Visual Outcome And Surgical Complications After Phacoemulsification In Fuch's Heterochromic Uveitis

Abstract

Aim: To evaluate the visual outcomes and surgical complications of Cataract surgery by phacoemulsification and foldable lens implantation in Fuch's heterochromic Uveitis

Material and Methods: 15 patients who presented to Comtrust Eye Hospital during the period from June 2008 to January 2011 and were diagnosed as Fuch's heterochromic uveitis with complicated cataract were evaluated preoperatively, intraoperatively, and postoperatively. Their visual outcomes were assessed during follow up.

Results

Age ranged from 31 to 49 yrs. 9 were females and 6 were males. All patients showed heterochromia irides. 6 (40%) patients showed blood in Schlemm's canal during gonioscopy. 1 (6.6%) showed Amsler's sign-filiform haemorrhage during gonioscopy. 6 were done under topical anaesthesia and the rest under peribulbar. 2 (13.3%) showed blood in the anterior chamber after peribulbar block before starting the surgery. 3 (20%) showed hyphema immediately after entering the anterior chamber (Amsler's sign). 6 (40%) developed hyphema on the first postoperative day. None had ongoing hyphema. Deposits on the posterior capsule was seen in 4 (26.6%). 6 (40%) were given postoperative short course systemic steroids. Postoperatively a visual acuity of 6/12 and better was achieved in 13 (86.6%).

Conclusion: Phacoemulsification with foldable IOL is the best option for Fuch's. They need close follow up during immediate postoperative period. Topical anaesthesia is a better option for surgery.

Introduction

Ernst Fuchs in 1906 described low grade chronic anterior uveitis occurring in one eye and characterised by heterochromia iridis in individuals between 20 to 40 years with equal sex preponderance. The classic triad of heterochromia, keratic precipitates and cataract was first described by Kimura and is taken as the diagnostic criteria. Iris stromal atrophy and defective posterior epithelial layer leads to the heterochromia and the moth eaten appearance of the iris. Symptoms of iritis are minimal and they often present with defective vision due to the complicated cataract, glaucoma or floaters due to vitreous opacities or are diagnosed during routine examination. Keratic precipitates are classically round or stellate distributed all over cornea. A flattening of anterior iris architecture and moth eaten appearance is classic. Neovascularisation of iris and angle of the anterior chamber over the trabecular meshwork may be seen and these vessels at the angle may bleed when IOP is suddenly reduced during surgery or paracentesis. Amsler and Verrey in 1946 observed filiform haemorrhages in the angle of the anterior chamber, seconds after paracentesis and Verrey has shown that this blood comes from Schlemm's canal.

The trigger for inflammation is not established, though several postulates including infectious—Toxoplasma, Rubella(7), HSV, and recently Chikungunya(4)—, an immune dysfunction, a sympathetic neurogenic factor—all have been put forth.

90% develop cataract which progresses rapidly. The surgical outcome is good except in situations where glaucoma is associated or vitreous opacities are present. Poor pupillary dialatation and rubeosis can produce surgical problems. Small incision, clear corneal section is preferred to avoid vessels at the angle. Slow decompression of the globe reduces risk of haemorrhage from the angle. An acrylic in the bag placement of lens is preferable.

Aim: To evaluate the visual outcomes and surgical complications of Cataract surgery by phacoemulsification and foldable lens implantation in Fuch's heterochromatic Uveitis.

Material and Methods: A prospective study was done in 15 patients who were seen in Comtrust Eye Hospital during the period from June 2008 to January 2011 and were diagnosed as Fuch's heterochromic uveitis with complicated cataract and were referred for surgery. They were evaluated pre-operatively, intraoperatively and postoperatively. All of them had phacoemulsification and 4 were implanted with hydrophobic acrysof IOLs whereas 11 had hydrophilic acrylic...Their visual acuity, intraocular pressure and dialated fundus examination findings were noted. A detailed slit lamp examination was done and gonioscopy with particular attention to the schlemm's canal and any neovascularisation. B-scan was done where there was no fundus view. Blood workup including Mantoux was done in all and Toxo titre was done in 6. The diagnostic criteria were—low grade anterior uveitis, absence of acute exacerbations, diffuse fine keratic precipitates, diffuse iris atrophy with loss of iris...
architecture, and absence of posterior synechiae. Their visual outcome were assessed and followed up for 6 months to 3 years.

**Results:**

**Demography**

There were 9 (60%) females and 6 (40%) males.

The mean age group was 40.6 years ranging from 31 to 49 years. All were unilateral. Defective vision was the main complaint in all the patients and 7 (46.6%) complained of floaters as well. Re was involved in 8 cases and LE in 7. None of the patients had positive Manteaux. 1 patient out of the 6 tested showed a high IgG toxo titre.

