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Internal Limiting Membrane Peeling as Prophylaxis of Epimacular Membrane Formation in Eyes Undergoing Vitrectomy for Rhegmatogenous Retinal Detachment

SUMMARY

Purpose: Rhegmatogenous retinal detachment is a serious condition that can significantly impair visual function, even after a successful surgery. One of the complications that can significantly impair visual acuity in the postoperative period is a development of the epimacular membrane (ERM). The aim of this work is to monitor the effect of peeling of the internal limiting membrane (ILM) in the macula at the anatomical and functional results in the postoperative period, especially with regard to the development of ERM.

Methods: Prospective study of 21 eyes, which underwent peeling of ILM during pars plana vitrectomy for rhegmatogenous retinal detachment (on detached macula). The ILM peeling was done without using decalin during this procedure. We tested best corrected visual acuity (BCVA) and followed fundus biomicroscopic findings. Proliferative vitreoretinopathy (PVR) was evaluated according to the recommendations of the Retina Society Terminology Committee. To exclude the development of ERM in the macula optical coherence tomography (OCT) was performed at the end of the 18-month follow-up period.

Results: In total, the results of 21 eyes of 21 patients who underwent PPV for rhegmatogenous retinal detachment were evaluated. In all of them was during PPV performed ILM peeling on detached macula, these are followed prospectively. ILM peeling without using decalin was sufficient in all eyes. All eyes with ILM peeling did not develop ERM at the end of the follow-up period.

Conclusions: ILM peeling during PPV for rhegmatogenous retinal detachment reduces the risk of developing secondary ERM.

Key words: rhegmatogenous retinal detachment, epimacular membrane, peeling, internal limiting membrane, pars plana vitrectomy

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INTRODUCTION

Rhegmatogenous retinal detachment is an ocular disorder in which the neuroretina is detached from the deeper layers of the eye. Detachment may initially be local and progressively spreads, and without surgical therapy leads to loss of visual acuity up to the point of blindness. Development of the disorder relates to the presence of a retinal tear.

Various methods exist for surgical treatment of retinal detachment. The choice of these methods usually depends on the intraocular finding (condition of lens, amount and position of tears) and the surgeon's preferences. The principle of therapy is closure of the tears and relaxation of the vitreoretinal traction forces.

Use of the technique of pars plana vitrectomy (PPV) is increasing in frequency. The method covers removal of the vitreous body, treatment of the tears and degenerations, and is completed with the instillation of an intraocular tamponade. The tamponade used includes expansive gas (perfluoropropane, C₃F₈) or silicon oil (SO). Other types of gas tamponade are hexafluorosulphide (SF₆) and perfluoroethane (C₂F₆). Silicon oil is usually used in more severe cases, which are generally related to a higher degree of proliferative vitreoretinopathy (PVR). An epiretinal membrane (ERM) is a fibrotic layer on the surface of the retina, formed by activated cells: glial cells, cells of the retinal pigment epithelium (RPE), macrophages and fibrocytes. ERM develops as a response to various insults: microtrau-

mas upon ablation of the posterior vitreous membrane (posterior vitreous detachment – PVD), ischemia, microvascular abnormalities, excessive laser treatment, presence of a retinal tear (upon PVD), intraocular surgery... ERM progressively exerts tension on the retina, macular oedema up to prominence or corrugation of the neuroretina. In the initial stages the outer retinal layers are not damaged. ERM afflicts approximately 7% of the population, and its incidence increases with age. Post mortem studies demonstrate ERM in 2% of fifty year-old patients and in 20% of those aged 75 and older. Over the course of time, ERM progressively damages the structure and function of the macular area, induces oedema of the neuroretina, which if it persists for a longer time leads to irreversible damage to

sight [4].

Activation of RPE cells relates to retinal detachment, excessive cryoretinopexy and the length of the period of duration of detachment. Activated RPE cells also share in the development of PVR. Stimulation of the development of ERM is further supported by the presence of blood in the vitreous body, inflammatory manifestations, or both in connection with PVD. Retinal detachment and surgery thereon are thus one of the potential causes of the development of ERM [2].

Following surgery for rhegmatogenous retinal detachment, ERM forms in approximately 3 to 18% of cases [5, 6, 12]. Complicating development of ERM is described also following external, cryosurgical operations [11]

METHODOLOGY

A prospective observation of eyes in which 20G pars plana vitrectomy (PPV) was conducted due to a surgical solution for rhegmatogenous retinal detachment. The observation was 18 months. In all cases the macula was detached.

