Section: Ophthalmology

Original Research Article

OPTICAL COHERENCE TOMOGRAPHY IN DIABETIC MACULAR EDEMA

Kondreddy Preethi[1], Pavithra K[2], Akinapalli Mounika[3]

[1]*Assistant Professor, Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital, Warangal, Telangana, India.*
[2]*Assistant Professor, Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital. Warangal, Telangana, India.*
[3]*Assistant Professor, Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital, Warangal, Telangana, India.*

Received *: 10/06/2025*
Received in revised form *: 01/08/2025*
Accepted *: 19/08/2025*

Corresponding Author:
Dr. Kondreddy Preethi,
Assistant Professor, Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital, Warangal, Telangana, India.
Email: preethikondreddy@gmail.com

DOI: 10.70034/ijmedph.2025.4.6

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

Int J Med Pub Health
2025; 15 (4); 28-35

ABSTRACT

Background: Aim: To evaluate the retinal changes in patients with diabetic macular edema and correlating with visual acuity.
Materials and Methods: This is a hospital based cross-sectional observational case study conducted between February 2024 - August 2025 in Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital, Warangal. During the above mentioned period a sample of 50 type 2 diabetic patients detected to have clinically significant macular edema were included in the study. The Eyes with clinically significant macular edema were evaluated by OCT examination. Morphological Pattern and macular thickness of DME were documented and evaluated. The data recorded was tabulated and evaluated using SPSS software and statistical techniques.
Results: Ratio between patients with NPDR and PDR was 3.47:1. Among the NPDR patients, moderate and severe types were common (38.2% and 36.8% respectively). PDR was relatively less common with PDR without HRC in 1.3% and PDR with HRC in 17.1%. Four different patterns of DME were found on evaluation of the OCT scans. Cystoid Macular Edema was the most common morphology (40.8%), followed by DRT (38.2%), and SRD (17.1%). Least common morphological type was VMIA (3.9%). The mean central macular thickness in all the 76 eyes is 364.34 microns. Mean thickness varied among various groups, being highest in Serous Retinal Detachment 421.77 microns and least among diffuse retinal thickening 283.86 microns. On statistical analysis of variance of mean thickness among various groups a statistically significant difference was observed ($p<0.0001$). The mean Visual acuity among 76 eyes was observed to be 0.48 log MAR units. Worse visual acuity was found in SRD pattern (0.61 log MAR). Visual acuity was better in DRT pattern (0.36 log MAR) compared to other patterns.CME pattern was also associated with worse visual acuity. There was a significant linear relation between Central Macular Thickness and Visual Acuity with $r=0.841$ and p Value <0.0001.
Conclusion: The present study concluded that OCT can perform micrometre-resolution, cross sectional imaging of retina that closely approximates its histological layers. It is a very comfortable, non invasive procedure with very short measurement time. It facilitates quantification of macular oedema, assessment of vitreomacular interface and detection of VMT that is not clinically identified. It helps to understand the anatomy of DME and the intraretinal damage and is the technique of choice for early detection of DME.
Keywords: Diabetic macular edema, OCT, CME, DRT, NPDR.

INTRODUCTION

Diabetes mellitus is the global epidemic of the 21st century. At present, there are 415 million diabetic persons in the world, and this number is projected to reach 642 million by the year 2040. 78 million people in South- East Asian region have diabetes and in India, there are 69.2 million cases of diabetes by 2015.[1] Diabetic retinopathy (DR), a microvascular complication of diabetes, is prevalent in approximately 35% of people with diabetes.[2]

Diabetic macular edema (DME), one of the major complications of diabetic retinopathy, is also one of the leading causes of visual impairment in the working-age population.[3] DME occurs in nearly 12% of patients with diabetic retinopathy and causes more than 10,000 new cases of blindness per year.[4] Duration and type of diabetes directly affect the prevalence rate of DME. Patients can develop DME in the first five years following diagnosis of type I diabetes. The prevalence rate gradually reaches up to 40% within 30 years.[5,6] About 5% of patients with type II diabetes already have DME at the time of diagnosis. Duration of diabetes, proteinuria, gender, cardiovascular disease, high levels of HbA1c, and use of diuretics are defined as systemic risk factors.[6] DME can occur at any stage of diabetic retinopathy.

