Research Article

Prevalence and Correlation between HbA1c Control and Duration of Diabetes with Blindness in the Eastern Part of Libya: Double Centers Study

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Abstract

A prospective cross-sectional study of diabetic patients registered at the Eye department of Tobruk Medical Center in Tobruk-Libya between (01.06.2023 to 29.02.2024). At the same time data was collected in the eye department in Alwahda Derna Teaching Hospital, Data was collected using the same administered questionnaire. Grading of DR was done by slit-lamp examination and Fundoscopy by an ophthalmologist. Descriptive analysis included percentage mean, median, and p - value by using SPSS 25. There were 185 diabetic patients, ages ranging between 30 and 90 years, with a mean of 58, the majority (97.6%) were of Libyan nationality. There were 86 males and 99 females. Patients with a duration of diabetes ranging between 11 and 15 years were at almost a five-fold risk of developing DR compared to those with a duration of < 10 years. Most of advanced complicated diabetic retinopathy cases had diabetes for more than fifteen years, and no advanced disease in the cases with a duration of less than 10 years.

The patients with poor controlled blood sugar and HbA1c > 9 throughout the disease were at almost five-folded risk of developing DR compared to those with moderate controlled diabetes cases were HbA1c between (7.5 - 9), patients with poor control of diabetes HbA1c> 9 was 25-folded risk of developing PRP than cases with good control HbA1c < 7.5. The majority of advanced diabetic retinopathy cases were correlated with non-controlled diabetes mellitus HbA1c > 9, where no advanced complication was recorded in well-controlled cases.

Introduction

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia/hypoglycemia, damage to large blood vessels (macrovascular) like cardiovascular and cerebrovascular disease, and damage to the small blood vessels (microvascular) like nephropathy or retinopathy [1].

Diabetic retinopathy is one of the most common microvascular complications of diabetes mellitus. Diabetic retinopathy (DR) is a common cause of blindness among adults in the Western world [1,2].

Diabetic retinopathy in patients with type 1 (insulin-dependent DM) more than with type 2 (insulin-dependent DM), was found to be related to both the severity of hyperglycemia and the presence of other chronic diseases like hypertension [3]. Diabetic retinopathy is usually detected in late stages, because of the lack of awareness in our country about the risk of the disease as well as poor motivation for regular health care, diabetic patients in our community only come for consultation after the disease has become symptomatic. , good control of blood sugar in the blood, and effective diabetes management with diet and exercise can significantly decrease the progression of diabetic retinopathy [4]. Diabetic retinopathy is one of the leading causes of blindness worldwide. Because prolonged time and less control of blood sugar in blood damage the retinal blood vessels. In the early stages, diabetic retinopathy is usually asymptomatic, this results in a late diagnosis of DR, and patients do not come for consultation unless the irreversible progressive stage starts to progress with time to different stages if not managed early [5]. Several stages start from mild non-proliferative DR with small microaneurysms of retinal blood vessels to severe proliferative stages with the growth of new fragile retinal blood vessels which can lead to advanced blindness leading problems like vitreous hemorrhage, macular ischemia, and retinal detachment [6]. There are some treatment options which depending on the severity of the disease, starting with laser, injection of steroids or intra vitreous anti-VEGF, until pars plana vitrectomy in the advanced stages [7]. The objective of this study is to estimate the prevalence and identify the correlation between risk factors like age of patients, type of

DM, duration, and control of diabetes mellitus patients with progression of DR attending the Eye Department at two centers Tobruk and Derna centers, eastern part of Libya.

The objective of this study is to estimate the prevalence and identify the correlation between risk factors like age of patients, type of DM, duration, and uncontrolled diabetes mellitus patients with blindness due to progression of DR attending the Eye Department at the two centers in eastern part of Libya.