During the surgery, MLI peeling was performed using Eckardt micro-forceps, after colouring with the aid dye MembraneBlue Dual®. The used dye sinks downwards very well, does not swirl in the vitreous area (thus not restricting the examination of applicable movements of the retina upon its drain-

age), and reliably colours the surface of the macula. Before this treatment, the elevated macula was first of all flattened by endodrainage of the original tear, using an exchange of water/air. Peeling was performed without the use of decalin, sparingly, with minimal traction in an anterior-posterior direction. Visual acuity was tested on ETDRS tables. The intraocular finding was assessed biomicroscopically at the following intervals: before surgery, 1 month, 6 months, 12 and 18 months after the procedure. In biomicroscopy, in addition to the complex finding on the fundus, we placed emphasis on the present stage of proliferative vitreoretinopathy (PVR), and observed the development of ERM after the surgery. The absence of ERM was confirmed with the help of an OCT examination at the end of the observation period. Preoperative OCT of the detached macula was not conducted. We classified PVR according to the recommendations of the Retina Society Terminology Committee [13, 14, 15].

RESULTS

In total we evaluated the results of 21 eyes of 21 patients, in which MLI peeling was performed on the detached macula during PPV. The performance of peeling without the use of decalin was possible to a sufficient extent in all eyes.

In 12 eyes peeling was performed due to the perioperative finding on the sur-

face of the macula. In these cases the MLI was "coarsened" or "puckered". In the remaining 9 eyes this concerned a suspected coincidence of macular hole, in which it was not possible to decide unequivocally at the given time as to whether this represented a complete defect of the neuroretina (it was not possible to conduct OCT perioperatively). The suspected macular hole was never the actual cause of retinal detachment. We used gas (perfluoropropane) as an intraocular tamponade at the end of the procedure in 5 eyes, and in the remaining cases (76%) silicon oil (Oxane® 5700).

The initial median of best corrected visual acuity (BCVA) was counting fingers from one metre (1/50), average BCVA 20/200. The median BCVA at the end of the observation period was 20/100 and average BCVA 20/80. An improvement of BCVA was attained in 16 cases (76%), a deterioration occurred in 5 cases (24%). The change of BCVA in the sense of improvement (following PPV with peeling) was statistically significant (Wilcoxon $p = 0.02$). In the immediate postoperative period the retina was reattached in 100% of eyes. However, during the observation period, redetachment occurred in 3 eyes with silicon tamponade (14%). Development of epimacular proliferation (example in Fig. 1) was not perceptible in all the eyes with performed MLI peeling at the end of the observation period, which we confirmed with

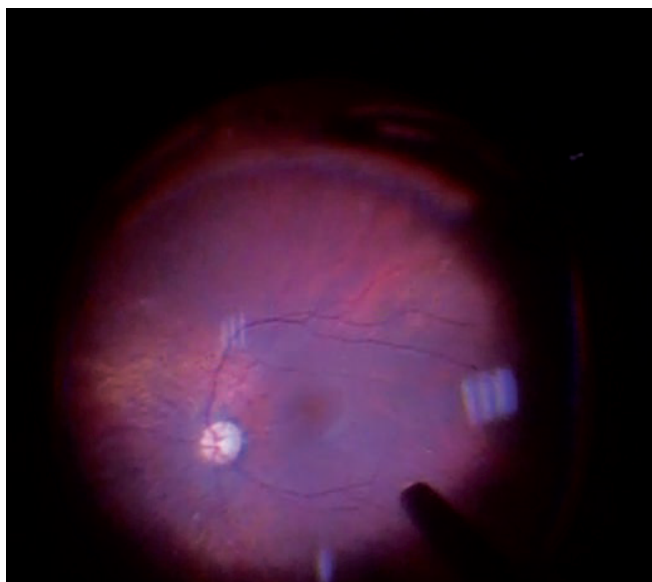


Fig. 1 A photograph from video recording of operation: examination of the retina following evacuation of the silicon tamponade, the centre is normal (peeling was performed on the detached macula during PPV), around it is a pale lining of the incipient ERM (corresponding to the line left by MLI).

