Infrared reflectance as a diagnostic adjunct for subclinical commotio retinae

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Commotio retinae (CR) is an outer retinal disorder following blunt trauma to the eye. Histologically it is characterized by disruption of the photoreceptor outer segments (OS), typically without injury to other retinal layers. Using spectral-domain optical coherence tomography (OCT) the condition is visible as hyper-reflectivity of the OS. Most cases of CR are associated with transient grey-white discoloration of the retina and are easily diagnosed clinically, but there have been reports of OCT-confirmed CR without retinal discoloration. It is likely that this subclinical variant of CR is under-recognized as the OCT features of CR are subtle. Here, we report a case of OCT-confirmed subclinical CR that demonstrated prominent infrared hypo-reflectance, using the infrared protocol of the SPECTRALIS® OCT, Heidelberg Engineering. This case suggests that infrared reflectance may have a role in diagnosing cases of subclinical CR.

Key words: Diagnostic techniques, macular, retinal imaging, traumatic injuries

The defining feature of commotio retinae (CR) is traumatic disruption of the photoreceptor outer segments (OS), visible on spectral-domain optical coherence tomography (OCT) as hyper-reflectivity of the OS layer. Transient retinal discoloration is a characteristic feature, but when this sign is absent, the diagnosis of subclinical CR may be easily missed. Here, we present a case of subclinical CR that demonstrated prominent infrared hypo-reflectance. The case suggests a role for infrared imaging as a diagnostic adjunct for cases of CR that are not readily detectable on examination.

Case Report

A 68-year-old male presented complaining of sudden and profound loss of central vision in his left eye following blunt eye trauma. He reported seeing a large, dense, central scotoma that began fading 1 h after the injury. He was emmetropic, phakic, and had no significant ophthalmic history. On examination, 24-h postinjury, best-corrected visual acuity (BCVA) in the left eye was reduced to 20/40 from a baseline of 20/25. There were periocular ecchymosis and subconjunctival hemorrhage but no identifiable retinal injury on examination. OCT of the left macula (SPECTRALIS®, Heidelberg Engineering, 5-line raster acquisition protocol) revealed abnormal hyper-reflectivity and nodularity of the photoreceptor OS layer. The history, examination, and OCT features were consistent with subclinical macula CR. Interestingly, the patient was found to have prominent abnormalities on infrared imaging using the infrared reflectance protocol of the SPECTRALIS® OCT [Fig. 1]. Infrared imaging of the left fundus revealed diffuse infrared hypo-reflectance dotted with spots of very low pixel value (dark), creating a stippled appearance. Point-to-point correlation between the infrared and OCT images using the SPECTRALIS® software (Heidelberg Engineering, Germany) demonstrated that the infrared dark spots correlated with foci of thickened OS seen on 5-line raster OCT. No pathology of the superficial retina, retinal pigment epithelium or choroid was detected using red-free reflectance, fundus auto-fluorescence, and enhanced-depth imaging (EDI), respectively. No treatment was given to the patient. By day 30 posttrauma, and at 8 months posttrauma, BCVA in the left eye was 20/25 and the retina appeared normal on examination and when imaged with infrared reflectance, 5-line raster OCT, fundus auto-fluorescence, and EDI [Fig. 2].

Discussion

In this case, there is a clear temporal relationship between eye trauma, transient vision loss, transient OCT changes consistent with CR, and transient infrared hypo-reflectance. Cases of CR detectable on OCT, but not fundus examination have been described,[1] confirming that some cases of CR are subclinical.[2] To the best of the authors' knowledge, the

