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Case Report

Functional and Anatomical Outcomes in Commotio Retina - a

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ABSTRACT

Introduction: Commotio retina is characterized by transient opacification of the retina, with mild to severe involvement of the posterior pole following blunt trauma to the globe. It often involves photoreceptor and retinal pigment epithelium damage without extracellular edema. Later, the retina can return to normal in mild cases, or there may be permanent loss in severe cases. No treatment has proven efficacy to restore visual function.

Methods: Retrospective medical chart review including clinical and imaging investigations.

Results: A healthy 18-year-old male presented with a 5-days history of blurred vision in the right eye after blunt trauma with a horse harness. At presentation, the Best Corrected Visual Acuity (BCVA) was 20/80. Fundus examination showed macular opacity at the level of papillomacular bundle. Spectral Domain Optical Coherence Tomography (SD-OCT) demonstrated parafoveal disruption of the external limiting membrane, ellipsoid layer and interdigitation zone, as well as decreased thickness of the outer nuclear layer. At 6 months after the first examination BCVA was 20/30, but the morphological alterations on OCT persisted. A paracentral scotoma was present on visual field testing. According to a clinical grading scale based on the morphology of the OCT, in this case the regeneration of outer retina, and associated visual recovery is unlikely.

Conclusion: Performing OCT at presentation, may help to define the structural abnormalities and their location within the retina, in order to establish a visual prognosis.

Keywords: Blunt ocular trauma; Commotio retina; Berlin's edema; Spectral domain optical; Coherence tomography

ABBREVIATIONS

CR: Commotio Retina; RPE: Retinal Pigment Epithelium; SD-OCT: Spectral Domain Optical Coherence Tomography; VA: Visual Acuity; BCVA: Best Corrected Visual Acuity; OD: Right Eye; OS: Left Eye; IOP: Intraocular Pressure; FAF: Fundus Autofluorescence; IRR: Infrared Reflectance; ELM: External Limiting Membrane; ONL: Outer Nuclear Layer; CMT: Central Macular Thickness.

INTRODUCTION

Commotio Retina (CR) was first described by Berlin in 1873 as a retinal whitening resulting from a contre-coupe mechanism after blunt trauma to the globe. Berlin suggested that the presence of extracellular edema could explain the pathogenesis of CR, and the condition became known as "Berlin's edema". However, histologic examinations have shown that CR often involves photoreceptor and Retinal Pigment Epithelium (RPE) damage without extracellular edema [1,2]. These findings are supported by Spectral Domain Optical Coherence Tomography (SD-OCT) which shows abnormalities confined to outer retinal layers [3-7]. Clinical findings of CR include transient grey-whitish opacification of the retina, with mild to severe involvement of the posterior pole. Presenting Visual Acuity (VA) depends on the severity of the injury, but it usually returns to normal in several days. In severe cases, there may be permanent loss of photoreceptors and retinal pigmentary changes, which are associated with poor visual recovery if macular area is involved [8-11].

Here we present a case of CR with structural retinal damage documented by multi-modal imaging, particularly SD-OCT, which may be useful as a prognosis biomarker.

CASE PRESENTATION

A healthy 18-year-old male, horse riding instructor, presented with a 5-days history of blurred vision in his right eye after blunt trauma with a horse harness. At presentation, the Best Corrected Visual Acuity (BCVA) was 20/80 in the right eye (OD) and 20/20 in the left eye (OS). Mild lid ecchymosis was observed. Anterior segment examination was unremarkable and Intraocular Pressure (IOP) was normal in both eyes. Dilated fundus examination of OD showed macular opacity at the level of papillomacular bundle

