Real-time in vivo micromorphology and histopathology of choroidal osteoma using enhanced depth imaging

Rameez Hussain, Giridhar Anantharaman, Bindu Rajesh, Mahesh Gopalakrishnan

Choroidal osteomas have been imaged from the era of time-domain optical coherence tomography (OCT). The advent of enhanced depth imaging (EDI) feature of OCT has provided better insight into the in vivo morphology of choroidal lesions.

Herein, we present a case of choroidal osteoma wherein the EDI technology of spectral-domain OCT (SD-OCT) has enabled visualization similar to a histopathological examination.

Case Report

A 45-year-old woman, with gradually progressive defective vision in her left eye (LE) for 4 months, had a best corrected visual acuity of 20/20 in her right eye (RE) and 20/40 in the LE. Anterior segment examination was within normal limits. Fundus examination of the RE was normal, whereas the LE showed an irregular elevated, yellowish white choroidal lesion with well-defined geographic borders, involving the inferior macula. There were areas of subretinal hemorrhage at and above the fovea clinically suggestive of a choroidal osteoma with a subretinal neovascular membrane [Fig. 1a]. Fundus fluorescein angiography confirmed the presence of an active subretinal neovascular membrane [Fig. 1b-d]. EDI performed using a confocal scanning laser ophthalmoscope (Spectralis Heidelberg retina angiograph + OCT; Heidelberg Engineering, Heidelberg, Germany) showed a dense hyperreflective choroidal mass, almost continuous with the overlying retinal pigment epithelium (RPE) causing significant widening of the choroidal layer [Fig. 2a]. The hyperreflective choroidal lesion showed complete obliteration of the normal choriocapillaris and the Sattler’s layer. The posterior border of the choroidal lesion could be well delineated with an intervening Haller’s layer beneath the sclerochoroidal junction. The inner part of the choroidal lesion showed the presence of compactly packed multiple medium to highly hyperreflective layers suggestive of bone lamellae whereas the outer part showed the presence of multiple hyperreflective dots in a spongiform pattern. An area of pre-RPE hyperreflectivity was visualized corresponding to the active neovascular membrane [Fig. 2b]. The tumor details observed by EDI were found to be very similar to those of the only available histopathological report of choroidal osteoma [Fig. 3a and b]. Considering the nonresponsiveness of the lesion despite nine consecutive anti-vascular endothelial growth factor (VEGF); bevacizumab (1.25 mg/0.5 ml) injections, the patient was treated with full-fluence photodynamic therapy (PDT), followed by intravitreal triamcinolone acetonide (IVTA) injection (2 mg/0.05 ml) the next day. IVTA was administered to mainly counteract the inflammatory response that occasionally occurs after PDT and also considering the nonresponsiveness of the lesion to anti-VEGF. After PDT, gradual resolution of the subretinal fluid with involution of the neovascular membrane was observed [Fig. 4a and b]. The patient was reviewed periodically, and the visual acuity remained stable at her last follow-up with no recurrence over a period of 1-year. EDI showed complete involution of the neovascular membrane with a reduction in the choroidal thickness. Though clinically the tumor size appeared the same [Fig. 5] a reduction was observed in the choroidal thickness as well as in the size of osteoma that could be better appreciated only on
EDI. Morphological changes in the form of replacement of the compact hyperreflective layers with more speckled appearance probably due to conversion to spongy trabecular or compact form of bone, could also be visualised.

Discussion

OCT has been used previously to study the morphological features of choroidal osteoma. Time-domain OCT initially gave information regarding the retinal architecture overlying the choroidal osteoma, however, was not able to provide details regarding the choroidal tumor characteristics. In comparison, the advent of SD-OCT enabled tumor characterization in terms of reflectivity as well as the surface topography. EDI feature of SD-OCT with deeper imaging capability allowed further in-depth visualization of the tumor morphology.

Enhanced depth imaging SD-OCT of our patient showed a mixed pattern consisting of horizontal lines and a spongiform pattern similar to the other reports. Shields et al. provided a detailed description and noted unique intrinsic tumor characteristics in the form of horizontal hyperreflective lamellar lines, denser lines, speckled tissue, and tubular channels. They have suggested that lamellar lines and the dense lines represent the bone lamella and the cement lines described...
manuscript received 12.12.14; Revision accepted: 24.01.15

A professional mountain trekker presented with gradual, moderate visual decline in one eye. The subnormal vision could be explained by the examination of anterior and posterior segment of either eye, which was unremarkable. Optical coherence tomography and autofluorescence imaging revealed small subtle defects in the outer retina, which correlated with the phototoxic maculopathy secondary to retinal phototoxicity due to indirect solar radiation reflected from snow.

Figure 5: Color fundus photo of the left eye 1-year later (a) showing complete regression of the subretinal neovascular membrane. Enhanced depth imaging of the lesion (b) at 1-year follow-up depicting significant reduction in choroidal thickness as well as replacement of the inner compact hyperreflective layers with more of the speckled pattern histopathologically.[2] According to them, Haversian canals or the vascular spaces are visible through EDI as horizontally or vertically oriented tubular channels.

Delineation of the posterior border of the tumor on EDI SD-OCT is a feature unique to choroidal osteoma, probably due to its transparent nature.[4,5] Though choroidal neovascular membranes secondary to choroidal osteoma are known to respond to anti-VEGF,[7] our patient seemed unresponsive despite multiple treatments. PDT as a successful treatment modality for choroidal neovascularization secondary to choroidal osteoma.[6] Decrease in the choroidal thickness after the treatment as well as the change in the tumor characteristics on EDI further highlight its capability of an in-depth assessment of the pathological changes better than any other imaging modality.

Thus, EDI OCT has been proven to be a valuable noninvasive imaging modality for diagnosis and follow-up of choroidal osteomas and can provide an insight into the real-time in vivo micromorphology that is comparable to histopathological examination.

References


Source of Support: Nil. Conflict of Interest: None declared.