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Original Research Article

Study of optical coherence tomography classification and outcome of intravitreal anti-VEGF injection in diabetic macular edema

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ABSTRACT

Background: Diabetic macular edema is the most common cause of vision loss in diabetes. OCT is a non-invasive and non-contact imaging modality that gives high-resolution images of the retina. OCT helps in early diagnosis of macular edema, to classify diabetic macular edema quantitatively, to decide the treatment option and assessing visual prognosis. Aim of this study was to analyse the different patterns of diabetic macular edema in OCT and to observe the visual outcome of intravitreal anti-VEGF injection.
Materials and Methods: All patients who were attending ophthalmology OPD in Tirunelveli medical college hospital with diabetic macular edema from January 2019 to July 2019 were included in the study. Patients with macular edema other than diabetes, OCT with poor signal strength less than 5 were excluded. Patients were subjected to a detailed history, examination with Slit-lamp biomicroscopy, Fundus examination with +90 D lens, Oct was taken in patients with macular edema. Macular cube, OCT classified type of macular edema, Central macular thickness value, quadrant wise distribution of edema, cube average thickness were measured. The number of Anti-VEGF injections and its effect on various types of macular edema was measured.
Results: The most common age group is between 41-50 years, males were more than females. The most common type of macular edema is CME (38.5%). There was a significant reduction in macular edema and improvement in visual acuity between pre and post-injection in Cystoid macular edema and diffuse retinal thickness.
Conclusion: OCT is an essential tool for the quantitative assessment of macular edema. It helps in deciding treatment modalities, explaining prognosis to patients and predicting the visual outcome.

1. Introduction

Diabetic macular edema is the most common cause of vision loss in diabetes.[1] The prevalence of diabetic macular edema in diabetes is 5% in 5 years and 15% in 15 years.[2] Chronic hyperglycemia is the major risk factor of diabetic macular edema. The incidence of DME over a 10 year period is 20% in patients with younger-onset diabetes versus approximately 40% in older onset diabetes. Chronic hyperglycemia results in deposition of advanced glycated end products which results in disruption of the blood-retinal barrier and an altered vitreoretinal interface. This alteration in the Blood retinal barrier results in interstitial fluid accumulation within the retina and cyst formation. Increased vascular permeability occurs as a result of breakdown of the BRB, due to loss of pericytes, altered glial cells, endothelial cell death, leukostasis in the retinal vasculature, leakage of tight junctions, increased expression of vascular endothelial growth factor (VEGF) and altered vitreoretinal interface with a thickened taut, posterior hyaloid with persistent vitreomacular traction (VMT).[3] OCT is a non-invasive, non-contact imaging modality that uses infrared light in 800-840nm wavelength and gives high-resolution images of the retina. Oct is similar to ultrasound

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B Scan, but it produces images of high resolution since it uses light waves rather than sound waves. It works on the principle of Michelson interferometry. Here, a beam of light is split into two and one is made to reflect from the reference mirror and another one from the target issue, recombining them creates interference pattern.[4] The main advantage of OCT over other imaging modality is that it quantitatively rather qualitatively assess the macular edema.[5] OCT plays a crucial role in the early diagnosis of macular edema and for deciding the treatment. Aim of this study was to analyse the different patterns of diabetic macular edema in OCT and to observe the visual outcome of Intravitreal anti-VEGF injection.

2. Aim

To study the different patterns of diabetic macular edema in OCT and to observe the visual outcome of Intravitreal anti-VEGF injection.

3. Materials and Methods

This cross-sectional study was done in the department of ophthalmology at Tirunelveli medical college hospital between January 2019 to June 2019. Inclusion criteria: All patients with diabetic macular edema. Exclusion criteria: Those who have macular edema other than diabetes, Patients with hazy media which makes it difficult to take OCT, OCT scans with poor signal strength less than 5.

All patients were subjected to history taking including age, sex, duration of diabetes, history of other systemic illnesses, previous treatment history. Slit-lamp examination dilated fundus examination using slit-lamp biomicroscopy with +90 D lens, Indirect ophthalmoscope, OCT examination including macular cube, type of macular edema, Central macular thickness value, quadrant wise distribution of edema, cube average thickness and associated findings in OCT were measured. The number of anti–VEGF injection, pre-injection and post-injection macular thickness, pre-injection and post-injection visual acuity, the effect of injection for each type of macular edema were measured.

