Case Report

Spectral domain optical coherence tomography imaging of punctate outer retinal toxoplasmosis

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Abstract

Punctate outer retinal toxoplasmosis is a recognized phenotype of this common ocular parasite. We present a case presenting with poor visual acuity, but with prompt treatment regaining excellent vision by the final time point. Imaging demonstrates progression of an active lesion adjacent to an inactive retinal scar with color photography, fluorescein angiography, and Spectral Domain Optical Coherence Tomography (SD-OCT). SD-OCT imaging of the chorioretinal scar demonstrated alternating hypertrophy and atrophy of the retinal pigment epithelium along with a discrete break in Bruch's membrane. At baseline, the active lesion demonstrated a large collection of inflammatory subretinal fluid adjacent to an area of active retinitis. Over time, the subretinal material was found to resolve, there was restoration of the foveal anatomy, and the area of retinitis progressed into a chorioretinal scar.

Keywords: Subretinal fluid, Inflammation, Retinitis, Chorioretinal scar, Bruch’s membrane, Retinal pigment epithelium, Toxoplasmosis

Introduction

Ocular toxoplasmosis has been reported to be the most common worldwide cause of posterior uveitis. The classic presentation of ocular toxoplasmosis includes an exuberant vitritis with an area of active fluffy retinal whitening bordering an adjacent pigmented scar, several subtypes have been described including the one described in this case: Punctate Outer Retinal Toxoplasmosis (PORT). This variant is typified by a relative paucity of intraocular inflammation, thus permitting excellent chorioretinal imaging of pathological changes of the retina. Spectral Domain Optical Coherence Tomography (SD-OCT) imaging may provide new insights into the pathogenesis of PORT.

Case report

A 13-year-old girl presented with a four-day history of a profound decrease in vision in her right eye unassociated with pain or redness. She did not recall any previous occurrences of decreased vision in either eye. She reported a viral illness approximately three weeks prior to presentation characterized by fever and cough, which resolved spontaneously. She was presumed to be immunocompetent, had no additional past medical or ocular history nor was taking any medication.

The best-corrected visual acuity (BCVA) was 8/200 OD and 20/20 OS. Intraocular pressure was 19 mmHg OD and 21 mmHg OS. Visual fields were full to confrontation,
and the blood pressure was 119/74. The anterior segment examination revealed Grade 0.5 + cell in the patient’s right eye, but there were no keratic precipitates or hypopyon present. There was Grade 1 + vitreous cell in the right eye. Examination of the left eye was unremarkable.

The dilated fundus examination of the right eye demonstrated macular elevation with irregular yellow–white spots centrally at the level of the deep retina (Fig. 1A). Adjacent to this, at the 10 o’clock position was an area of active retinitis with focal retinal thickening. Inferotemporally, there was an old hyper-pigmented chorioretinal scar with a surrounding halo of retinal pigment epithelium (RPE) disturbance. Between the area of active retinitis and the chorioretinal scar, there was an intervening area of apparently uninvolved retina. The disk margin appeared sharp. Dilated examination of the left eye was unremarkable without chorioretinal scars.

Fluorescein angiography demonstrated early blockage in the area of the focal retinitis and from the chorioretinal scar in the early frames (Fig. 1B). There was progressive leakage of the active area of retinitis (Fig. 1C), with an adjacent well-circumscribed area of pooling apparent in the late frames (Fig. 1D). There was late hyperfluorescence apparent within the old scar and mild disk leakage.

Spectral Domain Optical Coherence Tomography (SD-OCT) using Cirrus HD-OCT (Carl Zeiss Meditec, Inc.) revealed a large subfoveal collection of subretinal fluid (SRF) (Fig. 1E). There was an irregularly thickened hyper-reflective interface appearing deep into the outer nuclear layer (ONL) lining the superior aspect of the subretinal fluid space. There was weakly reflective material at the base of the fluid accumulation that contained several small hyper-reflective punctate foci (dark arrow). The images revealed string-like structure tethered between the materials at the base of the fluid cavity to the hyper-reflective band superiorly (white arrow). There was no frank RPE detachment, however Bruch’s membrane could be seen as a distinct structure, indicating that subtle RPE detachment may be present. There was no apparent focal choroidal thickening, though the chorio-scleral interface could not be visualized throughout the scans.

