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Idiopathic Epiretinal Membranes – Pathophysiology, Classifications and OCT-Biomarkers

Idiopathische epiretinale Membranen – Pathophysiologie, Klassifikationen und OCT-Biomarker

Authors

Verena Anna Englmaier, Jens Julian Storp, Sebastian Dierse, Nicole Eter, Sami Al-Nawaiseh

Affiliation

Klinik für Augenheilkunde, Universitätsklinikum Münster, Deutschland

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Correspondence

Dr. Verena Anna Englmaier, M. D.
Klinik für Augenheilkunde, Universitätsklinikum Münster
Domagkstraße 15, 48149 Münster, Deutschland
Phone: + 49 (0) 25 18 35 60 01, Fax: + 49 (0) 25 18 35 91 20
verenaanna.englmaier@ukmuenster.de

ABSTRACT

Epiretinal membranes (ERMs) are a common finding in patients with increasing age. Diagnosis and treatment of ERMs have changed dramatically in recent years due to technological advances in ophthalmological care. In recent years, tomographic imaging has allowed for accurate visualization of ERMs and contributed to the growing understanding of the pathophysiology of this condition. The literature review conducted here summarizes recent innovations in diagnosis, classification, and treatment of idiopathic ERMs and specifically addresses novel optical coherence tomography (OCT) biomarkers that allow for the generation of prognoses regarding the clinical postoperative outcome.

ZUSAMMENFASSUNG

Epiretinale Membranen (ERM) sind ein häufig auftretender Untersuchungsbefund bei Patienten mit steigendem Alter. Diagnostik und Therapie der ERM haben sich in den letzten Jahren aufgrund des technischen Fortschritts in der ophthalmologischen Versorgung stark gewandelt. Kohärenztomografische Untersuchungen erlauben die exakte Darstellung von ERM und haben zum wachsenden Verständnis um die Pathophysiologie dieses komplexen Krankheitsbildes beigetragen. Die hier durchgeführte Literaturrecherche fasst kürzliche Neuerungen in Diagnostik, Klassifikation und Therapie der idiopathischen ERM zusammen und geht insbesondere auf neuartige Biomarker in der optischen Kohärenztomografie (OCT) ein, welche die Erstellung von Prognosen bez. des klinischen, postoperativen Outcomes ermöglichen.

Introduction

Epiretinal membranes (ERMs) are a common finding in patients of increasing age [1]. The advent of optical coherence tomography (OCT) has led to the more frequent detection of ERMs with close to one-third of affected patients found to have ERMs in both eyes. By the age of 74, ERMs occur in over 50 % of cases [2].

In routine clinical practice, it is not only the morphological appearance of the ERMs but also the patient's visual acuity and subjective suffering that are of critical importance. Patients described having blurred vision, metamorphopsia, and aniseikonia. In addition, in severe cases, there can be a loss of visual acuity due to leakage from the retinal vessels. In such cases, there can sometimes be a discrepancy between the OCT findings and the patient's vision [3]. Newer, OCT-based, classifications not only consider the ERMs, but also neuroretinal changes. All of these changes play a critical role in terms of the postoperative visual acuity outcome [4].

ERM treatment consists of pars plana vitrectomy (ppV) combined with peeling of the ERMs and the internal limiting membrane (ILM).

This study aims to summarize new findings on the clinical picture, classification, and treatment of ERMs based on a review of the literature.

Method

To compile this review, we performed a literature search of the PubMed metadatabase (https://pubmed.ncbi.nlm.nih.gov). We limited our search to publications from 2000 to 2022 and used the following search terms: "epiretinal membrane", "macular pucker", "vitreoretinal traction", "preretinal fibrosis", "gliosis", and "epiretinal gliosis". These search terms were also used in combination with the terms "OCT", "optical coherence tomography", "postoperative", and "outcome". As the main focus of this article is on idiopathic ERMs, publications on secondary ERMs were excluded from the literature search.

Epidemiology, Pathophysiology, and Classifications

Idiopathic ERM is one of the most common retinal diseases. Depending on the literature consulted, it affects approximately 2 to 34% of all patients. The incidence of ERM increases with increasing patient age [5, 6]. The Beaver Dam Eye Study showed that an ERM was present in 34% of patients in the 63- to 102-year age group [2]. Several other studies also provide supportive evidence of an increasing prevalence of idiopathic ERMs with increasing patient age. According to Quinn et al., the odds ratio per year is 1.97 (confidence interval 1.34–2.98) for patients aged 60–69, and 4.61 (confidence interval 3.08–6.90) for patients over 70 years of age [7].

There is little proof that either the patient's ethnicity [8, 9] or sex is of relevance. It is possible that women may be affected more often than men [7]; however, the available data is inconsistent on this point.

Idiopathic ERM refers to the form of ERM that occurs only after vitreous body detachment, and in the absence of other risk factors or previous surgery. With vitreous body detachment, a distinction is made between complete detachment without demonstrable attachment or traction on OCT, and incomplete detachment. Incomplete vitreous body detachment is characterized by residual adhesion of the vitreous body to the retina [10].

