Pars Plana Vitrectomy for Primary Retinal Detachment

Persistent Anterior Peripheral Retinal Detachment

In the century since rhegmatogenous retinal detachment was first repaired by Jules Gonin,[1] a variety of surgical techniques have been successfully used. From the introduction of the scleral buckle by Ernst Custodis, MD, in 1949 to the development of the pars plana vitrectomy (PPV) by Robert Machemer, MD, in 1971, the principles of retinal reattachment remain consistent: identify the retinal breaks, treat the retinal breaks, and relieve vitreoretinal traction. Contemporary techniques provide unparalleled opportunities to address a variety of complex retinal detachments, but these techniques should not steer vitreoretinal surgeons away from these basic principles.

A newly recognized complication of PPV for retinal detachment is the 360° persistent anterior peripheral retinal detachment, which has increasingly emerged after the current emphasis on primary vitrectomy for retinal detachment repair.[2] This complication is identified after retinal detachment surgery using PPV without scleral buckling and with barrier laser demarcation at the equator, and it is due to untreated anterior retinal breaks (see representative patients in **Figures 1**, **2**, and **3**). These patients warrant discussion because of early and late management concerns.

First, if a decision is made to perform a primary vitrectomy for retinal detachment, a thorough anterior peripheral vitrectomy must be performed. Failure to sufficiently remove the anterior peripheral vitreous ignores mitigating radial and oblique vitreoretinal traction on the more anterior retina. These tractional forces are by far the most likely cause of new retinal tears and also impair closure of old ones (as opposed to the more benign tangential vitreoretinal adhesive forces).[3] Persistent vitreoretinal traction continues to elevate retinal breaks through which continued fluid flux associated with rotary eye movements maintains the retinal detachment.[4] After a more thorough vitrectomy, the traction on retinal breaks is relieved and fluid access is reduced.[5] While concomitant use of laser retinopexy to surround these retinal tears is generally successful, failure to remove sufficient peripheral vitreous may result in recurrent or persistent retinal detachment. When the neurosensory retina inadequately contacts the underlying retinal pigment epithelium (RPE) for the 3 to 14 days required for an effective chorioretinal adhesion to form after laser application, the retinal detachment will recur.[6] In patients where a view of the anterior retina is challenging, use of wide-angle intraoperative viewing systems provides an excellent field of view, especially when coupled with scleral depression,[7] although this requires a skilled surgical assistant. Additionally, contact-based wide-angle viewing systems may provide a larger field of view compared with noncontact systems.[8]

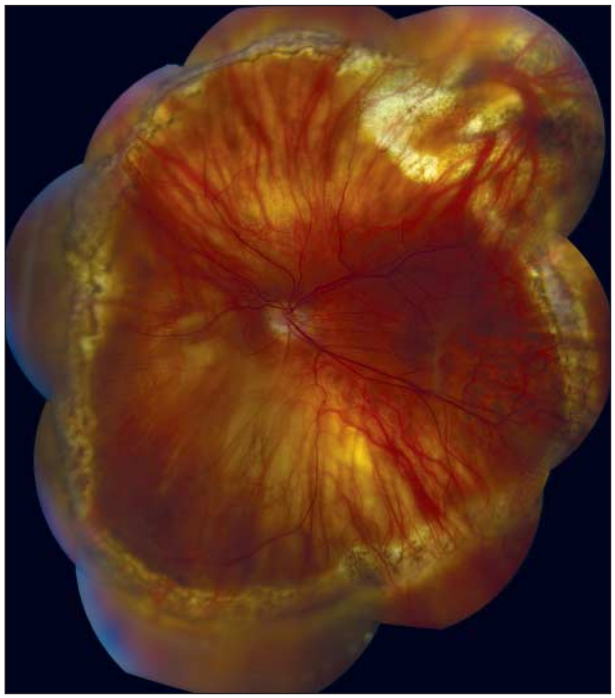

Figure 1. A 54-year-old man referred for evaluation 3 months after pars plana vitrectomy, endolaser treatment, and intraocular gas injection in the left eye. The posterior segment image shows a myopic fundus appearance (with a tilted optic disc and scleral crescent) and chorioretinal scars consistent with prior 360° laser retinopexy. Most significantly, a 360° anterior peripheral retinal detachment can be seen through the associated large retinal breaks (at the 6-o'clock and 9-o'clock positions) are not here visualized.

Second, the anterior peripheral traction could theoretically be lessened through use of an encircling scleral buckle. A buckle's action of apposing of the treated RPE/choroid to the retinal break facilitates retinal reattachment.[9] Additionally, persistent anterior retinal detachments would likely be precluded from the scleral buckle action of providing a tamponade of the break by formed vitreous of higher viscosity.[10] A final action of scleral buckles relevant in preventing anterior peripheral retinal detachments is related to their attenuation of residual vitreous traction: reducing both that which causes traction on the retinal break (and thereby directs liquid vitreous to flow into the subretinal space) as well as vitreous traction adjacent to retinal tears (which counteracts neurosensory retina-RPE adhesion and allows a retinal detachment to propagate). Specifically, with anterior tears, the

