

The Clinical Course of the Idiopathic Epiretinal Membrane After Surgery

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Purpose: To evaluate the clinical course of visual acuity and foveal thickness in the idiopathic epiretinal membrane (ERM) after a vitrectomy with the use of triamcinolone.

Methods: We retrospectively reviewed the records of 30 patients (30 eyes) with ERM that were treated by vitrectomy from 2004 to 2008. Visual acuity and foveal thickness from optical coherence tomography imaging was obtained preoperatively and at every postoperative follow-up visit.

Results: Visual acuity improved by two or more lines of vision in 30%, 50%, 60%, and 70%, and stayed the same within ± 1 line in 47%, 50%, 40%, and 30% at one month, three months, five months, and seven months after surgery. Twenty-three percents of the subjects deteriorated by two or more lines of vision within one month after surgery. None of the subjects had reduced vision three months after surgery. Foveal thickness decreased significantly after surgery. The mean thickness was $409.7 \pm 107.9 \mu\text{m}$ before surgery and $288.6 \pm 66.1 \mu\text{m}$ seven months after surgery. Parameters which were significantly correlated with the final visual acuity included preoperative visual acuity (0.683), preoperative foveal thickness (0.544), and final foveal thickness (0.643) ($p < 0.005$).

Conclusions: Foveal thickness and visual acuity improved until seven months after the vitrectomy in patients with idiopathic ERM. Preoperative visual acuity, foveal thickness, and final foveal thickness had a significant correlation with the final visual acuity.

Korean J Ophthalmol 2009;23:249-252 © 2009 by the Korean Ophthalmological Society.

Key Words: Epiretinal membrane, Foveal thickness, Optical coherence tomography, Visual acuity, Vitrectomy

The epiretinal membrane (ERM) is a cellular avascular membrane that can cause visual disturbances due to retinal wrinkling. Although the natural history of ERM is variable and the condition may only have a mild effect on vision, many patients report significant symptoms of distortion and blurring of vision. ERM can be associated with posterior vitreous detachment, retinal breaks, vascular retinopathy, ocular inflammation, some congenital conditions, and intraocular surgeries such as post-retinal detachment repair, retinal laser, and cryotherapy. However, idiopathic ERM is the most common. In 1978 Machemer was successful in removing the ERM by vitrectomy. Since then, surgery for the treatment of idiopathic ERM has had a 70-90% success rate.¹⁻³ Today it is possible to remove the ERM more precisely with the use of triamcinolone during the vitrectomy.

Several prognostic factors for the success of these surgeries have been suggested. These factors include preoperative visual acuity, the duration of symptoms, the presence of traction, the thickness of the ERM, and the presence of preoperative

macular edema. These factors are still controversial.³⁻⁵ Optical coherence tomography (OCT) offers a method for obtaining a quantitative measurement of the macular structure. In eyes with ERM, OCT can show increased thickness of the macula, loss of the foveal contour, or intraretinal cysts. Recent reports indicate that OCT has been used to investigate the preoperative or postoperative thickness and morphologic patterns of ERM.⁶⁻⁸ Massin et al.⁶ used OCT to examine the preoperative and postoperative anatomical features of the macula in patients who underwent surgery for ERM. However, they followed up three months after surgery to avoid the effects of nuclear cataracts. This period was too short to evaluate the clinical course and assess the prognostic factors. In another report, the authors analyzed the correlations between the preoperative characteristics of the OCT images and the visual improvements in ERM. However, postoperative OCT images were not included.⁷

The purpose of this study was to evaluate the clinical courses of visual acuity and foveal thickness using OCT in patients with idiopathic ERM after a vitrectomy. We investigated the factors that correlated with visual acuity.

Received: November 3, 2008 Accepted: October 23, 2009

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Table 1. Demographics and clinical characteristics of the epiretinal membrane patients who underwent a vitrectomy

Demographic	30 patients (30 eyes)
Gender (Male : Female)	7 : 23
Spherical equivalent (diopter)	0.15±2.50
Age at the initial visit (yr)	65.33±6.96
Follow-up period (mon)	8.6 (7-17)
Vitrectomy+cataract surgery*	18
Vitrectomy only (phakic eye : pseudophakic eye)†	12 (7 : 5)

* Number of patients who underwent a vitrectomy with concomitant cataract surgery; † Number of patients who underwent only a vitrectomy.