Traditional methods of assessing DME include contact and non contact slit-lamp biomicroscopy, indirect funduscopy, fluorescein angiography and fundus stereo-photography. However, given the relative lack of ability of these methods to detect and to quantify DME, alternative objective methods have been applied. The introduction of Optical Coherence Tomography (OCT)

allows an objective evaluation of DME with effectiveness in both qualitative and quantitative description of this pathology.[7]

OCT generates cross-sectional or three-dimensional images by measuring the echo time delay and magnitude of back-reflected light. It is a noninvasive, noncontact medical imaging modality that allows quantitative measurements of retinal thickness and volume. OCT provides images of vitreous, retinal, and choroidal structure that cannot be obtained by any other noninvasive diagnostic technique, and its scans have been compared with histologic sections seen with light microscopy.[8-11]

Aims and Objectives

Aim

To evaluate the retinal changes in patients with diabetic macular edema and correlating with visual acuity.

Objectives

1. To describe the morphological changes in the retinal layers in diabetic macular edema.
2. To quantify the severity of macular thickness in diabetic macular edema.
3. To determine the relationship between visual acuity and macular thickness in diabetic macular edema.

MATERIALS AND METHODS

Materials

This is a hospital based cross-sectional observational case study conducted between February 2024-August 2025 in Department of Ophthalmology, Father Colombo Institute of Medical Sciences, Medicare General Hospital, Warangal. During the above mentioned period a sample of 50 type 2 diabetic patients detected to have clinically significant macular edema were included in the study.

Inclusion Criteria

1. Diabetic patients with clinically significant macular edema.

Exclusion Criteria

1. Eyes with significant media opacities that can result in poor visualisation of fundus such as corneal opacity, dense cataract and vitreous haemorrhage.
2. Other ocular pathologies that can decrease visual acuity such as glaucoma, ischemic maculopathy, optic nerve disease and retinal detachment.
3. Other causes of macular edema such as retinal venous occlusion, recent intra-ocular surgery, inflammation, age related macular degeneration and serous chorioretinopathy.
4. Patients not willing to participate in the study.

Methods

After obtaining the approval of Institutional Ethics Committee, a written and informed consent was taken from patients in his/her vernacular language. A detailed history was taken regarding chief complaints, duration of diabetes, treatment taken, and relevant co-morbidities. Clinical examination of the patient included a detailed general physical examination and systemic examination.

This was followed by Ophthalmological examination, which included:

- Best corrected visual acuity assessed using snellen's chart and scored with log MAR Scale.
- Near vision
- Slit lamp examination of anterior segment
- Fundus examination with direct ophthalmoscopy, slit lamp biomicroscopy using 90D lens for macular assessment.
- Fundus photograph
- OCT was performed with dilated pupils using Cirrus OCT (ZEISS PRISMUS 200)

Fasting Blood Sugar and Post Prandial Blood Sugar were done for all patients to know the diabetic status, and other lab investigations were advised based on the need.

OCT was done as follows: Patient was explained about the procedure and after proper positioning of the patient, macular scans with fovea centered and more than or equal to 4/10 quality scans were obtained.

Macular thickness measurements were obtained in nine regions. The central circle had a diameter of 1 mm. The inner circle had a diameter of 3 mm and was

divided into four quadrants. The outer circle had a diameter of 6mm and was also divided into four quadrants. Central macular thickness was defined as thickness of the central circle (1mm) in the circular map. The central macular thickness (foveal thickness) was taken for correlation with visual acuity. The Patterns of retinal morphology was assessed using cross- sectional OCT images indicating the reflectivities of retinal structures, and these were classified into four patterns:

- **DRT:** sponge like swelling of the retina witha generalized, heterogeneous, mild hyporeflectivity compared to normal retina.
- **CME:** Intraretinal, round or oval cystoid areas of low reflectivity typically separated by highly reflective septae.
- **SRD:** Focal, arch-like elevation of neurosensory retina overlying a hyporeflective, dome shaped space.
- **VMIA:** include the presence of epiretinal membranes (ERM), vitreomacular traction (VMT) or both.

In the present study OCT patterns in DME were categorized as defined by NR Kim,et al., study[16].

- Any OCT showing sponge like thickening was classified as DRT pattern.
- The OCT forms which include Cystoid cavities were classified as CME and cases where there was combination of both DRT and CME are considered under CME group.
- Any pattern either DRT or CME if associated with Serous Retinal Detachment was categorised under SRD group.
- Regardless of pattern combinations, cases with VMT /ERM were classified as VMIA.