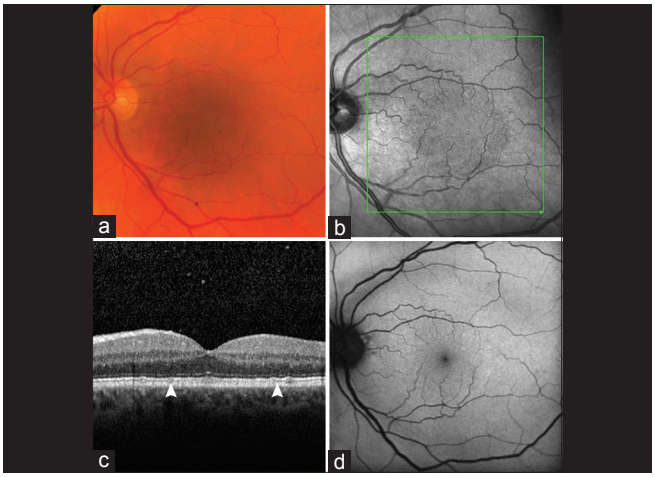

Figure 1: Left fundus images at day 1 postblunt trauma to the left eye. (a) Color fundus photograph. (b) Infrared confocal scanning laser ophthalmoscope fundus image demonstrating stippled hypo-reflectance at the macula. (c) Optical coherence tomography of the macula demonstrating abnormal hyper-reflectivity of the outer segments (between arrowheads). (d) Fundus auto-fluorescence

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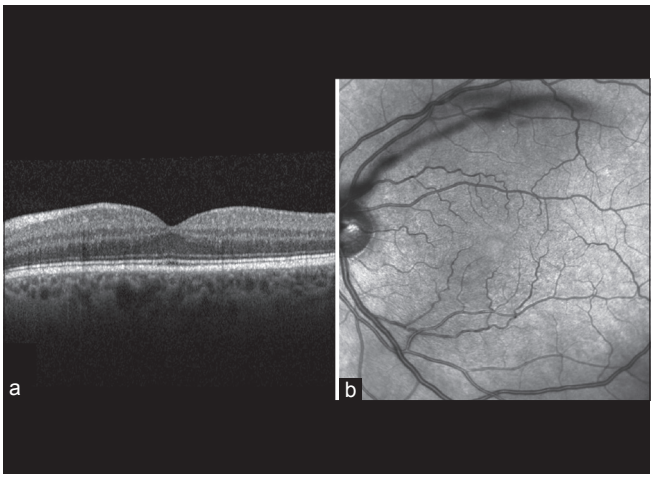

Figure 2: Left fundus images at day 30. (a) Optical coherence tomography demonstrates restoration of normal outer retinal architecture. The outer segments layer is now clearly defined. (b) Infrared confocal scanning laser ophthalmoscope fundus image reveals resolution of the infrared hypo-reflectance

detection of subclinical CR using infrared imaging has not been described previously. The pathology of CR has been studied histologically and on OCT, and comprises fragmentation of the photoreceptor OS without injury to the inner retina.[1-4] As demonstrated by our case, this manifests on 5-line raster OCT as abnormal hyper-reflectivity of the OS layer.[1] This OCT feature is subtle and is easily overlooked if the study is not carefully scrutinized. Our case implicates infrared imaging as a diagnostic adjunct for detecting subclinical CR. Since focal dark spots on infrared imaging correlated with points of nodular OS thickening in our case, we infer that the infrared hypo-reflectance in CR is caused by increased absorption of infrared light by an abnormal OS layer.

With a wavelength of 820nm, the infrared mode of the SPECTRALIS® OCT penetrates deeper into the retina than modalities using visible wavelengths of light. It is, therefore, useful for detecting outer retinal pathology, such as that of CR. The SPECTRALIS® uses a confocal scanning laser ophthalmoscope (CSLO) and records infrared reflectance without barrier filters.[5] Compared with conventional recording techniques, CSLO improves image resolution by using a higher emission of light energy and by reducing the capture of scattered light.[5]

We acknowledge that our findings in this case lack generalizability at present. Further studies are required to determine whether infrared hypo-reflectance is a consistent feature in all cases of CR, and whether this imaging modality has greater sensitivity for detecting subclinical CR than 5-line raster OCT. Nevertheless, this case suggests that infrared imaging may have a role as a diagnostic adjunct for detecting subclinical CR. We recommend that clinicians consider performing infrared imaging of the retina when managing a patient who presents with unexplained vision loss after blunt trauma and a normal-appearing fundus.

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