Materials and methods

A prospective cross-sectional study of diabetic patients registered at the Eye department in both centers at the same time between (01.06.2023 to 29.02.2024). Data was collected using the same-administered questionnaire. Grading of DR was done by slit-lamp examination and Fundoscopy by an ophthalmologist. Descriptive analysis included percentage mean, median, and p - value by using SPSS 25. Hba1c < 7.5% considered as controlled diabetic patients and > 7.5% poorly controlled diabetes mellitus patients. Diabetic retinopathy grading divided into non-proliferative diabetic retinopathy (mild, moderate, and severe), when complications start with new blood vessels in the retina is called proliferative diabetic retinopathy and when complications of PRP occur as neovascular glaucoma, vitreous hemorrhage, and tractional RD is advanced DRP. The diagnosis was done with Slit-lamp examination and lens Volk 78, 90 D and indirect ophthalmoscope and ultrasound. Detailed examination was performed by an experienced ophthalmologist. Visual impairment classification considered as WHO visual loss classification were good or normal vision considered > 0.8, mild visual impairment between (0.4 - 0.8), moderate visual impairment between (0.1 - 0.3), severe visual impairment between (> HM-0.05), subtotal blindness (HM or PL) and completely blindness no PL.

Results

In this study; ⊞there were 370 cases of diabetic patients, ages ranging between 30 and 90 years, with a mean of 58 years, whereas the majority (97.6%) were Libyan nationality living in Tobruk and Derna city. The prevalence of diabetic retinopathy was 225 (60.8%) of the study cases and 145 cases escaped the condition. Mild non-DR was found in 88 cases (39.1% of all cases) s, whereas moderate non-proliferative retinopathy type was in 42 cases (18.6% of the cases), and severe non-proliferative diabetic retinopathy was noted among 27 cases (12%). Whereas proliferative type was considered in about 63 cases, 28 % of all cases studied (Figure 1).

There were 31 out of 63 cases (49.2%) of proliferative diabetic retinopathy eyes, considered as advanced stages of PDR because these cases are complicated with severe complications of PDR as vitreous hemorrhage, neovascular glaucoma, and tractional retinal detachment;1 eyes presented

with vitreous hemorrhage, 10 cases with retinal detachment and 6 with neovascular glaucoma (Figure 2).

The most common visual impairment in diabetic patients was reported namely viz., diabetic retinopathy (DR) (60%), followed by cataracts (30%), glaucoma (6%), and uveitis (3%), and corneal diseases (1%). Systemic-associated diseases like systemic hypertension were observed in about (40%) and cardiac disease (13%) (Figure 3).

The duration of diabetes mellitus ranged between 5 and 40 years, there was (16%) duration of diabetes less than 10
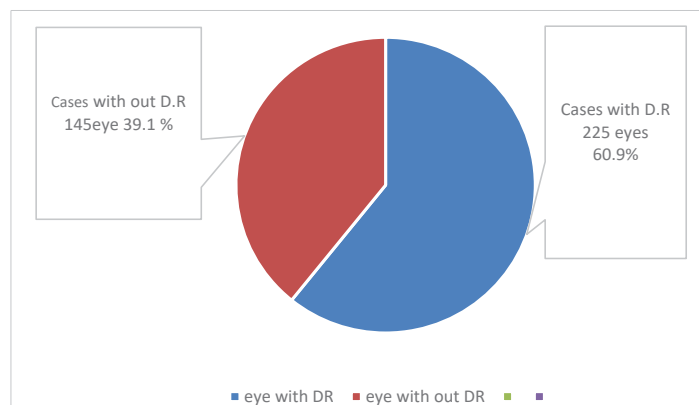

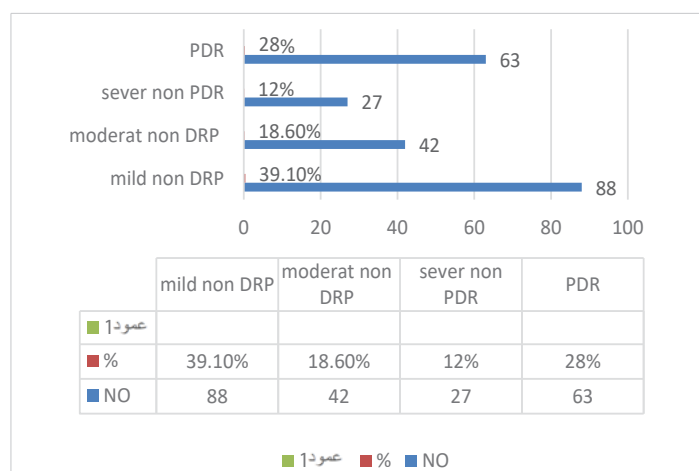**Figure 1:** Prevalence of diabetic retinopathy.

