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| RESEARCH ARTICLE

Correlation between Axial Length and Progression of Diabetic Retinopathy: Axial Length and Diabetic Retinopathy Progression

Rana Abdullah Mohammed Eldressi[1]✉ and Yasmena Mahmod Abdulhadi[2]
[1]MBBS, Master of Science Student, El-hadyek street, Benghazi, Libya
[2]Assistant Professor, Ophthalmology Department, Faculty of Medicine, University of Benghazi, Libya
Corresponding Author: Rana Abdullah Mohammed Eldressi, **E-mail**: reldressi@gmail.com

| ABSTRACT

Diabetes mellites (DM) can cause various eye issues, like a higher chance of getting cataracts. But the most common and serious problem is diabetic retinopathy. Some researches indicate that with every additional millimeter in axial length, there is a 19% reduction in the prevalence of DR. On the other hand, another study conducted to investigate the relationship between axial length and retinal involvement in patients with diabetes show different result that patients with retinopathy had shorter axial lengths than did patients without retinopathy. This study aims to investigate the potential correlation between ocular axial length and the progression of diabetic retinopathy in individuals with diabetes. A prospective cross-sectional randomized study designed to evaluate the relationship between axial length and the diabetic retinopathy (DR) for 105 eyes diagnosed with Diabetes Mellitus and having Diabetic Retinopathy in any stage, all case was attending and seeking routine eye examinations at Benghazi Eye Teaching Hospital. They underwent a complete ophthalmic evaluation, by slit lamp bio-microscopy, and a detailed fundus examination. Axial length measurement for all eyes using an A-scan Ultrasonography 12 Megahertz (MHz) focused probe (Ellex Eye Cubed i3 Ultrasound). In our investigation concerning patients diagnosed with diabetes, When analyzing the relationship between the duration of diabetes in years and the progression of diabetic retinopathy (DR), it was observed that as the duration of diabetes increases, the severity of DR also tends to increase. And we observed a heightened prevalence of diabetic retinopathy (DR) among those with shorter ocular axial lengths. significant at a 0.01 level, underscores an inverse association between ocular axial length and DR prevalence.

| KEYWORDS

Diabetes mellites (DM) , Diabetic Retinopathy (DR), Megahertz (MHz).

| ARTICLE INFORMATION

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1. Introduction

Diabetes mellites (DM) can cause various eye issues, like a higher chance of getting cataracts (1). But the most common and serious problem is diabetic retinopathy. Out of 246 million people with diabetes, about one-third show signs of DR. And of those, one-third could have a type that threatens their vision (2). Apart from its effects on vision, the presence of diabetic retinopathy also signifies a heightened risk of life-threatening systemic vascular complications.(3)

Several key risk factors contribute to the development and progression of diabetic retinopathy, a complication of diabetes that affects the eyes. Ethnic origin differences in the prevalence of diabetic retinopathy have been a significant focus in research, revealing variations among different racial and ethnic groups. Population-based studies indicate that African Americans, Hispanics, and south Asians tend to have higher prevalence and severity of diabetic retinopathy compared to white individuals. Interestingly, these differences cannot be fully explained by variations in established retinopathy risk factors .(4,5)

The emergence and advancement of retinopathy are influenced by various factors related to the overall health and the eyes (6). Knowledge about these factors helps in predicting and assessing the risk. Interestingly, myopia, especially high myopia, has been proposed to offer a protective effect against diabetic retinopathy.(7)

In cases of pathological myopia, the degeneration of the choroid and retina, which occurs alongside the lengthening of the eye, might decrease the metabolic demand. This reduction could help alleviate the harmful impacts on the small blood vessels caused by diabetes.(8,9)

Limited research has explored whether factors related to the eyes, in addition to overall health indicators, contribute to the onset and progression of diabetic retinopathy.(10,11)

Some researches indicate that with every additional millimeter in axial length, there is a 19% reduction in the prevalence of DR (12, 13). On the other hand, another study conducted to investigate the relationship between axial length and retinal involvement in patients with diabetes show different result that patients with retinopathy had shorter axial lengths than did patients without retinopathy (6).

2. Importance of our study

The main goal is to determine if there is a discernible relationship between axial length and the evolving status of diabetic retinopathy among diabetic patients.

3. Aim of the study (Objective)

This study aims to investigate the potential correlation between ocular axial length and the progression of diabetic retinopathy in individuals with diabetes.