The software Microsoft Excel was used to structure the data for statistical analysis with software SPSS. Student's t Test, Chi-Square Test, Pearson Correlation Coefficient, Variance Analysis and Linear Regression were various methods used in the present study. It was considered a 95% confidence level and statistical significance with $p<0.05$.

RESULTS

In the present cross-sectional observational case study with a sample size of 50 patients, the following results were obtained.

Age and Sex Distribution:

The age groups of the patients included in the study ranged from 41-75 years with a mean age of 56.10+7.51. The distribution of patients according to their age groups and sex is shown in Table 1. Using Student's t-test, there was no significant difference as for as the age in male and female subjects is concerned.

Among the 50 patients included in the study, majority were in the age group of 51-60 years (44%) and least belonged to >70 years (2%), 30 % belonged to 41-50 years and 24% to 61-70 years age groups. In the present study males represented 64% and females represented 36 % of the sample with a male to female ratio 1.77:1.

Table 1: Age and Sex Distribution

Age	Males		Females		Total		P Value
	n(32)	%	N(18)	%	n(50)	%	
41-50	8	25.0	7	38.9	15	30.0	0.532
51-60	16	50.0	6	33.3	22	44.0	
61-70	7	21.9	5	27.8	12	24.0	
>70	1	3.1	-	-	1	2.0	
Mean ± SD	**56.75±7.81**		**54.94±7.03**		**56.10±7.51**		**0.420**

Statistical Analysis: Student's t-test, P value =0.420 (statistically insignificant)

Duration of Diabetes Mellitus

As per the patient's history the duration of diabetis was categeroized in to various groups at 5year interval (table2). Majority of the patients gave a history of diabetes mellitus of 6-10 years (44%), 42% gave a history of diabetes of 0-5 years duration; 8% gave history of 11-15 years duration and 6% gave history of 16-20 years duration. Mean duration of Diabetes in this study was 7.4years.

Table 2: Distribution of patients according to duration of diabetes

Duration in Years	No of Patients (%)
0-5 yrs	21 (42.0%)
6-10yrs	22 (44.0%)
11-15 yrs	4 (8.0%)
16-20 yrs	3 (6.0%)
Total	**50 (100.0%)**

Morphological Patterns of DME on OCT:

Of the 50 patients in the present study 76 eyes showed Clinically Significant Macular Edema. On Optical Coherence Tomography scans four different patterns of DME were found. Cystoid Macular Edema was the most common morphological pattern (40.8%), followed by DRT (38.2%) and SRD (17.1%). Least common morphological pattern was VMIA (3.9%).[Table 3]

Table 3: Morphological patterns of DME on OCT

Morphological Patterns	Total No of Eyes (%)
DRT	**29(38.2%)**
CME	**31(40.8%)**
CME	16(21.1%)
CME, DRT	15(19.7%)
SRD	**13(17.1%)**
SRD, DRT	6 (7.9%)
SRD, CME	2 (2.6%)
SRD, CME, DRT	5 (6.6%)
VMIA	**3(3.9%)**
VMT	1(1.3%)
VMT,CME	2(2.6%)
Total	**76(100.0%)**

Stages of Retinopathy

The patients included in the study were subjected to fundus examination and the Eyes with CSME were classified according to ETDRS classification.

Eyes with NPDR (59) were more in number compared to those with PDR (17) at a ratio of 3.47:1. Among those with NPDR, 38.2% of the eyes showed moderate NPDR, followed by 36.8% with severe type and 1.3% with mild and Very Severe NPDR each. Among those with PDR (22.37%), 17.1%were without HRC and 5.3% were with HRC.

Table 4: Distribution of Eyes with CSME According to Stage of DR

Stage Of Diabetic Retinopathy		No of Eyes with CSME (%)	Total (%)
NPDR	MILD	1 (1.3%)	**59 (77.63%)**
	MODERATE	29 (38.2%)	
	SEVERE	28(36.8%)	
	VERY SEVERE	1 (1.3%)	
PDR	Without HRC	13(17.1%)	**17 (22.37%)**
	With HRC	4(5.3%)	

Association of Diabetic Retinopathy and various patterns of DME was analysed. Statistical analysis of occurrence of various patterns of DME on OCT and stages of Diabetic Retinopathy was calculated using Chi-Square Test. It was not statistically significant.