Figure 2: Distribution of the types of Diabetic retinopathy according to stage.
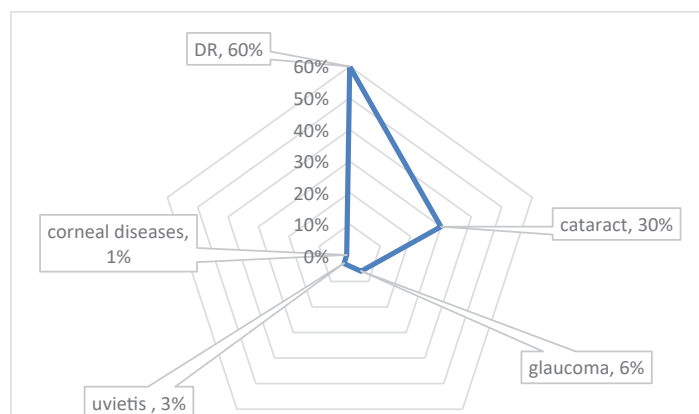

Figure 3: Visual impairment in diabetic patients.

years, whereas (44%) exceeded 15 years and (40%) ranged between 10 and 15 years. Type II Diabetes Mellitus (90.6%) which they treated with oral medication and diets, and type I-DM 9.4%.

The results considered that cases with a duration of diabetes ranging between 11 and 15 years were at almost five-folded risk of developing DR compared to those with a duration less than 10years, where cases with a duration of diabetes more than 15 years two-folded risk of developing DR than cases with duration less than 15 years (Figure 4).

In proliferative diabetic retinopathy (PR) most of the cases duration of diabetes is more than 15 Years, fivefold than the cases with duration of diabetes less than 15 Years.

Most advanced complicated diabetic retinopathy cases had diabetes of more than fifteen years, cases with a duration of diabetes between 10 - 15 years no more complication, and no advanced disease in the cases with duration of less than 10 years. The Figure 5 shows the progression of DRP concerning the duration of diabetes Miletus.

There were 142 cases (83.5%) with poor control of diabetes mellitus, where Hba1c > 7.5% throughout the diabetes and only 28 of the cases with controlled DM and Hba1c < 7.5% throughout the disease. Two cases out of eight of type I (IDDM) had controlled diabetes, where HbA1c does not exceed 7.5%.

Our study considered that cases with poorly controlled blood sugar and HbA1c > 9 throughout the disease were at
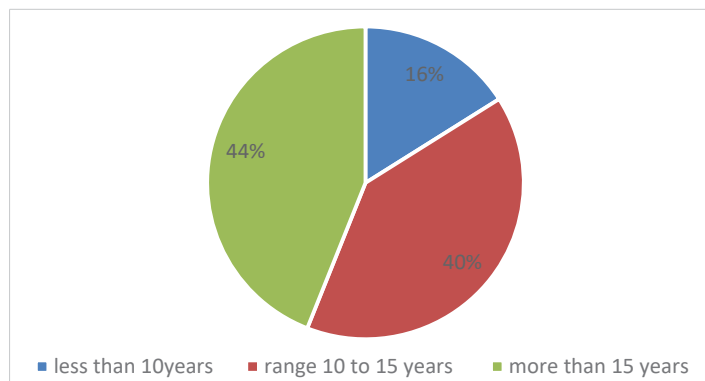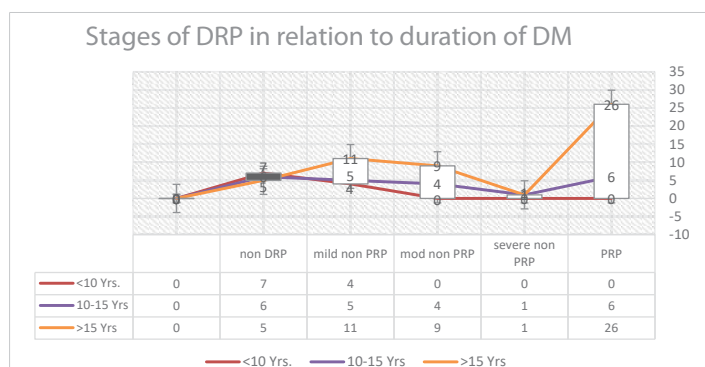
almost five-folded risk of developing proliferative diabetic retinopathy compared to those with moderately controlled diabetes cases were HbA1c between (7.5 - 9), and patients with poor control of diabetes HbA1c > 9 were 25-folded risk of developing PR than cases with good control HbA1c < 7.5. The majority of not controlled cases were HbA1c > 7.5 throughout the disease and had some degree of diabetic retinopathy.

