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ORIGINAL ARTICLE

The Frequency of Diabetic Macular Edema and its Systemic Risk Factors: A Cross-Sectional Study

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ABSTRACT

Objective: The goal of this research was to use optical coherence tomography to assess the prevalence of diabetic macular edoema and to determine the impact of systemic results and risk factors on the progression of DME.

Material and Methods: This cross-sectional research was carried out at the Department of Ophthalmology, Chandka Medical College & Shaheed Mohtarma Benazir Bhutto Medical University Larkana. Patients were asked to fill out questionnaires about their health and lifestyle habits like smoking and alcohol consumption as well as their hemoglobin A1C and lipid profiles, as well as the duration of their diabetes, and the type of diabetes they had. There was an investigation into the link between systemic findings and DME

Results: A total of 150 cases met the study's eligibility requirements. Males comprised 84 (56%) of the 150 participants, while females comprised 66 (44%). Sixty-five patients (43.33%) tested positive for DME, while 85 patients (56.66%) tested positive for DR. DME participants had HbA1c levels of 9.39 ± 1.67percent, whereas participants without DME had levels of 7.02 ± 3.23 percent and p=0.326; but no connection was found between the two measurements. There was a statistically significant difference between the mean serum creatine concentrations in cases with and without DME (p=0.011). For DME, a statistically significant difference (P-value = 0.001) was found between normal-albuminuric, microalbuminuric, and macroalbuminuric patients. Using the DME frequency in phakic and pseudophakic eyes as a guide, figure 2 below illustrates the results.

Conclusions: Diabetic macular edema was seen in 43.33% of cases in the current study. An OCT-based study revealed that DME is common in Larkana Sindh. Regulating DME risk factors can help prevent or limit the development of DME, and treatment response may be improved.

Keywords: Systemic risk factors, Diabetic macular edema, Optical coherence tomography,

INTRODUCTION

Diabetes retinopathy can lead to serious problems such as diabetic macular edema (DME). Many people in both the developing and developed world are suffering from diabetes, which is now an epidemic.[1] Diabetes can affect any organ in the body, and as a result, the complications and aftereffects of the disease are receiving more attention. Diabetic retinopathy is the most debilitating of all of the diabetes's side effects in terms of overall health and well-being (DR).[2]

In diabetic patients, the most prevalent cause of vision loss is diabetic macular edema (DME). Unfortunately, the general rise in the incidence of diabetes in developed countries may be increasing the absolute incidence of DME.[3] Type 1 diabetic patient have a incidence of DME of 4.2–7.9 percent, while type 2 diabetics have a frequency of 1.4–12.8 percent.[4–12] In a Cochrane evaluation of the incidence of DME utilizing OCT, the incidence ranged from 19% to 66%.[13] OCT has gained popularity in recent years as a tool for determining the extent of macular edema and other factors affecting retinal thickness.[14–16] if you can use photography or biomicroscopy to get a more accurate picture of the condition, you have a leg up on the competition. In Larkana, nothing is known about the current situation of DME in terms of turf epidemiology and disease burden. Accordingly, the study's goal was to determine the incidence, demographics of participants, and systemic correlations of DME in Sindh, using OCT.

MATERIAL AND METHODS

This cross-sectional study was carried out at Shaheed Mohtarma Benazir Bhutto Medical University Larkana between January 2021 and July 2021. In all, there were 150 participants with diabetes.

The demographic variables were recorded and analyzed. Participants in this study had their eyes examined using the slit-lamp biomicroscopy, IOP measurement, and dilated fundoscopy techniques. An OCT-based measurement of the central macular thickness (CMT) was also performed during the study.

The incidence of DME was shown to be related to the systemic results. Shaheed Mohtarma Benazir Bhutto Medical University Hospital Endocrinology Clinic patients diagnosed with type 1 or 2 diabetes from January 2021 to July 2021, who was sent to the Department of Ophthalmology for screens of diabetic macular edema, were involved in this research." Those who did not meet the inclusion criteria with an ocular condition were excluded from the study.

Ophthalmological investigation: The BCVA was measured using the Bailey-Lovie chart after correcting for refractive errors. Preliminary eye exams were carried out with the aid of biomicroscopes and dilated fundoscopy. Instruments for measuring IOP and Heidelberg retinal angiography were used in this study, and the Spectralis HRA-OCT II was used for OCT (Heidelberg, Germany). An OCT fixation point was used to align the images with the radial line scan and one another at a 30° angle. Early Treatment Diabetic Retinopathy Study (ETDRS) criteria and a CMT of less than 250 micrometers attributed to DME were examined by an OCT scan.[17]

Statistical analysis: SPSS 23.0 was used to enter and analyze all of the data. The student t-test was used to calculate the mean and standard deviation of the numerical variables. The frequencies and percentages were computed for categorical parameters. The X^2 test was performed for qualitative variables and the Student t-test was used for numerical parameters. The p-value less than or equal to 0.05 was measured as a significant level.

