Section: Ophthalmology

Original Research Article

A COMPARATIVE STUDY TO ANALYSE THE CHANGES IN CENTRAL MACULAR THICKNESS IN DIABETICS WITH DIFFERENT STAGES OF DIABETIC RETINOPATHY

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Received : 31/01/2023
Received in revised form : 08/03/2023
Accepted : 23/03/2023

Keywords:
Diabetic Retinopathy(DR), Non-Proliferative Diabetic Retinopathy(NPDR), Optical Coherence Tomography(OCT), Fluorescein angiography(FA), Intraretinal micro-vascular abnormalities (IRMA).

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DOI: 10.47009/jamp.2023.5.2.203

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (2); 953-957

Abstract

Background: The aim & objectives is to compare the changes in central macular thickness in diabetics with different stages of diabetic retinopathy and to evaluate the effect of visual acquity, age, gender, duration of diabetes in different stages of diabetic retinopathy and to also compare diabetes mellitus study group with non-diabetic controls. **Materials and Methods:** This was a time bound study conducted after clearance from Board of Studies and Ethical committee in the Department of Ophthalmology, TMMC & RC, Moradabad, UP till June 2022 and all diabetic patients who fulfill our inclusion and exclusion criteria was enrolled. An Equal number of non-diabetic age and gender matched volunteers) were taken as controls. There were 130 (56.0%) males and 102 (44.0%) females among study population. A detailed history, complete physical examination and routine & appropriate investigations including Best Corrected Visual Acquity (BCVA), Anterior segment examination on Slit Lamp, IOP Measurement, Slit lamp biomicroscopy, OCT for macular thickness evaluation were done for all patients. **Result:** There were 130 (56.0%) males and 102 (44.0%) females among study population. The mean age of the cases was 54.40±9.84 years, controls was 50.54±8.40 years and over-all study population was 52.45±9.324 years. There was Very Mild NPDR among 16.5%, Mild NPDR among 40.0%, Moderate NPDR among 30.4% and Severe NPDR among 13.0% cases. There was a significant association of BCVA (p-value = 0.020)with cases and controls. There was a significant association of UCVA with cases and controls(p-value =0.001). The mean Central Macular Thickness was significantly more among Severe NPDR compared to Moderate NPDR which was significantly more among Mild NPDR which was significantly more among Very Mild NPDR(p-0.001). The mean Central Macular Thickness was compared between cases and controls using the unpaired t-test. The mean Central Macular Thickness was significantly more among cases (423.60±217.58 µs) to controls (246.17±14.22 µs). There was a significantly positive correlation of Central Macular Thickness with duration of Diabetes(p-0.001). **Conclusion:** According to the results of our research, the Central Macular Thickness revealed a rise in thickness that corresponded with both the rising severity of diabetic retinopathy and the increasing duration of diabetes.

INTRODUCTION

With a projected prevalence of over 500 million in 2030, diabetes mellitus (DM) is one of the most common illnesses of the twenty-first century and has significant socioeconomic impact. Type 2 DM is brought on by decreased insulin sensitivity and relative insulin shortage, while type 1 DM is defined by inadequate insulin production as a consequence of autoimmune-mediated or idiopathic death of beta-cells.[1]

Macular edema is one of the most significant indicators of diabetic retinopathy, a leading cause of irreversible blindness. Therefore, early identification may prevent further sickness progression. There are two clinical stages of DR: non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). Key discoveries in the retinal

ISSN (O): 2687-5365; ISSN (P): 2753-6556

vasculature of NPDR, the initial stage of DR, include increased vascular permeability and capillary blockage. Retinal disorders such microaneurysms, hemorrhages, and hard exudates can sometimes be detected using fundus photography even in asymptomatic patients.

PDR, a more advanced form of DR, is characterized by neovascularization. Vision loss can be severe if new aberrant arteries bleed into the vitreous (vitreous hemorrhage) or tractional retinal detachment is taking place.[2]

Microaneurysms, intraretinal hemorrhages, intraretinal micro-vascular abnormalities (IRMA), and cotton wool patches are examples of non-proliferative alterations. Neovascularization of the optic disc or other locations is a sign of proliferative retinopathy. Macular edema and lipid exudation are prominent symptoms of diabetic maculopathy, a major consequence of diabetes mellitus. It is the primary factor in diabetic retinopathy-related visual loss.[3]

Localized oedema is induced by focal leakage from microaneurysms and dilated capillary segments, while diffuse retinal edema is caused by broad capillary leakage.

