Time-domain versus spectral-domain optical coherence tomography: Findings in acute central serous chorioretinopathy*

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Received 15 February 2012; revised version accepted 2 November 2012

Abstract

Aims: To evaluate the optic coherence tomographic (OCT) features in acute central serous chorioretinopathy (ACSC) with time-domain or spectral-domain OCT at Dokuz Eylul University, Department of Ophthalmology, Izmir, Turkey.
Subjects and Methods: Clinical data from the Department of Ophthalmology (of Dokuz Eylul University) including fluorescein angiography (FA) and OCT findings of 39 eyes of 34 patients with ACSC were retrospectively analyzed. Eleven eyes (*N*td =11) were examined with time-domain (Stratus OCT 3, Version 4.0) and 28 eyes (*N*sd =28) with spectral-domain OCT (Heidelberg HRA2 Spectralis).
Results: Of the sample of 34, twenty-four patients (70.6%) were men and 10 women (29.4%). FA demonstrated smokestack type hyperfluorescence in five eyes (12.8%), a round ink blot type hyperfluorescence in 32 eyes (82.1%) and diffuse leakage in two (5.1%) eyes. Twenty-five eyes (64.1%) had only one leakage site, five eyes (12.8%) had two leakage sites and nine eyes (23.1%) had three or more leakage sites. Detachment of the neurosensory retina was detected in 37 eyes (94.9%, 11 eyes with Stratus OCT and 26 eyes with Spectral OCT). Pigment epithelial detachment (PED) was detected in nine eyes (23.1%, one eye with Stratus OCT and eight eyes with Spectral OCT). Protrusion of the RPE layer was detected in 10 eyes (25.6%, all eyes with Spectral OCT). Both fibrinous exudates and bridging between the neurosensory retina and PED was detected with Spectral OCT in four eyes (10.2%). Retinal dipping was detected with Spectral OCT in two eyes (5.1%).
Conclusion: Spectral-domain OCT seems to yield more information and depicts RPE layer protrusion, fibrinous exudates and bridging better when compared to conventional time-domain OCT. (*S Afr Optom* 2012 **71**(4) 166-170)

Key words: Central serous chorioretinopathy, fluorescein angiography, optic coherence tomography, time-domain OCT, spectral-domain OCT.
the subjects following treatment.

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Introduction

Acute central serous chorioretinopathy (ACSC) is a common retinal disease characterized by an idiopathic flat retinal detachment within the macula and often reveals a shallow round and serous detachment of neurosensory retina; however small retinal pigment epithelium (RPE) detachment may also be present[1, 2]. Although the diagnosis can be established with ophthalmological examination, in almost all cases fluorescein angiography (FA) is performed to confirm the diagnosis by elucidating the classical leakage patterns, and thereafter follow the disease course[2, 3]. On the other hand, optic coherence tomography (OCT) demonstrates the morphological features of the disease more explicitly[4-9]. ACSC can be classified into three types according to the fluid distribution morphology. In Type I, fluid accumulates underneath the neurosensory retina, in Type II fluid pools under the RPE layer and in Type III fluid may accumulate both underneath the neurosensory retina and RPE[2, 10].

In this retrospective study, we focused on the OCT characteristics of ACSC either with time-domain or spectral-domain OCT to assess which type of OCT yields better information in cases with ASCS.

Subjects and Methods

Clinical data at Department of Ophthalmology, Dokuz Eylul University, Izmir, Turkey including FA and OCT of 39 eyes of 34 patients with ACSC were retrospectively analyzed. The remaining 29 fellow eyes were unaffected by ASCS. The diagnosis of ACSC 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 four months of examination. Patients with previous intraocular surgery or any other retinal disease were excluded. Stratus OCT (Stratus OCT 3, Version 4.0, Carl Zeiss Meditec, Dublin, CA, USA) as a time-domain OCT and Visucam ^{lite} (Carl Zeiss Meditec, AG 07740, Jena, Germany) were employed before November 2007 for obtaining angiographic and tomographic pictures. The Heidelberg HRA2 Spectralis (Spectralis HRA+OCT; Heidelberg Engineering, Heidelberg, Germany) as a spectral-domain OCT was used after November 2007 for obtaining angiographic and tomographic pictures. Color pictures were obtained with Visucam throughout the study period.

