Objective: To assess the prevalence of recurrence of macular geographic atrophy (GA) of the retinal pigment epithelium (RPE) after macular translocation with 360° retinectomy (MT360) in one institution.

Methods: A retrospective review of all cases of GA that were treated with MT360 in 1 institution. Demographic and clinical data including the duration of preoperative visual loss, preoperative and postoperative visual acuity, and the prevalence of postoperative foveal RPE atrophy were recorded for these patients, and these data were compared with similar data from patients who underwent MT360 for neovascular age-related macular degeneration (AMD) as part of the prospective Duke Macular Translocation Study, Duke University Eye Center, Durham, NC.

Results: Four eyes in 4 patients with GA secondary to AMD underwent MT360 and were compared with 63 eyes in 63 patients who underwent MT360 for neovascular AMD as part of the Duke Macular Translocation Study. The mean duration of preoperative visual loss was higher in the GA group (11.3 months) than in the neovascular AMD group (1.7 months) (P = .08). The prevalence of postoperative foveal RPE atrophy was significantly higher in the GA group (n=3; 75.0%) than in the neovascular AMD group (n=5; 8.3%) (P<.01); in the GA group, this corresponded to recurrence of the GA lesions. In contrast, the postoperative RPE atrophy seen in the neovascular AMD group was due to postoperative mechanical forces such as laser therapy or RPE tearing. There was no significant difference in the mean preoperative or postoperative visual acuity in either group.

Conclusions: Subfoveal RPE atrophy can reoccur following MT360 in eyes with nonneovascular AMD and GA; RPE atrophy similar to this has not been found in a large consecutive series of patients with neovascular AMD after MT360. Further research is needed to assess if the potential for visual recovery in eyes with end-stage non-neovascular AMD is outweighed by the possibility of postoperative recurrence of GA.

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location Study, clinical details of which have been previously reported.5,6 Preoperative and postoperative fluorescein angiograms of this series of eyes were reviewed to identify any postoperative RPE atrophy. Clinical and demographic data from the 2 groups of eyes were compared using the $\chi^2$ test for categorical variables and the $t$ test for continuous variables.

**RESULTS**

Reviewers identified 4 eyes with GA secondary to AMD in 4 patients who underwent MT360 with simultaneous cataract surgery in 1 patient (patient 3, Table 1). Three eyes in 3 patients were identified from the quality assurance database and 1 eye in patient 1 (Table 1) was identified from the Duke Macular Translocation Study. The initial clinical course of 1 patient (patient 1) was previously reported with recurrence of GA seen after the publication of the article (Figure 1).4 Sixty-three eyes in 63 patients in the Duke Macular Translocation Study had subfoveal neovascularization, fibrosis, or blood without GA. Four eyes in the Duke Macular Translocation Study had RPE atrophy secondary to postoperative thermal laser or photodynamic therapy with injectable verteporfin (Visudyne; QLT Inc, Vancouver, British Columbia) for recurrent CNV. One patient had a postoperative RPE tear that involved the subfoveal RPE. There was no evidence of GA after MT360 in any eye that had a preoperative diagnosis of neovascular AMD. The demographic and clinical data of both patient groups are summarized in Table 1 and Table 2.

Comparison of demographic and clinical data of patients who had recurrence of RPE changes after MT360 for GA with the group of patients who underwent MT360 for neovascular AMD is summarized in Table 2. There was no significant difference in the mean age of patients in either group. However, there was a higher proportion of female patients in the GA group when compared with the neovascular AMD group. The mean duration of visual loss prior to surgery was higher in the GA group than in the neovas-
cular AMD group. There was no significant difference in the mean preoperative visual acuity in either group. Patients with GA were followed up for a mean of 19.3 months with 3 patients having follow-up between 7 and 12 months. Only 12-month follow-up data were available for patients with neovascular AMD. Postoperative foveal RPE atrophy was seen in a significantly higher proportion of patients in the GA group. This postoperative foveal change corresponded to recurrence of the pattern of GA similar to that seen before surgery in the GA group (Figures 1, 2, and 3); the causes of postoperative RPE atrophy in the neovascular AMD group were outlined previously. Mean postoperative visual acuity was the same in both groups at the last follow-up visit.