RESULTS

A total of 150 cases met the study's eligibility requirements. Males comprised 84 (56%) of the 150 participants, while females comprised 66 (44%) The average age of the study participants was 55.56±11.29 years old. Sixty-five patients (43.33%) tested positive for DME, while 85 patients (56.66%) tested positive for DR. 10 receiving intravitreal anti-vascular endothelial growth factor (VEGF) or steroid treatment, and nine receiving both. The p-value was 0.030 when the demographics of the patients were compared to the laboratory characteristics and it was discovered that men outnumbered women. DME participants had HbA1c levels of 9.39 ± 1.67percent, whereas participants without DME had levels of 7.02 ± 3.23 percent and p=0.326; but no connection was found between the two measurements. Patients with DME, particularly those with a history of diabetes dating back more than a decade or two, had a significantly longer duration than those without a history of diabetes (p 0.001). Patients taking antihyperlipidemic drugs showed significant reductions in DME (p=0.030). We found significant variance between the mean serum creatine concentrations in cases with and without diabetic macular edema (p=0.011), with a mean creatine concentration of 1.23 mg/dL in patients with DME and 0.77 mg/dL in patients without DME. For DME, a statistically significant difference was found between normal-albuminuric, microalbuminuric, and macroalbuminuric patients; Using the diabetic macular edema frequency in phakic and pseudophakic eyes as a guide, figure 2 below illustrates the results. Psoduphakic eyes were found in 56 (86.15 percent) of the 65 patients with DME, which shows significant statistical variance and the P-value was less than 0.01 for the total of 65 patients with DME. Analysis of possible cataract surgery effect on DME and evaluation only of patients who were diabetic revealed that effects were seen because of diabetes period and duration of neuropathy and nephropathy and the use of antihyperlipidemic drugs in the same ways as their reported p-values. In diabetic macular edema patients, gender, creatine level, and HDL-C level have no statistically significant results.

Table 1: Demographic and laboratory characteristics of the patients with and without DME (n=150)

Characteristics	With DME (n = 65)	Without DME (n = 85)	P value
Age in years	55.56±11.29	56.03±11.95	0.062
Sex: Female and Male	27 (41.53%)/38(58.46%)	48(56.0%)/37(44.0%)	0.021*
BMI (kg/m^2)	28.25± 5.78	27.46 ± 5.80	0.697
Total time period of diabetic illness in years	15.77±8.16	6.64 ± 7.12	< 0.0001 *
DR (n) Mild-moderate DR	19 (29.23%)	13 (15.29%)	< 0.0001 *
Severe	10 (15.3%)	1 (1.17%)	
PDR	36 (55.38%)	3 (3.52%)	
Use of tobacco	12 (18.46%)	21 (24.70%)	0.267
Alcohol	5 (7.69%)	1 (1.17%)	0.020*
Hypertension	43 (66.15%)	49 (57.64%)	0.138
SBP (mmHg)	131.37 ± 20.15	130.56 ± 17.86	0.359
DBP (mmHg)	80.15 ± 7.87	79.01 ± 8.91	0.771
Anti-hyperlipidemic drug usage	10 (15.38%)	24 (28.23%)	0.030*
CVD	17 (26.15%)	15 (17.64%)	0.142
HbA1c (%)	9.39 ± 1.67	7.02 ± 3.23	0.326
Fasting Blood Glucose (mg/dL)	165.50 ± 57.86	159.50 ± 65.84	0.423
Creatinine (mg/dL)	1.23 ± 0.71	0.77 ± 0.53	0.011*
GFR (mL/min/1.73 m^2)	74.21 ± 27.71	89.52 ± 21.53	0.003*
Total cholesterol (mg/dL)	177.59 ± 41.75	196.00 ± 50.72	0.272

Results are presented as mean standard deviation. p values less than or equal to 0.05 were regarded as statistically significant CMT central macular thickness, BMI body mass index, CVD cardiovascular disease, Retinopathy due to diabetes GFR, FBG, HbA1 hemoglobin A1c.

