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STUDY OF DIABETIC RETINOPATHY IN PATIENTS WITH OR WITHOUT CSME USING OCT

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ABSTRACT

Introduction: Diabetic macular edema is the commonest cause of visual loss in patients with non proliferative diabetic retinopathy and a common cause of visual loss in PDR. According to ETDRS[1], early detection and laser treatment of CSME decreases the risk of moderate visual loss by 50%. Thus new techniques for quantitatively and qualitatively measuring retinal thickness have been explored. Recent imaging techniques can provide tomographic or cross sectional images of macula and can yield powerful diagnostic information, which is complimentary to FFA and fundus photo. Optical Coherence Tomography (OCT) is a new medical diagnostic imaging technology which can perform micrometer resolution cross sectional or tomographic imaging of macula.[2,3] While OCT allegantly demonstrates the anatomic effects of retinal edema in qualitative fashion,the great power of this technology resides in its potential for quantitative measures. OCT is established in the diagnosis of various macular disorders including CSME, macular hole, CNVM etc. **Aims and Objectives:** Quantitative assessment of retinal thickness in diabetic retinopathy in patients with or without CSME using OCT. **Materials and Method:** The study was done in Upgraded Department of Ophthalmology, L.L.R.M. Medical College Meerut. All the patients were enrolled from the retina clinic of the department. Study Period was between April 2019 to July 2020.It was a prospective observational study.

Two groups of patients were included in the study.

1. Patients of diabetic retinopathy with retinal thickness with CSME .
2. Patients of diabetic retinopathy with retinal thicknesss without CSME.

In selecting patients of CSME guidelines of ETDRS[2] were followed which defined CSME if one or more of following characteristic is present

- Thickening of retina at or within 500 microns of centre of macula.
- Hard exudates at or within 500 microns of centre of macula.
- A zone or zones of retinal thickening one disc area or larger any part of which is within one disc area of centre of macula.

Patients with uveitis, Trauma, Significant cataract, Glaucoma, Clinical evidence of any retinal disease other than diabetes and patients in whom any ocular treatment has been done, i.e.intravitreal bevacizumab or ranizumab, posterior subtenon injection of triamcinolone & any form of laser therapy were excluded from the study. 30 eyes of patients with diabetes mellitus were included. The study group included both Insulin dependent and non insulin dependent proliferative diabetic retinopathy and nonproliferative diabetic retinopathy patients. We considered macular edema to be clinically significant as defined by the Early Treatment Diabetic Retinopathy Study (ETDRS) protocol.

We classified patients into 5 groups based on slit lamp biomicroscopy findings as
Gr.1a- Focal CSME,
Gr.1b- diffuse CSME
Gr.2-CSME with ERM,
Gr.3- CSME with VMT/thickened posterior hyaloid, Gr.4- CSME with CME.
Gr.5- Retinal thickening without CSME as defined by ETDRS[2.]

Based on OCT findings, we classified CSME into five groups,
Gr.1- macular thickening with only spongy edema,
Gr.2- macular thickening with ERM,
Gr.3- macular thickening with VMT, Gr.4- macular thickening with CME, Gr.5- macular thickening with SRF.
Observations: OCT examination revealed macular thickening with spongy edema in all patients (100%), macular thickening (ME) associated with CME in 46.7%, ME associated with VMT in 10%, ME associated with SRF in 13.3% and ME associated with ERM in 13.3%. On OCT, eyes with spongy edema showed diffuse thickening of macula with small cystic spaces. Eyes with CME showed large cystic spaces in the foveolar and parafoveal region. VMT was seen as hyper-reflective band in the vitreous, which was adherent to the fovea, either centrally or paracentrally. Correlation of biomicroscopic and OCT finding with visual acuity revealed that 30% of eyes had a visual acuity of 6/9 or better, while 70% had vision worse than 6/9. Of those in biomicroscopy group with less vision, only 18% could be attributed to CME & VMT. On comparing clinical examination i.e. slit lamp biomicroscopy with the OCT quantitatively in each group i.e. CSME and non-CSME, macular edema was detected in all patient on OCT in CSME group while in non-CSME group on OCT 13 patients had macular edema on OCT which could not be detected on slit lamp biomicroscopy. **Conclusion:** Thus OCT is a useful technique for quantitative measurement and helps in better anatomical characterization of CSME than biomicroscopy and thereby more relevant while planning management strategies, followup, prognosis and predicting visual income.
We found that OCT is better compared with biomicroscopy to diagnose CME, to detect subretinal fluid with subfoveal detachment and to study the vitreoretinal interface changes like vitreomacular traction & epiretinal membrane which could not be detected on biomicroscopy.
In summary, intraretinal tomographic changes existed in eyes with diabetic macular edema even in the absence of CSME.

KEYWORDS

- EDTR'S
- CSME
- CME □ VMT
- SRF
- IRMA

INTRODUCTION

Diabetic macular edema is the commonest cause of visual loss in patients with non proliferative diabetic retinopathy and a common cause of visual loss in patients of proliferative diabetic retinopathy. According to Early Treatment Diabetic Retinopathy Study (ETDRS)[1], early detection and laser treatment of CSME decreases the risk of moderate visual loss by 50%.