Table 5: Association of Diabetic Retinopathy and various Patterns of DME

Stage of DRP	DRT	CME	SRD	VMIA	Total
Mild NPDR	-	1(100.0%)	-	-	**1(100%)**
Moderate NPDR	14(48.3%)	12(41.4%)	3(10.3%)	-	**29(100%)**
Severe NPDR	7(25.0%)	14(50.0%)	7(25.0%)	-	**28(100%)**
Very Severe NPDR	1(100.0%)	-	-	-	**1(100%)**
PDR	7(41.18%)	4(23.53%)	3(17.65%)	3(17.65%)	**17(100%)**
Total	**29**	**31**	**13**	**3**	**76**

Statistical Analysis -Chi-square test:P Value = 0.143 Statistically not significant

Mean central macular thickness

The mean central macular thickness in all the 76 eyes was 364.34 microns. The least CMT was 205 µm in DRT pattern. Highest CMT was observed to be786 µm with CME pattern of DME.

The mean CMT in various morphological patterns was DRT-283.86µm, CME-414.52µm, SRD-421.77µm, VMIA-375µm. The mean CST was highest in SRD pattern and was least in DRT pattern. Statistical analysis by Analysis of Variance revealed Significant difference of mean thickness among various patterns of DME on OCT (P <0.0001).

Table 6: Mean CMT of various patterns of DME on OCT

Morphological Pattern	Number of Scans	Mean CMT (Microns)	Range (Microns)
DRT	29	283.86	(205-479)
CME	31	414.52	(210-786)
SRD	13	421.77	(262-529)
VMIA	3	375.00	(265-564)

Statistical Analysis:

Analysis of Variance – P Value <0.0001 (Very High Significant)

Mean visual acuity:

The mean Visual acuity among 76 eyes was observed to be 0.48 log MAR units. Mean visual acuity of 0.36, 0.54, 0.61and 0.46 log MAR units were observed among DRT, CME, SRD and VMIA patterns respectively. The Best mean Visual Acuity was observed in DRT pattern (0.36 log MAR).The worst mean visual acuity was observed in SRD pattern (0.61log MAR). Statistical analysis of the variation of Visual acuity among groups on Analysis of Variance test was found to be Significant (p= 0.003)

Table 7: Mean Visual Acuity of various patterns of DME

Morphological Sub-types	Number of Scans	Mean Visual Acuity (logMAR)	Range (microns)
DRT	29	0.36	0.18-0.78
CME	31	0.54	0.18-1.30
SRD	13	0.61	0.30-0.78
VMIA	3	0.46	0.30-0.78

Statistical Analysis: Analysis of Variance – p = 0.003 (significant)

Table 8: Association of CMT and Visual Acuity in Diabetic Eyes

Central Macular Thickness (microns)	Mean Visual Acuity (logMAR)
≤300	0.29
301-400	0.51
401-500	0.58
501-600	0.76
> 601	1.30

Variables	Means	Pearson Correlation Coefficient	
		Central Macular Thickness (µm)	V/A_logMAR
CMT (µm)	**364.34**	**1**	**0.841**
VA_logMAR	**0.48**	**0.841**	**1**

Table 9: Linear Regression Analysis to see linear relation between CMT and visual acuity

Dependent Variable	N	Multiple R	Squared Multiple R
Visual acuity	76	0.841	0.707

Regression Coefficients B = (X'X)-1X'Y

Effect	Coefficient	S.E	Std. Coefficient	t	p-Value
CONSTANT	-0.143	0.049	0.000	-2.916	0.005
CMT	0.002	0.000	0.841	13.367	< 0.0001

Linear Regression Analysis was used to explain the variation in the dependent variable (Central Macular Thickness (µm)) and to see linear relation between CMT & Visual Acuity. On comparison of optical coherence tomography measurements of Central Macular Thickness with Visual Acuity, using Linear Regression Method in 76 eyes with CSME there is a Significant linear relation between Foveal Thickness and Visual Acuity with R= 0.841, R2 value-0.707and P-Value < 0.0001.

DISCUSSION

Diabetic macular edema (DME) is the most common cause of visual loss in diabetics.[12] It affects the central vision from the early stages of retinopathy, and it is the most frequent sight-threatening complication of diabetic retinopathy. DME leads to distortion of visual images and may cause a significant decrease in visual acuity even in the absence of severe retinopathy.