4. Results

A total of 52 patients were included in the study. 3.8% were in the age group of 30-40 years, 23.1% were in 41-50 years of age, 38.5% were 51-60 years of age, 25% 61-70, 9.6% were >70years of age. 76.9% were males and 23.1% were females. 32.7% had <5 years of diabetes, 63.5% had 5-10 years, 3.8% had >10 years of diabetes mellitus. 3.8% had mild NPDR, 17.3% had moderate NPDR, 32.7% had severe NPDR, 5.8% had very severe NPDR, 23.1% had early PDR, 17.3% had high-risk PDR. In OCT, 30.8% diffuse macular thickness, 38.5% had cystoid macular edema, 5.8% had posterior hyaloid traction, 7.7% had serous retinal detachment, 17.3% had cystoid macular edema with serous retinal detachment. Inpatient with posterior hyaloid traction, 66.7% had no tractional retinal detachment, 33.3% of patients were associated with tractional retinal detachment. In diffuse retinal thickness, there was a significant reduction in macular thickness between pre and post-injection ($p<0.001$)[Figure 1] and also a significant improvement in visual acuity ($p<0.001$). In cystoid macular edema, there was a significant reduction in macular thickness between pre and post-injection ($p<0.001$)[Figure 2] and also a significant improvement in visual acuity ($p <0.001$).In posterior hyaloid traction, there was no significance noted in the reduction of macular thickness between pre and post-injection ($p = 0.15$)[Figure 3] and no significant improvement in visual acuity ($p=0.057$). In serous retinal detachment, there was no significance noted in the reduction of macular thickness between pre and post-injection ($p <0.11$) [Figure 4] and no significant improvement in visual acuity ($p=0.340$). In cystoid macular edema with serous retinal detachment, there was a significant reduction in macular thickness between pre and post-injection ($p <0.02$)[Figure 5] and also a significant improvement in visual acuity ($p <0.001$). In moderate NPDR and severe NPDR the difference between pre and post-injection central macular thickness and visual acuity was statistically significant ($p <0.001$). In very severe NPDR, there was no significance between pre and post-injection visual acuity ($p=0.1$) and central macular thickness ($p=0.2$). In early PDR and high-risk PDR, the difference between pre and post-injection central macular thickness and visual acuity was statistically significant ($p <0.001$). In patients with diabetes less than 5 years and 10 years, there was a significant reduction in central macular thickness and significant improvement in visual acuity ($p <0.001$). In patients with diabetes for more than 10 years, there was no significant reduction of central macular thickness and visual acuity ($p<0.07$). Quadrant wise distribution in different types of macular edema [Table 1].

5. Discussion

The main pathogenesis of diabetic retinopathy is endothelial dysfunction, pericyte loss.[6] In OCT, the hyperreflective areas are nerve fiber layer and retinal pigment layer. The medium reflecting layers are the plexiform layer and the nuclear layer. The layer of rods and cones represent the low reflective area. Basic morphological characteristics of macular edema described by Otani et al.,[7] are spongy like retinal thickness, cystoid macular edema, and serous retinal detachment. In diffuse retinal edema, there will be an increased retinal thickness with reduced retinal reflectivity. Cystoid macular edema occurs because of two pathological components abnormal collection of extracellular fluid and cystoid space formation.[8] There will be ovoid low reflective areas, separated by high reflective septae.[9] In one study

Table 1: Distribution of macular edema among various quadrants

Quadrant distribution	Diffuse retinal thickness	Cystoid macular edema	Posterior hyaloid traction	Serous retinal detachment	CME with SRD
ITQ	371.50	437.40	454.00	424.25	432.44
INQ	368.19	432.45	369.00	451.25	441.78
ISQ	376.25	465.25	372.67	434.75	458.89
IIQ	337.88	448.50	392.67	502.75	441.67
OTQ	342.06	363.60	421.00	443.00	335.44
ONQ	316.38	353.35	414.33	386.25	379.44
OSQ	331.44	382.00	373.33	394.00	374.11
OIQ	318.31	355.80	354.67	433.50	369.22