The other eye of all patients were normal and had 6/6 vision with correction. Slit lamp examination showed fine, round and stellate keratic precipitates in all the patients, which were scattered all over the cornea and changed pattern during the course of days. There was no aqueous flare in any of the case. Vitreous floaters were seen in the anterior vitreous in 7 cases (46.6%) . 5 (33.3%) cases presented with total white cataract, 8 (53.3%) as posterior subcapsular and 2 (13%) presented as cortical cataract. 6 (40%) patients showed blood in Shleem’s canal, out of which one showed a linear haemorrhage during gonioscopy. No neovascularisation was seen. None of the patients had glaucoma.

All had phacoemulsification with foldable lens. 6 were done under topical anaesthesia and 9 were under peribulbar block. 10 had hydrophilic acrylic lens, 4 had hydrophobic acrylic lens and 1 had bifocal acrylic lens.

One patient showed mid-dilated pupil. Intraoperatively, 2 patients showed hyphema after peribulbar block and massage. 3 patients showed blood coming from the angle of the anterior chamber after paracentesis, ie Amsler Verrey sign was seen in 6 cases altogether (40%) of the cases.

Large vitreous floaters were seen in 8 (53%) patients. 4 patients showed white deposits on the capsule. All these patients had large vitreous opacities as well. Postoperatively, on day one, 3 patients showed mild diffuse hyphema and 3 patients showed a streak of blood clot in the anterior chamber which cleared completely by 4 days. None of the patients who were operated under topical anaesthesia, developed hyphema. 7 (46.6%) patients had VA 6/12 or better on the first postoperative day. None of the patients showed iritis postoperatively. One patient who had hyphema, developed mild corneal oedema postoperatively and had raised IOP was given oral acetazolamide and timolol topically, which cleared after one week and the IOP became normal in 2 weeks. 6 patients who had large vitreous floaters were given a short course of oral steroids postoperatively for 10 days. At 6 weeks postoperatively, 13 ie (86.6%) had VA 6/12 or better and 10 (66.6%) had VA 6/9 or better.
One patient who had VA 6/24 NIG, had macular oedema which was treated with topical NSAID, Bromfinac and one patient with VA 6/18 had large vitreous opacities obscuring vision. 12 patients were followed up for 1 year and 3 had yag capsulotomy after 6 months.

Discussion

All cases of Fuchs’ uveitis who were operated for cataract were unilateral. There was a predominance of females in this study, though many studies( 2,5,10) have shown equal sex prevalence. But Gordana Zlatanovic et al(3) showed a female preponderance. Vitreous floaters and opacities were seen in 7- ie47% cases. Only 1 patient showed visual disturbance postoperatively due to the vitreous opacity. Vitreous opacities have been reported to be a major factor producing visual deterioration after surgery necessitating vitrectomy(9) In our series of patients6-(40%) showed Amsler’s sign. One during gonioscopy, 2 after peribulbar block and 3 after paracentesis. I.S.Begg Sheffield(6) and B.Michael(5) has shown the constant occurrence of Amsler’s sign in these cases though many other studies have not. D. NSherwood(13) reported 100% occurrence of bleeding into the anterior chamber during paracentesis. Iritis was not seen as a significant postoperative finding in this study. Iritis from 15 to 20% has been reported(11). No difference in postoperative complications or visual outcome was found in the different type of lens used. Glaucoma has been found to complicate the condition from 6-30% of cases(1,8,10,12,14) but in our study none of them had glaucoma but for a transient rise in IOP during immediate postoperative period in 1 case which was controlled by medication and recovered after 2 weeks. We had 1 case of macular oedema producing defective vision. Many report as having no incidence of macular oedema(12)

Conclusion

Cataract surgery by phacoemulsification and foldable IOL gives good results in Fuchs heterochromic uveitis. Topical anaesthesia is better to avoid hyphema. Slow decompression during paracentesis is less traumatic to the fragile vessels to prevent hyphema. Close follow up during the postoperative period is necessary to look for ongoing hyphema or glaucoma.

Reference

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After her studies at Calicut Medical Collage and in UK, presently she is working as senior consultant at Comtrust Eye Hospital, Calicut
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Can FFA Be Replaced In The Evaluation Of Central Serous Chorioretinopathy? The Role Of Noninvasive Imaging

**Purpose:** To study the role of noninvasive imaging modalities like autofluorescence imaging and spectral OCT to identify the leakage site in patients with CSCR and study the feasibility of avoiding FFA.

**Methods:** Retrospective analysis of 117 eyes of 99 patients seen between February 2009 and February 2011 with acute CSCR were included. All these patients had undergone autofluorescence imaging (zeiss filter), spectral OCT and FFA imaging. FFA images were superimposed on the autofluorescence images and the site of leak analysed. Similarly the OCT characteristics corresponding to the site of leak was also analysed.