Traditional methods of evaluating macular thickening including slit lamp biomicroscopy and fundus photography are relatively insensitive to small changes in retinal thickness and also unable to detect specific anatomic details especially at vitreomacular interface.

Optical Coherence Tomography (OCT) is a new medical diagnostic imaging technology which can perform micrometer resolution cross sectional or tomographic imaging of macula.[2,3] While OCT allegantly demonstrates the anatomic effects of retinal edema in qualitative fashion, the great power of this technology resides in its potential for quantitative measures.

The operation of OCT is analogous to ultrasound B-mode imaging except that light is used rather than acoustic waves. OCT is a high resolution technique that permits cross sectional visualization of retinal structures in which the time delays of light reflected from different depths within the retina are located by means of low coherence interferometry.[4]
Characteristic pathological Changes.

Classification

It is classified as –

1. Exudative Maculopathy
2. Ischemic Maculopathy
3. Mixed Maculopathy

1. Exudative Maculopathy

It is diagnosed stereoscopically as retinal thickening within 1 disc diameter of the center of the macula using fundus biomicroscopy. To characterize the severity of macular edema and for treatment guidelines, the term clinically significant macular edema (CSME) is used.
Clinically significant macular edema is further classified into focal or diffuse, depending on the leakage pattern seen on the fluorescein angiogram (FA). In focal CSME, discrete points of retinal hyperfluorescence are present on the FA due to focal leakage of microaneurysms. In diffuse DME, areas of diffuse leakage are noted on the FA due to intraretinal leakage from a dilated retinal capillary bed and/or intraretinal microvascular abnormalities (IRMA), and/or (in severe cases) from arterioles and venules without discrete foci of leaking microaneurysms.[5]

2. Ischemic Maculopathy

This is the most severe form of diabetic maculopathy. Clinically, diabetic macular ischemia is detected by fluorescein angiography as a lack of filling of the macular capillaries. It is enlarged in diabetic ischemic maculopathy. The enlargement results from capillary closure. There is an increased risk of macular ischemia with diabetic macular edema, increased stage of diabetic retinopathy, and other factors that likely relate to severity of diabetes, such as age of onset.
Macular non-perfusion has been reported to occur sooner.

3. Mixed Maculopathy[6]
It has characteristics of both exudative & ischemic.

DEFINING THE DISEASE PATTERN: Diabetic Macular Edema Has
Five distinct patterns that can be defined by OCT alone:
1. Sponge like retinal thickness
2. Cystoids macular edema
3. Subfoveal serous retinal detachment
4. Foveal tractional retinal detachment
5. Taut posterior hyaloids membrane

Based on OCT findings, CSME can be classified into five groups,
Gr.1- macular thickening with only spongy edema,
Gr.2- macular thickening with ERM,
Gr.3- macular thickening with VMT,
Gr.4- macular thickening with CME and Gr.5- macular thickening with SRF.

The key benefits of OCT are
2. Live sub-surface images at near-microscopic resolution
3. Instant, direct imaging of tissue morphology
4. No preparation of the sample or subject
5. No ionizing radiation
6. Non invasive
7. Non contact

The following can be documented well
- Retinal thickness map
- Retinal nerve fire layer thickness map
- Retinal pigment epithelium deformation map
- Inner segment /outer segment –RPE deformation map

AIMS AND OBJECTIVE
1. Quantitative assessment of retinal thickness in diabetic retinopathy in patients with or without CSME using OCT.

MATERIAL AND METHODS
The study was done in Upgraded Department of Ophthalmology, L.L.R.M. Medical College Meerut.All the patients were enrolled from the retina clinic.

Study Period: April 2019 to July 2020.

STUDY DESIGN : A prospective observational study.

Inclusion Criteria
1. Patients of diabetic retinopathy with retinal thickness with CSME.
2. Patients of diabetic retinopathy with retinal thicknesss without CSME.

In selecting patients of CSME guidelines of ETDRS[2] were followed which defined CSME if one or more of following characteristic is present
- Thickening of retina at or within 500 microns of centre of macula.
- Hard exudates at or within 500 microns of centre of macula.
- A zone or zones of retinal thickening one disc area or larger any part of which is within one disc area of centre of macula.

Exclusion Criteria
- Uveitis, Trauma, Significant cataract, Glaucoma, Clinical evidence of any retinal disease other than diabetes, Patients in whom any ocular treatment has been done, i.e.intravitreal bevacizumab or ranizumab, posterior subtenon injection of triamcinolone & any form of laser therapy.

Patient Selection: 30 eyes of patients with diabetes mellitus were included. We classified patients into 5 groups based on slit lamp biomicroscopy findings as
Gr.1a- Focal CSME, Gr.1b- diffuse CSME
Gr.2-CSME with ERM,
Gr.3- CSME with VMT/thickened posterior hyaloid, Gr.4- CSME with CME. Gr.5- Retinal thickening without CSME as defined by ETDRS[2.]