Results

Twenty-four patients (70.6%) were men and 10 were women (29.4%). The mean age was 44 years (range, 21-60). On FA fluorescein leakage was observed in all eyes with a typical smokestack configuration in five eyes (12.8%), a round ink blot type in 32 eyes (82.1%) and diffuse leakage in two (5.1%) eyes. Thirty eyes (76.9%) had Type I, two eyes (5.1%) had Type II and seven eyes (17.9%) had Type III CSC. Twenty-five (64.1%) had only one leakage site, five eyes (12.8%) two leakage sites and nine eyes (23.1%) three or more leakage sites. Detachment of neurosensory retina was detected in 37 eyes (94.9%, 11 eyes with Stratus OCT and 26 eyes with Spectral OCT). See Figure 1 for an example of PED on the Stratus OCT.

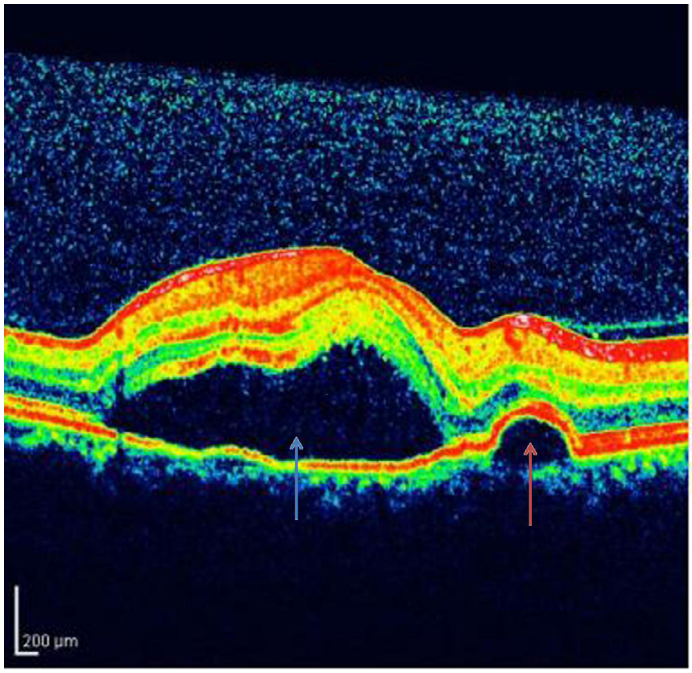

Figure 1: A Spectral OCT image demonstrating (red arrow) the pigment epithelial detachment (PED) and subretinal fluid (blue arrow) in ACSC.

PED was detected in nine eyes (23.1%, one eye with Stratus OCT and eight eyes with Spectral OCT). Protrusion of RPE layer was detected in 10 eyes (25.6%). All eyes were examined with Spectral OCT. See Figures 2 and 3 for examples of anomalies.

