Correlation of visual acuity with retinal thickness and submacular choroidal thickness in patients of central serous chorioretinopathy

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Abstract

Background Central Serous Chorioretinopathy is a self-limiting condition of middle aged males. The course of the disease is varies from spontaneous resolution within 2-3 months to chronic and recurrent forms. Recently increased choroidal thickness has been identified in cases of CSCR using Enhanced depth imaging Optical coherence tomography technology.

Purpose to study correlation of visual acuity at 1 month with baseline retinal and submacular choroidal thickness in patients with CSCR using EDI-OCT.

Method This was a prospective pilot study of 11 consecutive cases of CSCR that presented to our retina services over a period of 6 months (March 2019 to August 2019). FFA and Enhanced depth imaging (EDI) OCT was done in all cases and the choroidal thickness was assessed manually using EDI Fast macula scans. All patients were kept under observation and no treatment was given. At 4 weeks follow up repeat OCT scans were done and correlated with the final visual acuity at 1 month follow-up.

Results At initial visit, the mean retinal thickness was 388.7 ± 97.7µm (mean ± SD) and mean height of serous retinal detachment was 173.0 ± 99.6 µm (mean ± SD). The mean choroidal thickness showed Haller’s layer thickness of 479±101.4 µm (range 314-580) and Sattler’s layer thickness of 121.3 ± 33.6 µm (range 54-170). At 4 weeks follow up, the retinal thickness decreased to 321.7±88.9 µm (Mean±SD) and height of serous retinal detachment to 114.7±106.9 µm (Mean±SD). The thickness of the Haller’s layer was 384.5 ± 76.0 µm (Mean±SD) (Range 280-511) and Sattler’s layer was 104.36 ± 18.4 µm (Mean±SD) (Range 60-119). At the first visit the logMAR visual acuity was 0.5 ± 0.5 and at the last visit, visual acuity improved to 0.3 ± 0.3 (mean ± SD). The serous retinal detachment (SRD) height and choroidal thickness showed a marked decrease after 1 month in 9 eyes (81.8%), with complete resolution of SRD in 3 eyes (27%). The study shows a positive but weak correlation of retinal thickness, choroidal thickness and SRD height with visual acuity at 1 month.

Conclusion: Acute CSCR undergoes significant and spontaneous improvement in 81% of the cases at 1 month with complete resolution of 27% cases. The height of SRD in CSCR significantly correlates with the final visual outcome. A larger study with more number of patients and longer follow up will give us long term results in this condition.

Keywords: Visual acuity, retinal thickness, choroidal thickness.

Introduction

Central serous chorioretinopathy (CSCR) is characterized by serous detachment of the neurosensory retina associated with focal or multifocal areas of leakage at retinal pigment epithelium (RPE). As the name suggests the changes in inner choroid and retina represent the primary and secondary abnormality of this disorder respectively. The increased hydrostatic pressure of choroid, causes detachment of the neurosensory layer from the pigment epithelial layer and accumulation of fluid between the two. Central vision is affected early due to macular involvement and is one of the prognostic factor for CSCR. Although known to be idiopathic, there are several risk factors associated with its causation which include glucocorticoid use, smoking, type A personality, disorders associated with increased endogenous steroids like stress, emotional distress, pregnancy, Cushing’s syndrome, systemic hypertension, systemic lupus erythematosus, poor quality of life, psychological problems, and a history of psychiatric illness.

CSCR can occur in both acute and chronic forms; the former is usually self-limiting with simple
observation being the standard management in most cases. The duration in the latter has varied in different studies from persistence of fluid for 3 months, to at least 6 months. However, recurrences within 1 year are commonly seen in approximately 30%-50% of patients.

The diagnosis of CSCR is confirmed by Fundus Fluorescein Angiography (FFA). Although several studies have described the angiographic characteristics of acute CSCR in the Western population, data in Asians is limited. Recently OCT has emerged as a newer diagnostic tool for evaluating CSCR under the spectrum of Pachychoroid disorders. The altered morphology in the form of abnormally thickened choroid (>395 µm) with vascular dilatation (pachyvessels in the Hallers and Sattlers layer), hyperpermeability and alteration of chorio capillaries (inner choroidal layer) can be assessed by the Enhanced Depth Imaging in OCT. OCT thus has become an important tool in assessing the choroidal thickness in CSCR both during diagnosis and subsequent follow up. As the disease is known to affect Type A personality people, OCT prognosticators could help in patient counseling to a great extent.