A septum within the SRF accumulation was visible in Fig. 1F. Temporally, the abnormal but recognizable inner-segment/outer-segment (IS/OS) junction (also called the Ellipsoid Zone) was visible and seen to lead to a split (white arrow) between the material occupying the base of the fluid collection and the continuation of the material superiorly. Multiple hyper-reflective foci were seen within the subretinal space. Adjacent to this space and overlying the SRF was the area of retinitis visualized on the color photograph and angiography (dark arrow). There was increased hyper-reflectivity extending through the full thickness of the retina. The normal hypo-reflective inner nuclear layer (INL) and ONL were not visualized due to this hyper-reflectivity, which was indicative of inflammation.

An SD-OCT image was obtained through the old chorioretinal scar (Fig. 1G) which demonstrated central irregular thickening of the RPE causing marked attenuation of the underlying choroid (dark arrow) surrounded by a zone of RPE atrophy and increased choroidal visibility. There were no normal laminations of the overlying retina present. There was a bulb-shaped structure apparent (white arrow) that ap-

Figure 1. A. Fundus photograph of affected eye at presentation demonstrating subretinal fluid with fine white–yellow spots adjacent to superotemporal area of active retinitis and inferotemporal chorioretinal scar. Lines indicate the locations of SD-OCT images in E, F, and G. B–D. Fluorescein angiogram demonstrating early blocking and increasing hyper-fluorescence of area of active retinitis as well as pooling of the subretinal space. E. SD-OCT demonstrating large collection of subretinal fluid with weakly reflective material at base (dark arrow) and lined superiorly by hyper-reflective material (white arrow), with a string of material tethered across. F. Septum within subretinal fluid visualized with frank sub-retinal fluid temporal, and loculated fluid nasal enclosing fibrin like material. Area of active retinitis adjacent to fluid pocket (dark arrow). G. Cross-section through old chorioretinal scar demonstrating alternating areas of irregularly bunched RPE (dark arrow) adjacent atrophy with visualization of underlying Bruch’s membrane. Bulb-shaped structure (white arrow) shown with frank disruption of RPE and Bruch’s membrane.
pears to pierce through the RPE and Bruch’s membrane from the choroid to the retina.

The diagnosis of ocular toxoplasmosis was made clinically and treatment with 800 mg/160 mg Trimethoprim/Sulfamethoxazole (Bactrim DS) twice a day for 60 days was promptly initiated. No steroidal medication was given.

One week after presentation, BCVA had improved to 20/160 OD, anterior segment cell was absent but trace vitreous cell remained. Fundus examination revealed a reduction in the subretinal fluid collection and an enlargement of the yellow–white spots at the level of the deep retina (Fig. 2A). The areas of active retinitis and old retinitis appeared unchanged. SD-OCT demonstrated persistence of SRF with an increased accumulation of material hanging from the undersurface of the retina like stalactites in a cave (Fig. 2B). The external limiting membrane can clearly be seen moving over the fluid accumulation. At the base of the SRF, there was still weakly hyper-reflective material present. There was a focal RPE detachment with a punctate area of increased choroidal reflectivity. The septum of this material, which had been apparent at presentation, was diminished (Fig. 2C) but the area of full-thickness hyper-reflectivity associated with the focal retinitis was still apparent.

One month after initial presentation, BCVA had improved to 20/40. The fluid centrally had cleared and no white dots remained at the level of the deep retina (Fig. 3A). There were spiculated pigmentedary changes present in the RPE. On dilated examination, the area of active retinitis had contracted and the edges of the lesion were more distinct. SD-OCT revealed a more discreet area of full thickness hyper-reflectivity, with improved visualization of adjacent retinal layers (Fig. 3B). A limited pigment epithelial detachment immediately underneath the retinitis was visible, as well as circumferential RPE loss and increased Bruch’s membrane visualization.

Figure 2. A. Fundus photograph of affected eye one week after presentation demonstrating larger yellow–white subretinal spots and early consolidation of retinitis. Lines indicate locations of SD-OCT images in B and C. B. SD-OCT through subretinal fluid pocket showing subretinal material accumulations (white arrow) and clearly visualized external limiting membrane moving above the subretinal fluid (asterisk). C. SD-OCT demonstrating decreased subretinal fluid under persistent retinitis.