**Results:** Hypoautofluorescence was found in 105 eyes (89.7%) corresponding to the leakage points on FFA. Hypoautofluorescence corresponding to the areas of subretinal fluid accumulation was seen in majority of the eyes. On the OCT, RPE abnormalities in 92 eyes (78.6%) corresponding to the site of leak was seen- 50.4% with PED and 28.2% with a bumpy RPE site. Subretinal fibrin seen as reflective deposits in the subretinal space was seen in 73 eyes (62.4%) and sagging/dipping of the posterior layer of the neurosensory retina above the leakage sites were seen in 42 eyes (35.9%). An RPE defect within the PED and intraretinal fluid was observed in 1 eye (0.9%).

**Conclusion:** Noninvasive imaging tools like AF imaging and spectral OCT can be used as an alternative to FFA to identify the leakage site in acute CSR.

**INTRODUCTION**

Central serous chorioretinopathy (CSCR) is a common cause of visual deficit especially in the younger age group that we see commonly in our day to day practice. Eyes with acute CSCR have focal leakage at the level of the retinal pigment epithelium (RPE) seen on fluorescein angiography. Evaluations using indocyanine green angiography in eyes with CSCR have shown multifocal islands of inner choroidal staining and choroidal vessel hyperfluorescence. It is now believed that these exudative changes within the inner choroid to be the primary event in the disease. The subsequent changes at the RPE allow the fluid to enter the subretinal space, and those changes are thought to be reversible because spontaneous resolution of the subretinal fluid (SRF) is not uncommon. However many patients require laser treatment or photodynamic therapy to help resolution of the SRF early. Until recently fundus fluorescein angiography had been the only available investigation to study the RPE. Angiography is an invasive test with a risk of adverse events even though small. With the advent of non invasive tests like optical coherence tomography and autofluorescence imaging detailed study of the outer retina and RPE is now possible. Morphologic changes in eyes with CSC have been reported using optical coherence tomography (OCT). This imaging technology records the various features of CSCR, including subretinal fluid (SRF), fibrinous exudation, pigment epithelial detachment (PED) and cystic changes within the retina. RPE changes corresponding precisely to the leakage points on FFA have been evaluated on OCT and minute pigment epithelial detachments (PEDs)/RPE protrusions have been observed. Also recent enhanced depth imaging optical coherence tomographic evaluation of the choroids have showed an abnormally thick choroid in eyes of CSCR, even in unaffected fellow eyes, which is consistent with the choroidal vascular hyperpermeability theory.

Autofluorescence photography provides functional images of the fundus by employing the stimulated emission of light from naturally occurring fluorophores, the most significant being lipofuscin. Because accumulation of lipofuscin occurs in retinal pigment epithelial cells because of their unique metabolic role autofluorescence imaging may provide clues to the pathobiology of central serous chorioretinopathy especially with regard to the RPE. Various studies have reported the findings of autofluorescence imaging in eyes with acute and chronic CSCR.

In the current study, we examined the OCT images and fundus autofluorescence images (FAF) from patients with CSCR where FFA was done and tried to correlate the findings corresponding to the sites of leakage.

**MATERIALS AND METHODS**

This study is a retrospective study of 117 eyes of 99 patients diagnosed to have CSCR between February 2009 and February 2011 who have undergone FFA, OCT and Autofluorescence imaging as part of evaluation for the disease. A diagnosis of CSCR was made based on the presence of a serous detachment of the neurosensory retina, focal dye leakage on FA, and the duration of recent subjective symptoms within 3 months. Eyes with recent CSCR with definite ink blot or smoke stack leaks on the angiography were included in
the study. Exclusion criteria included patients with chronic
disease, those with sick RPE disease and in those in whom
autofluorescence imaging was unclear or poor quality. Eyes
with other macular abnormalities such as Age related macular
degeneration (ARMD), polypoidal choroidal vasculopathy
(PCV) and other causes of maculopathy were also excluded
from the study.

All these patients had fundus examination, measurement of
the best-corrected visual acuity (BCVA), and spectral domain
OCT imaging performed at baseline and at every subsequent
visit whenever possible. FFA was done usually at 4 weeks of
poor resolution or earlier in special situations. Poor resolution
was defined as significant persistant fluid as defined by
the surgeon at 4 weeks after the onset of the disease. FFA
was done earlier if the presenting visual acuity was poor,
in patients with recurrent disease and in those who were
not prepared for a conservative waiting period due to their
occupational demands. Indocyanine green angiography was
performed whenever necessary especially in older patients
suspected to have PCV.

OCT was done using the ZEISS cirrhus system on all patients.
Both 5 line raster and 512x200 cube data were taken and
analysed. After obtaining the FFA and identifying the site of
leakage the corresponding site on the OCT SLO fundus image
selected with the tracker and the corresponding OCT image
which comes on display was analysed. This was possible with
the cube data. The higher resolution raster line scans were
also then studied corresponding to these sites.

