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**Assessment and Classification of Proliferative Vitreoretinopathy in Rhegmatogenous Retinal Detachment with Swept-Source Optical Coherence Tomography: A Novel Conceptual Framework**

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**Introduction:** To describe the morphologic features of proliferative vitreoretinopathy (PVR) detected with swept-source OCT (SS-OCT) in rhegmatogenous retinal detachment (RRD).

**Methods:** "Primary RRDs presenting to St. Michael's Hospital from January 2020-July 2023 were retrospectively assessed at baseline for signs of PVR. Posterior pole and/or ultra-widefield SS-OCT was assessed for the predominant type of PVR (pre, intra or subretinal), and the associated retinal abnormalities were characterized.

**Results:** "Forty-one patients had signs of PVR on baseline SS-OCT, of which 66%(27/41) were male, mean age of 53.5(±18.5) years old, and 78%(32/41) were phakic. Mean baseline logMAR visual acuity was 1.4(±0.7), with a duration of fovea-off of 46.1(±135) days and RRD extent of 7.3(±3.08) clock hours. 44%(18/41) presented with subretinal PVR, of which 17%(3/18) had coexisting pre-retinal PVR. 56%(23/41) presented with intra-retinal PVR, of which 83%(19/23) presented with concurrent pre-retinal PVR. Sub-retinal PVR appears on SS-OCT as a hyperreflective line in contact with the neurosensory retina or as an amorphous band over the RPE. The former may cause folding of the outer retina if photoreceptor segments are still intact. Subretinal PVR was associated with shallow regulated RRDs on clinical examination ( $p < 0.001$ ). In contrast, intra-retinal PVR was associated with bullous dysregulated RRDs, and was always present with concurrent outer retinal corrugations (ORCs). Intra-retinal PVR is observed as a thickening of the inner retina with disorganized and indistinguishable retinal layers ( $p < 0.001$ ). Intra-retinal PVR is also characterized by fused ORCs which appear to form irregular protrusion of the outer retina. Initial signs of intra-retinal PVR were noticed in areas of RRD morphologic stage 3b and 4, where ORCs were fused together. On the contrary, subretinal PVR was associated with RRD morphologic stage 5.

**Conclusions:** In order to better characterize the intrinsic retinal changes in PVR in humans in vivo, we assessed baseline SS-OCT. The type of PVR observed was significantly associated with baseline RRD clinical status (regulated versus dysregulated). PVR formation seems to be associated with a proliferative pathway (when intra-retinal), which occurs primarily in dysregulated cases, versus an apoptotic/atrophic pathway (when subretinal), which occurs primarily in regulated cases. Intraretinal PVR seems to occur at RRD morphologic stage 3b and 4, when ORCs seem to fuse together. This fusion of ORCs appears to be an early and important sign of intraretinal PVR. Recognizing the spectrum of morphologic changes on OCT may assist with early and accurate diagnosis and classification of PVR, particularly intra-retinal PVR, which is most challenging to address surgically.