% whereas the Chennai Urban Rural Epidemiology Study (CURES) in 2005 found the prevalence of DR in Urban India to be 17.6%. [14,15] In a study conducted in Tehran province, Iran in 2007 and found the overall standardized prevalence of any diabetic retinopathy was 37.0%.[16]

Considering local studies in Pakistan, a study carried out at Akhtar Jamal Khan's Hospital, Gulshan-e-Iqbal, Karachi, the prevalence was 26%.[17] Other studies at The Ibrahim Eye Hospital old Thana, Malir and New Karachi Township, Karachi it was 28.8% and 42.86 % respectively.[18,19] In Peshawar, a study carried out by the department of Diabetes and Endocrinology, Hayatabad Medical Complex, diabetic retinopathy was observed in 51%.[20]

In our research work, one of our objectives was correlation of levels of HbA1c with different stages of diabetic retinopathy. Our results showed that patients in the lower ranges of HbA1c (below 6%) had no DR. The frequency

of PDR was seen at almost all ranges of HbA1c compared to NPDR. Cases of severe NPDR were seen in ranges of 8-11% of HbA1c. According to Diabetes Control and Complications Trial (DCCT), intensive therapy aimed at maintaining near-normal blood glucose values markedly reduced the risks of development or progression of retinopathy and other complications when compared with the conventional treatment regimen. The mean HbA1c during the trial was the dominant predictor of retinopathy progression in the two groups. It was seen that 10% reduction in HbA1c was associated with 43% lower risk in the intensive group and 45% in the conventional group.[21]

Our results also showed that high levels of HbA1c had an association with the production and progression of diabetic retinopathy. In another study on optimal HbA1c cutoff for detecting diabetic retinopathy, the prevalence of retinopathy was very low until the HbA1c range of 6.5–6.8 %. The optimal HbA1c cutoff for detecting any diabetic retinopathy was 6.6 %, moderate or severe retinopathy was 6.9 %.[6] This study confirmed that the proposed HbA1c threshold of 6.5 % allowed the proper detection of diabetic retinopathy.

Conclusion

In our study the higher frequency of retinopathy is alarming by considering it one of the leading causes of blindness in working class. Routine ophthalmologic examination is highly recommended along with diabetes control.

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