Although macular edema is a common and characteristic complication of diabetic retinopathy and shows apparent association with the systemic metabolic alterations of diabetes, it does not necessarily fit the regular course of diabetic retinopathy progression. It may occur at any stage of diabetic retinopathy, whether non-proliferative, moderate, or severe, or even at the more advanced stages of the retinopathy.[13]

Histopathologic studies by Yanoff and associates, suggest that the development of macular edema is initiated by fluid accumulation within Muller cells.[14] In this early state, while fluid accumulates intra cellularly within the Muller cells, it can be reversed. However, if the accumulation continues, or remains chronic, then at some point, death of the Muller cells is likely to occur which may result in the formation of large cystoid cavities, or CME. The cavities are formed following necrosis of the Muller cells.

In the present cross sectional observation study 76 eyes of 50 diabetic patients with CSME were evaluated and subjected to OCT examination of macula. Visual acuity was assessed and scored with log MAR scale.

Morphological Pattern and macular thickness of DME on OCT were documented and evaluated. The data recorded was tabulated and evaluated using SPSS software and statistical techniques.

The mean age of the patients was 56.10+7.51 years, with maximum incidence between 51-60 years. Male to Female ratio was 1.77:1 indicating male preponderance. In most of the patients the duration of diabetes was between 6 -10 years (44 %), the mean

duration being 7.4years. Diabetic retinopathy changes in eyes were staged according to ETDRS Classification. Ratio between patients with NPDR and PDR was 3.47:1.

Among 76 eyes with CSME, four different patterns of DME were found on evaluation of the OCT scans. CME was the most common morphology (40.8%), followed by DRT (38.2%), and SRD (17.1%)and least common morphological type was VMIA (3.9%).

The mean central macular thickness in all the 76 eyes was 364.34 microns. Mean thickness varied among various groups, being highest in SRD pattern and least in DRT pattern. The mean Visual acuity among 76 eyes was0.48 log MAR units. The visual acuity was worse in SRD pattern and better in DRT pattern. Using linear Regression Analysis there was a significant linear relation between Central Macular Thickness and Visual Acuity with r=0.841 and p Value <0.0001. These results were analysed and compared with other studies.

Age analysis:

In the present study, age of the patient ranged from 44-77 years with mean age of the patients being 56.10 + 7.51 years. Among 50 cases, 44% of patients were found between 51-60 years, 30% between 41-50 years and 24% between 61-70 years and 2% in > 70 years age group. Most of the patients were found in the age group of 51 - 60 years and least in the age group of >70 years. Mean age in male subjects was 56.75 + 7.81 and in female subjects was 54.94 + 7.51. Using Student's t-test, there was no significant difference as for as the age in male and female subjects is concerned. This is in concordance with study conducted by Hannouche et al,[15] which showed mean age 58.76 + 8.86. It was also in concordance with N R Kim et al.,[16] study Alkuraya et al.,[17] study and Faried M Wagdy et al,[18] study with the mean age of patients being 58.76 + 13.01 years, 55.6 + 7.8 years,53.16 years respectively.

Gender analysis:

In the present study conducted on 50 patients, males were more compared to females (64% and 36% respectively) with male to female ratio of1.77:1. This difference may be because, more health facilities were availed by men than women. A similar male preponderance was documented by Faried M Wagdy et al,[18] study, Brian Kim et al,[19] study, Alkurayaet al,[17] study.

Duration of diabetes analysis:

Duration of Diabetes ranged between 1 to 20 years with 44% of patients falling in the catergory of 6-10 years, 42 % between 0-5 years, 8% between 11-15 years and 6% between 16-20 years. Mean duration of diabetes in this study was 7.4 years. It is in relative concordance with Shrestha, et al,[22] study which showed 9.89±5.1 years as mean duration of diabetes mellitus. It is less when compared with the findings of Faried M Wagdy et al,[18] study (12.62 yrs), N R Kim et al,[16] study (12.04±8.60) study and Mohammadreza et al,[20] study (12.21±6.1). This may be due to early identification of cases due to increased awareness and regular screening of diabetic patients. On Evaluating the current sample of diabetic patients, status of DM was assessed by Fasting Blood Sugar (FBS) and Post Prandial Blood Sugar (PPBS) levels. The state of control of Diabetes could not be commented upon, as only FBS and PPBS were considered, which indicates only short term control of DM unlike HbA1c which indicates the long term control of DM.

Stage of Diabetic retinopathy analysis:

In the present study, the patients with NPDR were more compared to those with PDR (77.63% and 22.37% respectively) in a ratio of 3.47:1. This ratio was in acceptance with Qureshi, et al,[57] study and Faried M Wagdeyet al,[18] study which showed more number of eyes with NPDR than PDR with ratio of 3.64:1 and 3.2:1 respectively. N R Kim, et..al,[16] study also showed more number of eyes with NPDR than PDR with ratio of 1.25:1.More Number of Eyes with NPDR than PDR could be due to early presentation of patients due to defective vision and early identification of cases with DR due to regular screening and referral of cases from other specialties in the institute.