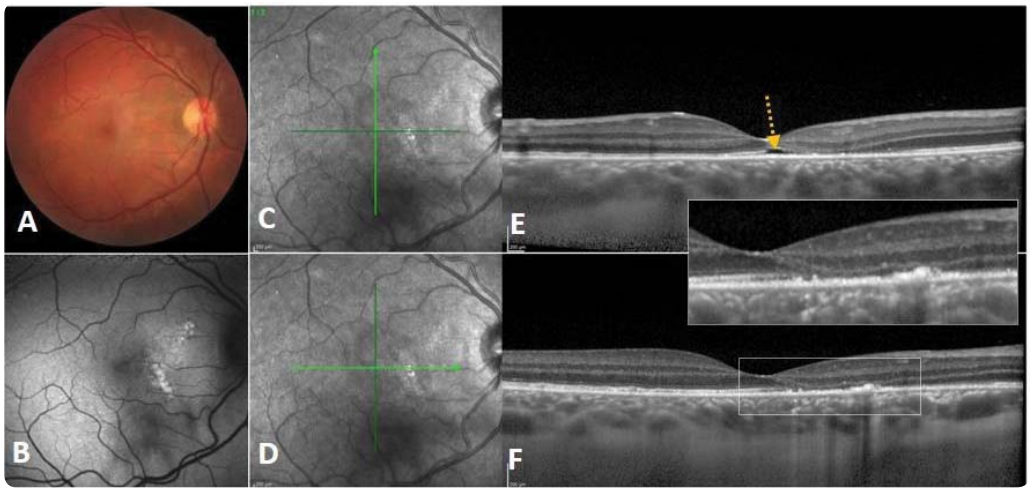

Figure 1: Multi-modal imaging at baseline: fundus photography (A) showing mild retina opacification in the papillomacular bundle; FAF (B) with granular hyper and hypo autofluorescence; IRR (C, D) demonstrating macular hypo-reflectance; SD-OCT vertical scan (E) showing a subfoveal cleft (yellow arrow); SD-OCT horizontal scan (F) showing interdigitation zone, ellipsoid and ELM disruption and ONL atrophy.

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(Figure 1A), without retinal abnormalities at the periphery. Fundus Autofluorescence (FAF) showed a granular pattern of hypo and hyper-autofluorescence at the same area (Figure 1B) and Infrared Reflectance (IRR) disclosed macular hypo-reflectance (Figures 1C,D). Macular SD-OCT (Spectralis® OCT, Heidelberg Engineering) demonstrated parafoveal disruption of the External Limiting Membrane (ELM), ellipsoid layer, interdigitation zone (previously called cone outer segment tips – COST line) and decreased thickness of the Outer Nuclear Layer (ONL) (Figure 1F). Additionally, a horizontal cleft of empty hyporeflective space under the fovea could be seen on vertical scan (Figure 1E). Central Macular Thickness (CMT) measured 238 µm in OD (290 µm OS). A paracentral inferior temporal scotoma was present on visual field test (Octopus 101®, Haag-Streit) (Figure 2A). The patient was advised to avoid strenuous activity.

Two weeks after presentation, the described morphological changes persisted but BCVA had improved to 20/50. Two months after the initial trauma, Visual Acuity (VA) of the OD was 20/40. Fundus examination revealed an abnormal foveal reflex, but a partial regression of the retina opacity was evident. Tomographic features of outer retina injury were still visible, however the subfoveal cleft had disappeared. At 6 months follow-up, Visual Acuity (VA) had improved to 20/30 but a symptomatic visual field defect persisted, despite being smaller (Figure 2B). RPE and outer retina structural abnormalities were still present on FAF, IRR and SD-OCT (Figure 3).

DISCUSSION

The current case describes the OCT, AFF and IRR findings of macular CR subsequent to blunt trauma with a horse harness. To date, there have been no reports describing CR secondary to riding accidents. Previous case reports have described OCT results of CR from different types of sports injury, most of them with progressive visual improvement over time.

Multimodal imaging has been applied to several ocular pathologies, regarding diagnosis and follow-up. Studying retinal anatomy as a possible surrogate of function may allow us to predict prognosis in this setting. Souza-Santos, et al. studied the tomographic

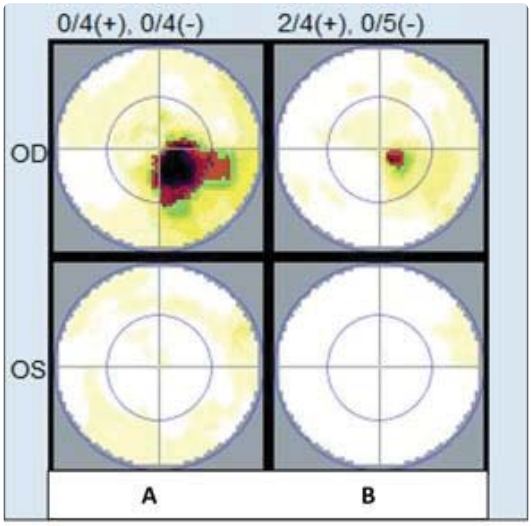

Figure 2: Visual field test demonstrating a paracentral scotoma in OD at initial observation (A), and 6 months later (B).