We performed FAF photography with a modified filter
provided by ZEISS (excitation light with bandwidth of 535–
585 nm and a matched barrier filter having a bandwidth of
605–715 nm). FAF images were enhanced with increasing
contrast and then analysed. The fundus photograph/
angiography were loaded beside the FAF photograph
and the analysis done.

**RESULTS**

117 eyes of 99 patients were part of this analysis. The
mean age of the patients was 34.7 years (range, 29–45). At
presentation the duration of symptoms ranged from 1 to
86 days (mean, 16.0). In 80 patients the disease onset was
for the first time atleast symptomatically, in 19 patients it
was a recurrent disease in the same eye, and 3 patients had
CSCR history in the fellow eye. Out of these 22 patients with
known past history of CSCR, 10 patients had undergone laser
photocoagulation for persistant leakage. The mean BCVA at
baseline was 0.84 (range, 0.2–1.5). 106 eyes had single point
leakage while 11 eyes showed more than 1 point of leakage.
91 eyes had an inkblot leakage pattern, and 26 eyes showed
a smokestack leakage pattern on FFA. FFA of the other eye
also revealed RPE window defects in 43 eyes and leakage
points in 18 eyes many of whom were asymptomatic.

On SD OCT examination, a detachment of the neurosensory
retina was confirmed in all patients. The OCT feature
observed at the site of leak is tabulated in Table 1. An RPE
defect within the PED and intraretinal fluid was observed in
1 eye (0.9%). Thus an RPE abnormality- focal RPE thickening
(Fig 1) or PED (Fig 2) was seen corresponding to the site of
leak was seen in 79% of eyes. In the other eyes there was
evidence of fibrin leading to the site of leak with or without
the corresponding site of the neurosensory layer showing
sagging/ dipping (Fig 3, 4). 7 eyes (5.9%) had no abnormality
detected corresponding to the site of leak on the OCT. Thus
majority of the eyes (100/117- 85.5%) had some abnormality
or the other at the site of leakage on the OCT.

<table>
<thead>
<tr>
<th>OCT Feature</th>
<th>No of eyes (%)</th>
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<tbody>
<tr>
<td>Pigment epithelial detachment (PED)</td>
<td>59 (50.4%)</td>
</tr>
<tr>
<td>Bumpy, irregularity of RPE</td>
<td>33 (28.2%)</td>
</tr>
<tr>
<td>Subretinal fibrin at the site of leak</td>
<td>73 (62.4%)</td>
</tr>
<tr>
<td>Sagging/dipping of posterior neurosensory layer</td>
<td>42 (35.9%)</td>
</tr>
<tr>
<td>No OCT abnormality at the site of leak</td>
<td>7 (5.9%)</td>
</tr>
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**TABLE 1**
Fig 1; OCT showing focal RPE thickening

Fig 2; OCT showing PED at the site of leak

Fig 3; OCT showing fibrin at site of leak

Fig 4; OCT showing sagging of the neurosensory retina at site of leak with fibrin.

Fig 5; FAF showing hypofluorescence (arrow) corresponding to the site of leak on FFA

Fig 6. FAF finding corresponding to the site of leak. Eyes (%)
On the FAF photograph hypoautofluorescence was seen in 105 eyes (89.7%) corresponding to the site of leakage on FFA (Fig;5,6). Granular and confluent areas of hypoautofluorescence were seen in these eyes. The area of detachment revealed hypoautofluorescence on FAF images in 73 eyes (62.4%).

96 of the 100 eyes with OCT features corresponding to the site of leakage also showed hypoautofluorescence on FAF images. All the 92 eyes with RPE abnormalities showed a change in autofluorescence on FAF images. 4 eyes did not have any change in autofluorescence on OCT images but showed evidence of fibrin leading to the site of leak with or without the corresponding site of the neurosensory layer showing sagging/dipping on the OCT. Out of the rest 7 eyes which had normal OCT, 3 eyes also showed hypoautofluorescence on FAF imaging at the site of leakage. The remaining 4 eyes (3.4% of the whole series) showed no change in the OCT or in FAF images corresponding to the site of leak. Thus 113 out of the 117 (96.6%) eyes in this series demonstrated either an abnormality in the OCT or on FAF imaging corresponding to the site of leakage.

**DISCUSSION**

The primary pathology of acute CSCR is thought to begin with disruption of choroidal circulation. The RPE then decompensates and allows exudation from the choroidal vasculature to pass into the subretinal space.1,2,3,4 These hypotheses are based on FFA and indocyanine green angiography findings, and precise morphologic correlations have not been observed. The development of OCT has provided a better understanding of the mechanism in CSCR, especially the abnormalities in RPE layer.5,6 Reports on 3D OCT images have revealed certain specific RPE abnormalities corresponding to the leakage points on FA.7 These RPE abnormalities were within areas of choroidal vascular hyperpermeability.10