At first, the fluid is situated between the inner and outer nuclear lavers. When there is a central fluid buildup, the fovea develops a cystoid look called cystoid macular oedema (CMO), which is easily seen on optical coherence tomography (OCT) and takes on the appearance of a center flower petal pattern on florescence angiography (FA).[4]

Two standard methods for determining DR, known as slit-lamp biomicroscopy and stereo fundus photography, are rather insensitive to minute pathological abnormalities in the retina. OCT is a practical imaging technology that is useful for the quantitative as well as the qualitative examination of the macula.[5,6]

The aim of the study was to analyse the changes in central macular thickness in diabetics with different stages of diabetic retinopathy and to evaluate the effect of visual acquity, age, gender, duration of diabetes in different stages of diabetic retinopathy.

MATERIALS AND METHODS

This cross-sectional observational research study was carried out in the Department of Ophthalmology at TMMC & RC, Moradabad. This was a time bound study after CRC and IEC clearance till June 2022 and all diabetic patients who fulfilled our inclusion and exclusion criteria were enrolled. The inclusion criteria for the study group included diagnosed case of Diabetes Mellitus. Self-reported, using diabetic medication or physician-diagnosed diabetes. All the patients with diabetes mellitus of either gender, more than 18 years of age and for control group included an equal number of non-diabetic volunteers who were matched for age and gender whereas Patients with Coexisting Malignant hypertension, Patients with History of cataract surgery done in last 6 months, Patients with Previous history of Retinal Surgery, Patients with History of Retinal Scar, Patients with History of Macular Scar, Patients with any ocular trauma, Patients with any other ocular/systemic co-morbidities which was hinder fundus examination and OCT, Patients with any ocular or systemic condition that can cause macular edema, Patients with history of treatment for DME or proliferative diabetic retinopathy within 6 months, Pregnancy and patients who refused to give Informed Consent were excluded from the study.

A detailed ocular and systemic history was asked from both study and control groups and patients underwent an initial work-up and following parameters was recorded: Best Corrected Visual Acuity (BCVA), Anterior segment examination on Slit Lamp, IOP Measurement, Slit lamp biomicroscopy was done to visualise Dilated fundus examination using +90 dioptre lens and +20D to see peripheral retina using indirect ophthalmoscope, OCT for macular thickness evaluation using Zeiss OCT machine.

RESULTS

There were 130 (56.0%) males and 102 (44.0%) females among study population.

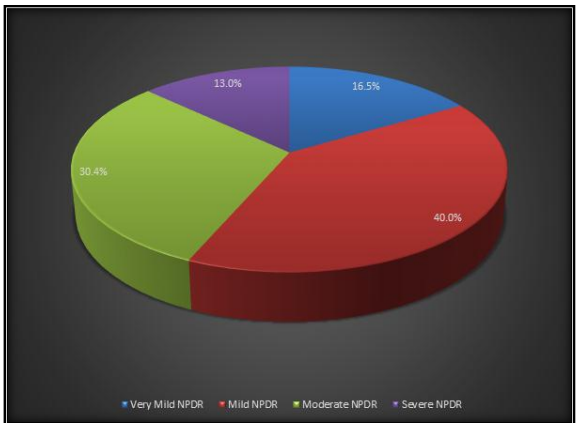

Figure 1: Distribution of study population according to diagnosis

There was Very Mild NPDR among 16.5%, Mild NPDR among 40.0%, Moderate NPDR among 30.4% and Severe NPDR among 13.0% cases.

Table 1: Distribution of study population according to Gender

Gender	Groups		Total
	Case	Controls	
Male	68	62	130
	59.1%	53.0%	56.0%

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Female	47	55	102
	40.9%	47.0%	44.0%
Total	115	117	232
	100.0%	100.0%	100.0%

Table 2: Distribution of study population according to Age.

	Age				
Groups	**Mean**	**Std. Deviation**	**Mean Difference**	**t-test value**	**p-value**
Case	54.40	9.84	3.86	1.217	0.101
Controls	50.54	8.40			
Over-all	52.45	9.32			

Table 3: Distribution of study population according to BCVA

BCVA	**Groups**		**Total**
	Case	**Controls**	
LE 6/6-6/12	38	55	38
	33.0%	47.0%	16.4%
LE 6/12-6/36	10	3	7
	8.7%	2.6%	3.0%
LE 6/36-6/60	8	0	6
	7.0%	0.0%	2.6%
RE 6/6-6/12	42	57	41
	36.5%	48.7%	17.7%
RE 6/12-36	12	2	4
	10.4%	1.7%	1.7%
RE 6/36-60	5	0	1
	4.3%	0.0%	0.4%
□2 value = 44.222, p-value = 0.020*			

There was a significant association of BCVA(p-value = 0.020) with cases and controls.