Table 1: Best-corrected VA and IOP in patients with and without DME

Variable	With DME	Without DME	p-value
BCVA mean (logMAR)	0.51±0.63	0.51±0.21	0.001
IOP mmHg	14.10±2.51	15.10±2.73	0.514

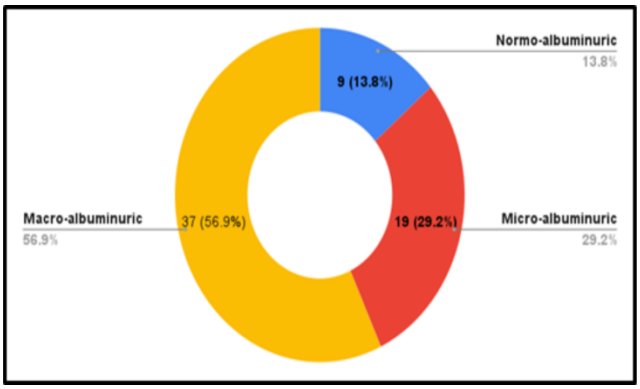

Figure 1:

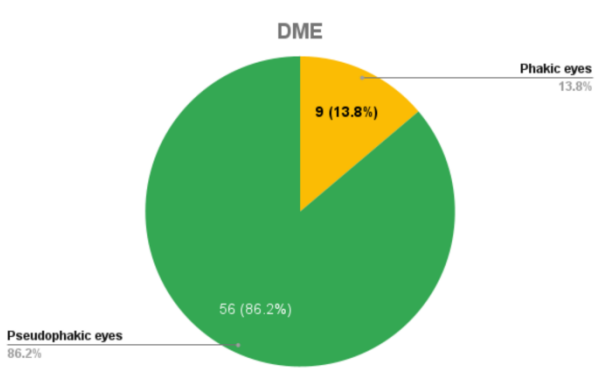

Figure 2:

DISCUSSION

DME is on the rise, as is well-documented. Diabetes mellitus cases in Pakistan are predicted to rise as a result of this increase in diabetes-related comorbidities. The frequency of DME was determined to be 43.45% in research conducted in Pakistan before OCT.[18] Only using stereoscopic slit-lamp microscopy can lead to both an under and overdiagnosis of DME. About half of the prior research used the CSME criteria to characterize macular edema, which only included the more severe forms of DME. When a stereoscopic fundus examination failed to pick up on DME, doctors turned to OCT in the clinic. Pre-OCT DME identification and assessment are more objective and reproducible than in the pre-OCT era, allowing for more consistency in interventions and treatment outcomes. A high-resolution histological macular picture was obtained with the Spectralis HRA OCT II in this investigation, and 15.3 percent of patients had DME. The OCT's sensitivity was elevated as compared to prior studies showed in 2006. Incidence of DME is inversely proportional to illness duration DME was found in 2.8% of cases within 5 years of their diabetes diagnosis and in 22.0 percent of patients 5 years after their diabetes diagnosis in this study (p 0.001). After a decade, there was a noticeable increase in incidence. In the first five years following a diagnosis, the incidence was 5%, and at 15 years, it was 15% in research by Aiello et al.[19] For the males, the odds ratio (OR) was 1.811 (95 percent CI: 1.052-1.311) (p = 0.031), and the males had a higher incidence of DME. Males had considerably higher HbA1c levels than females, indicating that DME is more common in men due to both gender and poorer diabetes control in male patients. Patients with DME had somewhat higher HbA1c levels than those without DME (8.02 2.23 percent), although the variation was insignificant (p = 0.226). Patients with HbA1c values of 7.0% had a incidence of 10.62%, while those with HbA1c levels of > 7.0 percent had a incidence of 18.18%.

