

Correlation of Visual Acuity with Diabetic Macular Edema and its Subtypes in Type 2 Diabetes Mellitus Patients

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Abstract: Background: Diabetic macular edema (DME) is the major cause of visual deterioration in diabetic retinopathy. India is known as the "Diabetic capital of the world". Diabetic retinopathy is one of the microvascular complications of DM which affects 1 out of 3 patients with diabetes resulting in poor quality of life in patients with severe DR. Aims: Evaluate the correlation of visual acuity with the type of macular edema on Optical coherence tomography (OCT) in Type 2 Diabetes mellitus (T2DM) patients and also to find the association of visual acuity with the central subfield thickness. Settings and Design: A cross sectional study Methods and Material: A cross sectional study is done on 90 eyes of naïve T2DM patients who had Macular edema from February 2021 to August 2022 at our tertiary eye care Hospital. Statistical analysis used: The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used. Results: 29 patients had Sponge like retinal thickness (SLRT) with visual acuity of LogMAR 0.728, 19 patients had Cystoid macular edema (CME) with visual acuity of LogMAR 0.894, 8 patients had Serous retinal detachment (SRD) with visual acuity of LogMAR 1.182, 8 patients had Foveal tractional retinal detachment (FTRD) with visual acuity of LogMAR 1.307, 7 patients had Taut posterior hyaloid membrane (TPHM) with visual acuity of LogMAR 0.759, 19 patients had combined type DME with visual acuity of LogMAR 1.317 and Central subfield thickness (CST) is noted in all patients. There was a linear correlation between visual acuity and the central subfield thickness ($p=0.000$). Conclusions: Majority of the patients had SLRT with good visual acuity, less no of patients had TPHM with fair visual acuity and combined pattern had poor visual acuity. There was a linear correlation between visual acuity and the central subfield thickness ($p=0.000$).

Keywords: Diabetic macular edema, Optical coherence tomography, Central subfield thickness

1. Introduction

Diabetic retinopathy represents microvascular end organ damage as a result of Diabetes. Diabetic macular edema is the sight threatening condition caused primarily by hyperglycemia, and is the major cause of loss of vision and blindness^{1, 2, 5}. Pathogenesis has a complex etiology that has not yet been fully understood.

Optical coherence tomography is a non invasive, high resolution, three dimensional surface imaging modality. Macular thickening which is picked up on clinical examination does not reflect severity, extent of edema, source of fluid leakage and the affected layers of retina which can be picked up by OCT, aiding in quantitative measurement of retinal thickness.^{4, 6}

Subjects and Methods: A cross sectional study is done on 90 eyes T2DM patients attending our Outpatient and Inpatient department at our tertiary eye care Institute from February 2021 - August 2022.

Inclusion Criteria:

The institutional ethical committee Approval was obtained.

1) Individuals willing to give informed written consent

2) All naïve DME cases of T2DM above 18 years of age and clear media enough to allow OCT

Exclusion Criteria:

- 1) Patients not willing to give informed consent.
- 2) Macular edema patients other than Diabetics
- 3) Patients with intra - ocular inflammation, evidence of glaucoma, epiretinal membrane, previous intra ocular surgeries
- 4) Patients with ocular media opacity or cataract
- 5) Patients with Pre - retinal haemorrhage, Vitreous haemorrhage
- 6) Individuals with DME treated earlier with Laser/Pharmacotherapy.

Patients fulfilling the inclusion criteria were enrolled for the study.

Best corrected Visual acuity (BCVA) was noted done using LogMAR chart. Details of Anterior segment evaluation which was done using Slit lamp biomicroscopy and posterior segment by ophthalmoscopy (direct and indirect) and +90 D Biomicroscopy were noted. OCT images which were acquired in Dilated pupil were analysed. The OCT examination was performed using CARL ZEISS MEDITEC CIRRUS HD - OCT (5000 - 19681). Macular cube 512*128

software is used to assess the total macular thickness. The central subfield thickness (Central subfield is defined as the circular area 1mm in diameter centered around the central point of fovea is measured.

In our study we considered OCT based classification of Diabetic macular edema proposed by Vaishali Gupta⁷ –

- 1) Sponge like retinal thickness (SLRT)
- 2) Cystoid macular edema (CME)
- 3) Serous retinal detachment (SRD)
- 4) Foveal tractional retinal detachment (FTRD)
- 5) Taut posterior hyaloid membrane (TPHM)

The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Chi - square/ Fisher Exact test has been employed to find the significance of study parameters on

categorical scale between two or more groups, non - parametric setting for qualitative data analysis. Shapiro wilk test is used to check the normality of the sample and kolmogorov Smirnov test is used to test the null hypothesis. p <0.05 will be considered statistically significant.