Materials and Methods

We reviewed the records of the patients who underwent a pars plana vitrectomy for idiopathic ERM between January 2004 and February 2008. All of the subjects had a complete ocular examination to exclude possible peripheral retinal breaks or other anomalies which could result in ERM formation. Exclusion criteria included a history of ocular or systemic conditions known to be associated with macular ERM formation, potentially irreversible significant loss of vision, less than seven months of follow-up, and clinical or angiographic evidence of a vascular occlusion or other anomaly involving the macula. Thirty eyes from 30 subjects were included in this study. The patients underwent a standard three port pars plana vitrectomy assisted with triamcinolone and membrane peeling. The procedures were performed by a single surgeon and used high-magnification viewing and intraocular forceps. Because the ERM was peeled without identification of the internal limiting membrane (ILM), the ILM was unintentionally peeled off together with the ERM in some patients. Concomitant cataract surgery was performed if necessary. Preoperative and postoperative examinations, performed at every follow-up visit, included the best-corrected visual acuity using a standard Korean visual acuity chart (Han's chart). The examinations also included a slit-lamp examination, fundus examination, fundus photography, and OCT. Patients followed-up every one or two months until they showed no further changes in visual acuity. After they were stable, they were followed every three to six months according to their postoperative status.

Optical coherence tomography was performed using commercially available equipment (software 3.0; Carl Zeiss Meditec, Dublin, CA, USA). After papillary dilation, measurements of the average thickness of the central 1 mm of the retina before and after surgery were compared. All of the subjects were divided into two groups according to the concomitant cataract surgery. Eighteen eyes underwent a vitrectomy with concomitant cataract surgery; 12 eyes underwent a vitrectomy alone. The visual acuity and foveal thickness was measured for each group, and statistical analyses were carried out.

The statistical analysis was performed using SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA). All of the comparisons were two-tailed. Means of the two groups were compared us-

ing a *t*-test. Appropriate prognostic parameters were analyzed by Pearson's correlation against the final postoperative visual acuity.

Results

The 30 subjects in this series consisted of seven men and 23 women. They ranged in age from 52 to 78 years (mean, 65.33 years). The follow-up period ranged from seven to 17 months (mean, 8.7 months) (Table 1). The preoperative best-corrected visual acuity in logMAR units was 0.43±0.30 (Table 2). Eighteen eyes underwent concomitant cataract surgery. Twelve eyes had only a vitrectomy without concomitant cataract surgery. Five out of 12 eyes had a previous history of cataract surgery before the diagnosis of ERM.

Visual acuity expressed on a logMAR scale at one month, three months, five months, and seven months after surgery were 0.45±0.40, 0.27±0.36, 0.22±0.35, 0.21±0.35, and 0.20±0.34, respectively. Visual acuity on the Han's chart at one month, three months, five months, and seven months improved by two or more lines of vision, in 30%, 50%, 60%, and 70% of the patients and remained within ±1 line in 47%, 50%, 40%, and 30% of the patients, respectively. The proportion of the subjects who had worsened by two or more lines of vision decreased to 23% after one month and to 0.0% three months after surgery (Table 2). Visual acuity changes were greatest one month and three months after surgery. None of the eyes in either group showed changes in visual acuity seven months after surgery, with one exception. This exception was an eye which had cataract surgery after six months due to a secondary cataract. Visual acuity improved greatly from one to three months after the vitrectomy in patients with idiopathic ERM. Seventy percent of the eyes showed visual improvements up to approximately seven months after the vitrectomy, but not thereafter.

Optical coherence tomography showed that foveal thickness decreased significantly after surgery. The mean foveal thickness was 409.7±107.9 µm before surgery and gradually decreased to 288.6±66.1 µm in the seven months after surgery (Table 2).

