Optical coherence tomography imaging of chorioretinal folds associated with hypotony maculopathy following pars plana vitrectomy

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Abstract: Chorioretinal folds may occur as a consequence of hypotony and can be a cause of vision loss when associated with macular involvement. In this report, the spectral domain ocular coherence tomography imaging of three patients with chorioretinal folds before and after management are presented. The cases had unique presentations and each underwent different management approaches, but the results included improved visual acuities and lessened chorioretinal folds.

Keywords: hypotony, chorioretinal folds, ocular coherence tomography

Introduction
Maculopathy associated with hypotony was first described by Dellaporta in 1954, but the term “hypotony maculopathy” was coined by Gass in 1977. Chorioretinal folds can be identified with a number of conditions, but they are most frequently associated with hypotony. When folds extend to the macula, vision loss often results, leading to the term “hypotony maculopathy”. These changes are perhaps most common following glaucoma surgery and have been more frequently reported during the last 20 years since the initiation of antimetabolite adjuncts for trabeculectomy. Conservative management may lead to spontaneous resolution, but some may require surgical intervention.

If hypotony is the cause, normalizing the intraocular pressure (IOP) will often lead to resolution of the folds. A subset of patients may require additional interventions including pressure patch, anterior chamber injection of viscoelastic, cryotherapy to a filtering bleb or to a cyclodialysis cleft, conjunctival compression sutures, or wound revision. Furthermore, delayed normalization of the IOP may result in permanent macular chiorioretinal changes and poor vision. Three cases of hypotony maculopathy following pars plana vitrectomy (PPV) documented by spectral domain ocular coherence tomography (SD-OCT) are presented with differing underlying causes. The visual acuity improved after normalization of the IOP and lessening of the folds was confirmed by SD-OCT. The management of these clinical situations is discussed.

Case reports
Case 1
A 47-year-old Mexican-American man was treated for a macula-involving retinal detachment in the right eye. He was pseudophakic with a history of high myopia in both eyes and a prior manifest refraction of −22.00 D prior to cataract surgery. The best-corrected visual acuity (BCVA) was 20/400 and a rhegmatogenous retinal detachment was present. He underwent PPV and had an excellent visual outcome, achieving 20/20 BCVA with final OCT imaging showing resolution of the chorioretinal folds.
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after the cleft closure with a near visual acuity of Jaeger 2. His pressure gradually decreased again, and he was treated with a 23-gauge PPV, membrane peeling, Healon injection, and cryotherapy to the cyclodialysis cleft to induce elevation in IOP. However, his IOP rose to 48 mmHg. A vitreous chamber tap was performed but rebound increases in IOP occurred, and the patient was taken back for a 23-gauge PPV and Healon removal 3 days after initial injection. Postoperatively, his IOP remained in the low-teens and vision stabilized. His chorioretinal folds by SD-OCT resolved (Figure 3B) over

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**Figure 2** The horizontal line scan from the SD-OCT of the right eye of the patient demonstrates subtle chorioretinal folds (A). The vertical line scan more clearly demonstrates the chorioretinal folds (B). On both the horizontal and vertical line scans taken after treatment, there is a resolution of the folds (C and D).

**Abbreviation:** SD-OCT, spectral domain ocular coherence tomography.

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**Figure 3** The horizontal line scan from the SD-OCT of the left eye of the patient demonstrates subtle chorioretinal folds (A). The vertical line scan more clearly demonstrates the chorioretinal folds (B). On both the horizontal and vertical line scans taken after treatment, there is a resolution of the folds (C and D).

**Abbreviation:** SD-OCT, spectral domain ocular coherence tomography.
the ensuing 2 months, and 17 months after his most recent surgery, the BCVA had improved to 20/40 with a stable IOP ranging from 9 to 12 mmHg.

Discussion
Chorioretinal folds were diagnosed clinically but confirmed by the use of fluorescein angiography prior to the routine use of SD-OCT. A strictly retinal fold could be distinguished from a chorioretinal fold by the lack of involvement of the linear hyper and hypofluorescence of the choroid in the early stages. Since the advent and documentation by SD-OCT, chorioretinal folds that were previously unrecognized have become better documented, allowing improved correlation with visual acuity and IOP. In addition to diagnostic assistance, SD-OCT may aid in the follow-up of chorioretinal folds. Clinically, patients with chorioretinal folds caused by hypotony are more likely to show swelling of the choroid around the optic nerve head and may produce concentric folding that can be confused for papilledema. Management typically is directed to the source of hypotony in each individual case. With resolution of the hypotony, the macular chorioretinal folds may become less prominent or disappear. However, in prolonged hypotony, the folds may be evidenced by permanent pigmented lines corresponding to the troughs of the folds.

In patients who underwent transconjunctival bleb resuturing for hypotony after trabeculectomy, there was no statistically significant difference in IOP or BCVA when comparing patients with short-term hypotony to those with long-term hypotony. Long-term hypotony was defined as greater than 4 months. In that study, chorioretinal folds were only recorded in approximately half of the patients during the hypotonic period demonstrating that hypotony does not always lead to a maculopathy but also that these patients may have transiently had folds that spontaneously resolved between follow-up periods. There is the possibility that subtle chorioretinal folds were underdiagnosed in the absence of SD-OCT. These findings also suggest that medical management can be successful while reserving surgical intervention for more severe hypotony and folds. In the current series, one of the three patients had documented chorioretinal folds for over a year prior to resolution and still regained baseline visual acuity and normalization of IOP. Furthermore, evidence has been presented in the form of case reports that delayed intervention, as much as 7 years, may still result in a good visual outcome.

The chorioretinal folds that present in hypotony maculopathy are often oriented horizontally, radiating temporally from the optic nerve. In order to identify the folds on SD-OCT, vertical line scans may better illustrate the folds. Cases 2 and 3 in this series presented with horizontal folds that would not have been identified if only focusing on the horizontal line scans. This observation emphasizes the importance of two-dimensional sectioning and analysis when evaluating OCT in these patients.

The three cases of hypotony-induced chorioretinal folds following vitrectomy presented here highlight varied management approaches for resolution of the folds. Chorioretinal folds resulting from hypotony maculopathy may resolve spontaneously as the IOP normalizes as evidenced by case 1. In scenarios in which hypotony does not resolve with medical therapy, cases 2 and 3, surgical intervention may be considered and can result in good visual outcomes. Despite different treatment regimens, all the three cases retained good visual acuity (20/25–20/40).

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Disclosure
The authors report no conflicts of interest in this work.

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Imaging of chorioretinal folds following pars plana vitrectomy