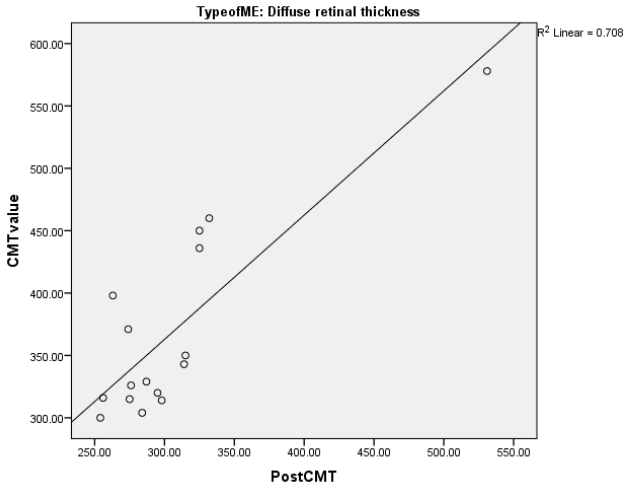

Fig. 1: Correlation of central macular thickness with pre and post injection in diffuse retinal thickness

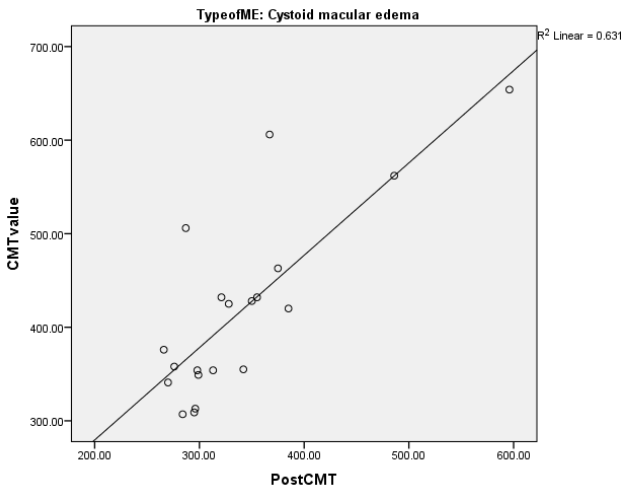

Fig. 2: Correlation of central macular thickness with pre and post injection in cystoid macular edema

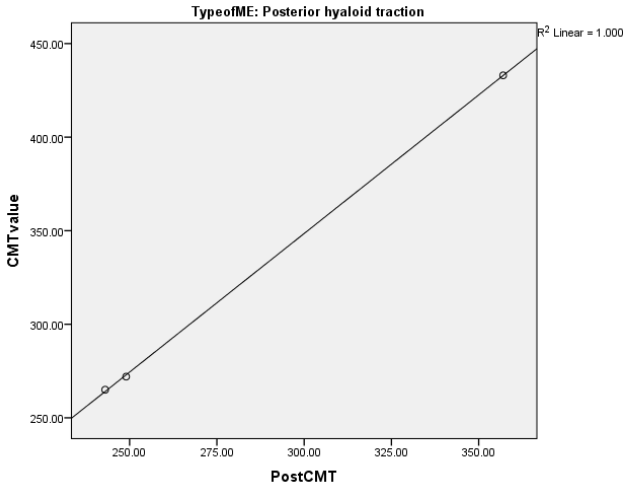

Fig. 3: Correlation of central macular thickness with pre and post injection in posterior hyaloid traction

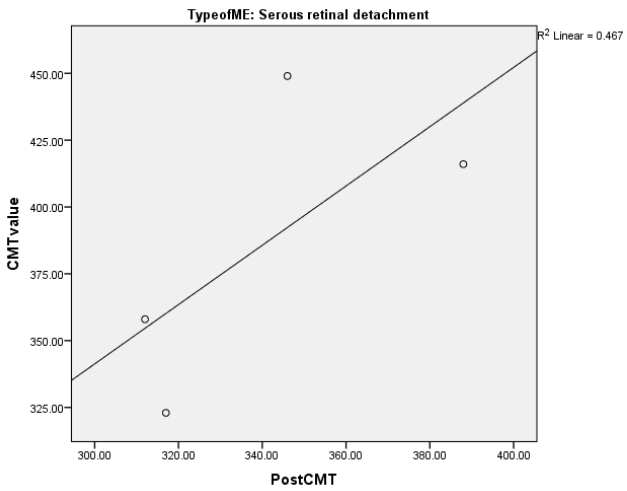

Fig. 4: Correlation of central macular thickness with pre and post injection in serous retinal detachment

