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Outcomes of Pars Plana Vitrectomy for Epiretinal Membrane in Eyes With Coexisting Dry Age-related Macular Degeneration

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Purpose: There has been limited evidence on the benefits of pars plana vitrectomy with membrane peel (PPV-MP) for epiretinal membrane (ERM) in eyes with dry age-related macular degeneration (AMD). We sought to assess anatomic and functional outcomes of PPV-MP for ERM in this subset of eyes.

Design: A retrospective cohort study.

Participants: Patients with dry AMD who underwent PPV-MP for ERM from January 1, 2010, to December 1, 2016.

Methods: Visual acuity (VA) and central foveal thickness (CFT) as measured on spectral-domain OCT were recorded and analyzed for the preoperative, 6-month, and final follow-up visits. The presence of cystoid macular edema (CME) and ellipsoid zone (EZ) integrity were recorded and compared with postoperative imaging. Conversion to neovascular AMD in eyes for which at least 2 years of follow-up were available, as confirmed by either OCT and/or fluorescein angiography and documentation of treatment with intravitreal antivascular endothelial growth factor, was recorded and compared between case eyes that underwent PPV-MP versus fellow control eyes.

Main Outcome Measures: Postoperative VA.

Results: A total of 38 eyes from 38 patients met the study criteria. There was a significant improvement in the median (interquartile range, [IQR]) logarithm of the minimum angle of resolution [logMAR] VA from 0.60 (IQR 0.46−1.00) (20/80, Snellen equivalent) at the preoperative visit, to 0.48 (IQR 0.30−0.70) (20/60, Snellen equivalent) at the 6-month follow-up visit ($P = 0.04$), and to 0.48 (IQR 0.30−0.70) (20/60, Snellen equivalent) at the final visit ($P = 0.01$). There was a significant median decrease in CFT at the final visit ($P < 0.001$) compared with the preoperative CFT. Only eyes with either CME or an intact EZ showed significant improvement in median logMAR VA at the final visit compared with the preoperative visit ($P = 0.01$ and $P = 0.004$, respectively). In a subgroup analysis of eyes for which a minimum of 2 years of follow-up were available, 4 of 25 (16.0%) vitrectomized eyes and 1 of 25 (4.0%) fellow control eyes progressed to neovascular AMD ($P = 0.16$).

Conclusions: PPV-MP appears to confer anatomic and functional improvement in eyes with ERM and coexisting dry AMD. Moreover, greater preoperative CFT, the presence of CME, and an intact EZ were predictors of VA improvement in these eyes. *Ophthalmology Retina 2018;■:1−6 © 2018 by the American Academy of Ophthalmology*

Age-related macular degeneration (AMD) is the second leading cause of visual impairment worldwide with an estimated prevalence of 8.69% in those between 45 and 85 years of age.[1] Studies have previously demonstrated a multitude of risk factors associated with the progression of AMD, some of which include age, diet, and smoking status.[2−4] It has been estimated that 18% of eyes with either extensive intermediate drusen, large drusen, or noncentral geographic atrophy progress to advanced AMD within 5 years.[5] Up to 38.2% of eyes with AMD also have a concomitant epiretinal membrane (ERM),[6] which can also cause or contribute to metamorphopsia and decreased visual acuity (VA). Two previous studies have evaluated outcomes of vitrectomy with membrane peel (PPV-MP) in eyes with concomitant dry AMD[7,8]; however, they were limited by duration of follow-up. Therefore, we sought to assess anatomic and functional outcomes of PPV-MP for ERM in eyes with dry AMD.

Methods

The institutional review board of Wills Eye Hospital approved the protocol before the commencement of the study and it was conducted under the compliance of the Health Insurance Portability and Accountability Act. Eyes with both bilateral dry AMD and a history of PPV-MP for ERM were identified using International Classification of Diseases, Ninth and Tenth Revisions, Clinical Modification and Current Procedural Terminology billing codes from January 1, 2010, to December 1, 2016. Inclusion criteria included (1) eyes with bilateral nonexudative AMD, (2) a history

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of unilateral PPV-MP for ERM, (3) a minimum of 6 months of post−PPV-MP follow-up, and (4) meeting the Age-Related Eye Disease Study (AREDS) Category 3, defined as nonneovascular AMD with numerous intermediate drusen (63-124 μm), at least one large druse (≥125 μm), or geographic atrophy not involving the center of the macula. Exclusion criteria included a history of any of the following: (1) diabetic macular edema, (2) angioid streaks, (3) myopic degeneration, (4) rhegmatogenous retinal detachment, (5) neovascular AMD, (6) uveitis, (7) full-thickness macular hole, (8) prior intraocular surgery (except cataract surgery), or (9) vitreomacular traction. All surgeries were performed by one of the 15 physicians of the retina practice. The decision to proceed with surgery differed depending on the physician; however, most physicians often required there to be a visually symptomatic ERM with either persistent subjective symptoms or reduced VA for more than 6 months' duration. The procedures were performed with either a peribulbar or a retrobulbar block using a 23-gauge or a 25-gauge vitrector. A posterior vitreous detachment was induced if one was not already present. ERM and internal limiting membrane peeling was performed using an internal limiting membrane forceps with a peeling area of 2 to 3 optic disc diameters around the centered fovea. All except 1 eye underwent internal limiting membrane peeling with indocyanine green dye staining.

