Original article

Epiretinal membrane surgery: Anatomic and functional outcomes


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ABSTRACT

Objective: To study the influence of anatomic preoperative characteristics (based on the parameter, foveal central thickness, measured by optical coherence tomography) and functional characteristics (based on the parameter, best corrected visual acuity; [BCVA]) on functional recovery after epiretinal membrane (ERM) surgery.

Methods: A total of 88 eyes (of 86 patients), on whom a vitrectomy due to ERM was performed during a 3 years period were reviewed in this longitudinal, prospective study.

An analysis was made of, ERM aetiology, BCVA, presence or absence of metamorphopsia, lens status, and central foveal thickness. Data relating to surgery and local complications, changes in BCVA, and changes in foveal central thickness were collected during the follow-up period.

Results: An improvement was in observed in BCVA in 82%, as well as a decrease in foveal thickness in 79% of the eyes which underwent surgery, both of these being statistically significant (P<.01). However, most of the patients showed different grades of oedema and/or macular thickening in the postoperative period. A significant correlation was found between preoperative and postoperative BCVA (P=.001), and also between preoperative and postoperative central foveal thickness (P=.004), but not between BCVA and foveal thickness.

Conclusions: There is functional recovery in terms of BCVA in more than 80% of the patients after ERM surgery. Most of the eyes showed persistent macular thickening, but this did not seem to have influenced the final BCVA. The best determinant of postoperative functional recovery (postoperative visual acuity) is, in our experience, the preoperative BCVA, and not the macular thickness.

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Cirugía de las membranas epiretinales: resultados anatómicos y funcionales

R E S U M E N

Objetivo: Estudiar la implicación de las características preoperatorias anatómicas (según el parámetro del grosor foveal central, determinado mediante tomografía de coherencia óptica) y funcionales (según el parámetro de la mejor agudeza visual corregida [MAVC]) en la recuperación funcional tras la cirugía de las membranas epiretinales maculares (MEM).

Métodos: En este estudio prospectivo, longitudinal se incluyeron 88 ojos (de 86 pacientes), intervenidos mediante vitrectomía debido a MEM, en un periodo de 3 años.

Se analizaron: etiología de la MEM, MAVC, existencia o no de metamorfopsia, estado del cristalino, y grosor foveal central. Asimismo se recogieron los datos relativos a la cirugía y las complicaciones derivadas de la misma, así como los cambios observados en la MAVC y en el grosor foveal a lo largo del periodo de seguimiento.

Resultados: Se produjo mejoría de la MAVC en el 82% de los casos, así como una disminución del grosor foveal en el 79% de los casos intervenidos, ambos estadísticamente significativos (p < 0,01). Sin embargo, la mayor parte de los pacientes exhibieron grados variables de edema y/o engrosamiento macular en el postoperatorio. Se halló correlación significativa entre la MAVC preoperatoria y postoperatoria (p = 0,001), así como entre el grosor foveal central preoperatorio y postoperatorio (p = 0,004), pero no entre la MAVC y el grosor foveal.

Conclusiones: Se produce una recuperación funcional en términos de MAVC en más del 80% de los pacientes tras cirugía de MEM. La mayor parte de los ojos muestran persistencia del engrosamiento macular, si bien este no parece tener influencia en la agudeza visual final. El mejor determinante de recuperación funcional postoperatoria (agudeza visual postoperatoria) parece ser, en nuestra experiencia, la agudeza visual preoperatoria y no el grosor macular.

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Introduction

The macular epiretinal membrane (MEM) is a translucent or semitranslucent fibrocellular proliferation which forms on the internal surface of the retina at the level of the macula.¹

MEM can be associated to posterior vitreous detachment (PVD), retinal tears, vascular retinopathy, ocular inflammation, congenital ocular disorders, retina detachment (RD) surgery, laser photoacoagulation and cryotherapy among others. However, the most common forms of MEM are idiopathic.²

Usually, the evolution of MEM is benign and produces very few symptoms, but when it contracts it could cause varying degrees of distortion, intraretinal edema and degeneration of the underlying retina, causing visual loss and metamorphopsia.³⁴

In these cases vitrectomy pars plana surgery (VPP) could be necessary involving MEM peeling, associated or not to rhexis of the internal limiting membrane (ILM), facilitated by the use of vital dyes.

Various prognostic factors have been described to date as involved in the results of MEM surgery, including pre-surgery visual acuity (VA), the duration of symptoms, the presence of vitreoretinal traction, MEM thickness and the presence of pre-surgery macular edema. However, some of said factors still remain controversial.²

The primary objective of this paper is to study the involvement of the anatomic pre-surgery characteristics (according to the parameter of central foveal thickness determined by means of optic coherence tomography [OCT]) and functional characteristics (according to the parameter of best corrected visual equity [BCVA]) in functional recovery after MEM surgery.

Subject, materials and methods

A prospective longitudinal study with patients intervened for MEM in the Central University Hospital of Asturias, from January 2007 up to January 2010.