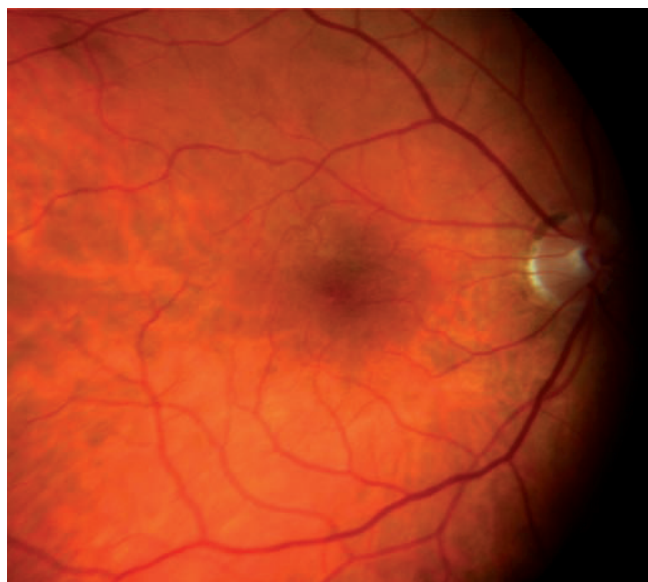


Fig. 2 Focal ERM above foveola, photographic finding 6 months after PPV (without performance of MLI peeling) for rhegmatogenous detachment.

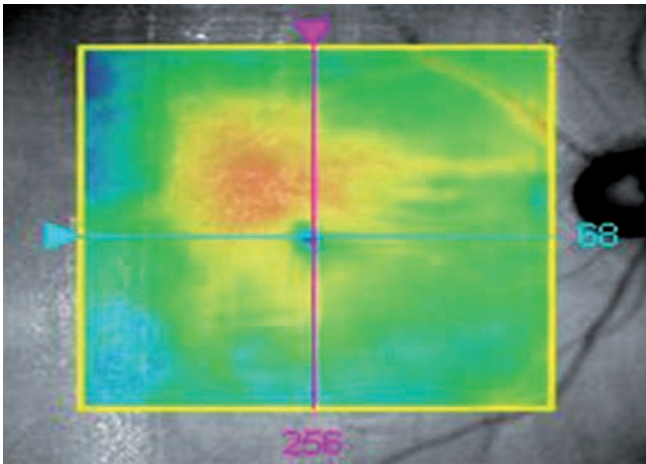


Fig. 3 A map of OCT finding pertaining to Fig. 2



Fig. 5 A postoperative photograph of fundus 3 months after procedure, reflections of silicon tamponade and pronounced epimacular fibrous membrane (pucker). BCVA 1 month after surgery was 20/40, progressively declining to 20/200 in 3rd month of observation period.

the help of OCT. In one case of perioperatively identified suspected macular hole, a minor defect of the neuroretina persisted even at the end of the observation period.

DISCUSSION

The development of an epimacular membrane following a surgical solution to rhegmatogenous detachment is a familiar complication. It afflicts eyes following pars plana vitrectomy (in 3 to 18% of cases), as well as eyes following surgeries by exterior procedure [6, 7, 11, 12]. Uemura published a group of 105 eyes operated on via exterior procedure (cryoretinopexy and

plombage), in which he observed a development of ERM in 24% of cases in the first month following the procedure and an increase thereof to 68% following a twelve-month observation period [11]. Eyes in which ablation of the posterior vitreous membrane was not present before the surgery were not afflicted by epimacular membrane during the course of the observation period.

Progression of ERM may be gradual or also eccentric, and does not always require a surgical solution. Such an example is presented in Fig. 2 and 3. However, it may also progress rapidly and severely impair visual functions, as documented in Fig. 4 and 5. Pro-

nounced fibrous epimacular proliferation causes severe corrugation of the central region ("pucker"), the surgical removal of which is generally mechanically traumatic for the macula (Fig. 6).

The presupposition of our work is the hypothesis that peeling of the internal limiting membrane during surgery for rhegmatogenous retinal detachment is an effective prophylaxis for the formation of a postoperative epimacular membrane [9]. Many surgeons consider MLI peeling to be an important component of primary vitrectomy of advanced cases of rhegmatogenous retinal detachment with proliferative vitreoretinopathy (PVR, worse than in stage B).