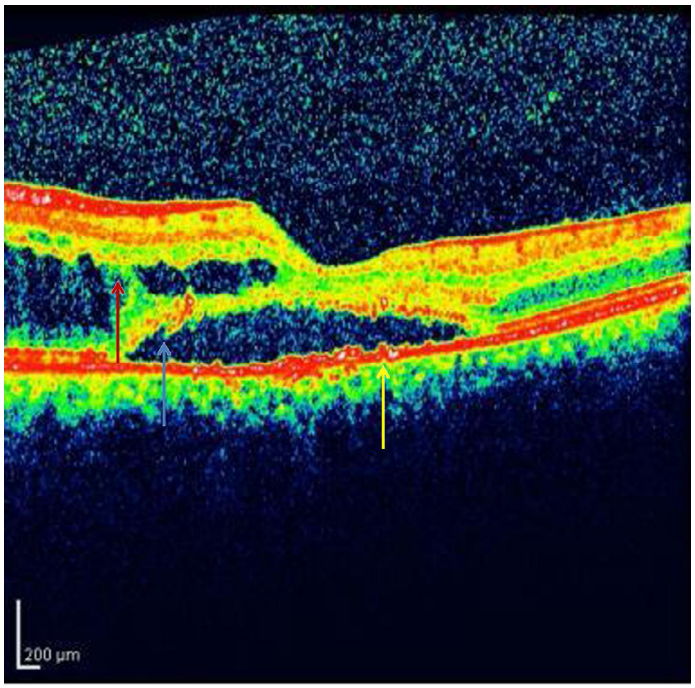

Figure 2: A Spectral OCT image showing pigment epithelial protrusion (yellow arrow), retinal dipping (red arrow) and fibrinous exudate (blue arrow) in ACSC.

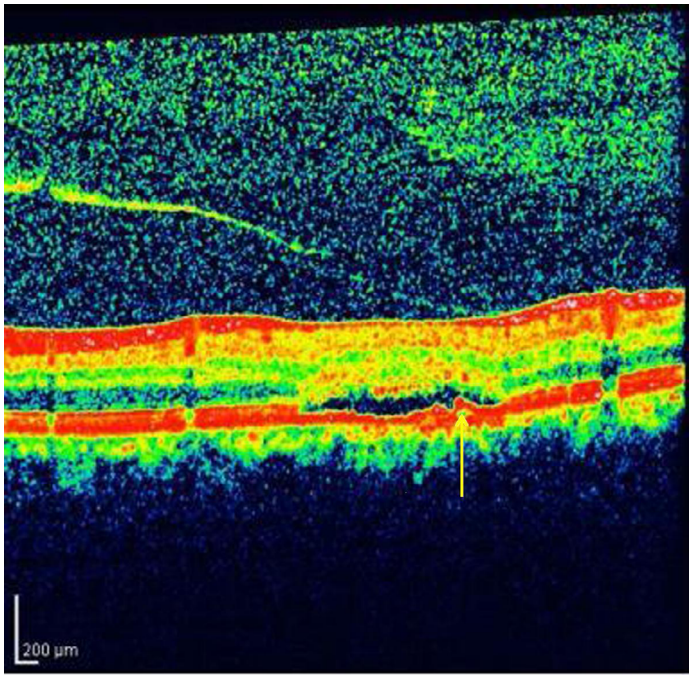

Figure 3: A Spectral OCT image demonstrating the pigment epithelial protrusion (yellow arrow) in ACSC.

Both fibrinous exudates and bridging between the neurosensory retina and pigment epithelial detachment was detected in four eyes (10.2%). All eyes were examined with Spectral OCT- see Figure 4 for an example of bridging.