Macular edema incidence in type 1 diabetes cases was reduced by 29 percent at the 9-year follow-up in the Diabetes Control and Complications Trial.[20,21], and the use of focal laser treatment for DME was reduced by 50 percent. Even if glycemic control deteriorates after a while, the benefits of long-term, continuous glycemic control has been demonstrated to endure. Extending the DCCT, the Epidemiology of Diabetes Interventions and Complications (EDIC) study found that those who received intensive treatment fared better than those who received conventional treatment. This is consistent with previous findings four years after the DCCT ended (p 0.001).[22] It was found that stringent blood glucose management decreased the need for laser treatment in type 2 diabetes patients by 29% over a 10-year follow-up period, with the vast majority of those treatments being for DME (diabetes-related microvascular edema).[23] Study participants using insulin had a significantly higher rate of developing DME (p 0.0001). Taking insulin has been shown to precipitate the acute onset of DME in earlier research. There's an increase in VEGF transcription during this time because the hypoxia-inducible factor binds to the VEGF promoter region. Protein kinase C activation causes a breakdown of the blood-retina barrier and an increase in permeability as a result of this. Insulin has anti-inflammatory and anti-apoptotic properties in the long term, and it also decreases oxidative stress.[24] Poor glycemic control may be to blame for the elevated incidence of DME seen in this study's insulin-using participants.[25] Furthermore, it has been hypothesized that the therapy of uncontrolled hypertension may provide significant benefits to patients with macular edema.[26] According to the results of this investigation, 17.4% of cases with and 12.3% without systemic hypertension were found to have DME. Blood pressure including systolic and diastolic of cases who have DME and those who have not DME were not statistically different. This study's outcomes could be tainted by the use of antihypertensive medicines. Patients with diabetes mellitus type 2 who have DME are more possible to develop heart illness and to die from it, according to a new meta-analysis.[27] Fluid retention owing to heart failure or further heart disease is well-known to aggravate DME and maybe a significant consideration in its treatment..[27] 20.5 percent (16) of cases with type 2 diabetes and cardiovascular disease (CVD) were found to have DME, compared to 14.0% (43) of those without CVD (p = 0.151). Subclinical signs may have gone unnoticed or the patients may not have known they had CVD because they were not checked by a cardiologist. DME was more prevalent in patients who drank alcohol (50 percent) than those who didn't (p = 0.010). Drinking alcohol increased the odds-relative risk 5.95-fold in the advanced analysis, according to the 95 percent confidence interval: 1.67 to OR 21.19. This could be because of the negative impact of alcohol on diabetic mellitus or as patients who drink regularly have a more difficult time adhering to medication. The incidence of DME and alcohol intake were not found to be associated in a prior Turkish investigation.[28] Vision loss and DME have been linked to dyslipidemia, an independent risk factor for both conditions. Though, no one lipid measurement has been proven to be reliably related with DME.[29] Only the Madrid Diabetes Study found a link between DR incidence and low density lipoprotein cholesterol (LDLC) in the most current research.[30] Patients with DME had lower HDL-C levels in this research (p = 0.046). The incidence of DME was 9.2 percent in individuals taking antihyperlipidemic medications and 17.4 percent in those who weren't (p = 0.040). Statins were prescribed to 106 of the 109 individuals on antilipidemic medicines. CSME in dyslipidemic type 2 diabetes individuals was found to be less affected by atorvastatin, a statin component, in a 2004 study, and the migration of

subfoveal lipids was also reduced.[31] Study participants with dyslipidemic diabetes who took atorvastatin saw a decrease in hard exudates and fluorescein leakage.[32] Fat exudates associated with DME typically resolve spontaneously within two years or more.[33] Phagocytosis is the mechanism through which macrophages remove exudates. There are two ways to speed up the clearance of lipid exudates in DME: either by controlling blood cholesterol levels or by using focused or grid photocoagulation.[31] Statins are expected to prevent inflammation and subsequent microvascular leukocytosis by lowering serum lipid levels.[34] Despite this, a meta-analysis found a dose-dependent link amongst statin usage and an increased risk of developing type 2 diabetes. Consequently, statins were thought to affect control of blood sugar levels by increasing insulin resistance and/or lowering insulin production.[3536] That's why statins and diabetes are still a hot topic of discussion. Patients with and without DME had significantly different mean blood creatinine concentrations (p = 0.021). In contrast to the 11% of cases without nephropathy who had DME, the DME rate was 29.0% in cases with microalbuminuria and 26.7% in cases with macroalbuminuria (p = 0.001). Diabetes mellitus (DME) is related to macroalbuminuria in type 1 diabetes, according to a 15-year follow-up study.[37] DME was shown to be linked with both macro-and microalbuminuria in this investigation. DR severity is the primary risk factor for developing DME.[38–42] The frequency of DME increased from 25 percent to 37 percent in a 14-year study when the baseline retinopathy severity went from mild to moderate NPDR.[40]. Patients with mild-moderate NPDR had a DME incidence of 28.6%, but cases with severe NPDR to PDR had a DME frequency of 72.6 percent (p 0.001).

For decades, researchers believed that great IOP levels could help prevent the formation of exudates.[42] But there is still a lack of study in this area. There was no statistically significant difference in the IOPs of eyes with and without DME in this study (p = 0.562), but the IOPs were 14.91 mmHg and 15.12 mmHg. In certain population-based research, diabetes has been linked to an increased risk of developing primary glaucoma.[43] According to the Singapore Malay Eye Study, ocular hypertension and diabetes are linked, however, glaucoma was not.[44] Eyes with or without diabetes are more likely to develop macular edema as a result of ophthalmological illness that can release inflammatory and angiogenic mediators.[45–47] A recent study has found that DME frequencies in phakic and pseudophakic eyes were respectively 12.9% (49) and 43.7% (14) higher than expected. This was significant (p 0.001).

CONCLUSION

We concluded that an estimated 43.33% of participants in the current study had diabetic macular edema. DME is associated with diabetes duration, baselines such creatinine, lipoprotein, and albuminuria levels, as well as other variables. To avoid diabetic macular edema, which can cause blindness, regular monitoring of the patient's underlying health is an effective strategy.

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