Patient Characteristics

Relevant patient demographics were obtained from the clinical charts and tabulated for evaluation. The dates of the preoperative visit, the surgery, and the final encounter were obtained for each patient. Best available Snellen VA measurements based on corrected or pinhole vision were recorded for the preoperative visit, the 6-month follow-up visit, and the final visit. Baseline characteristics, including age, gender, smoking status, and history of hypertension, were also obtained.

OCT Measurements

All OCT images were obtained using spectral-domain OCT (Spectralis HRA + OCT; Heidelberg Engineering, Inc, Heidelberg, Germany); images were analyzed using the Heidelberg software package (Heidelberg Eye Explorer; Heidelberg Engineering, Inc). Measurements and evaluations were taken and agreed upon by three reviewers (A.O., J.D., and X.G.). OCT images from the preoperative and final visit were assessed for the presence of cystoid macular edema (CME) and disruption in the ellipsoid zone (EZ). An intact EZ was defined as a continuous hyperreflective line between the retinal pigment epithelium and the external limiting membrane. EZ disruption was defined as a disruption of this hyperreflective line at the foveal region. Central foveal thickness (CFT) and largest druse size were measured using the built-in software calipers at the preoperative visit, the 6-month follow-up visit, and the final visit. CFT was measured from the inner surface of the retina to the base of the retinal pigment epithelium. Largest druse size was determined using all available cuts from the radial scan.

Conversion to Neovascular AMD

Conversion to neovascular AMD was defined as a confirmation of conversion on OCT and/or fluorescein angiography that necessitated intravitreal antivascular endothelial growth factor therapy.

Statistical Analysis

All statistical analyses were performed using SPSS (v. 24) (SPSS, Inc, Chicago, IL) and SAS (v. 9.4) (SAS Institute Inc, Cary, NC). Snellen VA was converted to the logarithm of the minimum angle of resolution (logMAR) for analysis. Continuous variables were assessed for Gaussian distribution using the Shapiro-Wilk test for normality. Correlation between initial, final, or change in CFT and logMAR VA was evaluated using either linear regression or the generalized linear model for normally and not normally distributed data, respectively. Before and after measurements were assessed using a paired *t*-test or the Wilcoxon signed rank test for normally and not normally distributed data, respectively. Frequency of conversion to neovascular AMD and categorical characteristic comparisons were made using a chi-square analysis. Statistical significance was defined as $P < 0.05$.

Results

A total of 173 eyes with dry AMD and a history of PPV-MP for ERM were identified. A total of 135 eyes were excluded for the following reasons: 86 had OCT images that were not in a format that could be analyzed electronically with the Heidelberg software, and 49 had additional retinal pathology that met exclusion criteria. A total of 38 case eyes were eligible for the final analysis. The 38 fellow control eyes were used for comparative purposes. The median (interquartile range [IQR]) patient age was 78.5 years (70.0−82.3 years). The cohort consisted of 25 (65.8%) females and 13 (34.2%) males. Of the 38 case eyes included, 19 (50.0%) were pseudophakic while 14 (36.8%) of the 38 fellow control eyes were pseudophakic before surgery. The median duration of follow-up was 2.6 years (IQR 1.2−4.6 years). Additional baseline characteristics are summarized in Table 1.

Visual Acuity

Compared with the preoperative visit, there was a significant improvement in logMAR VA in the 38 eyes that underwent PPV-MP, with a decrease in the median logMAR VA from 0.60 (IQR 0.46−1.00) (20/80, Snellen equivalent) at the preoperative visit, to 0.48 (IQR 0.30−0.70) (20/60, Snellen equivalent) at the 6-month

Table 1. Baseline Characteristics of Patients/Eyes With Age-Related Macular Degeneration Undergoing Pars Plana Vitrectomy for Epiretinal Membrane

Factor	Value*
Age (yrs)	78.5 (70.0−82.3)
Gender	
Female	25 (65.8%)
Male	13 (34.2%)
Smoking status	
Never smoked	32 (84.2%)
Previous smoker	4 (10.5%)
Smoker	2 (5.3%)
Hypertension	
Yes	17 (44.7%)
No	21 (55.3%)
Duration of follow-up (yrs)	2.6 (1.2−4.6)
Lens status (case eye)	
Phakic	19 (50%)
Pseudophakic	19 (50%)
Lens status (fellow eye)	
Phakic	24 (63.2%)
Pseudophakic	14 (36.8%)

*Data represent the median (interquartile range) or N (%).