4. Material and methods

5. Study design

A clinic-based prospective cross-sectional randomized study designed to evaluate the relationship between axial length and the diabetic retinopathy (DR) state in patients visited Benghazi Eye Teaching Hospital.

6. Sample size

The study sample for 105 eyes diagnosed with Diabetes Mellitus and having Diabetic Retinopathy in any stage, all case was attending and seeking routine eye examinations at Benghazi Eye Teaching Hospital.

7. Exclusion criteria

The study's exclusion criteria for cases where the lens is not sufficiently clear to allow examination of the fundus, previous ocular surgeries, Hypertension and uveitis.

8. Method

- All participants in this study had receive information about the study's objectives. The research was adhere to the principles outlined in the Helsinki Declaration of 1964.
- All subjects will underwent a complete ophthalmic evaluation, which included history taking, slit lamp bio-microscopy, and a detailed fundus examination using a 90 ocular slit lamp bio-microscopy lens.
- Axial length measurement for all eyes using an A-scan Ultrasonography 12 Megahertz (MHz) focused probe (Ellex Eye Cubed i3 Ultrasound).
- All data from patients involved in this study recorded in the data collection sheet .

9. Results

9.1 Sociodemographic characteristics of participants :

9.1.1 Age : The patient's ages in study group fluctuated between 24 to 82 years,the mean age of presentation was = 58.05 ± 11.14, and the mode age were 49 years. By Kolmogorov Smirnov test, the age data for study group was normally distributed as in figure (1).

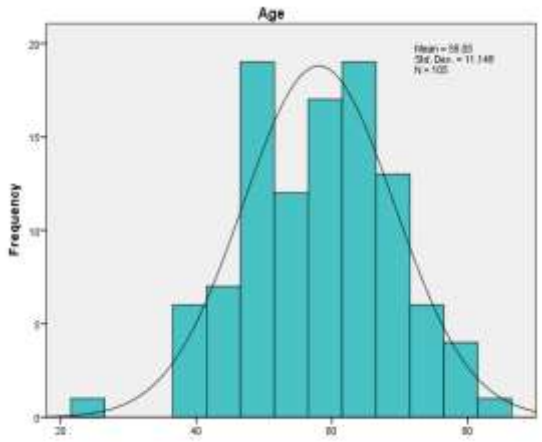

Figure 1 show : Histogramshow that age has normal distribution pattern

9.1.2 Gender and its presentation.

Among those, females accounted for 64.8% of the cases, whereas males comprised 35.2%. as in (Figure 2).

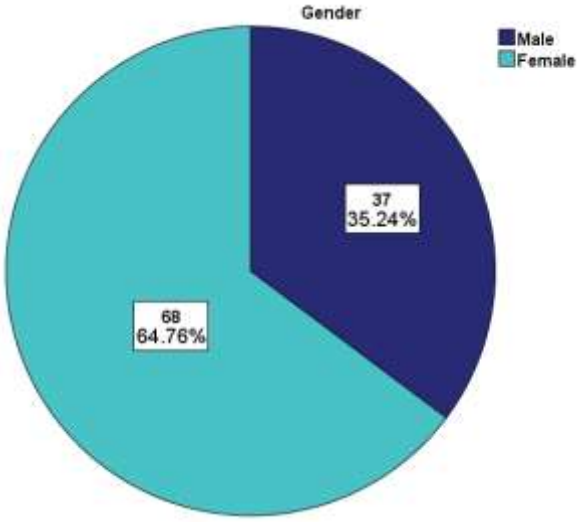

Figure (2) show a Pie Chartshow for Gender distribution

9.2 Quantitativecharacteristics of participants

9.2.1 Axial Length And duration of disease.

The axial length parameter analysis within the study group showed variability ranging from 18.60 mm to 30.93 mm. The average axial length recorded was 22.58 mm with a standard deviation of 1.95. Additionally, the predominant age within the group was approximately 19.7 years old. (Table1). Upon analyzing the duration of the disease, it was found that the mean duration was 12.43±7.86 years.

	N	Minimum	Maximum	Mode	Mean	Std. Deviation
Axial length	105	18.60	30.93	19.70	22.5773	1.95189

Table1: Statistical analysis for Axial length and Duration of diabetes

Duration of DM	105	1	35	---	12.43	7.86

9.2.2 Retinopathy status of participants

The examination of retinopathy status, divided into three stages, reveals an even distribution of cases across each stage, with approximately 33.3% or 35 cases per group. Regarding the mean axial length associated with different diabetic retinopathy (DR) statuses, background DR exhibits a mean axial length of 24.22mm, pre-proliferative DR 22.06mm, and proliferative DR 21.20mm as in table (2).

