SURVEY OF OPHTHALMOLOGY VOLUME 52 • NUMBER 4 • JULY–AUGUST 2007

ELSEVIER

DIAGNOSTIC AND SURGICAL TECHNIQUES

MARCO ZARBIN AND DAVID CHU, EDITORS

Optical Coherence Tomography Use in Evaluation of the Vitreoretinal Interface: A Review

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Abstract. Optical coherence tomography (OCT) is a valuable tool for assessment of the vitreoretinal interface. This article reviews the normal process of age-related posterior vitreous detachment as viewed by OCT. Abnormalities of the vitreoretinal interface as imaged by OCT are described including vitreomacular traction syndrome, cystoid macular edema/ diabetic macular edema, epiretinal membranes, full thickness macular holes, lamellar holes, pseudoholes, microholes, and schisis from myopia or optic pits/colobomas. This tool has given us new insights into the pathogenesis of these retinal abnormalities. (**Surv Ophthalmol 52**:397–421, 2007. © 2007 Elsevier Inc. All rights reserved.)

Key words. coloboma • cystoid macular edema/ diabetic macular edema • epiretinal membrane • lamellar hole • macular hole • microhole • myopia • optic pit • optical coherence tomography • pseudohole • schisis • vitreomacular traction • witreoretinal interface

Assessment of the vitreoretinal interface has been greatly aided by the development of optical coherence tomography (OCT). General reviews of the utility of OCT in retinal diseases have been published.[53,129] This cross-sectional imaging technology has allowed investigators to study disease processes that were previously unrecognizable in a non-invasive manner by biomicroscopy alone.[8,103,118,129] The contrast in reflectivity of the acellular vitreous and the parallel-fiber orientation of the inner retina allows for visible differentiation and interpretation of this interface.[137] In fact, the use of OCT has catalyzed the publication of a multitude of papers describing diseases of the vitreoretinal interface, including vitreomacular traction syndrome, epiretinal membranes, macular holes, and schisis. These studies clarify and at times introduce novel ways of staging and thinking about these processes. The recent introduction of ultrahigh-resolution imaging further enhances our capacity to image these entities and undoubtedly will improve our understanding of these processes.[18,22,67,140] This article will review these studies and illustrate the usefulness of OCT in the evaluation of the vitreoretinal interface.

Posterior Vitreous Detachment

In order to understand pathology at the interface, one must first understand the normal sequence of

0039-6257/07/$–see front matter
doi:10.1016/j.survophthal.2007.04.007

events in healthy eyes with evolving posterior vitreous detachment (PVD). Uchino et al studied the right eye of 209 healthy volunteers (mean age 52.3 years) with biomicroscopy, ophthalmoscopy, and OCT of the vitreoretinal interface.[133] Based on their observations, they created a classification of normal posterior vitreous detachment:

- Stage 0: No PVD (seen in 29% of subjects)
- Stage 1: Incomplete perifoveal PVD in up to 3 quadrants (seen in 47.8%)
- Stage 2: Incomplete perifoveal PVD in all quadrants with residual attachment to the fovea, optic nerve, and mid-peripheral retina (12.4%) (Fig. 1)
- Stage 3: Incomplete PVD over the posterior pole with residual attachment to the optic nerve and mid-peripheral retina (1.9%)
- Stage 4: Complete PVD identified biomicroscopically but not with OCT due to instrument limitation (8.6%)

An additional stage, complete PVD apart from vitreopapillary adhesion, is intermediate between stages 3 and 4 and can be detected with ultrasonographic or intraoperative evaluation.[55]

Uchino and co-authors noted that the initial manifestation of PVD was a focal one quadrant shallow vitreous detachment from the perifoveal retina, with persistent attachment to the fovea and optic nerve.[133] This developed in healthy eyes as early as the fourth decade of life. The superior quadrant was most frequently the initial site of incomplete PVD. The study did not comment on any predilection for either the nasal or temporal sites to detach. Although not longitudinal in design, the study demonstrated a significant age-related progression from no PVD through partial PVD to complete PVD, and suggested that this progression is generally a slow process.