Based on OCT findings, we classified CSME into five groups,
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Gr.2- macular thickening with ERM,
Gr.3- macular thickening with VMT, Gr.4- macular thickening with CME, Gr.5- macular thickening with SRF.

OBSERVATION AND RESULTS
Of the total 30 patients, there were 7 patients in 40-49yrs age group (23.3%), 13 in 50-59 yrs age group (43.3%), 9 in 60-69 age group (30%), 1 in 70-79 age group (3.3%) and none above 80 yrs. The mean age of the population studied is 56.17±8.0 yrs.

Table 1: Age distribution of study population.

Age distribution (in yrs)	No of patients
40-49	7
50-59	13
60-69	9
70-79	1

Males predominated the study in both the groups.The male: female ratio was approximately 3:1. Of the 30 patients, 22 had NPDR (73.3%) and 8 had PDR (26.6%).In CSME group 7 patients had non proliferative diabetic retinopathy and 8 patients had proliferative diabetic retinopathy and in non –CSME group all patients were having nonproliferative diabetic retinopathy.

Table 2: Basic characteristic of diabetic eye with or without clinically significant macular edema.

	CSME	Non-CSME	P value
Age(yrs) (mean)	56±9.198	56.33±6.946	0.9116(unpaired t-test)
NPDR/PDR	7/8	15/0	0.0022(Fischer exact test)
CMT with OCT(µm)	418.47±81.144	298.40±19.511	<0.0001(paired ttest)

Table - 3: Comparison of retinal thickness detection between biomicroscopy and OCT.

Retinal thickness	Biomicroscopy	OCT
Present	15 (CSME)	28
Absent	15 (non-CSME)	2

The basic characteristics of the diabetic eyes without and with CSME were shown in Table 3. The mean±SD foveal thickness was 418.47±81.144 µm in eyes with CSME, and 298.40±19.511 µm in eyes without CSME with p value <0.0001 which is extremely significant. Proliferative diabetic retinopathy is more in CSME group which is statistically significant with p value of 0.0022.

Comparison of retinal thickness detection between biomicroscopy and OCT has been shown in Table no 3, retinal thickness seen in 28 patients on OCT while on slit lamp biomicroscopy only 15 patients had retinal thickness which is significant with two sided p value of 0.0004 which is again extremely significant.

OCT examination revealed macular thickening with spongy edema in all patients (100%), macular thickening (ME) associated with CME in 46.7%, ME associated with VMT in 10%, ME associated with SRF in 13.3% and ME associated with ERM in 13.3%. On OCT, eyes with spongy edema showed diffuse thickening of macula with small cystic spaces. Eyes with CME showed large cystic spaces in the foveolar and parafoveal region. VMT was seen as hyper-reflective band in the vitreous, which was adherent to the fovea, either centrally or paracentrally, SRF was seen as a subfoveal detachment on line scans. ERM was identified as a hyper-reflective thickening.

Correlation of biomicroscopic and OCT finding with visual acuity revealed that 30% of eyes had a visual acuity of 6/9 or better, while 70% had vision worse than 6/9. Of those in biomicroscopy group with less vision, only 18% could be attributed to CME & VMT.

No obvious clinical cause for defective vision was detected in the rest 52% eyes with visual loss. In OCT group, 58% could be attributed to CME, VMT, SRF & ERM.

On comparing clinical examination i.e. slit lamp biomicroscopy with the OCT quantitatively in each group i.e. CSME and non-CSME, macular edema was detected in all patient on OCT in CSME group while in non-CSME group on OCT 13 patients had macular edema on OCT which could not be detected on slit lamp biomicroscopy.

Table – 4: Shown below are the results qualitatively obtained.

	Biomicroscopy	OCT
Spongy edema	28	28
Cystoids macular edema	5	14
Epiretinal membrane	1	4
Vitreomacular traction	0	3
Subretinal fluid	0	4

Result: By statistical analysis expected result and observer result proved to be the same.
Inference: Both Biomicroscopy and OCT methods can be adopted.
OCT is found to be better as compared to biomicroscopy.
OCT method can be adopted for SRF.

CONCLUSION

The present study included total of 30 consecutive patients with diabetic retinopathy. Total 30 patients were divided into two groups based on slit lamp biomicroscopy findings 15 Eyes of 15 patients with CSME and 15 Eyes of 15 patients without CSME. In the CSME group all the patients had retinal thickness which was detected on biomicroscopy as well as on OCT. While in non-CSME group out of 15 patients 13 patients were found to have retinal thickness which was not following the criteria of clinically significant macular edema as defined by ETDRS.

Thus OCT is a useful technique for quantitative measurement and helps in better anatomical characterization of CSME than biomicroscopy and thereby more relevant while planning management strategies, followup, prognosis and predicting visual income.

We found that OCT is better compared with biomicroscopy to diagnose CME, to detect subretinal fluid with subfoveal detachment and to study the vitreoretinal interface changes like vitreomacular traction & epiretinal membrane.

In summary, intraretinal tomographic changes existed in eyes with diabetic macular edema even in the absence of CSME. The changes may contribute to the topographic variations in the retinal thickening throughout the macula.

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