Table 4: Distribution of study population according to UCVA

UCVA	**Case**	**Controls**
LE 6/6-6/12	27	27
	23.5%	23.1%
LE 6/12-6/36	11	20
	9.6%	17.1%
LE 6/36-6/60	2	8
	1.7%	6.8%
LE > 6/60	16	3
	13.9%	2.6%
RE 6/6-6/12	29	29
	25.2%	24.8%
RE 6/12-6/36	12	15
	10.4%	12.8%
RE 6/36-6/60	4	12
	3.5%	10.3%
RE > 6/60	14	3
	12.2%	2.6%
□2 value = 72.214, p-value =0.001*		

There was a significant association of UCVA with cases and controls

Table 5: Distribution of study population according to Severity of Retinopathy

Severity of Retinopathy	**Central Macular Thickness**			
	Mean	**Std. Deviation**	**p-value**	**Post-hoc comparisons**
Very Mild NPDR	256.16	26.02	0.001*	Severe
Mild NPDR	339.83	120.16		
Moderate NPDR	450.49	162.40		
Severe NPDR	829.87	185.48		

Table 6: Distribution of study population according to Correlation of Duration of Diabetes with Central Macular Thickness

		Duration of Diabetes
Central Macular Thickness	Pearson Correlation	0.721
	p-value	0.001*

** Correlation is significant at the 0.01 level (2-tailed).

There was a significantly positive correlation of Central Macular Thickness with duration of Diabetes. (p=0.001)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

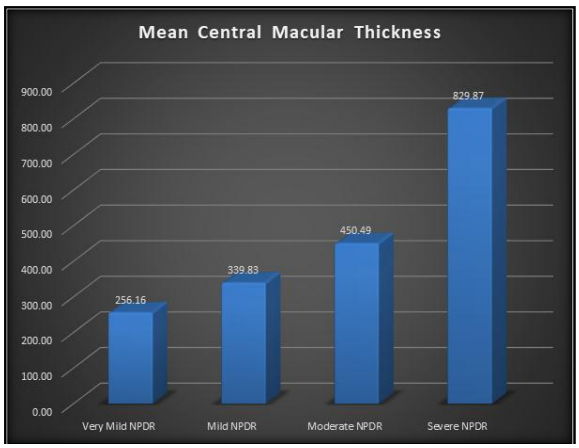

Figure 2: Distribution of study population according to Severity of Retinopathy

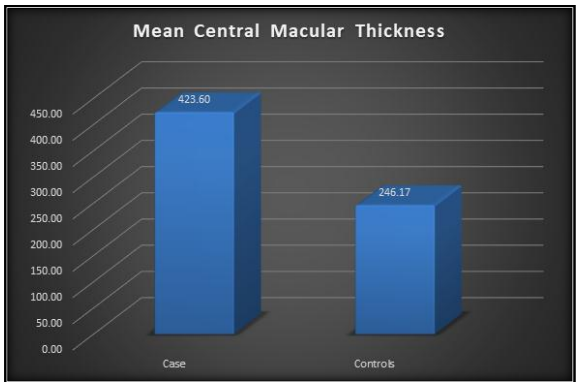

Figure 3: Distribution of study population according to Central Macular Thickness

The mean Central Macular Thickness was compared between cases and controls using the unpaired t-test. The mean Central Macular Thickness was significantly more among cases (423.60±217.58 µs) to controls (246.17±14.22 µs) (p=0.001).

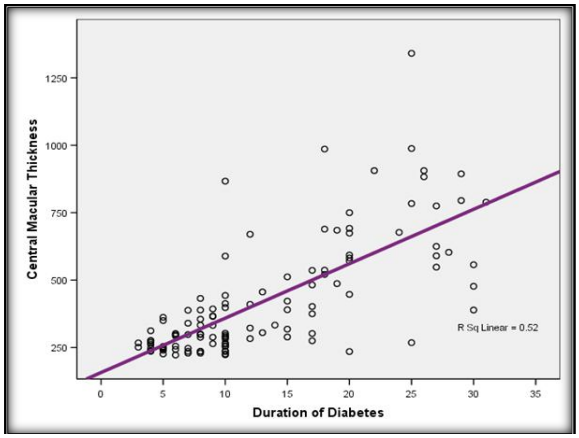

Figure 4: Distribution of study population according to Correlation of Duration of Diabetes with Central Macular Thickness

DISCUSSION

Age and Gender

In our study, there were 56.0% males and 44.0% females among study population. The mean age of the cases was 54.40±9.84 years, controls was 50.54±8.40 years and over-all study population was 52.45±9.324 years. Similar to our study, Abrar et al,[5] found that maximum (38%) were in the age group of 50-60 years followed by28% in 40-50 years.