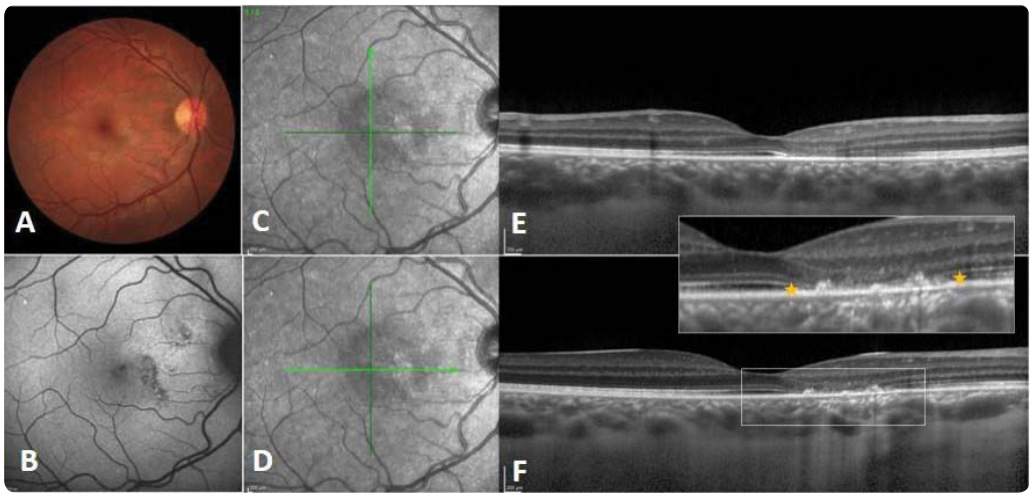

Figure 3: Multi-modal imaging at 6-months: fundus photography (A) showing some intraretinal pigmentation; FAF (B) showing localized hypo-autofluorescence (retinal atrophy); IRR (C,D) demonstrating persistent macular hypo-reflectance; SD-OCT vertical scan (E) showing resolution of the subfoveal cleft; SD-OCT horizontal scan (F) showing persistent RPE and outer retina injury (between yellow stars).

features in 11 eyes with CR and also evaluated its utility in prognosis and follow-up. Cases with severe trauma had acute disruption of the ellipsoid zone and hyperreflectivity of the overlying retina and were associated with retinal atrophy, pigment disturbance, and poor visual prognosis [6] Chen H, et al. studied 52 eyes with CR, using SD-OCT and found disruption of the ellipsoid layer and atrophy of the outer nuclear layer. Moreover, foveal thickness and severity of outer retinal atrophy were predictors for final visual outcome [10]. Blanch, et al, studied the prognosis and retinal location in 53 patients with acute traumatic maculopathy. Patients with final VA <20/30 had concomitant retinal abnormalities (macular hole, retinal folds or retinal atrophy) [8]. Ahn, et al. described the SD-OCT features of 59 eyes with macular CR and its association with anatomic and visual outcomes. They have also proposed a clinical 4-step grading scale based on the morphology of the OCT: increased ellipsoid zone reflectivity with disappearance of the thin hyporeflective optical space (grade 1), interdigitation zone defect only (grade 2), interdigitation zone and ellipsoid zone defects (grade 3), and interdigitation zone, ellipsoid zone, and ELM defects (grade 4). Eyes with higher grades at baseline had poorer anatomical and visual outcomes. According to this scale, our patient shows the abnormalities present in grade 4, suggestive of photoreceptors destruction. In these cases the regeneration of the outer retina, and associated visual recovery, may be unlikely [11]. Indeed, after 6 months, persistent focal defects in ellipsoid, interdigitation zone line and ELM, had not resolved and a localized outer retina atrophy became evident on OCT and FAF, as well as some intraretinal pigment. VA improved to 20/30 but a symptomatic paracentral scotoma subsisted. This partial recovery is related to the location of the damaged area at the level of the papillomacular bundle, without subfoveal involvement, except for a slight decrease in thickness. Andrew NH et al, suggested that IRR may also play a role in diagnosis of subclinical CR [12]. Indeed a longer wavelength (820 nm in Spectralis OCT) penetrates deeper into the retina and enables better RPE and outer layers visualization. In our patient a well demarcated area of macular hypo-reflectance was consistently present across all imaging modalities, showing a topographic correlation with outer retina injury.

CONCLUSION

In conclusion, when the macula is involved in CR, VA may be permanently impaired. Therefore, the use of multimodality imaging, in particular SD-OCT should be considered when predicting visual prognosis.

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