In our study 50% eyes had PED’s, 28.% eyes had irregularity of the RPE, 62.% eyes revealed increased reflectivity corresponding to subretinal fibrin at the site, 36 % eyes showed sagging/dipping of the posterior surface of the neurosensory layer corresponding to the site of leakage on FFA. Similar findings have been reported by other authors. Fujimoto et al11 had reported that among 23 leakage sites in 21 eyes, FD OCT showed RPE abnormalities - 61% with PED and 35% with a protruding or irregular RPE layer. Fibrinous exudates in the subretinal space and sagging/dipping of the posterior layer of the neurosensory retina above the leakage sites were seen in 52% and 43% respectively. Hirami et al10 reported that of the 20 eyes studied, a leaking point was located within PEDs in 25% and was consistent with the bulge of RPE in 45%. 91% of eyes with PED showed PED within the areas of choroidal vascular hyperpermeability on ICG. 89% of eyes with a bulge of RPE showed the bulge within areas of choroidal vascular hyperpermeability on ICG. Hussain et al12 reported that 60% of eyes in their series showed a characteristic dipping pattern of neurosensory retina with intervening hyper-reflective echoes suggestive of fibrin over the leakage site. All these eyes had ink-blot leak on FFA. Shukla et al13 had also reported that presence of subretinal reflective fibrin on the OCT could alter the angiographic pattern of leakage often presenting with atypical leakage patterns.

Even though gross RPE abnormalities corresponding to the site of leakage as discussed above may be seen, the initial point of leakage on FA is smaller than a PED or RPE protrusion as seen on OCT. Therefore, there might be a defect in the RPE layer that allows passage of fluid from the sub-RPE to the subretinal area. The newer generation SD/FD OCT is superior to conventional OCT in picking up these defects. Fujimoto et al11 observed RPE abnormalities in 95% of eyes with acute CSC and clearly visualized a minute defect of the RPE within the PED, which seemed to correspond precisely to the leakage point on FA in 24% eyes. In our study an RPE defect within the PED and intraretinal fluid was observed only in 1 eye (0.9%). Gupta et al14 also had reported that 54.5% of eyes in their series showed PED’s with a disruption/breach in the RPE on transverse C-scan and on OCT fit C-scan and called them microrips of PED all of which showed spontaneous closure with resolution of subretinal fluid.

The absence of RPE at the leakage point is supported by recent findings of fundus autofluorescence. In acute CSC, focal areas of hypoautofluorescence corresponding to the site of the focal RPE leak were observed, and it is speculated that the origin of the hypoautofluorescence may be blowout of the RPE at or near the junction of the attached and detached RPE.15 However, not all eyes with CSC had hypoautofluorescence at the leakage site.16 In acute CSC, decreased AF is presumably due to a blockage caused by oedema, whereas in chronic-recurrent forms, irregular and increased AF is observed, possibly reflecting reactive RPE changes secondary to RPE defects and neurosensory detachment. FAF might be an interesting non-invasive tool for monitoring RPE changes in CSCR and for performing differential diagnosis.17

In our study hypoautofluorescence at the site of angiographic leakage was seen in 90% eyes and hypoautofluorescence corresponding to the subretinal fluid in 62%. Eandi et al15 had reported that all nine eyes in their series demonstrated hypo-autofluorescence corresponding precisely to the site of the focal RPE leak seen on FA. Framme et al17 had observed that in 36 patients with acute CSCR (<6 wks) a significantly decreased AF at the leakage
point was seen in 72% and decreased AF in the area of neurosensory detachment was seen in 77%. In chronic-recurrent CSC as determined by a decrease in VA for longer than 6 weeks and mottled hyperfluorescent appearance in angiography, decreased or mottled AF was observed at the leakage point itself in 76%, whereas significantly increased AF was seen in the area of residual neurosensory retinal detachment in 85%. Dinc et al. had reported that hypoautofluorescence was found in 80% and 88% of eyes in the acute and chronic CSCR groups respectively, corresponding to the leakage points depicted by fluorescein angiography. Hypoautofluorescence corresponding to the areas of subretinal fluid accumulation was seen in 92% and 82% of the acute and chronic CSCR groups respectively. In 12% eyes with chronic CSR, hyperautofluorescent changes were noted at the previous leakage points. Ayata et al. reported that focally decreased AF at the leakage site was seen in 77% eyes in SW-AF and 100% eyes in NIR-AF imaging in eyes with acute CSC.

Spaide et al. had reported that autofluorescence imaging of the posterior pole showed several interrelated findings that were predictive of visual acuity. He classified hypoautofluorescence, a finding indicative of RPE atrophy into 2 types- granular and confluent types. Confluent hypoautofluorescence showed a slightly stronger correlation with visual acuity than did granular hypoautofluorescence, implying that any loss of the RPE centrally is an important factor correlated with visual acuity. However, hyperautofluorescence, which has been suggested to be the result of accumulations of unphagocyted photoreceptor outer segments did not seem to affect visual acuity. Imamura et al. studied the pattern and frequency of FAF abnormalities and their correlations with corrected visual acuity and found that confluent hypoautofluorescence of the macula, granular hypoautofluorescence of the macula, and increasing age all were independent predictors of decreased visual acuity.