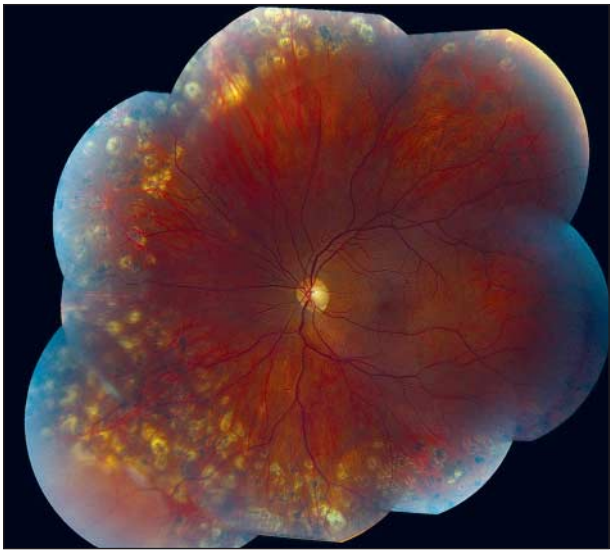

Figure 2. A 38-year-old man referred for evaluation 6 months after pars plana vitrectomy, endolaser treatment, and silicone oil injection for a giant retinal tear in his left eye. Three months prior to evaluation, the patient underwent silicone oil removal. Posterior segment examination of the left eye demonstrated temporal pallor of the optic nerve, a mild epiretinal membrane in the macular region, retinal pigmentary alterations, and rows of laser retinopexy at the equator. An anterior peripheral retinal detachment was noted anterior to the laser treatment.

Figure 3. A 42-year-old woman presented with a chief complaint of seeing "flashing lights" in her left eye. One year prior, she had undergone a pars plana vitrectomy and barrier laser demarcation for retinal detachment following a giant retinal tear in this eye. The posterior segment examination shows chorioretinal scars from prior laser retinopexy at the equator. An anterior peripheral retinal detachment is present anterior to the region of laser demarcation.

vitreoretinal traction conferred to the peripheral retina is partially relieved by the buckle's indentation of the eye wall. If the buckle is placed sufficiently anterior, this yields a net reduction in the (radially) inward-directed vitreous traction through the buckle's reduction in the vitreous base's circumference.[11] For this reason, even if an anterior retinal tear persisted, subretinal fluid would be unlikely to propagate under the peripheral retina as occurred in these cases. This action of the scleral buckle circumvents the need to perform an aggressive removal of the vitreous base, which may yield iatrogenic breaks and is particularly challenging in phakic patients with media opacities.[12] Additionally, primary repair of phakic retinal detachments with a scleral buckle may yield better postoperative visual acuity and obviate cataract formation when compared with primary vitrectomy.[13,14]

Finally, an important distinction must be drawn between barrier laser demarcation[15] to limit progression of retinal detachments and laser retinopexy specifically to treat retinal breaks. Barrier laser demarcation, among the least-studied treatments for retinal detachments (and generally less favored over far more used scleral buckle and vitrectomy procedures), is applied with the primary goal of limiting progression of subretinal fluid, with little emphasis on restoring the function or reattaching the area of detached retina.[16] Thus, the already detached retina is effectively sacrificed at the expense of halting detachment progression.[11] Because the goals of this treatment approach do not encompass reattaching the retina, barrier laser demarcation is sometimes used in patients with limited asymptomatic peripheral retinal detachments (because this treatment will not improve visual disturbances or field defects).[6,17,18] It is generally used to circumvent the risks and adverse effects of scleral buckling and PPV (ie, buckle intrusion, buckle extrusion, endophthalmitis, refractive changes, strabismus, and cataract formation),[19,20] while providing a time-efficient office-based procedure without the added need for trained support staff (ie, anesthesiologists), operating room equipment, or even postoperative positioning.[21] Barrier laser demarcation was performed using an endolaser in the illustrated patients here, but endolaser retinopexy to seal retinal breaks would be a more ideal choice because surgical intervention was already being performed. Laser retinopexy, when applied in this setting (during PPV or prophylactically in symptomatic retinal tears), is aimed at creating a chorioretinal adhesion immediately surrounding a retinal tear to prevent a new (or recurrent) retinal detachment. Treatment of anterior peripheral tears should usually be extended to the ora serrata.[6] In fact, the most common cause of unsuccessful treatment of horseshoe tears is failure to treat far enough anteriorly[22,23] because this is the area that is most subjected to vitreous traction.[24] Interestingly, while in previous reports[17,18] it is likely that failed laser retinopexy emanated from underestimation of the posterior extent of subretinal fluid (thus incomplete posterior laser treatment), in cases of persistent anterior peripheral retinal detachments, incomplete anterior laser treatment resulted in subretinal fluid extension to involve the entire anterior retina. Such treatment failure places patients at risk for persistent intraocular inflammation, proliferative vitreoretinopathy, increased vascular endothelial growth factor production, and ocular hypotony (through decreased aqueous humor production and abnormal posterior aqueous humor outflow).[25,26]

When left unrepaired, retinal detachments may be associated with proliferation of RPE cells, degeneration of photoreceptor outer segments, and enlargement of retinal breaks and progression to involve the macula.[27] Management options for these persistent anterior peripheral retinal detachments are tailored to the individual patient. Observation is a reasonable option for some patients for whom surgery is risky and who have a stable,

well-demarcated anterior peripheral detachment. Definitive retinal detachment surgery should be considered in more severe retinal detachments, including those with a higher risk for progression, in patients who are symptomatic, and in those whose chronic anterior detachment has yielded areas of retinal rigidity necessitating a retinectomy to achieve stability.

The persistent anterior peripheral retinal detachment is a consequence of both incomplete vitrectomy procedures and inappropriately placed laser retinopexy. While most vitreoretinal surgeons embrace the new primary vitrectomy technology available today in the repair of retinal detachments, maintenance of traditional vitreoretinal principles will provide optimal retinal reattachment rates and better long-term visual outcomes.

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Conflict of Interest Disclosures: None reported.
Funding/Support: This work was supported in part at the Bascom Palmer Eye Institute by Research to Prevent Blindness, New York, New York.

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