**COMMENT**

In this study we have reported 3 cases in which patients who underwent MT360 for the treatment of GA developed new RPE changes under the translocated macula. This was in striking contrast to the absence of new GA under the fovea in a series of 63 eyes with more than 1 year follow-up after MT360 for neovascular AMD. One previous study has reported clinical outcomes after MT360 for GA in 7 eyes. In that series, GA recurred in 1 eye, although recurrence of RPE changes under the translocated macula were not seen in the other 6 eyes. This patient with the noted GA recurrence had a 14-month follow-up, whereas 4 of the remaining 6 eyes had less than 12 months’ follow-up. In a subsequent presentation, Claus Eckardt, MD, reported a total of 4 eyes with recurrent GA of 14 eyes translocated for GA (oral communication to the American Academy of Ophthalmology Retina Preacademy meeting, November 2002). The pattern of the GA seen in the 3 cases documented in this article was similar to the recurrence reported by Eckardt and Eckardt and was characterized by mild RPE changes seen 3 to 4 months postoperatively followed by frank RPE atrophy seen approximately 12 months after MT360. This recurrence was contiguous with the preoperative atrophic area, and the dimensions of the recurrence were similar to those of the original areas of GA. The exact timeframe for development of recurrent RPE atrophy cannot be accurately determined by these retrospective studies. Thus, to date, including the current series and the updated series presented by Eckardt,
7 (39%) of 18 eyes had recurrence of GA under the new fovea after MT360 for GA.

As in the previously reported cases, recurrence of GA was not associated with a decrease in visual acuity in most eyes. However, the long-standing GA in one of the cases reported in this article is likely to have resulted in some sensory retinal damage or cell death and may, therefore, account for the poor postoperative visual acuity in this eye. Interestingly, GA has been treated with limited macular translocation in both eyes of 1 patient with postoperative improvement in visual acuity in both eyes and no recurrence of the preoperative lesions after follow-up periods of 13 and 22 months. 

It is unclear why GA recurs after MT360 in eyes with previous GA. Geographic atrophy is the end stage of a chronic process affecting both retinal photoreceptors and RPE cells that are interdependent and communicate through diffusible trophic factors and direct cell-to-cell contact. Histological studies of neovascular AMD have shown that RPE cells degenerate first followed by sequential degeneration of overlying rod and then cone photoreceptors. If GA is a panretinal condition, repositioning of the more densely packed and, therefore, more metabolically demanding macular photoreceptors over peripheral RPE cells may be sufficient to precipitate RPE cell loss, particularly if those RPE cells are already unhealthy or stressed. However, it is also possible that the primary defect in GA arises in the photoreceptors leading secondarily to RPE death. If this is the case then translocation of the defective sensory macula could result in accelerated damage to the RPE if it is placed over. Alternatively, apoptosis has been implicated as the cause of cell death in AMD as evidenced by Fas receptor expression in RPE and photoreceptors, with the strongest Fas labeling seen in photoreceptors at the edge of atrophic areas or overlying fibrovascular scars. The translocated photoreceptors expressing Fas receptor may be able to induce apoptosis in underlying RPE cells at the new macular site.

Eyes with GA that underwent MT360 in this study already suffered a chronic degenerative process, as evidenced by the longer duration of symptoms prior to surgery documented in patients with GA when compared with patients with neovascular AMD. This relatively shorter period in eyes with subfoveal neovascular AMD may be insufficient for the neovascular degenerative process to trigger either the apoptotic pathway or another, as yet undetermined, metabolic pathway. Alternatively, eyes with neovascular AMD may have sustained less irreversible photoreceptor damage than eyes with GA because of this temporal difference, thus allowing postoperative recovery. Surgical trauma associated with the retinal detachment that is an inherent part of MT360 is unlikely to be a cause of the GA recurrence seen in the cases reported herein and previously since it is not seen in cases treated with the same techniques for neovascular AMD. Furthermore, MT360 for GA does not include removal of subretinal CNV which is potentially the most traumatic part of the MT360 procedure. Interestingly, significant postoperative foveal RPE atrophy occurred in only a small proportion of 63 consecutive eyes that had MT360 for neovascular AMD and in all cases this was due to postoperative mechanical forces such as laser therapy or an RPE tear. In addition, Mruthyunjaya et al reported that all of the recurrent neovascularization (21% of eyes) arose from the original site where CNV had been removed and not de novo under the new fovea.

Geographic atrophy poses a significant problem as 3.5% of all people older than 75 years have this form of AMD and it accounts for approximately 80% of all cases of the disease. Geographic atrophy is bilateral in up to 56% of cases and 50% of eyes with early GA and good vision have reduced contrast sensitivity and reading rates secondary to parafoveal scotomas. Furthermore, profound visual loss secondary to severe GA occurs in up to 42% of affected eyes. Besides macular translocation, no treatment has been demonstrated to prevent visual loss in patients with GA. Further research is needed to assess if the potential for visual recovery in eyes with end stage nonneovascular AMD is outweighed by the possibility of postoperative recurrence of the atrophic lesions.

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