Are Preoperative Intraretinal Cysts at Macular Hole Borders Useful Predictors of Visual Performance After Surgery to Repair Macular Holes?

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Introduction

Macular holes form when there is a break in the central part of the retina. The retina is the light-sensitive tissue in the back of the eye. The macula provides the central part of the field of vision and is key in overall visual acuity due to its high density of photoreceptor cells. When a macular hole occurs, the central vision is distorted and blurred.[1] The formation of intraretinal cysts at the boarder of these macular holes caused by traction of the vitreous as it pulls away from the back of the eye can further exacerbate these symptoms--but could also potentially suggest a more recent break in the macula, and thus the potential for better recovery after repair.

It is estimated that 7.8 per 100,000 new persons develop macular hole each year, 80% of which are unilateral.[2] The risk is also almost two-thirds greater in women than in men. If left untreated, a macular hole can progress and result in further impairment of the visual field. The most common treatment for macular hole repair is surgical vitrectomy where the vitreous is removed from inside the eye, coexisting epiretinal membrane is peeled with or without the internal limiting membrane removal. The use of Optical Coherence Tomography (OCT) is the current gold standard imaging modality for diagnosis and management of macular holes. The images provided by OCT allow for visualization of the ten retinal layers and their densities.[3]

Purpose

To determine if the number of pre-operative intraretinal cysts bordering a macular hole ("border cysts") and/or their spectral domain optical coherence tomography (SD-OCT) optical density ratios are potentially useful predictors of visual performance after the surgical repair of a full-thickness macular hole.

Methods

A retrospective chart review was performed on 375 patients who underwent macular hole surgery at the University of Kansas Medical Center over the past 10 years and had preoperative SD-OCT scans. Two independent readers examined all available scans. Image-J software was used to measure macular hole diameter, count border cysts and determine the ratio of SD-OCT optical density within border cysts to that of the overlying vitreous (ODR). Data collected included LogMAR visual acuity for analysis using the equation [LogMAR VA = -log(decimal acuity)][4,] age, gender, ODR and macular hole diameter. The institutional review board of the University of Kansas School of Medicine approved this study.

Results

Thirty-two patients met the study inclusion criteria (24 females, 8 males). Their average age was 71.9 ± 6.5 years old. All patients included in the study had preoperative border cysts (average number: 6 ± 4 intraretinal cysts). The number of border cysts was marginally correlated with 1-month postoperative LogMAR visual acuity (R-value: -0.31, p-value: 0.085). The ODR of these intraretinal cysts was not significantly correlated with LogMAR visual acuity 1-month postoperatively (R-value: -0.2, p-value: 0.27). Preoperative visual acuity and macular hole diameter correlated significantly with 1-month postoperative LogMAR visual acuity [(R-value: 0.58, p-value: 0.0005) and (R-value: 0.49, p-value: 0.005), respectively].

STUDY DEMOGRAPHICS

Age	71.91 ± 6.54
Gender	Male: 25.00 % (8 patients) Female: 75.00 % (24 patients)
Eye Surgically Corrected	OD: 53.13 % (17 patients) OS: 46.87% (15 patients)
Average Cyst Count in Corrected Eyes	6.81 ± 4.32

