Topographic assessment of retinal pigment epithelium detachment in central serous chorioretinopathy by three-dimensional optical coherence tomography single-layer retinal pigment epithelium map

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Abstract

Purpose This study aims to compare the topographic distribution of retinal pigment epithelium detachment (PED) in central serous chorioretinopathy (CSC) on spectral domain optical coherence tomography (SD-OCT) single-layer retinal pigment epithelium (SL-RPE) map and fluorescein angiography for the first time.

Methods Twenty-seven eyes of CSC with PEDs were studied retrospectively. Topographic distribution of PEDs was documented on 50° fluorescein angiography and SD-OCT SL-RPE map on macular cube 512×128.

Results Quantity of PEDs ranged from 1 to 5 on SD-OCT SL-RPE map macular cube 512×128 and corresponding macular cube area on 50° fluorescein angiography. Topographic distribution of PEDs on SL-RPE map matched with PEDs on fluorescein angiography in the corresponding macular cube area, in all the cases (interobserver correlation=0.9).

Conclusion SD-OCT SL-RPE map is a noninvasive, three-dimensional advanced tool for documentation of topographic assessment of PEDs and obviates the need of fluorescein angiography for monitoring CSC.

Keywords Central serous chorioretinopathy · Spectral domain optical coherence tomography · Fluorescein

angiography · Single-layer retinal pigment epithelium map · Pigment epithelium detachment

Introduction

Central serous chorioretinopathy (CSC) is characterized by the development of serous neurosensory retinal detachment at the posterior pole [1] and is mainly diagnosed by fluorescein angiography that shows one or multiple areas of leakage from the retinal pigment epithelium (RPE) seen as “expanding dot” or “smoke stack” sign [1, 2].

The diagnosis of CSC is primarily clinical, aided by fluorescein angiography and optical coherence tomography (OCT). Fluorescein angiography classically shows the leakage of dye from the choroid through a focal RPE defect and it is pooling in the subretinal space in acute CSC. The serous detachment of the RPE (PED) underlying the retinal detachment is variable in size and in some patients is impossible to detect without the aid of fluorescein angiography. Multiple PEDs may occur. Although PEDs are typically small, in some patients they may encompass a disk diameter or larger [1]. OCT is traditionally used to quantify the amount and extent of the subretinal fluid, demonstrate thickening of the neural retina, and is commonly used for monitoring during the follow-up and also for diagnosing the changes in the neurosensory retina that can cause permanent impairment in vision in such eyes [3].

Spectral domain optical coherence tomography (SD-OCT) has begun a new era in three-dimensional retinal imaging. Three-dimensional high-speed OCT has facilitated the understanding of pathophysiologic changes in CSC [4]. Visualization of separate retinal layers on SD-OCT may be utilized to give a novel perspective in three-dimensional retinal imaging.

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A retrospective study was undertaken to compare the topographic distribution of PEDs in CSC on SD-OCT single-layer retinal pigment epithelium (SL-RPE) map and fluorescein angiography for the first time.

Material and methods

This retrospective analysis included 27 eyes of 21 consecutive cases of CSC with PEDs, presenting at a tertiary care center, between February 2010 and October 2010. The diagnosis of CSC was established by the presence of serous macular detachment, documented on stereoscopic fundus examination in the charts and on color fundus photographs. Patients with symptomatic CSC of less than 6-month duration were included. Our study had institutional review board clearance and was performed in accordance to the tenets of the Helsinki declaration. Using two different examiners, all the cases had undergone fluorescein angiography and three-dimensional spectral domain optical coherence tomography (Cirrus HD OCT, Carl Zeiss, Dublin, CA). Topographic distribution of PEDs was documented on 50° fluorescein angiography. SD-OCT SL-RPE map on macular cube 512×128 was done to document the quantitative and topographic distribution of PEDs. Corresponding macular cube area was defined in the 50° fluorescein angiogram. Fluorescein angiograms and optical coherence tomograms were compared by two independent observers. Pearson correlation analysis was used to assess the interobserver correlation.

Results

The mean age of the cases was 42.3 ± 4.6 years (range, 38 to 45 years). All were males. Mean logMAR visual acuity was 0.3 ± 0.1 (range, 0.2 to 0.5). On SD-OCT, serous neurosensory retinal detachment was observed in 24 out of 27 eyes. Quantity of PEDs ranged from 1 to 8 on 50° fluorescein angiography. SD-OCT SL-RPE map macular cube and corresponding macular cube area on fluorescein angiogram showed 1–5 PEDs. Each PED could be discerned well and its location with respect to the foveal center (depicted by crossing of horizontal and vertical lines) could be noted well. The topographic distribution of PEDs on SD-OCT SL-RPE map on macular cube 512×128 matched with PEDs on fluorescein angiography, in the corresponding macular cube area (Figs. 1 and 2), in all the cases (interobserver correlation=0.9).

Fig. 1 a–d. **a** Right eye of a case of central serous chorioretinopathy. **b**, **c** Fluorescein angiogram and single-layer retinal pigment epithelium map on spectral domain optical coherence tomography shows corresponding retinal pigment epithelial detachments. **d**. High definition spectral domain optical coherence tomography shows large pigment epithelium detachment

Fig. 2 a–c. **a** Left eye of a case of central serous chorioretinopathy. **b**, **c** Fluorescein angiogram and single-layer retinal pigment epithelium map on spectral domain optical coherence tomography shows corresponding retinal pigment epithelial detachments

Discussion

Morphologic changes in acute central serous chorioretinopathy have been evaluated by spectral domain optical coherence tomography. OCT findings offer new information to facilitate understanding of the mechanisms of CSC [5]. Spectral domain OCT can pick up the presence of the sub-retinal fluid and RPE changes even before they could manifest on fluorescein angiography in CSC [6].

On SD-OCT, visualization of separate layers may be utilized to give a novel perspective in three-dimensional retinal imaging. Topographic assessment of PEDs on SD-OCT SL-RPE map provides an elegant option, as shown in this study, for the first time.

Three-dimensional optical coherence tomography may be performed using an SD-OCT scanning protocol that achieves high sampling density in all three dimensions and acquires high density volumetric data of the macula. Volume

rendering of the three-dimensional data generates a three-dimensional image. The data can be processed to provide comprehensive structural information. With three-dimensional image reconstruction, the three-dimensional area scans can be manipulated and viewed from multiple angles. The unprecedented visualization provided by this technology enables determination of specific alterations in retinal anatomy characteristics. Three-dimensional OCT data can be used to segment, measure, and map intraretinal layer thicknesses [7].

The ability to visualize three-dimensional morphology may be helpful in fundamental research applications for elucidating structural changes in retinal diseases or for future clinical applications. Currently, the clinical applications of three-dimensional retinal imaging are being evaluated for selective visualization of macular layers [7].

The use of SD-OCT enables improved visualization of the pathological structural changes in the foveal photoreceptor layer of patients with macular diseases [8]. Topographic changes in CSC can be visualized with three-dimensional reconstructions in all locations [9]. SD-OCT shows morphologic alterations in retinal pigment epithelium elegantly [10].

In the present study, topographic assessment of PEDs, on SD-OCT SL-RPE map, compared well with fluorescein angiography in all the cases. SD-OCT SL-RPE map is indeed a noninvasive advanced tool for documentation of topographic distribution of PEDs and obviates the need for fluorescein angiography for monitoring the progress of PEDs in eyes with CSC.

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