2. Results

A total of 90 eyes of diabetic patients with DME were included in our study of which 22% of the eyes were of females and 78% were of males. The mean visual acuity was LogMAR 0.981, mean age of the study population was 56.51 years, mean duration of DM was 10.20 years and mean CST was 474.08µm. All stages of DR were included of which majority of the patients 46 (51%) had PDR changes.

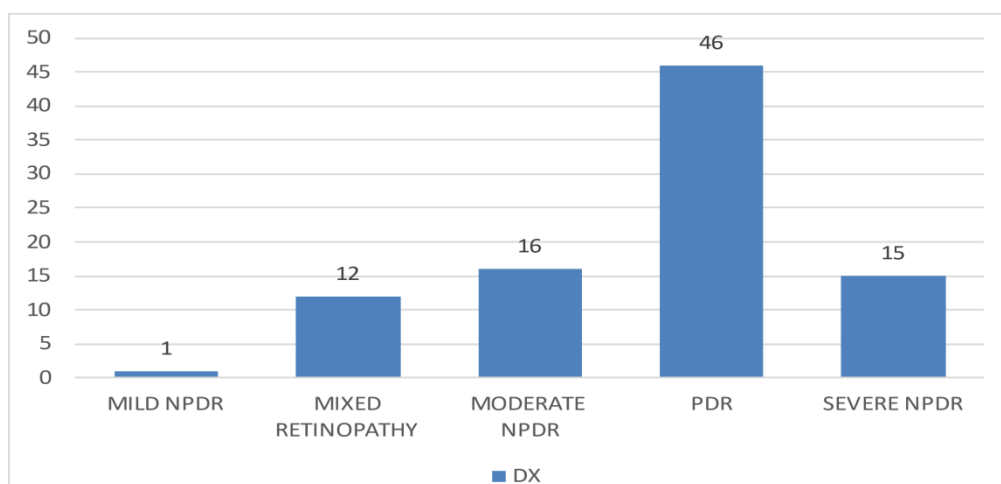


Figure 1: Showing stages of DR and mixed retinopathy.

Table 1: Showing distribution of OCT types in study population.

	SLRT	CME	SRD	FTRD	TPHM	Combined
Male	20	15	6	5	6	18
Female	9	4	2	3	1	1
Total	29	19	8	8	7	19
Percent	32.22%	21.11%	8.88%	8.88%	7.77%	21.11%

On OCT SLRT was seen in 29 (32.22%), CME in 19 (21.11%), SRD 8 (8.88%), FTRD in 8 (8.88%), TPHM in 7 (7.77%) and combined pattern of DME was seen in 19 (21.11%) of the patients. The predominant pattern of Macular edema was a Spongy like retinal thickness followed by Combination of various types of OCT. Least pattern found was TPHM.

Table 2: Showing comparison of Visual acuity with OCT types.

OCT Type	Mean Visual Acuity (LOGMAR)	Standard Deviation
Spongy like retinal thickness	0.728	0.338
Cystoid macular edema	0.894	0.306
Serous retinal detachment	1.182	0.420
Foveal tractional retinal detachment	1.307	0.407
Taut posterior hyaloid membrane	0.759	0.220
Combination Of SLRT±CME±SRD±FTRD±TPHM	1.317	0.389

Patients with Spongy like retinal thickness, Cystoid macular edema, Serous retinal detachment, Foveal tractional retinal detachment, Taut posterior hyaloid membrane and combination of various types of OCTs had mean visual acuity of 0.728, 0.894, 1.182, 1.307, 0.759, 1.317 respectively. Patient’s with SLRT had better visual acuity.