The inclusion criteria were: patients over 18 years of age diagnosed with MEM and intervened with vitrectomy in the period of time between January 2007 and January 2010 who did not exhibit other ophthalmological disorders that could produce VA reduction and/or metamorphopsia.

The surgery was carried out on an outpatient basis and under locoregional and peribulbar anesthesia and sedation. The technique consisted of 3-way vitrectomy with 20 G or 23 G systems. In phakic patients with lens opacity combined surgery was performed with phacoemulsification and intraocular lens (IOL) and VPP either in the same surgery or sequentially. In addition, the patients who developed cataracts after VPP were intervened for cataracts during the follow-up period.

In what concerns VPP, first a medium and posterior rather short vitrectomy was performed, releasing the posterior hyaloids if adhered. Subsequently, the MEM was released with tweezers and removed. In all cases the ILM was removed after staining with brilliant blue G (Brilliant Blue G 0.25 mg/ml,
absence of subjective metamorphopsia (determined with the Watzke–Allen test), lens condition and central foveal thickness. In addition, the database also collected data on the type of surgery (VPP on its own, combined phaco-VPP or VPP with deferred phacoemulsification), peri-surgery complications and changes observed in BCVA and foveal thickness throughout the follow-up period.

The statistical study was carried out using the SPSS application version 15.00 (SPSS Inc, Chicago, IL). The T for student parametric test was applied to compare quantitative variables (BCVA and foveal thickness) before and after surgery. Pearson’s correlation test was applied to identify possible associations between BCVA and foveal thickness variables before and after surgery (i.e., if with a higher increase or decrease of one of the variables there was a higher increase or decrease in another variable). In all cases, the presence of an error probability equal or below 5% was considered to be statistically significant.

**Results**

The study included 88 eyes (28 left eyes and 60 rights eyes) of 86 patients (63 males and 23 females), with a mean age of 70.12 ± 8.73 years (range: 41–85), intervened for VPP due to MEM of any etiology during a 3-year period.
Over 87% of cases (77 eyes) were idiopathic MEM, with the remainder being secondary to diabetic retinopathy (3 eyes), to diabetes mellitus without retinopathy (5 eyes), and to retina detachment surgery (3 eyes). These 11 patients with non-idiopathic etiologies were excluded from the statistical analysis in order to standardize the sampling as much as possible.

Eighteen out of 77 eyes (23.37%) exhibited pre-surgery metamorphopsia. In contrast, after surgery only 2 of said 18 patients referred persistent metamorphopsia.

Of the 77 eyes of the analysis, 14 had previous pseudophakia, 52 exhibited cataracts and the remainder had a transparent lens.

VPP on its own was performed in 14 eyes and in 42 a combined procedure of phaco-VPP was performed due to the association of MEM with opacified lens, and 21 eyes were intervened for VPP followed by phacoemulsification in a second time due to the appearance or progression in 11 eyes of previous cataracts (10 eyes) after vitrectomy surgery. In 90% of cases VPP was performed with the 23 G system, and in 10% VPP 20 G was performed. After the extraction of MEM and ILM rexis, in 15 eyes it was necessary to perform fluid-air or fluid-gas exchange at the end of the surgery due to the pre-surgery detection of lamellar holes or the intra-surgery detection of complete macular holes, tears or holes in the peripheral retina.

BCVA was improved in 82% of patients, worsened in 10% and remained unchanged in 6%. The mean BCVA at the baseline of the study was of 0.34 (SD: 0.11) (range: 0.01–0.70), increasing to 0.51 (SD: 0.22) (range: 0.01–1.00) at the end of the follow-up period (p = 0.003) (Fig. 3).

No statistically significant differences were found in the BCVA of patients intervened with VPP on its own, phaco-VPP or VPP with deferred phacoemulsification (p < 0.01). This could be related to the fact that patients intervened only for vitrectomy without associating cataracts surgery either exhibited transparent lens or previous pseudophakia and therefore had the same medium transparency as the eyes intervened for cataract during the follow-up.

After the surgery, diminished foveal thickness was observed in 79% of patients and increased thickness in 21%. At study baseline, the mean and foveal thickness was of 502.60 μm (SD: 110.63) (range: 260–735), and at the end of the study of 360.98 μm (SD: 91.22) (range: 188–599). This central foveal thickness reduction was a statistically significant (p = 0.003) (Fig. 4).

Pre-surgery, 24 eyes exhibited edema and/or macular thickening, and 3 eyes exhibited lamellar macular holes (LMH). The LMH diagnostic was reached according to the criteria set forth by Michalewska et al. (2010) (uneven foveal contour, disfigurence of the retina internal and external layers at the level of the fovea, absence of complete thickness defects, presence of MEM and possible alteration of the photoreceptor layer). In addition, 10 patients exhibited slight alteration of this layer prior to surgery.

The restoration of the foveal profile in the post-surgery period was observed in only 9 eyes. In the rest, variable degrees of edema and/or macular thickening were evidenced with the appearance of damages in the IS/OS layer in 6 of the 77 eyes and the persistence of the alteration thereof in the previously mentioned 10 eyes.