Fig. 4 A photograph of fundus before rhegmatogenous amotio surgery (PPV without performance of peeling). Detachment is subtotal, visual acuity 2/50.

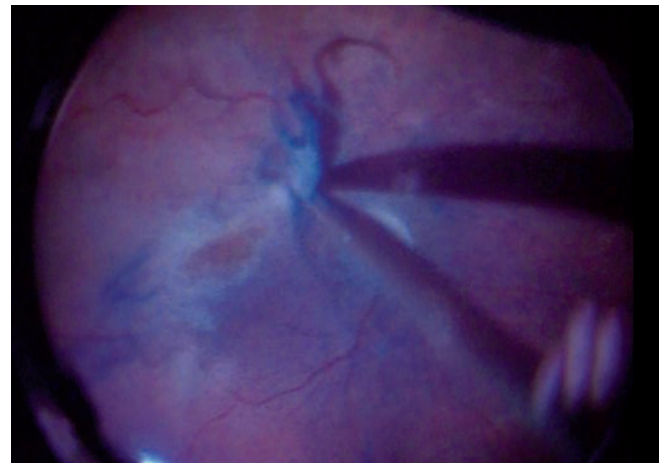


Fig. 6 An image from recording of surgery, peeling of epimacular pucker: thickened ERM passes into rigid edges of MLI, together with which it is peeled. The centre of the macula beneath the ERM is atrophic, its edges pale and enlarged.

Some authors recommend the performance of MLI peeling routinely in all stages of PVR and even in cases where the macula is not detached [16].

In our relatively small group of 21 eyes, the development of ERM did not take place following the performance of MLI peeling of the macula in accordance with the other authors [9]. On the basis of our results, we are of the opinion that the performance of MLI peeling in the case of rhegmatogenous retinal detachment reduces the risk of secondary development of an epimacular membrane. A question remains as to whether MLI peeling limits the proliferation and migration of active cells on the surface of the retina, and if it represents prevention against the development or progression of PVR.

A controversial part of the procedure is the performance of MLI peeling on a detached macula without the use of decalin. We inclined towards this variant for several reasons. The first and main of these is the clinical experience that in higher stages of PVR at least one layer of a fine epimacular membrane is generally present within the macular region before MLI, which is able to imitate the MLI faithfully. The second reason is the finding that MLI peeling is easier without the use of decalin, and

the edges of the peeling are more visible. If the macula is flattened by prior endodrainage, no pronounced mechanical strain is placed on the retina upon careful manipulation. Furthermore, the force which detaches the MLI and may potentially impair the anatomical arrangement of the neuroretina is the same as upon peeling under decalin. Under decalin it is very difficult to "disrupt" intact MLI. It is suitable to perform at least this initial stage without the use of decalin (if we wish to perform peeling under decalin). Subsequent handling of the MLI under decalin also causes traction on the macula, and if a macular hole is present, it increases the risk of the penetration of decalin beneath the retina.

The main risk of peeling without the use of decalin is the initial phase of manipulation, in which we must frequently begin in a maculo-papillary bundle close to the optic disc. In the postoperative period we did not observe possible failures of the visual field or measure any development in the retinal nerve fibre layer (RNFL). However, Odrobina et al. have published results, in which they demonstrated failures of RNFL in 100% of eyes following the same type of procedure with the help of OCT [9].

It is also necessary to draw attention

to the danger of subretinal penetration of (any) dye. Practically all currently available preparations are in vitro toxic for RPE cells [1, 3].

Last but not least, it is necessary to mention the possibility of creating an iatrogenic defect of the centre of the retina upon MLI peeling within the terrain of a markedly attenuated and secondarily afflicted macula [8, 10].

In cases of rhegmatogenous detachment, where it is technically possible, we recommend the performance of preoperative OCT examination of the macular region. OCT eases perioperative decision-making: it clarifies already present ERM, objectivises IMH, or conversely detects "masking findings" – cystic degeneration of the central region, thinning of the neuroretina in the fovea, lamellar defect of the neuroretina etc., which may faithfully imitate IMH. A promising technique for the near future is the possibility of routine use of intraoperative OCT.

CONCLUSION

With reference to our results, we presume that the performance of MLI peeling in the case of rhegmatogenous retinal detachment reduces the risk of secondary development of an epimacular membrane.

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