113 out of the 117 (97%) eyes in this series demonstrated either an abnormality in the OCT or on FAF imaging corresponding to the site of leakage. However as the remaining 4 eyes (3%) of the eyes did not have any OCT or FAF characteristic corresponding to the site of leak on FFA, these noninvasive tests could miss the site of leak in some eyes. CSCR being a relatively benign disease with a fairly good spontaneous resolution missing the site of leakage in these small percentage of eyes will not do any harm to these patients. Hence these noninvasive modalities may help in detecting the site of leak in majority of the eyes and can therefore replace FFA. Another consideration to be kept in mind is the fact that FFA can detect the pinpoint site of leak origin while the above noninvasive tests may not be able to pinpoint the site of leak at least in some cases. Though traditionally it is these point of leakages that is treated with laser photocoagulation, it is now believed that treating areas of choroidal hyperpermeability on ICG (which are larger areas) is a better way to treat these pathologies. Also many of these eyes may have similar OCT characteristics in areas other than the site of active leak like the presence of PED or irregularity of the RPE etc. FAF images may be more consistent in this situation but again in FAF interpretation the images analysed were modified manually by increasing the contrast in our study which could alter sometimes the actual autofluorescence obtained and affect the resolution. FAF images with the Hiedelberg system may have better resolution than the Zeiss filters and may overcome some of the above problems mentioned. Correlating the leaking points to the OCT and FAF images again may not be a point to point representation in the manual method that we have adopted. Such point to point representation and correlation is possible with the Hiedelberg system where all these images namely FFA, OCT and FAF images can be compared and analysed simultaneously in the same screen. In spite of these possible drawbacks this study has demonstrated a correlation between OCT and FAF findings with FFA leakage in eyes with CSC and explored the feasibility of replacing an invasive procedure like FFA with noninvasive investigations like OCT and FAF.

REFERENCES

Dr. MANOJ S is currently head of Vitreoretinal services at Chaithanya Eye Hospital and Research Institute, Trivandrum. He completed his MBBS from JIPMER. He then completed his DNB-Ophthalmology from Aravind Eye Hospital, Madurai (2000) and later completed Vitreoretinal fellowship in the same institute (2002) and was awarded FRCS(Glasgow) in 2002.
Evaluation Of Optical Coherence Tomography Patterns In Diabetic Macular Oedema

ABSTRACT

Purpose
To identify, categorize and analyze the Optical coherence tomography patterns of Diabetic Macular Edema

Methods
In this observational study, 43 eyes of 25 patients with Diabetic Macular Edema (DME) were evaluated. DME is defined as the retinal thickening due to fluid leakage and pooling in the macular area. Macular oedema due to other ocular illness was excluded. All patients underwent visual acuity estimation by Snellen’s visual acuity chart, dilated slit lamp Biomicroscopic examination, Fundus Fluorescein Angiography (FFA) and Optical Coherence Tomography (OCT) by the same examiner. OCT patterns were categorized under 7 headings. Central foveal thickness was also measured by OCT and macular oedema classified into mild (201µm-300µm), moderate (301µm-400µm) and severe (≥400µm).

Results
Of the total 25 patients in the age group 35-75 years (Mean age 54.08), males predominated in this study (Males-75%, Females-25%). OCT examination revealed that, 30% had Cystoid macular edema and 26% had Sponge-like retinal thickness. Mixed cystoid and spongiform pattern was observed in 28%, Epiretinal membrane (ERM) in 9%, Plaque of hard exudates in 7%, Serous retinal detachment in 9%, and Vitreo-macular traction in 5%. 32% were with mild macular edema, 21% moderate and 35% severe forms.

Conclusion
Cystoid macular oedema was the predominant form of DME according to this study. Both eyes of a same patient can present with different DME patterns. Subfoveal serous detachment was always seen along with cystoid macular oedema. Spongiform thickening and sub-foveal serous detachment show better responsiveness to laser treatment.

INTRODUCTION
Diabetic Macular Oedema (DME), a microvascular complication which is caused by the breakdown of the blood-retinal barrier, promotes neuroglial dysfunction and concomitant visual disturbance.1 It is the commonest cause of visual loss in patients with non-proliferative diabetic retinopathy and a common cause of visual loss in proliferative diabetic retinopathy.

Diabetic macular oedema is diagnosed stereoscopically as retinal thickening in the macula using slit lamp biomicroscopy. The ETDRS defined DME as retinal thickening or presence of hard exudates within 1 DD of the centre of the macula. To characterize the severity of macular oedema, and for treatment guidelines the term Clinically Significant Macular Oedema (CSME) is used. Macular oedema is clinically significant, if one of the following conditions is present: 1. Retinal thickening at or within 500µ of the centre of the macula 2. Hard exudates at or within 500µ of the centre of the macula if associated with thickening of retina 3. A zone or zones of retinal thickening one disc area or larger, any part of which is within one disc diameter of the centre of the macula.