There have been no studies evaluating the correlation between thickness of choroid and visual outcome in CSCR especially among Indian patients even though CSCR is known to resolve completely with a good visual outcome in the majority. However in some, sequelae are known to occur as a result of which visual gain may not be complete. With this background in mind, we measured the retinal thickness and submacular choroidal thickness with help of OCT and correlated it with visual outcome in patients of CSCR.

**Methods**

A hospital based, prospective, observational study was carried out among outpatients visiting the retina clinic of a teaching and referral tertiary centre. A total of 11 consecutive cases of CSCR were enrolled between March 2019 to August 2019. A written, informed consent was obtained prior to enrollment. The diagnosis of CSCR was made if the patient showed a neurosensory detachment of retina on OCT which was further confirmed by FFA. In order to avoid confounding effects of other causes of decreased vision, patients with advanced cataract, macular pathologies, history or evidence of any ocular disease such as uveitis, glaucoma, amblyopia, strabismus or retinopathies of any type were excluded.

The study included 11 eyes of 10 patients (3 females, 7 males) with the age ranging from 27-59 years (Mean 38.6±11.2SD). A detailed history was taken from all patients especially for the use of steroids in any form. A trained blinded optometrist recorded logMAR visual acuity using Snellen acuity chart at a distance of 4 meters (S). All patients were subjected to a detailed slit lamp biomicroscopic examination. A thorough dilated fundus examination using slit-lamp biomicroscopy with +90 D lens was done by a trained Ophthalmologist (SN). All patients were subjected to color fundus photography (VisuCam 524), High-Definition (HD) macular cube 512×128 scanning using Cirrus HD-OCT 500 (Carl Zeiss Meditec, Inc., 5160 Hacienda Drive, Dublin, CA 94568 USA) (RN) and EDI scan using Zeiss Cirrus HD-OCT 500. FFA was done in all the patients using 10% sodium fluorescein dye. The leakage points and types of leakage pattern seen on FFA were recorded in all. Measurement of SRF height (distance from RPE to photoreceptors) and sub-macular choroidal thickness (distance from inner scleral boundary to RPE) were performed for each patient using the caliper function. Data analysis was done using a two-tailed paired t test to calculate statistical significance of logMAR visual acuity, retinal thickness, choroidal thickness and serous thickness at first visit and 4 weeks. A P value of less than .05 was considered to be statistically significant. The correlation between visual acuity and retinal and choroidal thickness was studied using Pearson correlation coefficient.

**Results**

All patients were kept under observation and no treatment was given. The mean± SD age of the study subjects was 38.6±11.2 (Range, 27-59) years. There were 7 males (70%) and 3 females (30%). Of the 11 eyes, at 4 weeks follow up, CSCR persisted in 2 (18.2%), decreased by >10% of SRD in 6 (54.5%) and completely resolved in 3 eyes (27.3%). Bilateral CSCR was present in 1 patient and the rest had...
unilateral disease.

The mean ± SD logMAR visual acuity at baseline was 0.5 ± 0.5. The mean ± SD retinal thickness at initial visit was 388.7 ± 97.7 µm and the height of serous retinal detachment was 173.0 ± 99.6 µm. The mean ± SD choroidal thickness during initial visit showed Haller's layer thickness of 479±101.4 (range 314-580) and Sattler's layer thickness of 121.3 ± 33.6 (range 54-170).

The logMAR VA noted at 4 weeks of follow up 0.0-1.04 (Mean 0.3 ± 0.3SD). It had improved in 8 eyes (72.7%), decreased in 1 eye (9.1%) and remained same in 2 eyes (18.2%). This difference was statistically significant (P=0.05). The mean±SD retinal and SRD height at 4 weeks was 321.7±88.9 µm and 114.7±106.9 µm respectively. This too was statistically significant (p=0.05). The mean ± SD choroidal thickness during initial visit showed Haller's layer thickness of 479±101.4 (range 314-580) and Sattler's layer thickness of 121.3 ± 33.6 (range 54-170).

Although retinal and choroidal thickness decreased after 1 month, it did not reach normal levels.

We found a positive but weak correlation between final visual acuity and retinal thickness, choroidal thickness and SRD at baseline.