The Eyes with NPDR were further staged into Mild, Moderate, Severe, Very Severe according to ETDRS Classification. 1.3% eyes showed Mild NPDR, 38.2% of the eyes showed Moderate NPDR and 36.8% of eyes showed Severe NPDR and 1.3% of the eyes were having Very Severe NPDR. The Eyes with PDR were categorized into PDR without HRC and PDR with HRC. 17.1% of eyes showed PDR without HRC and 5.3% showed PDR with HRC. The above findings suggested that CSME can be present irrespective of stage of Diabetic Retinopathy.

Analysis of OCT patterns of DME:

On evaluating the various patterns of Diabetic Macular Edema on OCT in 76 Eyes, four distinct patterns were found. 40.8% of the eyes showed CME Pattern, which was the most common pattern found in the present study. DRT was found in 38.2% of the eyes. SRD was found in 17.1% of the eyes. VMIA was the least common pattern observed (3.9%). CME was the most common pattern found in the present study and this was in concordance with NR Kim et al,[16] study and Hannoucheet al.,[15]study. The findings did not correlate with Mohammadreza et al,[21] study.

Analysis of mean CMT:

The mean central macular thickness in all the 76 eyes in present study was 364.34 microns. It was in concordance with Hannoucheet al,[15] study and Shrestha et al.[22] study and was less when compared to Qureshi et.al,[20] study.

Analysis of mean CMT in various patterns of DME:

The mean central macular thickness varied among various groups, being highest in Serous Retinal Detachment (SRD) pattern being- 421.77 microns and least in Diffuse Retinal Thickening (DRT) pattern being-283.86 microns. This was comparable to NR Kim et al,[16] study, Shrestha et al,[22] study and

Hannoucheet al,[15] study where highest average CMT was observed in SRD pattern and least average CMT in DRT pattern. In Qureshi et al.,[20]study, highest average CMT was observed in SRD pattern but least average CMT was obseved in VMIA pattern. In Mohammadreza et al,[21] study, least average CMT was observed in DRT pattern but highest average CMT was observed in CME pattern.

Analysis of mean visual acuity in various patterns of DME:

The mean Visual acuity among 76 eyes was observed to be 0.48 log MAR units. Mean visual acuity among various patterns were studied. The mean visual acuity was found to be lowest in SRD pattern (0.61 log MAR) and better in DRT pattern (0.36 log MAR). Better visual acuity in DRT pattern was in concordance with NR Kim et al,[16] study, Hannoucheet al,[15] study and Mohhamadrezaet al,[21] but not in concordance with Qureshi et al,[57] study where better visual acuity was observed in VMIA pattern. Worst mean Visual Acuity in SRD pattern was in concordance with Qureshi et al,[20] study but not in concordance with NR Kim et al,[16] study, Hannoucheet al,[15] study where worst visual acuity was observed in CME pattern.

Analysis of correlation of CMT with visual acuity:

Linear Regression Analysis was used to explain the variation in the dependent variable (Central Macular Thickness (µm)) and to see linear relation between Central Macular Thickness & Visual Acuity. On comparison of optical coherence tomography measurements of Central Macular thickness with Visual Acuity, using Linear Regression Method in 76 eye, there was a Significant linear relation observed with R = 0.841, R2 = 0.707 and P-Value < 0.0001. Similar results of significant correlation was found in other studies with p-values <0.01, <0.001, and <0.001 in Qureshi et al.,[20] study, Hannoucheet al,[15] study and Mohammadreza et al.,[55] study respectively.

STRENGTHS OF THE STUDY:

- OCT helped in understanding the anatomy of DME and the intaretinal damage occurring due to accumulation of fluid.
- OCT was helpful in quantifying DME, as it correlated significantly with visual acuity. This could not be achieved by slit lamp biomicroscopic examination using +90D lens.
- The precise and useful data obtained from OCT was helpful to classify DME patients into various categories. This helped in implementing the correct treatment protocol for various types of DME.