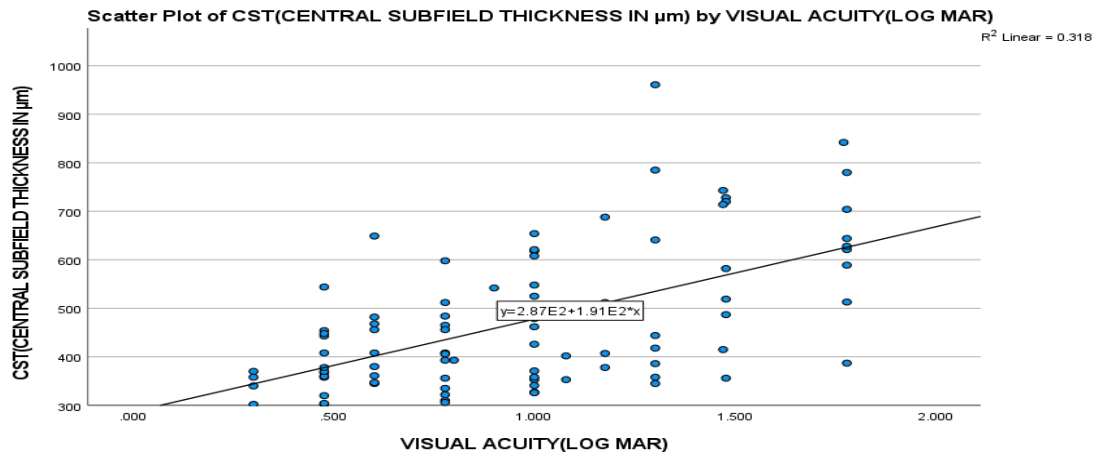


Figure 2: Correlation of Visual acuity with Cental subfield thickness

Scatter plot was plotted with CST in y axis and VA in x axis. It showed that there was linear correlation between VA and CST with $p=0.000$, statistically significant with Spearman rho correlation coefficient 0.526^{**}

3. Discussion

Diabetic macular edema is one of the leading causes of visual impairment in diabetic patients. The incidence and prevalence of macular edema increase with longer duration of diabetes and with increasing severity of concurrent retinopathy. Optical coherence tomography (OCT) is a non invasive, safe and quicker procedure and is based on low - coherence interferometry and provides high - resolution cross - sectional images of the retina. It allows more precise evaluation of retinal pathology which includes retinal thickness and edema, vitreomacular interface abnormalities, subretinal fluid and foveal microstructural changes. Fluorescein angiography is a sensitive method for qualitative assessment of fluid leakage in diabetic macular edema, however its not a reliable indicator of the actual macular thickness.

Among Diabetics, Majority of the patients develop SLRT with better VA and Poor VA is seen in patients who had combined forms of OCTs and FTRD.

The aim of the study was to determine whether there was any association between Visual acuity and OCT findings in diabetic macular edema and also Visual acuity with the Central subfield thickness. 70 eyes (77.8%) eyes belonged to males and and 20 eyes (22.2%) belonged to females and their ages ranged from 38 to 80 years, Study conducted by Hossam T. Al - Sharkawy¹ there were 55 (59.78%) men and 37 (40.22%) women and their ages ranged from 40 to 77 years with a mean age of 57.25 ± 8.15 years. Study conducted by Hossam T. Al - Sharkawy¹ Egypt in 168 eyes of 92 patients and found that Diffuse retinal thickening in 109 (65%) of eyes, Diffuse retinal thickening and Cystoid macular edema in 27 (16%) of eyes, Diffuse retinal thickening and Serous retinal detachment in 22 (13%) of eyes and combined pattern of Diffuse retinal thickening, Cystoid macular edema and Serous retinal detachment in 10 (6%) of eyes. Study conducted by otani et al² Japan wherein OCT was performed in 59 eyes of 42 patients with DME. 52 eyes (88 %) had sponge like retinal swelling , 28

eyes (47 %) had cystoid macular edema, 9 (15 %) had serous retinal detachment⁹. Our study showed Majority of the patients 32.2% had diffuse retinal thickness. Studies conducted by Hossam T. Al - Sharkawy¹ and otani et al⁹ found that 65 % of the pateints and 88% of the eyes had diffuse retinal thickness respectively. The results obtained from our study is similar to the results of the study conducted by Hossam T. Al - Sharkawy¹ and otani et al⁹

SLRT had best visual acuity. Combination of different type of OCTs had poor visual acuity comparable to the study done by Hossam T. Al - Sharkawy¹. Visual acuity is poor in eyes having Foveal tractional detachment and is comparable to the study done by alkuraya et al⁸.

There was significant correlation between the CST and the BCVA, which supports the finding done in earlier studies by alkuraya et al⁸, Mansour et al, Rathi et al² and Hosaam t. Al - Sharkawy¹ Thus, retinal thickness at the fovea is significantly correlated with the best - corrected visual acuity.

4. Conclusion

Our study revealed a significant correlation between visual acuity and Central subfield thickness regardless of different tomographic features. Diabetic changes like foveal tractional retinal detachment, serous retinal detachment, Taut posterior hyaloid membrane which may not be evident by ophthalmoscopy are detected by OCT. These results indicate that OCT can facilitate deciding of the treatment protocol either (Medical/Surgical) and follow up of patients. OCT plays an important role in early stages of Diabetic maculopathy where the structural changes are not yet evident with slit lamp biomicroscopy, Fluorescein angiography. OCT has revolutionized the management of Diabetic macular edema. Intervention in early stages of DR will prevent the progression of the disease course and prevents patients from loosing vision.

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