In a recent observational case series, Johnson reported data demonstrating that the early stages of PVD in eyes with vitreomacular disorders persist chronically and progress slowly.[55] In this study, eyes were evaluated with slit-lamp biomicroscopy, B-scan ultrasonography, OCT, and/or intraoperative examination of the posterior hyaloid. Of 31 eyes with perifoveal vitreous detachment seen in follow-up, only three (9.7%) showed progression to complete PVD over an average preoperative or total follow-up period of 30.0 months (range, 2 to 237 months).

Further evidence for the chronicity of the early stages of PVD is found in the observations reported by Van Newkirk and co-workers,[135]of patients with macular pseudo-operculum. In this study, ultrasonography revealed a broad macular (stage 3) PVD in 22 (100%) of 22 eyes with pseudo-operculum. Over

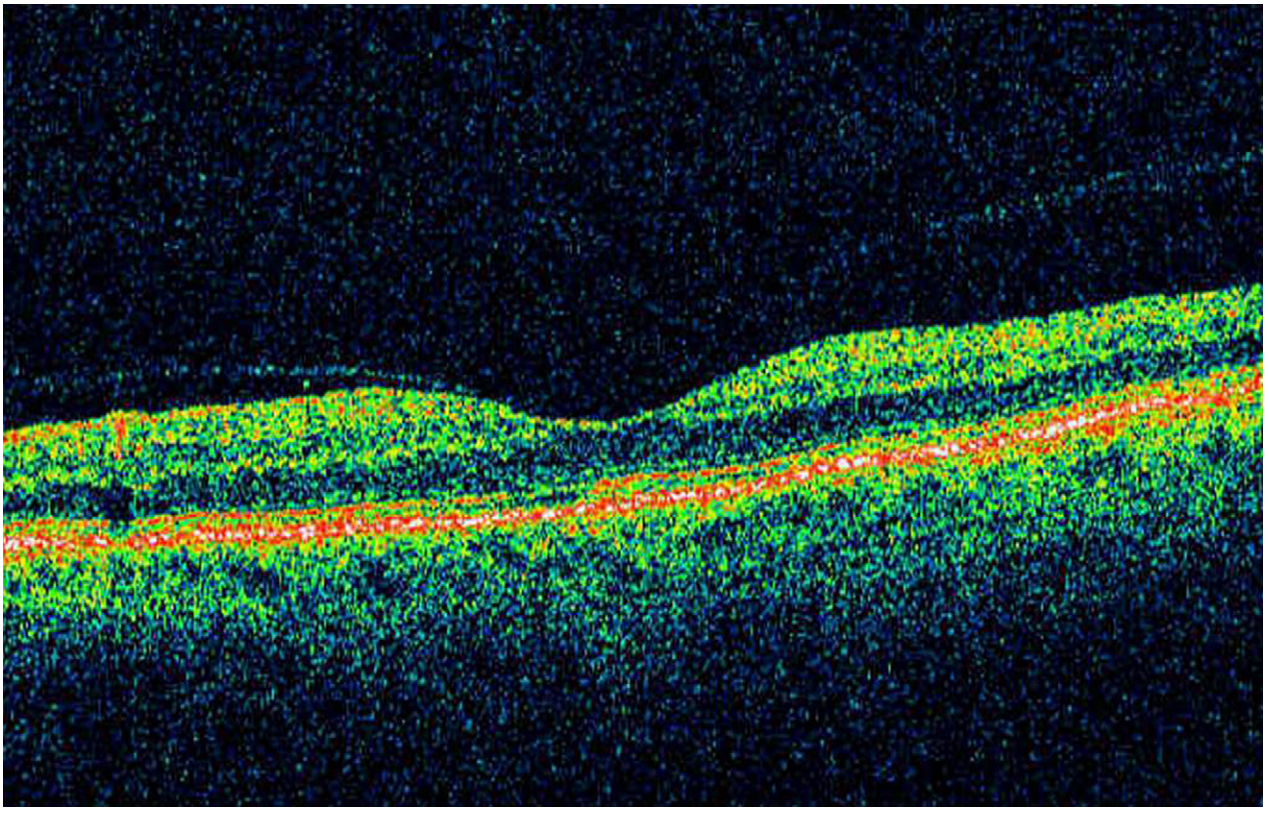

Fig. 1. Stage 2 PVD. Persistent foveal attachment seen here with perifoveal detachment.