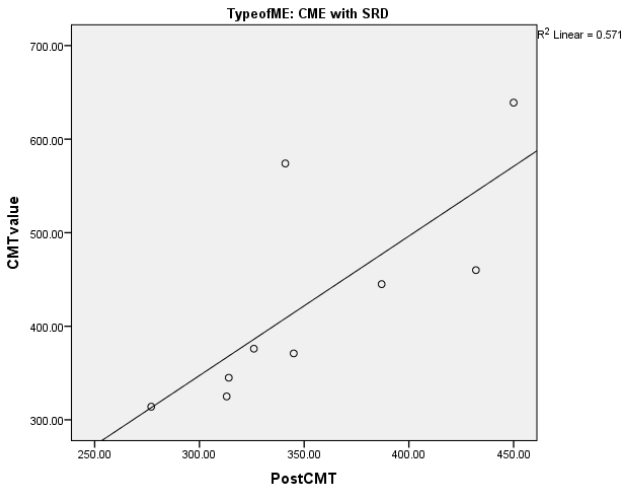

Fig. 5: Correlation of central macular thickness with pre and post injection in cystoid macular edema with serous retinal detachment

by Yamamoto et al., 40% of the OCT detected CME was not detected by slit-lamp biomicroscopy and 63% were not detected by fluorescein angiography.[10] In a study conducted by Vukicevic et al.[11] CME was classified into mild, moderate and severe according to the size of the cysts. The cystoid spaces are mainly located in outer retinal layers in patients with intermediate and severe CME.[12] Posterior hyaloid traction appears as a highly reflective band on the retinal surface. In Subretinal detachment, dark accumulation of SRF under the high reflective and dome-like elevation of a detached retina. The highly reflective band represents the outer surface of the detached retina it differentiates SRF from the intraretinal fluid. In TRD, there will be low signal underlying the highly reflective border of a detached retina.

In our study, the most common OCT pattern of diabetic macular edema was cystoid macular edema (38.5%). There was a significant reduction in macular edema and improvement in visual acuity in diffuse retinal thickness and cystoid macular edema between pre-treatment and post-treatment. There was no significant improvement in visual acuity in pre and post-treatment groups of posterior hyaloid traction and serous retinal detachment. In patients with diabetes mellitus, less than 10 years of there was a statistical improvement in visual acuity between pre and post-treatment.In patients with very severe NPDR, there was no significantimprovement pre and post-injection. It is because of the increased incidence of posterior hyaloid traction in this group. Hyperreflective foci are observed in cystoid spaces with disruption of the blood-retinal barrier. They are the condensed proteins or lipids resulting in the development of hard exudates.[13] The integrity of IS/OS junction and the external limiting membrane is a significant predictor of visual acuity.[14] In our study, Vitreomacular traction accounts for poor visual outcome after intravitreal injection. It is characterized by the partial posterior vitreous detachment which results in traction in the macula at the site of vitreous adhesion. It results in a broad and dumbbell-shaped region involving the macula and optic nerve.[15,16] The effect on the improvement of visual acuity is more for central macular thickness than age, fluorescein leakage, the severity of perifoveal capillary occlusion.[17,18] This study was limited by cross-sectional nature and by the small sample size. Longer follow-up in a larger number of subjects is needed to assess the post-injection visual outcome.

6. Conclusion

OCT is an essential tool for the quantitative assessment of macular edema. Chronic hyperglycemia is the major cause of diabetic macular edema. Hence the early diagnosis of diabetic macular edema using OCT plays a vital role in preventing permanent vision loss in diabetes patients. CME and DRT have a good visual prognosis for anti-VEGF injections than Posterior hyaloid traction and subretinal detachment. Oct plays a vital role in deciding the treatment modality, explaining prognosis to patients and for predicting the visual outcome.

7. Source of Funding

None.

8. Conflict of Interest

None.

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