<table>
<thead>
<tr>
<th></th>
<th>AT DIAGNOSIS (MEAN ± SD)</th>
<th>AT 4 WEEKS FOLLOW UP (MEAN ± SD)</th>
<th>CORRELATION COEFFICIENT (BASELINE PARAMETERS WITH FINAL VA)</th>
</tr>
</thead>
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<tr>
<td>Visual acuity (Log MAR)</td>
<td>0.5 ± 0.5</td>
<td>0.3 ± 0.3</td>
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<tr>
<td>Total Retinal thickness</td>
<td>388.7±97.7</td>
<td>321.7 ± 88.9</td>
<td>a b 0.017</td>
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<tr>
<td>Serous thickness</td>
<td>173.0 ± 99.6</td>
<td>114.7 ± 106.9</td>
<td>a c 0.10</td>
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<td>Haller's layer</td>
<td>479±101.4</td>
<td>384.5±76.0*</td>
<td>1.04 &lt; 0.05</td>
</tr>
<tr>
<td>Sattler's layer</td>
<td>121.3±33.6</td>
<td>104.5±18.2*</td>
<td>1.04 &lt; 0.05</td>
</tr>
</tbody>
</table>

* P value <0.05

OCT at first visit (Figure 1) and 4 weeks (Figure 2) showing resolution of SRF and reduced retinal and choroidal thickness and subretinal detachment height.

The visual acuity of the patient was 0.0 LogMAR.

Discussion

CSCR is a relatively common condition and usually affects healthy middle-aged males between 20 and 50 years. Sex ratio (male: female) in our study was 8:3. 9 out of 10 cases had unilateral disease (81.8%). In our prospective study we found that CSCR in most eyes was self limiting and resolved at 4 weeks follow up. Our findings also revealed significantly decreased retinal and choroidal thickness in all the eyes from diagnosis to 4 weeks follow up. Furthermore, there was a commensurate and significant improvement in visual acuity in about three fourths of the eyes.

The findings compare favorably with that reported in literature, where a large majority of patients with acute classic CSC resolve spontaneously and experience complete restoration of vision. The visual acuity in our patients had spontaneously improved in 72.7% within 4 weeks and was logMAR 0.0 in 27% patients. This is much higher than previously reported wherein 40% of patients had improved to 6/6, 30% to 6/9 and 10% to 6/12.
We observed a positive correlation between visual acuity and the serous detachment height and retinal thickness as measured by OCT. These findings imply that inflammation and fluid accumulation between neurosensory and retinal pigment epithelium layers in CSCR possibly decreases with time. However some patients may experience permanent visual deficits in the form of decreased visual acuity, contrast sensitivity or color vision or distortion of central vision in the affected eye. Some of the postulated reasons for failure to regain complete vision are photoreceptor damage due to neurosensory detachment, atrophy, RPE pigmentary abnormalities or subretinal fibrosis. CSCR induced retinal serous detachment, central scotoma, metamorphopsia, dyschromatopsia, and decreased visual size and visual contrast sensitivity are well reported visual abnormalities. The follow up period over which these visual abnormalities were reported ranged from 3 months to 14 years. In our study, one patient with bilateral disease showed a deterioration in logMAR visual acuity over 4 weeks due to increase in height of SRD. History of steroid intake or any other medical event was unremarkable.

In another study evaluating the role of eplerenone in chronic CSCR and subretinal fluid, 14 eyes were monitored for a period of 3 months wherein visual acuity and choroidal thickness were measured. The findings of this study at 1 month follow up showed concordance with our OCT findings; 10 eyes had decreased subfoveal fluid height as measured on OCT, 2 eyes showed complete resolution of subretinal fluid with mean CT reduced (p=0.07). However the finding of a corresponding improvement in mean VA was different from ours. More eyes showed improvement at 3 months follow up: 13 eyes had reduced subfoveal fluid height and 9 eyes showed complete resolution with improvement in mean VA suggesting that with longer time the sub-retinal fluid gets further resorbed.

OCT plays an important role in the diagnosis and monitoring the evolution of CSCR. It not only helps in observing the retinal neuroepithelial layer morphology and the changes of RPE, but also in tracking the subretinal fluid changes. Most studies on CSCR have used OCT.

**Conclusion**

Most eyes with CSCR resolve without treatment at 4 weeks as evident by the significantly decreased retinal and choroidal thickness. The visual acuity had also improved significantly in nearly three fourths of the eyes. There was a positive correlation between visual acuity and the serous detachment height and retinal thickness. The study however failed to show any strong correlation of choroidal thickness with visual acuity and a definite correlation of retinal thickness and visual acuity at 1 month.

The strength of our study is that it is one of its kind from Asian region where there is paucity of literature on CSCR. A short follow up period of 4 weeks seems to be the major limitation of our study. A longer follow up duration would have thrown more light on the evolution of morphological and functional changes and its correlation with visual acuity. This study paves the way for a larger study with more sample size and a longer follow up period to map out the chronic persistent changes in CSCR. This will help in planning definitive targeted therapy for persistent changes.
References


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