As the incidence of posterior vitreous body detachment increases with increasing patient age, this may explain why the occurrence of idiopathic ERMs also increases with patient age [6].

The formation of idiopathic ERMs is attributed to pathological posterior vitreous body detachment with subsequent proliferation of various cells [11, 12]. Müller glia, hyalocytes, and the retinal pigment epithelium (RPE), as well as the cytokines and growth factors they secrete, are involved in the formation and proliferation of myofibroblasts [1, 10]. ERM growth is promoted by extracellular proteins such as type I collagen. The tractive components of the ERM are attributed to α-smooth muscle actin (SMA). Other factors such as vimentin and anti-CD45 are also involved [12].

Evidence shows that surgical procedures can play a critical role in the formation of preretinal membranes. For example, a secondary ERM following a cataract operation has been demonstrated in 16% of cases. These retinal changes following cataract operations appear to be caused by the surgically induced effects on the vitreous body [5, 6].

Retinal diseases such as retinal detachment, retinal foramina, retinal vein occlusion, traumatic injury, or diabetic retinopathy can provoke the formation of a secondary ERM [13]. Diabetes mellitus with accompanying hyperglycemia also appears to have an effect on the vitreous body, which in turn favors the formation of an ERM [8, 14].

ERMs can be viewed clinically using fundoscopy, or on imaging using OCT, en-face OCT, fundus photography, and autofluorescence. Fibrocellular membranes manifest clinically through a cellophane-type retinal reflex and the formation of retinal folds, which can change the anatomy of the retina [5]. On OCT, the ERM typically appears as a hyperreflective line above the retina. A distinction can be made here between global attachment or focal partial attachment of the membrane to the retina [15]. Advanced stages are characterized by fibrotic remodeling of the ERM. This preretinal fibrosis may lead to macular edema, metamorphopsia, or loss of visual acuity due to strain and deformation of the retinal layers caused by traction [9, 11, 16]. This deformation of the retina can be visualized using autofluorescence, a technique which is particularly suitable for visualizing deformation of retinal vessels. Fundus photography can also be helpful in detecting deformations [11]. En-face OCT enables direct visualization of the changed morphology, as well as the extent of the ERM [17]. On the microstructural level, ERM impairs neuronal transduction performed by Müller cells inside the retina [16, 18].

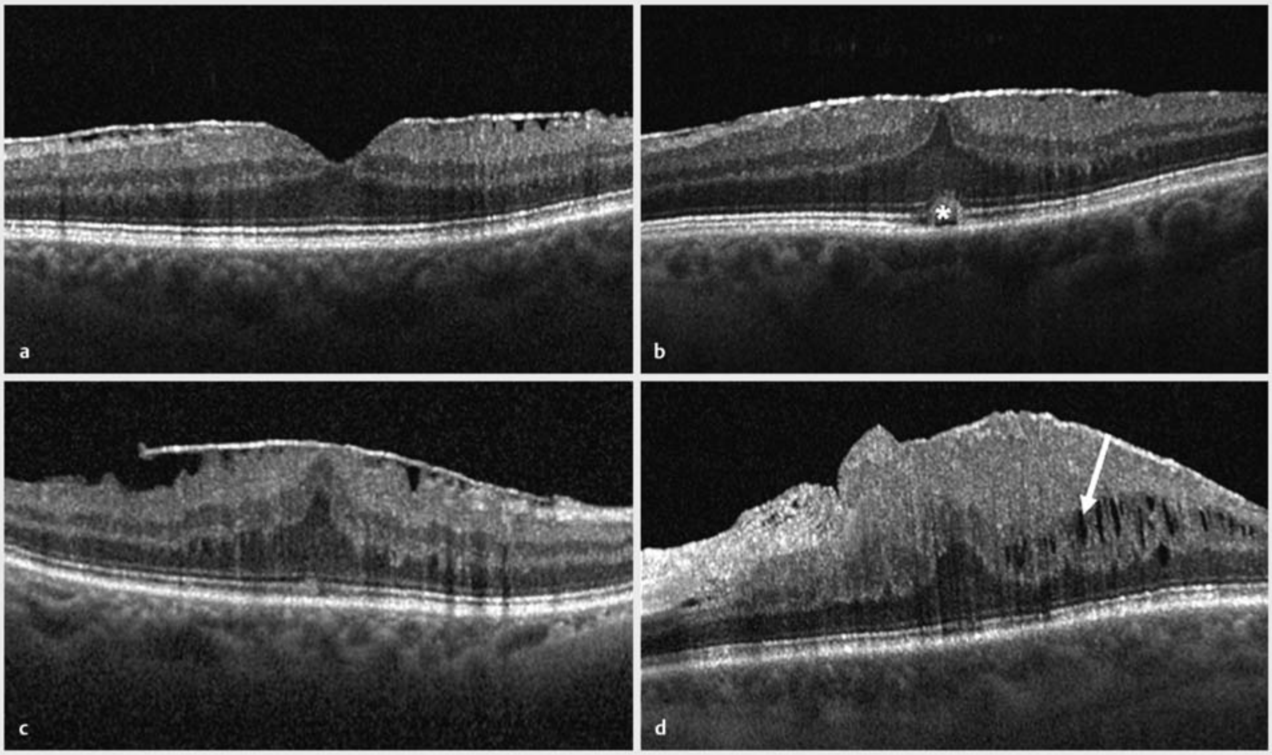
A distinction should be made between classic idiopathic ERMs and epiretinal proliferations. In contrast to an ERM where a hyperreflective line above the macula is visible on OCT, with epiretinal proliferations, an isoreflective line is present above the macula and above the ILM. In terms of histopathology, studies have shown that unlike ERMs, epiretinal proliferations have no or only very few demonstrable tractive characteristics [19].