Table 1. Study Patient Demographics: Data recorded from Redcap and analysis of patient OCT images through ImageJ software.
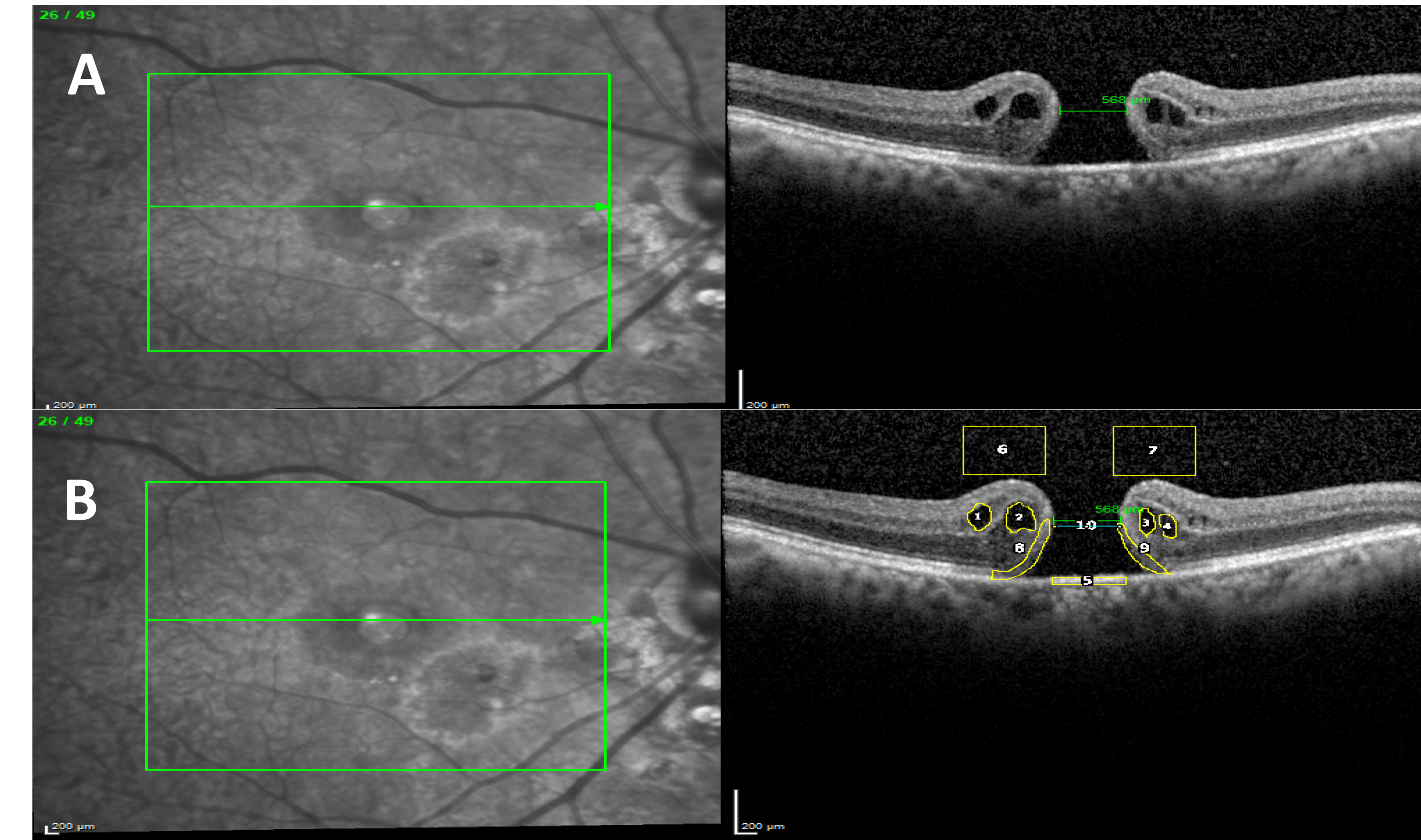

Figure 1. Retina images of a patient with full thickness macular hole with cyst presence: (A) SD-OCT scan of an affected eye, showing full thickness macular hole with complete break of retinal layers through the RPE, and presence of intraretinal cysts at the boarder of the macula. (B) SD-OCT scan of the same affected eye, with overlaying measurements taken with ImageJ software to determine retinal cyst density and size, density of the vitreous humor immediately anterior to the cysts, angle ant the macular hole boarder, and the density of the RPE both centrally and at the macular hole angle.

Conclusions

Preoperative visual acuity and macular hole size were the most reliable biomarkers of postoperative visual acuity in this study cohort. Correlation with postoperative visual acuity was marginal for border cyst number and absent for their ODR. Prospective studies are needed to determine the prognostic significance of border cysts and their SD-OCT optical densities.

Financial Conflict of Interest

None to Disclose

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