A significant correlation was found between pre-surgery and post-surgery BCVA (p = 0.001), as well as between the pre-surgery and post-surgery central foveal thickness (p = 0.004), which means that poorer pre-surgery BCVA involved a poorer post-surgery BCVA and vice versa. Likewise, thinner pre-surgery foveal thickness led to cinema foveal thickness after surgery.

In contrast, no statistically significant correlation was observed between pre-surgery foveal thickness and pre-surgery BCVA (p = 0.063), post-surgery foveal thickness and post-surgery BCVA (p = 0.345), pre-surgery foveal thickness and post-surgery BCVA (p = 0.632), or between post-surgery foveal thickness and pre-surgery BCVA (p = 0.331).

**Fig. 3** – Evolution of best corrected visual acuity (BCVA) (decimal scale): before and after surgery, respectively. Noteworthy improvement (p < 0.01).

**Fig. 4** – Evolution of the central foveal thickness (determined with optic coherence tomography in microns): before and after surgery, respectively. Noticeable reduction (p < 0.01).
The complications observed during the follow-up period were 4 retina detachments (one identified during surgery and the remaining 3 at month one, 2 and 4 after surgery), one complete macular hole which occurred 4 months after surgery and 2 LMH diagnosed at month 8 (Fig. 5) and 12, respectively after vitrectomy.

Discussion

VPP with MEM peeling has demonstrated functional recovery rates of between 70% and 90% in the majority of studies. However, the VA is frequently diminished after surgery and several months must elapse before reaching definitive VA. It is known that the best functional recovery does not occur before 2–3 months after the intervention, although it can extend throughout the first year.

Numerous studies have demonstrated good functional results. De Bustros et al. observed improvements in at least 2 lines of vision in 70% of intervened patients (in a series of 70 eyes); Bouwens et al. found a mean improvement of 2 vision lines in a series of 107 patients and Konstantinidis et al. found improvements in 3 or more lines of vision in 74% of 39 intervened eyes.

This study has shown similar percentages: 82% of the 77 intervened eyes experienced BCVA improvements.

In what concerns metamorphopsia, the majority of patients experienced improvements (even during the first month), with a mean reduction of between 60% and 83% of cases. In this series, only 2 out of 18 patients with pre-surgery metamorphopsia referred persistence thereof after surgery, involving a reduction of 89%.

In the 3 eyes with previous LMH the anatomic or functional results were not worse than other eyes. It is known that the existence of LMH does not involve an adverse prognostic value in these cases.

As regards foveal thickness, Massin et al. described a significant reduction after surgery in 55 out of 62 cases (88.7%), a percentage slightly above that found in this study (79%). The foveal thickness did not return to normal values in any of the subjects. The mean macular hole was of 326 ± 59 μm after surgery in 42 eyes, similar to our results (360.98 μm). In addition, post-surgery VA did not correlate with pre- or post-surgery central foveal thickness, as was the case with the patients of this study.

However, several authors have described a significant correlation between VA and pre- and post-surgery foveal thickness. In what concerns complications, the most usual complication after MEM surgery is the formation of cataracts, described in between 12% and 68% of phakic eyes. Generally, said cataracts are nuclear and found more frequently in patients over 50. Therefore, in this group of patients it is considered convenient to perform combined phacoemulsification and vitrectomy surgery.

In the instant study, 21 out of 35 patients (60%) intervened for vitrectomy required extraction of the opacified lens in the course of the follow-up period, due to new appearances or progression of previous cataracts.

An additional complication are iatrogenic tears during surgery (1–6%), retina detachment (RD) (between 1% and 7%), and MEM recurrence (0–5%). Other, less frequent complications are choroidal neovascularization, retinal phototoxicity, macular holes and endophthalmitis. Of these, in this study we only found 4 RD (5.1%) and 4 holes, one with full thickness and 3 with partial thickness.

By way of conclusion, it can be said that MEM surgery on its own or associated to phacoemulsification produces functional recovery of BCVA in over 80% of patients. However and even though after surgery there is a significant reduction of foveal thickness, the majority of eyes exhibit persistence of macular thickening even though this does not seem to influence the final VA. In addition, the photoreceptors layer (IS/OS) could suffer damages in relation to pre- and post-surgery long-term macular edemas. Even though this is not the object of this study, the authors consider that patients with chronic photoreceptor damage should probably be warned of lower functional recovery probabilities after said surgery.

In the authors experience, the best post-surgery functional recovery indicator (post-surgery VA) appears to be pre-surgery

Fig. 5 – Lamellar macular hole developed 8 months after epiretinal membrane: (1) uneven foveal contour; (2) dehiscence of internal and external retinal layers; (3) intraretinal split or separation; (4) slight photoreceptor layer alteration.
VA and not the macular thickness as a number of authors have proposed in previous articles.

**Conflict of interest**

No conflict of interest has been declared by the authors.

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