The majority of advanced diabetic retinopathy cases were correlated with non-controlled diabetes mellitus HbA1c > 9%, with only four cases with moderate control HbA1c between (7.5% - 9%). There were no advanced complications recorded in well-controlled cases.

Deterioration of vision as an indicator of function outcome of the eye was recorded in the majority of the cases. There were 64 tested eyes recorded as mild visual impairment, were visual acuity > 0.3 on the Snellen chart. Whereas moderate visual impairments were considered in 88 eyes (visual acuity between 0.1 - 03), severe visual impairment in 27 eyes, visual acuity between (0.05 - > HM), legal or subtotal blindness (vision HM or PL) resulted in 20 eyes, and total blindness (no PL) in 6 eyes of the study.

Deterioration of vision is statistically significantly related to poor stage of severe diabetic retinopathy. (p value 0.01) and significantly related to poor follow-up cases (p value 0.000) (Tables 1,2) (Figure 6).

Table 1: Stages of diabetic retinopathy in compression to degree of diabetes control by patient's diet history and HBA1c control and blood sugar level.

Degree of control of DM	Non DRP	Mild non PRP	Mod non PRP	Sever non PRP	PDRP
good controlled*	18	10	4	2	8
mod controlled*	24	15	7	4	10
non controlled*	30	19	10	7	13

*Good controlled HbA1c < 7.5, moderate controlled HbA1c (7.5 - 9), poor controlled HbA1c > 9.

Table 2: Test Statistics[a]

	Vision - severity	Vision - follow-up
Z	-3.317[b]	-3.925[b]
Asymp. Sig. (2-tailed)	0.001	0

[a]Wilcoxon Signed Ranks Test. [b]Based on negative ranks.

Figure 4: Duration of diabetes mellitus (in years).

Stages of DRP in relation to duration of DM

	non DRP	mild non PRP	mod non PRP	severe non PRP	PRP
<10 Yrs.	0	7	4	0	0
10-15 Yrs	0	6	5	4	1	6
>15 Yrs	0	5	11	9	1	26

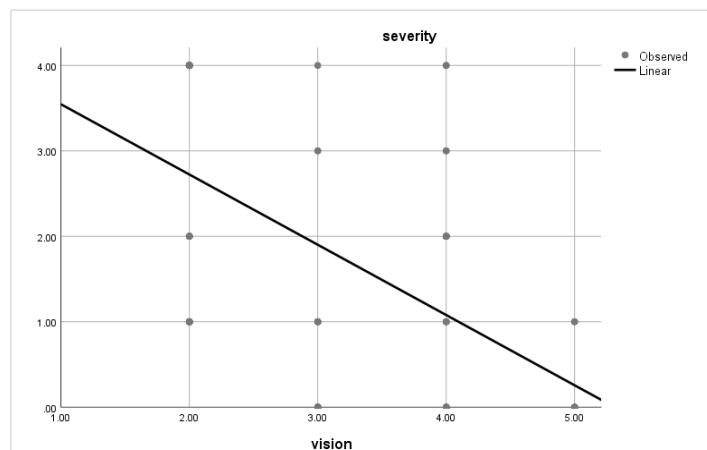**Figure 5:** Progression of DRP concerning the duration of diabetes Miletus.

Figure 6: The deterioration of vision with the severity of the disease.
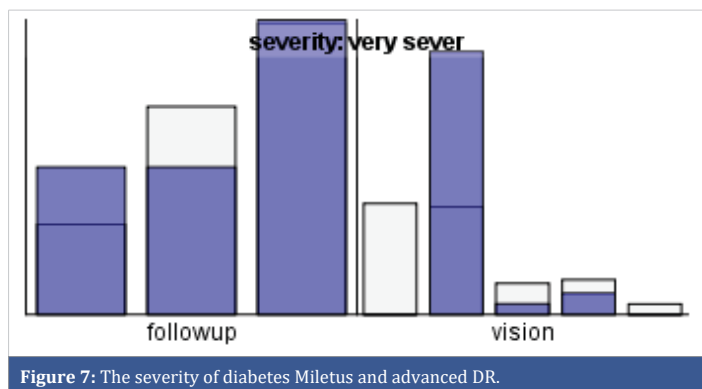
Figure 7: The severity of diabetes Miletus and advanced DR.