In contrast to our study, Hepokur et al,[7] stated that the mean ages of the three groups included in the study were16.85±1.53 years old in the type 1 DM group, 16.53±1.83 years old in the type 2 DM group, and 16.66±1.06 years old in the control group.

Central Macular Thickness

In present study, the mean Central Macular Thickness was compared between cases and controls using the unpaired t-test. The mean Central Macular Thickness was significantly more among Diabetic patients (423.60±217.58 µs) to controls (246.17±14.22 µs).

Similar to current study, Pradhan et al,[8] concluded that there is the increase in the macular thickness of all sectors among type 2 Diabetic patients than the controls. Abrar et al,[5] reported that the mean Central Macular Thickness (CMT) in the Diabetes group was 391.06±3.0 microns, whereas it was 216.51±1.7 microns in the control group.

Contradictory to present findings, a research by Demir M et al,[9] conducted in Turkey found that diabetics had lower retinal thickness (227.19±29.94) in healthy individuals compared to 232.12±24.41 m in diabetics). Khan et al,[10] found that the mean central macular thickness among diabetic patients was found to be 214.48±31.41, which was lower than the 236.79±19.38 m mean central macular thickness of healthy cases.

Association of Central Macular Thickness with Severity of Retinopathy

In our study, the mean Central Macular Thickness was significantly more among Severe NPDR compared to Moderate NPDR which was significantly more among Mild NPDR which was significantly more among Very Mild NPDR.

Abrar et al,[5] discovered that mean CMT across several DR subgroups revealed that it was continuously increasing with each stage of DR. Gupta et al,[4] showed that the mean Central Macular Thickness was shown to be steadily rising with increasing stage of diabetic retinopathy when comparing it in different grades of diabetic retinopathy subgroups.

Contradictory results were obtained in the Italian study by Querques et al,[11] which found that people with diabetes had significantly thinner thickness of subfoveal choroid than controls. Oshitari et al,[12] observed that central macula in early stages of DR was significantly thinner than controls. It was hypothesized that neuronal changes caused the thinner macula in diabetic individuals since they occurred before the vascular abnormalities in early-stage diabetic participants.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Association of Central Macular Thickness with Duration of Diabetes

In present study, there was a significantly positive correlation of Central Macular Thickness with duration of Diabetes. As the duration of diabetes increased, there was a subsequent increase in the thickness of Central Macular Thickness. In line with our findings, Caroline et al,[13] demonstrated that people with DR lasting 5–10 years have somewhat thicker CMT than other groups.

Jiang et al,[6] found that despite a negative link between temporal region thickness and diabetes duration, the difference was not statistically significant. The duration of the so-called "course of diabetes" may not have been sufficient to cause significant damage to the retinal structure, as shown by the results of the diagnostic examination, which were frequently shorter than the actual duration of the illness.

CONCLUSION

According to the results of our research, the Central Macular Thickness revealed a rise in thickness that corresponded with both the rising severity of diabetic retinopathy and the increasing duration of diabetes. Therefore, more research may be conducted across many centres in order to validate our findings.

Even if the vascular lesions are mild and there is no macular edoema, functional and structural changes can be seen in individuals with diabetes who have moderate DR. This demonstrates that diabetes causes a decline in retinal sensitivity as well as a reduction in the thickness of the inner retinal layer. Since CSME is more likely to develop in these individuals, they should undergo follow-up that is both more frequent and more in-depth. Macular thickness rose even though there were no visible evidence of clinically significant macular oedema when diabetic retinopathy progressed to a more advanced stage. It is possible to make use of it as a trustworthy indicator in order to keep a check on these diabetic folks. Additionally, early detection of macular oedema, which poses a danger to one's vision, is possible.

Even in the early stages, when there is no indication of clinically significant macular oedema, OCT is a highly sensitive approach for identifying macular oedema. This is because OCT measures the thickness of the macular pigment epithelium. It is applicable to the continuing monitoring and care of diabetic retinopathy patients as well as the supervision of such individuals.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556