Table2: Statistical analysis for mean Axial length and Stage of DR

Retinopathy Status	Mean	N	Std. Deviation
Background Diabetic Retinopathy	24.2254	35	2.00543
Pre prolifrative Diabetic Retinopathy	22.0634	35	.90066
Prolifrative Diabetic Retinopathy	21.2023	35	1.55918

These observations suggest a negative linear relationship between axial length and DR progression, indicating that as axial length increases, DR severity tends to decrease. The coefficient of determination (R^2 = 0.384) signifies a moderate linear association between these variables. Additionally, Spearman's correlation coefficient of -0.651 at a significance level of 0.01 further confirms a strong inverse relationship between the variables, implying that as one variable increases, the other typically decreases significantly as seen in table (3) below.

Table 3: Measures of Association between Axial length and Stage of DR

	R	R Squared	Eta	Eta Squared
Axial length * Retinopathy Status	-.619	.384	.638	.407

9.2.3 Retinopathy status and duration of Diabetes of participants

When analyzing the relationship between the duration of diabetes in years and the progression of diabetic retinopathy (DR), it was observed that as the duration of diabetes increases, the severity of DR also tends to increase. The mean durations for background DR, pre-proliferative DR, and proliferative DR were found to be 9.89 years, 12.26 years, and 15.14 years, respectively. However, the coefficient of determination (R^2 = 0.075) indicates a weak linear relationship between these variables, suggesting that the duration of diabetes explains only a small portion of the variability in the progression of DR severity as seen in tables (4,5).

Table 4: Statistical analysis for mean Duration of diabetes by years and Stage of DR

Retinopathy Status	Mean	N	Std. Deviation
Background Diabetic Retinopathy	9.89	35	7.522
Pre prolifrative Diabetic Retinopathy	12.26	35	7.010
Prolifrative Diabetic Retinopathy	15.14	35	8.325

Table 5: Measures of Association between Axial length and Stage of DR

	R	R Squared	Eta	Eta Squared
Duration of Diabetes(Years) * Retinopathy Status	.274	.075	.275	.075

10. Discussion

The diagnostic examinations were performed for 105 patients with diabetes (68 [64.8%] female and male was 37 [35.2%]) with a mean age of 58.05 ± 11.14 years (mode, 49years; range, 24 to 82 years), and data on axial length were available in all individuals, with a mean of 24.22±2.00mm for Background DR , 22.06±0.9mm for Pre prolifrative DR, and 21.20±1.55mm for Prolifrative DR.

In our investigation concerning patients diagnosed with diabetes, we observed a heightened prevalence of diabetic retinopathy (DR) among those with shorter ocular axial lengths. The coefficient of determination (R^2 = 0.384) indicates a moderate linear relationship between these parameters. Moreover, Spearman's correlation coefficient of -0.651, significant at a 0.01 level, underscores an inverse association between ocular axial length and DR prevalence. The potential link between ocular axial length and DR has been a subject of enduring debate. Notably, since the 1960s, myopia has been proposed as a potential protective factor against DR [(14)]. Lim et al. [(11)] further support this notion, suggesting that myopic individuals are less prone to developing DR. Additionally, several studies [(6,15)] have reported a plausible protective correlation between myopia and DR. Conversely, findings from the Wisconsin Epidemiologic Study of Diabetic Retinopathy[(16)] contest this notion, asserting that myopia lacked an association with DR incidence or progression in univariate analyses. However, they did identify a protective effect of myopia against proliferative DR progression in individuals with younger-onset diabetes in multivariable models. In our investigation into the relationship between the duration of diabetes and the progression of diabetic retinopathy (DR), a conspicuous trend emerged: as the duration of diabetes extended, the severity of DR demonstrated a corresponding escalation. Notably, this observation is consistent with findings from various studies in the literature[(4,15,17)].

11. Conclusion

Individuals with shorter axial lengths exhibited a markedly elevated prevalence of diabetic retinopathy and maculopathy, while those with myopia displayed a decreased susceptibility to developing DR. Furthermore, our findings underscored that the duration and onset of Diabetes Mellitus represent significant risk factors for the progression of diabetic retinopathy.

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