Figure 3. A. Fundus photograph one month after presentation showing resolution of subretinal fluid with persistent pigmentedary changes and consolidation of area of retinitis. Line demonstrates location of SD-OCT image B. B. Discreet area of full-thickness hyper-reflectivity visualized with underlying Bruch’s membrane visible and early atrophy.
Three months after initial presentation, BCVA was 20/20. Clinically, there was no remaining active retinitis, but there was increasing chorioretinal scarring at this location with increased pigmentation centrally and circumferential RPE atrophy (Fig. 4A). SD-OCT demonstrated that the area of PED two months earlier now demonstrated diffuse RPE loss accompanied by visualization of Bruch’s membrane and increased choroidal visualization (Fig. 4B). Centrally, the foveal contour and retinal layers normalized. The IS/OS junction was present throughout, with only slight thickening irregularity of temporal IS/OS and the photoreceptor outer segment tips hyper-reflective band remaining perifoveally. Temporal to the periphery there was a region of RPE and outer retinal atrophy, which comprised the inferior aspect of the resolved area of active retinitis.

**Discussion**

Several authors have demonstrated some of the classic OCT features of ocular toxoplamosis, or focused on punctate outer retinal toxoplamosis (PORT). There are several findings in this case that have not been visualized by SD-OCT in PORT previously. Most prominently, the visualization of the changes to the SRF space and the finding of the necrotic chorioretinal lesion penetrating through Bruch’s membrane were visualized within the inactive scar.

The features of SRF, photoreceptor accumulations, and a septum of presumed fibrinous material have been previously attributed to cases of the Vogt–Koyanagi–Harada Disease and Acute Posterior Multifocal Placoid Pigment Epitheliopathy. These diseases likely all have a common final pathway resulting in the marked inflammatory process that results in the creation of the vigorous fibrin response that has been hypothesized.

Recently, this finding has also been reported in Toxoplamosis, being called a huge outer retinal cystoid space (HORC). The assertion that this finding represents intraretinal fluid has several weaknesses. First, there is no anatomical potential space where this fluid could accumulate as the ONL, ELM, and IS/OS junction represent optical boundaries within the photoreceptor and Muller cell complex. Consequently, fluid would either have to be in the outer plexiform layer or in the subretinal space, and the ONL is visualized clearly above the fluid in its subfoveal location. The authors further maintain that because the fibrin at the base of the fluid is roughly the same thickness as the ELM to RPE that this likely represents retinal tissue. While this similarity in thickness is interesting, the possibility of this representing inflammatory debris within the extracellular matrix where the photoreceptor tips had recently resided is equally plausible. Evidence for the HORC actually being subretinal fluid is convincingly supported by the present case, which clearly shows the ELM above the lesion at follow-up (Fig 2B).

The hyper-reflective band beneath the ONL may correlate to a structure within the photoreceptors. However, the source of that reflectivity cannot be the normal photoreceptor wave-guided IS/OS junction, as it does not display the expected directional reflectivity properties. Specifically, the intensity of the layer would be expected to diminish with increasing angle of incidence from the OCT light source. Consequently, the source of this reflection may be secondary to a new hyper-reflective surface within the photoreceptor as a result of the pathological changes observed. Whatever the source of this reflection, the photoreceptors must not have been permanently damaged as they normalize at the final time point.

Doft and Gass concluded that the failure of the observed deep retinal spots to be associated with angiographic changes suggested that they represented focal outer retinal gliotic scars. The use of SD-OCT in this case, raises the possibility that these changes are due to the accumulation of photoreceptor fragments dangling down from the elevated retina. These are numerous and small at the initial point.
presentation, and became larger as they appear to aggregate by one week, perhaps due to a mix of regenerating photoreceptors and circulating fibrin.

The striking appearance of the complete loss of Bruch’s membrane and the RPE is visualized within the inferotemporal atrophic scar in Fig. 1G. Fluorescein angiography demonstrates early hyperfluorescence and late staining within this area, though no intraretinal or subretinal fluid is present. This lesion may represent the initial site of chorioretinal invasion into the retina, and there may be a fibrotic response giving the appearance of the bulb on OCT. Furthermore, this could represent a location of chorioretinal anastomosis at the location of a defect in Bruch’s membrane. Ultimately, pathological correlation will be required to fully validate each component of the chorioretinal anatomy that is exquisitely visualized by SD-OCT.

Conflict of interest

The authors declare that there is no conflict of interest

References