Diabetic macular oedema tends to be a chronic disease. Although spontaneous recovery is not uncommon, 24% of eyes with CSME and 33% of eyes with centre involving CSME will have a moderate visual loss (15 or more letters on the ETDRS chart) within 3 years if untreated.

The incidence of DME over a 10-year period was 20.1% among patients diagnosed before age 30 years (younger onset ) and 39.3% among patients diagnosed after 30 years.4 As the severity of overall retinopathy increases, the proportion of eyes with macular edema also increases. 3% in eyes with mild non-proliferative diabetic retinopathy (NPDR), 38% with moderate-severe NPDR and 71% with proliferative diabetic retinopathy (PDR) develop DME.

Optical coherence tomography (OCT) is a fast and non-invasive tool for examining the retina in cross sectional images that correlate reasonably with the retinal histology. It is not only helpful in detecting DME early, but has the added advantage of being able to reveal not only the presence of cystoid macular oedema, but subfoveal serous retinal detachment, vitreo-macular traction or an Epiretinal membrane which cannot be detected in FFA. Moreover, the macular thickness map gives us a very accurate idea of central retinal thickness and can quantify the degree of improvement or worsening following therapy.

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AIM OF STUDY
The aim of the study was to identify, categorize, and analyze the OCT patterns of Diabetic Macular Oedema.

MATERIAL AND METHODS
This was an observational study done between October 2010 and March 2011 in patients who attended the retina clinic of Govt. Medical College, Thrissur. 43 eyes of 25 patients with Diabetic Macular Oedema were evaluated. The study group included both insulin dependent and non-insulin dependent proliferative diabetic retinopathy and non-proliferative diabetic retinopathy between the ages of 35-75 years. The study population had varied glycemic levels and HbA1c evaluation was not done.

None of these patients in our study had undergone previous focal laser or pan-retinal photocoagulation. Other exclusion criteria were dense cataract, macular oedema owing to other ocular illness and advanced diabetic retinopathy.

Some of the patients had associated other systemic illness like hypertension, nephropathy and hyperlipidemia and were on treatment.

All these patients underwent visual acuity estimation by Snellen’s visual acuity chart, and dilated slit lamp biomicroscopic examination. Fundus photographs were taken and FFA and spectral OCT done for them on the same day, by the same examiner. OCT was done in all eyes, a line scan program was chosen and the image processed and analyzed. Based on the OCT findings, we classified DME into 7 groups. 1. Macular thickening with Cystoid features 2. Macular thickening with Spongy oedema 3. Macular thickening with Mixed Spongy and Cystoid features 4. Macular thickening with Epiretinal membrane 5. Macular thickening with Plaque of hard exudates 6. Macular thickening with Serous Retinal detachment and 7. Macular thickening with Vitreo-Macular traction.

Central macular thickness was measured in line scan in all possible cases and thickness mapping done. Macular oedema was categorized into mild (with a thickness of 201-300µ), moderate (301-400µ) and severe (≥400µ).

RESULTS
Of the 25 patients we analyzed, there were 3 patients in the age group 30-39 years (12%), 2 (8%) in 40-49 yrs age group, 11 (44%) in 50-59 years age group, 8 (32%) in 60-69 age groups and 1 (4%) in 70-79 age group. Males predominated with M: F of 2.6:1. 67.3 % had NPDR and 32.7%PDR. Mean diabetic age was 14.08 years.

Biomicroscopically all these patients had Diabetic macular edema, 11% with DME associated with cystoids macular oedema (CME), and 2% had DME with vitreous-macular traction (VMT). No patients had Epiretinal membrane (ERM) or Serous Macular Detachment with SubRetinal Fluid (SRF) clinically. In OCT, eyes with spongy edema showed diffuse thickening of macula. It mostly involves the outer retinal layers, while the internal layers maintain their normal reflectivity. Cross sectional scans show swelling of the retina giving it a spongy appearance with increase retinal thickness.
Eyes with CME showed large cystic spaces in the foveolar and parafoveal region. It involves various depth of retina and has intervening septa in between.

Serous macular detachment is seen as a hypo reflective area between neurosensory retina and RPE.

Vitreo-macular traction was seen as hyper-reflective band in the vitreous, which was adherent to the fovea, either centrally or paracentrally causing traction and pulling up the macula.