Deterioration of vision is related to the severity of the disease, look to Figure 4 Majority of advanced cases presented with severe visual impairment.

Patients with uncontrolled diabetes were at a significantly higher risk of developing advanced DR compared to those whose disease was well-controlled and had good follow-up ($p < 0.001$) (Figure 7).

Discussion

Diabetic retinopathy is one of the diabetes mellitus complications that can lead to loss of vision if not early discovered and properly controlled. For this, we should know the DR problem and identify its associated risk factors, and routinely fundus examination, to detect the RP in the early stage, which is essential for the achievement of better management to improve the outcome [8].

Our study's overall DR prevalence was 60.8%, which is almost higher than the projected global prevalence of 34.6% among people with diabetes that has been documented, but because most of the cases come to our department symptomatic and come to get a consultation, which can explain our higher prevalence [9] or could be related to the disaster that happened in that area (denial) eastern part of Libya at the time of this study which makes the follow-up or regularity of treatment not assessable or may be related to stress and type of lifestyle at that time

In general DR formation in diabetic patients was significantly associated with male patients, older age patients, long duration of disease, uncontrolled HbA1c, adherence to medications and unhealthy diet, irregular diabetes follow-up, irregular fundus examination, patients with history of HTN, dyslipidemia, chronic kidney disease, patients with diabetic complications (cataract, glaucoma, diabetic foot ulcer, renal insufficiency, Myocardial Infarction [MI], and heart failure), and patients with higher BMI and lower GFR. Patients' nationality, marital status, place of residence, and family history of diabetes, were not significantly associated with the development of DR [10].

The most frequent risk factors for the detection of DR are a type of diabetes, disease duration, poor glycemic control (high HbA1c levels), and the presence of other systemic diseases like hypertension were associated with an increased probability of developing DR [11]. Other risk factors for developing DR include obesity, hyperlipidemia and less exercise and stress. Smoking and obesity did not seem to be important risk factors in this study, and were considered in some other studies [12]; however, a report from [13] found that smoking was associated with a higher risk of developing diabetes mellitus. The fact fewer people smoked in the group we studied might be responsible for the above finding [13].

As expected, the uncontrolled patients who did not take regular daily medications and those with as well as those patients they not on regular ophthalmological follow up were at a higher significant risk of developing DR [14]. In the current study, diabetic patients with a long duration of diabetes (10 and 15 years) were at the highest risk for developing DR. The same has been documented in other studies [15].

Concerning the distribution and grading of the retinopathy, the results we obtained from our study are consistent with many other studies, but in our finding, the frequency of proliferative retinopathy is higher in our study than the other studies [16] in the current study revealed proliferative diabetic retinopathy prevalence that was higher to the (KSA) study and also higher than that reported from the Ethiopia [16].

One of the complications of diabetes that can lead to blindness is diabetic retinopathy. The first 10 years following a diabetes diagnosis have been designated by a significant decline in visual acuity [17]. Our study's findings support the majority of previous studies in showing that retinopathy worsens with a prolonged period of diabetes. Individuals who have just received a clinical type 2 diabetes diagnosis should be informed that even though age-related vision loss is inevitable, additional diabetes-related vision loss can be largely avoided with careful ophthalmological monitoring and surgical intervention.

Diabetes control, which includes routine doctor visits, a nutritious diet, exercise, and early management with retinal laser photocoagulation and anti-VEGF therapy, is one strategy to lessen vision loss from diabetic retinopathy.

In addition, patients with type 1 DM were at higher risk of developing DR (87.5%). The same has been documented in Saudi Arabia [18] and Ethiopia [19]. The mechanism of the association between DR and insulin use is still unclear.

Conclusion

Despite the improvements in health care services, DR is still a leading cause of reduced daily life activity and emotional distress due to visual acuity impairment.

DR is a serious problem, 40 years patients and older with diabetes have sight-threatening DR. Early detection and

treatment of DR can save vision. For that, we need to plan DR services to avoid complications of DR as vision loss, and to health strategy to improve the management of diabetes to decrease the risk of DR.

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