Visual improvement was greater in the concomitant cataract surgery group compared to the group who underwent a vitrectomy alone. Visual acuities expressed on a logMAR scale

Table 2. LogMAR visual acuity, distribution of eyes according to visual improvement, and foveal thickness before and after surgery in all of the eyes (N=30)

	Preop*	1 mon*	3 mon*	5 mon*	7 mon*	Final*
BCVA	0.43±0.30	0.45±0.40	0.27±0.36	0.22±0.35	0.21±0.35	0.20±0.34
VA>2 [†]	-	9 (30)	15 (50)	18 (60)	21 (70)	21 (70)
VA<±1 [†]	-	14 (47)	15 (50)	12 (40)	9 (30)	9 (30)
VA<-2 [†]	-	7 (23)	0	0	0	0
Foveal (μm) [‡]	409.7±107.9	320.9±88.2	311.9±73.4	295.9±71.5	288.6±66.1	287.9±66.8

Values are presented as mean±SD or number (%).

BCVA=best corrected visual acuity expressed on a logMAR scale.

* Preoperative, 1, 3, 5, 7 mon, and final follow-up after surgery; [†] Visual acuity in Han's chart improved by two or more lines, stayed the same within ±1 line, worsened by two or more lines of vision; [‡] Foveal thickness measured by optical coherence tomography.

Table 3. LogMAR visual acuity, distribution of eyes according to visual improvement, and foveal thickness before and after surgery in the eyes that underwent vitrectomy with concomitant cataract surgery and vitrectomy alone

	Preop*	1 mon*	3 mon*	5 mon*	7 mon*	Final*
Vitrectomy with concomitant cataract surgery (N=18)						
BCVA	0.38±0.27	0.30±0.33	0.12±0.21	0.09±0.18	0.11±0.20	0.09±0.17
VA>2 [†]	-	7 (39)	12 (67)	14 (78)	15 (83)	15 (83)
VA<±1 [†]	-	7 (39)	6 (33)	4 (22)	3 (17)	3 (17)
VA<-2 [†]	-	4 (22)	0	0	0	0
Foveal (μm) [‡]	392.2±87.9	314.9±44.2	296.7±58.9	281.7±58.1	276.2±51.3	274.8±52.6
Vitrectomy alone (N=12)						
BCVA	0.52±0.34	0.65±0.39	0.47±0.44	0.42±0.45	0.37±0.46	0.36±0.47
VA>2 [†]	-	2 (17)	3 (25)	4 (33)	6 (50)	6 (50)
VA<±1 [†]	-	7 (58)	9 (75)	8 (67)	6 (50)	6 (50)
VA<-2 [†]	-	3 (25)	0	0	0	0
Foveal (μm) [‡]	436.1±132.3	328.3±125.6	333.6±88.2	317.2±86.2	307.2±82.5	307.6±82.4

Values are presented as mean±SD or number (%).

BCVA=best corrected visual acuity expressed on a logMAR scale.

* Preoperative, 1, 3, 5, 7 mon, and final follow-up after surgery; [†] Visual acuity on the Han's chart improved by two or more lines, stayed the same within ±1 line, or worsened by two or more lines of vision; [‡] Foveal thickness measured by optical coherence tomography.

preoperatively and one month, three months, five months, and seven months after surgery were 0.38±0.27, 0.30±0.33, 0.12±0.21, 0.09±0.18, and 0.11±0.20, respectively, in the concomitant cataract surgery group. The values in the vitrectomy only group were 0.52±0.34, 0.65±0.39, 0.47±0.44, 0.42±0.45, 0.37±0.46, and 0.36±0.47, respectively (Table 3).

Visual improvement was statistically significant in the concomitant cataract surgery group at three months and five months after surgery ($p<0.05$). The proportion of subjects who improved by two or more lines of vision after surgery was significantly greater in the concomitant cataract surgery group compared to those in the vitrectomy only group (Table 3). The foveal thickness before and after surgery showed no significant differences between the two groups ($p>0.05$).