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### Table 1: OCT types in DME

<table>
<thead>
<tr>
<th>Type of DME</th>
<th>% manifestation</th>
</tr>
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<tbody>
<tr>
<td>Spongy</td>
<td>26</td>
</tr>
<tr>
<td>Cystoid</td>
<td>30</td>
</tr>
<tr>
<td>Mixed</td>
<td>28</td>
</tr>
<tr>
<td>ERM</td>
<td>9</td>
</tr>
<tr>
<td>SRF</td>
<td>9</td>
</tr>
<tr>
<td>VMT</td>
<td>5</td>
</tr>
<tr>
<td>Plaques of hard exudates</td>
<td>7</td>
</tr>
</tbody>
</table>

### Table 2: Comparison of DME characteristics identified by biomicroscopy and OCT

<table>
<thead>
<tr>
<th>Type of DME</th>
<th>Biomicroscopy</th>
<th>OCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CME</td>
<td>11%</td>
<td>30%</td>
</tr>
<tr>
<td>SRF</td>
<td>nil</td>
<td>9%</td>
</tr>
<tr>
<td>VMT</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>ERM</td>
<td>nil</td>
<td>9%</td>
</tr>
</tbody>
</table>

ERM was identified as a hyper reflective thickening at the level of ILM, causing distortion and flattening of the foveal surface.
Hard exudates are seen as hyper reflective intraretinal plaque which cast a black shadow due to blocking of the light.

According to OCT picture, 26% of our study group had macular thickening with Spongy oedema, 30% with Cystoid changes, 28% with Mixture of spongy and cystoid oedema, 9% with ERM, 9% with Serous retinal detachment with Subretinal fluid, 5% with Vitreo-macular traction and 7% with Plaques of hard exudates.

Measurement of macular thickness revealed, 33% of eyes with mild macular oedema, 21% moderate oedema and 35% with severe diabetic macular oedema.

DISCUSSION

Optical Coherence Tomography is a fast and non invasive tool for examining the retina in cross sectional images that correlates reasonably with the retinal histology. Till recently slit lamp biomicroscopy and FFA were the tools for the diagnosis and management of DME. It is true that they are highly sensitive for the qualitative detection of DME. OCT enables us to detect and understand the accurate subclinical retinal changes associated with DME that may not be detectable even in FFA. Yang et al have suggested that OCT may be more sensitive than clinical examination in assessing DME and is a better tool for documenting changes in macular thickening. In his series, OCT identified spongy retinal thickness was seen in 58% of eyes. Otani et al found spongy retinal thickness in 88%, CME in 47%, SRF in 15% of eyes with CSME. Kim et al found spongy retinal swelling in 97%, CME in 55%, SRF in 7%, VMT in 13% of eyes with DME. Ozdek et al had reported spongy swelling in 66%, CME in 16%, SRF in 10% of eyes with DME. In our series, cystoid macular was the common form of presentation. Our study revealed that 26% had macular thickening with spongy edema, 30% with cystoid changes, 28% with mixture of spongy and cystoid edema, 9% ERM, 9% with serous retinal detachment, 5% with vitreo-macular traction and 12% with plaques of hard exudates. The higher incidence of cystoid form of macular edema in our series could be due the fact that the section of diabetic population presenting to our retina clinic is with longer diabetic age and thus their diabetic macular edema a long standing one. CME type represents a chronologically later stage of DME. Further this was a smaller group and thus the fact require confirmation by further study and follow up involving larger number of diabetic macular edema population.

In our study, 30% of the eyes had CME on OCT, compared to 11% detected by biomicroscopy. Ozdek et al also found that 40% of CME detected on OCT were not detected by biomicroscopy and 63% were not detected even by FFA. Thus OCT tends to be a better diagnostic tool in detecting CME than biomicroscopy or FFA.

In our study, 9% of eyes had SRF with subfoveal retinal detachment, which could not be detected by biomicroscopy. Most series have found SRF in 8-12% of eyes with DME.

According to our study, 5% had VMT as per OCT and 2% in biomicroscopy. VMT has been reported by various authors.
between 10-60% of eyes with DME.

Another important finding of our study was both eyes of a same patient can present with different DME patterns

Spongiform thickening and sub foveal serous detachment which may be chronologically earlier than the CME type are the ones which show better responsiveness to conventional laser treatment. The newer modalities like intravitreal triamcinalone, posterior subtenon’s injection of triamcinalone, intravitreal anti-vascular endothelial growth factor are the other options to the laser resistant cases of DME. VMT and ERM require surgical intervention.

CONCLUSION
Diabetic macular edema is a major cause of visual disability in diabetic patients. DME may be more easily and accurately diagnosed in an early stage with OCT compared to clinical methods and other diagnostic modalities. Being non-invasive, its acceptance as a follow up imaging modality to monitor the course of DME and response to therapy is high. It helps to selectively identify cases like VMT and ERM which needs surgical intervention.

REFERENCES
1. Murkami et al. CME, FAZ and MAs in Diabetic Macular Edema. Ophthalmology 2011;118;359-66
2. Early Treatment Diabetic Retinopathy Study Research group; Treatment techniques and guidelines for photocoagulation of Diabetic macular Edema: ETDRS Report 2. ophthalmology 1987; 94(7): 761-774

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