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Original Article

Evaluation of the Relationship between Hemoglobin A1c and Diabetic Retinopathy in Patients with Type II Diabetes at Tishreen University Hospital- Latakia- Syria

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Abstract *- Background: Diabetic Retinopathy (DR) may be a common and specific microvascular complication of diabetes leading to blindness in working-aged people. Glycated hemoglobin (HbA1c) has an important role in diagnosing diabetes, but the assessment of its role in Diabetic Retinopathy (DR) is still unclear. Objective: This study aims to determine the prevalence of Diabetic retinopathy in Tishreen University Hospital- Latakia-Syria and evaluate its association with HbA1c. Methods: A cross-sectional survey was conducted on patients in the ophthalmic clinic of Tishreen University Hospital from May 2020 to December 2021. Results: The total number of diabetic patients in the current study was 222, 190 of them with type II and 32 with type I. Of 190 patients, 99 were males and 91 were females. The mean age of them was 64.46± 8.29 years, with a range (of 27-82) years. Of 222 patients, the prevalence of DR was 72.97%. As for the relationship between HbA1c levels and DR, a statistically significant association was recorded between them (p<0.001). Conclusion: It is important to control blood glucose and maintain HbA1c levels within the normal range. We recommend early diagnosis, treatment and prevention measures.*

Keywords *- Diabetic Retinopathy, DR, HbA1c, Glycated hemoglobin, Diabetes, Syria.*

1. Introduction

Diabetes Mellitus DM is considered an important medical problem that has increased worldwide, especially in the Asia Pacific region [1, 2]. According to the American Diabetes Association, Diabetes is defined as a fasting blood glucose level greater than 126 mg/dl, a glucose level two hours after a meal greater than 200 mg/dl, and an HbA1c level more than 6.5% [3-5]. Diabetes is divided into two main types: DM type I, which is insulin-dependent, constitutes 10%, while DM type II, which is not dependent, constitutes 90% [4]. HbA1c is the most important marker for diagnosis and long-term monitoring of blood glucose control, giving information about the previous 3-4 months [3].

Suppose it is not controlled (high HbA1c level). In that case, diabetes can cause many complications, and the major microvascular complication is Diabetic Retinopathy DR, which is the main cause of visual defect and blindness in working-age adults [6-8]. Early loss of pericytes, the thickness of basement membrane, vascular permeability-increasing, and changes in platelet aggregation and leukocytes [9]. So, early diagnosis and treatment of DR are required.

The objectives of the present study are to determine the prevalence of DR and to assess the association between the HbA1c levels and DR as a predictive indicator of the progression of DR.

2. Materials and Methods

The Study Design: A cross-sectional study was conducted on patients in the Ophthalmic Clinic of Tishreen University Hospital from May 2020 to December 2021. All personal data, such as name, age, address, and job, as well as clinical data, such as retinal findings and arterial pressure, were recorded after obtaining informed consent from all patients and remained confidential. Approval of the study protocol was taken by the Ethical Committee of the hospital.

The study samples: This study involved 222 diabetic patients admitted to the Ophthalmic Clinic during the period from May 2020 to December 2021. They were divided into two groups: type I diabetes (IDDM) and type II diabetes (NIDDM). The interrogation included the presence of previous diseases, smoking and alcohol status. All patients had clinical tests such as arterial pressure. The patients with anemia and hemoglobinopathy were excluded.

Diabetic retinopathy diagnosis: All patients in this study underwent eye fundus examination by an ophthalmologist. This examination included spectral domain OCT linear scans (SD-OCT images scan)

HbA1c analysis: 2.5 ml venous blood samples were collected into anti-coagulant EDTA tubes. HbA1c level was determined by two different assays; the first using the automated cation-exchange high-performance liquid chromatography HPLC Bio-Rad D-10 Hemoglobin Testing System (D-10TM Hemoglobin A1c Program USA); the degree of glucose control was recorded as >8% with a high risk of developing DR, 6.5-7% glucose intolerance and subclinical diabetes [10]. In addition, the fluorescence immune assay FIA for the quantitative determination of HbA1c was also used by I-Chroma^{TM} HbA1c KIT (Biotech Med Inc., Canada); the normal range was 4.5-6.5%. [11]

Statistical Analysis: The results were presented as mean±SD and percentage for continuous variables. The Pearson's correlation coefficient was used to evaluate the association between HbA1c and DR. Correlation is significant at the 0.01 level.

3. Results

The total number of diabetic patients in the current study was 222, 190 of them with type II and 32 with type I. Of 190 patients, 99 were males and 91 were females.