The parameters which were statistically significantly correlated with the final visual acuity included the preoperative visual acuity (0.683), the preoperative foveal thickness (0.544), and the final foveal thickness (0.643) ($p<0.005$). Therefore, it may be possible to predict the postoperative visual outcome based on preoperative visual acuity and foveal thickness.

Discussion

Vitrectomy and membrane peeling for the idiopathic epiretinal membrane has been reported to result in visual improvement in 70-90% of eyes.^{8,9} In this study, visual improvement by two or more lines of vision was 30% after one month and 70% at the final follow-up. These results are similar to previous results that have been reported in the literature.^{2-7,10} Combined cataract and ERM surgery is another option for selected patients who have a concurrent cataract. Visual improvement by two or more lines of vision in combined cataract and ERM surgery was 39% after one month and 83% at the final follow up. The visual improvement in the vitrectomy only group was 17% after one month and 50% at the final follow-up. Compared to the vitrectomy only group, visual acuity was statistically better at three months and five months after surgery in the concomitant cataract surgery group. However, there was a borderline statistically significant difference at seven months. Removal of lens opacity could explain the three and five month results. Several patients who had undergone

a vitrectomy alone had a cataract surgery several months after the vitrectomy. This could be the reason why the borderline difference was seen after seven months. Because there were no differences in the foveal thicknesses between the concomitant cataract surgery group and the vitrectomy only group, concomitant cataract surgery may have little influence on the foveal thickness. Concomitant cataract surgery could enhance the visual improvement during the early postoperative period by removing lens opacity. However, a vitrectomy and delayed cataract surgery could show similar long-term visual outcomes.

Massin et al.⁶ reported that foveal thickness decreased significantly after surgery in 55 of 62 cases. Foveal thickness did not return to a normal macular profile. The mean foveal thickness was $326 \pm 59 \mu\text{m}$ after surgery in 42 cases. Postoperative visual acuity did not correlate with preoperative and postoperative central macular thickness. However, there have been several reports that visual acuity does correlate with preoperative and postoperative foveal thickness.^{10,11}

In our study foveal thickness decreased significantly from $409.7 \pm 107.9 \mu\text{m}$ before surgery to $287.9 \pm 66.8 \mu\text{m}$ at the final follow-up after surgery. This is still greater than the normative data. The final visual acuity correlated with preoperative visual acuity (0.683), preoperative foveal thickness (0.544), and final foveal thickness (0.643, $p < 0.005$). Visual acuity improved in proportion to foveal thickness after surgery. We were able to predict the final visual outcome based on the preoperative visual acuity and foveal thickness.

Intra-operative complications could include vitreous hemorrhage, retinal petechiae, retinal surface damage, and peripheral iatrogenic retinal breaks. Postoperative complications could include the recurrence of ERM, accelerated nuclear sclerosis of a crystalline lens, retinal detachment, and visual field disturbances. The most common complication, occurring in 12% to 68% of cases, is accelerated nuclear sclerosis of a crystalline lens.^{2,12,13} Recurrence occurs in 3% to 12% of cases, and retinal detachment occurs in 3% to 14%.^{2,12-14} No intraoperative complications were noted in our study. Secondary cataracts developed in four of the seven phakic eyes (57%) that underwent only a vitrectomy. Two of these patients had cataract surgery at six months and 12 months after the vitrectomy, respectively. Two patients did not have cataract surgery. One patient refused to have cataract surgery because of her general condition. An optic neuropathy was identified during follow-up in the other patient. Consequently, we did not recommend cataract surgery. One eye out of the 30 subjects (3%) had a partially persistent ERM, and

a recurrence of ERM was seen in one eye out of 30 subjects (3%) six months after surgery. A retinal hole was found in one eye, and it was immediately treated with a barrier laser.

Foveal thickness and visual acuity showed improvements in patients with idiopathic ERM until seven months after the vitrectomy. Preoperative visual acuity, foveal thickness, and final foveal thickness showed a significant correlation with the final visual acuity. Because of this, surgeons may be able to predict the final visual outcome based on the preoperative visual acuity and foveal thickness.

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