Recommendations

- In the present study only Central Macular Thickness was correlated with visual acuity, new parameters like Inner segment-ellipsoid band (defined as an outer highly reflective band next to retinal pigment epithelium located at the inner segment ellipsoids) disruption with increasing severity of DME and its correlation with BCVA can be analysed. Further studies to assess these parameters in assessing severity of DME and visual outcome are recommended.
- Use of ultrahigh resolution OCT has the advantage of improved delineation of all retinal layers, more detailed structural imaging and more precise measurements.
- Enface OCT where the scanning is done in X-Y plane can be recommended. This provides a higher image resolution.
- OCT angiography is helpful in identifying ischemic maculopathy.

Summary

The present study is a cross sectional observational case study over a period of one and half year in a sample of 50 patients (76eyes) attending Department of Ophthalmology who met the inclusion and exclusion criteria of the study.

After obtaining the approval of Institutional Ethics Committee and consent from patients, detailed clinical history and clinical examination of the patient was done. The Eyes with clinically significant macular edema were evaluated by OCT examination. Morphological Pattern and macular thickness of DME were documented and evaluated. The data recorded was tabulated and evaluated using SPSS software and statistical techniques.

The mean age of the patients was 56.10+7.51 years, with maximum incidence between 51-60 years. Male to Female ratio was 1.77:1 indicating male preponderance. There was no significant difference as for as the age in male and female subjects is concerned. In most of the patients the duration of diabetes was between 6 -10 years (44%), the mean duration being 7.4years.

Ratio between patients with NPDR and PDR was 3.47:1. Among the NPDR patients, moderate and severe types were common (38.2% and 36.8% respectively). PDR was relatively less common with PDR without HRC in 1.3% and PDR with HRC in 17.1%.

Four different patterns of DME were found on evaluation of the OCT scans. Cystoid Macular Edema was the most common morphology (40.8%), followed by DRT (38.2%), and SRD (17.1%). Least common morphological type was VMIA (3.9%).

The mean central macular thickness in all the 76 eyes is 364.34 microns. Mean thickness varied among various groups, being highest in Serous Retinal Detachment 421.77 microns and least among diffuse retinal thickening 283.86 microns. On statistical analysis of variance of mean thickness among various groups a statistically significant difference was observed (p<0.0001).

The mean Visual acuity among 76 eyes was observed to be 0.48 log MAR units. Worse visual acuity was found in SRD pattern (0.61 log MAR). Visual acuity was better in DRT pattern (0.36 log MAR) compared to other patterns. CME pattern was also associated with worse visual acuity.

Linear Regression Analysis was used to explain the variation in the dependent variable (Central Macular Thickness (µm)) and to see linear relation between Central Macular Thickness & Visual Acuity. There was a significant linear relation between Central Macular Thickness and Visual Acuity with r=0.841 and p Value <0.0001.

CONCLUSION

The present study concluded that Four distinct morphological patterns of DME were observed on OCT: DRT, CME, SRD and VMIA. CME was the most common pattern, and VMIA was the least common pattern. The mean Central Macular Thickness varied among Various patterns of DME on OCT. Highest mean CST was observed in SRD pattern and Least mean CST was observed in DRT pattern. Visual acuity varied among various patterns of DME on OCT. Worst mean Visual Acuity was observed in SRD pattern and best mean visual acuity was observed in DRT pattern. There is a Significant Correlation between Central Macular Thickness and Visual Acuity. OCT can perform micrometre-resolution, cross sectional imaging of retina that closely approximates its histological layers. It is a very comfortable, non invasive procedure with very short measurement time. It facilitates quantification of macular oedema, assessment of vitreomacular interface and detection of VMT that is not clinically identified. It helps to understand the anatomy of DME and the intraretinal damage and is the technique of choice for early detection of DME.