The mean age of them was 64.46± 8.29 years, with a range (27-82) years. Of 222 patients, the prevalence of DR was 72.97%. 77.89% of diabetes type II, and 43.75% of type I. The mean HbA1c levels is 6.75± 0.991%

Table 1. Shows the distribution of diabetic and DR patients according to age, gender, and HbA1c levels

Diabetes			HbA1c levels [1]		DR [2]	
	Type I	Type II			Type I	Type II
Gender	N [3] (%)	N (%)	Mean	±SD [4]	N (%)	N (%)
Male	26 (11.7)	99 (44.59)	6.7	1.00	5 (3.08)	88 (54.32)
Female	6 (2.7)	91 (40.9)	6.8	1.05	9 (5.55)	60 (37.03)
Age (years)	N (%)	N (%)	Mean	±SD	N (%)	N (%)
20-30	1 (0.5)	0 (0.0)	5.3	-	0 (0.0)	0 (0.0)
31-40	0 (0.0)	0 (0.0)	-	-	0 (0.0)	0 (0.0)
41-50	0 (0.0)	3 (1.4)	5.6	0.50	0 (0.0)	0 (0.0)
51-60	8 (3.6)	62 (27.9)	7.3	1.50	7 (4.32)	23 (15.5)
61-70	13 (5.9)	80 (36.0)	6.8	0.83	4 (2.46)	80 (54.0)
71-80	10 (4.5)	43 (19.4)	6.9	0.00	3 (1.85)	43 (29.0)
>80	0 (0.0)	2 (0.0)	7.0	0.00	0 (0.0)	2 (1.35)
Total	32 (14.5)	190 (85.5)	6.75	0.991	14 (43.75)	148 (77.89)

[1]((Glycated hemoglobin)); [2] Diabetic Retinopathy; [3] number; [4] standard deviation

Table 2. Shows the association between the HbA1c levels and Type II Diabetes and the distribution of patients according to the HbA1c levels groups

Type II Diabetes				
HbA1c	N	%	Mean±SD	P-value
4.5-6.5%	57	30	6.17±0.29	0.000
6.6-7%	95	50	6.8±0.13	0.000
>8%	38	20	8.16±0.24	0.000
Total	190	100		

Table 3. Shows the association between the HbA1c levels and Type II Diabetes and the distribution of patients according to the HbA1c level groups

DR				
HbA1c	N	%	Mean±SD	P-value
4.5-6.5%	22	14.86	6.17±0.00	0.000
6.6-7%	97	65.54	6.38±0.15	0.001
>8%	29	19.59	8.76±0.19	0.001
Total	148	100		

4. Discussion

Diabetic Retinopathy is a common and serious complication that can cause blindness [6], and uncontrolled blood glucose contributes to it [12, 13]. There are no Syrian studies that provide information about the relationship between diabetic retinopathy and HbA1c levels. The results of the present study showed that out of 222 diabetic patients, there were 190 (85.5%) patients with type II diabetes, and 32 (14.5%) were type I. Out of 190 type II diabetic patients, there were 99 (52%) males and 91 (47.8%) females, and out of 148 type II diabetic retinopathy patients the number of males was 90 (60.8%) and 58 (39.2%) were females. These results are similar to those of previous studies such as the Singh et al. study conducted in India in 2021 (60.78% males, 39.22% females) [4] and other studies conducted by Lokesh S et al. 2018 (62.5% males, 37.5% females) [14], and Garg P et al. in India 2018 (46.85% males, 53.15% females) [12]. On the contrary, there was an outperformance of the number of females over the number of males in previous studies, such as the Long M et al. study conducted in China in 2017 (51.8% males, 48.2% females) [15].

In the present study, the majority of patients with type II diabetes and DR were between the ages of 61-70 years (36%) (54%), respectively. Similar results were recorded by Hajar et al. in Saudi Arabia in 2015 [16] and Lokesh S et al. (38% in the age range 61-70) [14]. Contrasting results were found in the investigations conducted by Singh et al. [4], Long M et al. [15], and Garg P et al. [12], which have the largest number of patients in the age range 50-60.

Of 190 type II diabetic patients, there were 148 (77.8%) patients with DR. Compared to other studies around the world, we have shown a large variation in the prevalence of DR. The results of the current study differ from the results of studies conducted by Mafuszewski W et al. 2020 [17], Hajar et al. 2015 [15], Kampen JH et al. 2004 [18], and Tapp RJ 2003 [19] (23.4%, 27.8%, 28.5% and 21.9%) respectively. They also differ from the results recorded in the studies of Romero-Aroca P et al. in Spain 2017 (20), Polack S et al. in Mexico 2012 [21], Rabiu MM et al. in Irbid 2015 [22], and Ross SA et al. in Canada 2007 [23] (47.26%, 47%, 49.9% and 40%) respectively. These differences in prevalence rates may be explained by the difference in the protocols and methods of detection and early diagnosis and the lack of follow-up of the patients.

As for the relationship between HbA1c levels and DR, a statistically significant correlation was recorded between them ($p<0.001$) where the DR patients with HbA1c levels between 6.5-7% were 65.5% with mean 6,83±0.15%, and >8% were 19.5% with mean 8.76±0.19%.

Similar results were observed in the study that was carried out by Singh et al. [4] and the one in India by Garg P [12], where a strong relationship was recorded between poor blood glucose control and the presence of retinopathy (72.08% with HbA1c> 7%) [12]. There are many other similar results reported by Manaviat et al. 2004 [23], Long M et al. [15], Chen H et al. 2012 [25] and Lokesh S et al. 2018 (73.33%) [14].

5. Conclusion

DR is a common and important complication among diabetic patients; it is important to control blood glucose and maintain HbA1c levels within the normal range. We recommend early diagnosis, treatment and prevention measures.

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