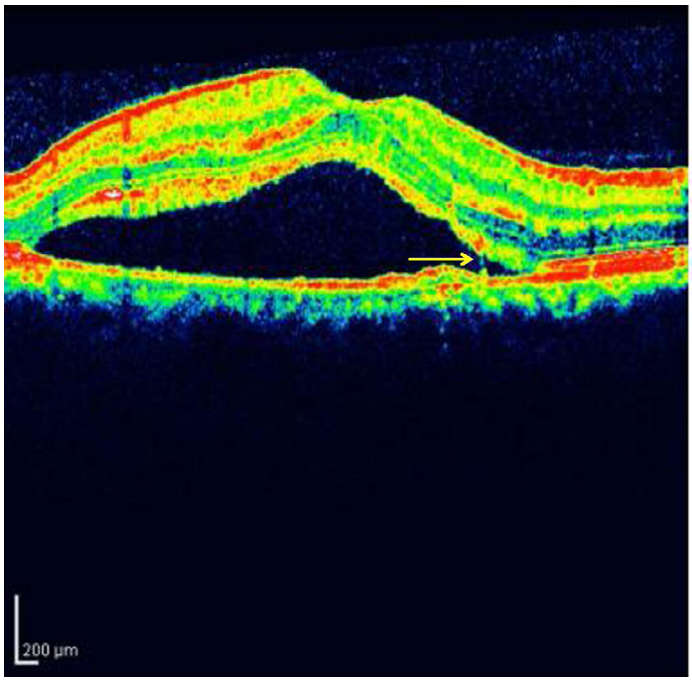

Figure 4: A Spectral OCT image depicting the bridging (yellow arrow) between the neurosensory retina and pigment epithelium in ACSC.

Retinal dipping (see Figure 2) was detected in only two eyes (5.1%) with Spectral OCT. OCT characteristics of ACSC were summarized in the Table 1 below:

Table 1: Optical Coherence Tomography (OCT) characteristics of acute central serous chorioretinopathy (ACSC).

	Spectral OCT (Number of eyes)	**Spectral OCT** (Number of eyes)	**Total number of eyes**
Detachment of sensory retina	11	26	37
PED	1	8	9
Protrusion of RPE layer	-	10	10
Fibrinous exudates	-	4	4
Bridging	-	4	4
Retinal dipping	-	2	2

Discussion

The development of OCT has provided a better understanding of the mechanisms in ACSC and evolving OCT technology even detects previously some unknown morphological features of ACSC[4-9, 11-15]. Stratus OCT is based on time-domain detection technology and 600 A-scans can be acquired in one second and achieve a resolution of ~8-10 µm. The HRA-2 Spectralis is a spectral-domain OCT and has an acquisition speed of 40000 A-scans per second and a digital axial resolution of 4-6 µm through averaging samples. Spectral-domain OCTs enable us to capture smaller lesions and delineated larger structures with improved resolution[16]. Recently, enhanced depth imaging spectral-domain optical coherence tomography (EDI-OCT) has been described to improve choroidal imaging[17].

Several morphological alterations in the RPE, detached retina and subretinal space can be observed in ACSC. OCT features of ACSC reported with spectral-domain OCT are: neurosensory retinal detachment, thickening of photoreceptor outer segments, RPE detachment, bridging of the detached neurosensory retina and RPE with fibrin, fibrinous exudates in the subretinal space, granular appearance of the posterior surface of detached retina sagging/dipping of the posterior layer of the neurosensory retina and a RPE defect at the edge of or within the PED[11, 13-15]. Also in eyes with CSC the choroid layer was found with EDI-OCT to be much thicker than normal eyes[18]. Fujimato *et al*[13] observed RPE abnormalities in 96% of eyes with ACSC with a spectral-domain OCT (RTVue-100-Optovue, Fremont, CA) and were able to visualize a minute defect of the RPE within the PED in a group of 21 eyes.

Very recently Song *et al*[19] retrospectively analyzed the spectral-domain optical coherence tomographic characteristics of central serous chorioretinopathy in a group of 76 eyes of 75 patients including also chronic cases. In eyes with ASCS, they showed several changes such as relatively high serous detachment, semicircular pigment epithelium detachment, retinal dragging with fibrin and thickened posterior surface of the detached retina.

In our retrospective data analysis we showed that neurosensory detachment and RPE detachment can easily be detected by time-domain OCT but other likely changes stated above could only be demonstrated by spectral-domain OCT. Currently OCT plays a major role in establishing the diagnosis of ACSC, enabling physicians to better understand the disease and to predict the visual outcome more satisfactorily.

Conclusion

We strongly believe that OCT should be performed in each and every case with ACSC and spectral-domain OCT is clearly more advantageous over time-domain OCT as spectral-domain OCT demonstrates subtle morphological changes better.

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