Conflict of Interest: None
Funding Support: Nil

REFERENCES

1. International Diabetes Federation (IDF). IDF Diabetes Atlas. 7thed. 2015.Available from: http://www.idf.org/idf-diabetesatlas-seventh-edition.
2. Yau JW, Rogers SL, Kawasaki R, et al. Meta-Analysis for Eye Disease (META-EYE) study group. Global prevalence and risk factors of diabetic retinopathy. Diabetes Care2012;35:556–64.
3. Klein R, Knudtson MD, Lee KE, Gangnon R, Klein BE. The Wisconsin Epidemiologic Study of Diabetic Retinopathy: XXII the twenty-five-year progression of retinopathy in persons with type 1 diabetes. Ophthalmology. 2008; 115 (11): 1859-1868. doi:10.1016/ j.ophtha.2008.08.023.
4. Paulus YM, Gariano RF. Diabetic retinopathy: A growing concern in an aging population. Geriatrics. 2009;64(2):16-20.
5. Zhang X, Zeng H, Bao S, Wang N, Gillies MC. Diabetic macular edema: new concepts in patho-physiology and treatment. Cell Biosci. 2014;4:27. doi: 10.1186/2045 3701-4-27.
6. White NH, Sun W, Cleary PA, Tamborlane WV, Danis RP, Hainsworth DP, et al. Effect of prior intensive therapy in type 1 diabetes on 10-year progression of retinopathy in the DCCT/EDIC: comparison of adults and adolescents. Diabetes. 2010;59(5):1244-1253. doi: 10.2337/db09-1216
7. Massin P, Girach A, Erginay A, Gaudric A (2006) Optical coherence tomography: a key to the future management of patients with diabetic macularoedema. ActaOphthalmolScand 84: 466-474.
8. Drexler W, Fujimoto JG. State-of-the-art retinal optical coherence tomography. ProgRetin Eye Res 2008; 27:45–88.
9. Spaide RF. Age-related choroidal atrophy. Am J Ophthalmol 2009; 147: 801–810.
10. Toth CA, Narayan DG, Boppart SA, et al. A comparison of retinal morphology viewed by optical coherence tomography and by light microscopy. Arch Ophthalmol 1997; 115:1425–1428.
11. Hee MR, Izatt JA, Swanson EA, et al. Optical coherence tomography of the human retina. Arch Ophthalmol 1995; 113:325–332.
12. L.P. Aiello, T.W. Gardner, G.L. King, G. Blankenship, J.D. Cavallerano,F.L.I.I.I. Ferris, R. Klein, Diabetic retinopathy. Technical review. Diabetes Care 21, 143–156 (1998)
13. Klein BE, Klein R, Lee KE. Components of the metabolic syndrome and risk of cardiovascular disease and diabetes in Beaver Dam. Diabetes Care. 2002 Oct; 25(10):1790-4.
14. Yanoff M, Fine BS, Brucker AJ, Eagle RC Jr. Pathology of human cystoid macular edema. SurvOphthalmol. 1984 May; 28 Suppl: 505-11.
15. Rosana Zacarias Hannouche1, Marcos Pereira de Ávila2, David Leonardo Cruvinel Isaac3, Rodrigo Salustiano Corrêa e Silva1, Alan Ricardo Rassi3Correlation between central subfield thickness, visual acuity and structural changes in diabetic macular edema. Arq Bras Oftalmol. 2012;75(3):183-7
16. KimNR1,KimYJ,ChinHS,MoonYS.Opticalcoherencetomographicpatterns in diabetic macular oedema: prediction of visual outcome after focal lasephotocoagulation. Br J Ophthalmol. 2009 Jul;93(7):901-5. doi: 10.1136/bjo.2008.152553. Epub 2009 Mar 1.
17. Alkuraya H1, Kangave D, Abu El-Asrar AM. The correlation between optical coherence to mographicfeatures andseverity of retinopathy, macular thickness and visual acuity in diabetic macular edema. Int Ophthalmol. 2005 Jun;26(3):93-9.
18. Faried M. Wagdy, Abdel Rahman E. Sarhan, Osama A. Elmorsy, MarwaA. ZakyGalal, Moustafa K. Nassar.Optical coherence tomography as a prognostic tool for visual improvement after management of diabetic macular edema. Menoufia Medical Journal 2014, 27:174–177
19. Kim BY, Smith SD, Kaiser PK. Optical coherence tomographic patterns of diabetic macular edema. Am J Ophthalmol. 2006 Sep; 142(3): 405-12.
20. Tariq Qureshi, Rahila Ramzan, Aijaz Akbar, Andlib Ahangar, Arshi Nazir, Anjum Fazli. Assessment of Morphology of Diabetic Macular Edema with Optical Coherence Tomography and its Association with Visual Acuity in Kashmir. Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 30, July 28; Page: 8294-8307, DOI: 10.14260/jemds/2014/3045
21. MohammadrezaAhmadpour-Baghdadabad,MasoudrezaManaviat, Ahmad Shojaoddiny-Ardekani Optical coherence tomography in diabetic macular edema: patterns and related risk factors. Nepal J Ophthalmol 2013; 5 (10): 190-194.
22. ShresthaA et al Optical coherence tomographic assessment of macular thickness Nepal J Ophthalmol 2012; 4 (7):128-133.