Classifications

The clinical ERM grading proposed by Gass is the current established nomenclature. The grades are classified as follows. Grade 0: cellophane maculopathy, stage 1: cellophane maculopathy with puckering, stage 2: preretinal macular fibrosis [11]. The Xiao et al. review describes an overall prevalence of idiopathic ERMs of 9.2% [95% confidence interval (CI): 4.7–13.8%]. Cellophane maculopathy has a prevalence of 7.2% (95% CI: 3.3–10.8%), and preretinal macular fibrosis a prevalence of 2.0% (95% CI: 1.3–2.8%) [9].

In addition to the grading proposed by Gass, idiopathic ERMs may also be distinguished based on their appearance on OCT. A newer classification proposed by Govetto et al., based on OCT imaging, divides ERM into 4 stages (see ▶ **Fig. 1**):

- Stage 1: Presence of a foveal pit with well-defined retinal layers.
- Stage 2: Absence of a foveal pit with well-defined retinal layers.



▶ **Fig. 1** Images for Govetto staging of the epiretinal glia. **a** Epiretinal gliosis stage 1: presence of a foveal pit, retinal layers well defined. **b** Epiretinal gliosis stage 2: cotton wool spot as a secondary finding marked with a star; absence of a foveal pit, retinal layers well defined. **c** Epiretinal gliosis stage 3: absence of a foveal pit, retinal layers well defined, presence of ectopic inner foveal layers (EIFLs). **d** Epiretinal gliosis stage 4: intraretinal cavity or macular edema marked with an arrow; absence of a foveal pit, retinal layers disrupted, presence of EIFLs.

- Stage 3: Absence of a foveal pit with well-defined retinal layers and presence of ectopic inner foveal layers (EIFLs).
- Stage 4: Absence of a foveal pit, disrupted retinal layers, presence of EIFLs [20].

Surgical Indications

Determining when to operate on an ERM does not depend solely on the OCT findings. Primary consideration should be given to the patient's subjective level of suffering. In some cases, an ERM may be present for a prolonged period of time without causing any significant symptoms in the patient or morphological changes on OCT [21]. For this reason, the decision on when to operate should always be made in close consultation with the patient, considering their subjective suffering; not all patients need to be operated on immediately after diagnosis. In early-stage ERM with no subjective impairment or loss of visual acuity, it is possible to monitor the course of the disease before performing surgery [3].

If the ERM is accompanied by a loss of visual acuity, this is usually due to a combination of tractions in the region of the inner and outer retina. An ERM may also have a negative impact on the patient's visual acuity due to changed light refraction and the occurrence of intraretinal edema [9]. According to data from a British case series, the average preoperative loss of visual acuity was between 0.2 and 0.32; this improved, on average, to 0.5 after surgery [22].

In patients with poor initial visual acuity, a considerable improvement in postoperative visual acuity has been described. In patients with initially moderate to good visual acuity, a form of "ceiling effect" is presumed to prevent further improvement of visual acuity following surgery [3].

Considering the question of when to operate, it has been shown that an early operation can lead to a better postoperative visual acuity outcome. Yusuf et al. were able to demonstrate a bigger improvement in postoperative visual acuity following surgery at an early stage compared to a "wait and see" approach [23].

Besides loss of visual acuity, patients often complain of aniseikonia or metamorphopsia; if the OCT findings are consistent, this may be considered an indication for surgery. OCT-supported analysis has shown that macropsia in the form of aniseikonia occurs in the presence of changes to the photoreceptor distribution, while metamorphopsia is attributed to changes in the inner retinal layers. Interestingly, the OCT findings often do not reflect the patient's subjectively perceived loss of visual acuity.

While metamorphopsia can often be alleviated through surgery, this tends not to be the case for aniseikonia [16]. A prospective study by Bouwens et al. investigating postoperative metamorphopsia showed that out of 63 patients included in the study, 82% experienced an improvement in metamorphopsia and 48% an improvement in visual acuity. Remarkably, according to the study data, improvement in visual acuity did not correlate to the reported severity of the preoperative metamorphopsia [24]. Moreover, analyses of the British population have shown that surgery was only considered to be indicated due to tractive effects on the central retina in approximately 10% of cases [14].

Anatomical Characteristics and Factors That May Be Predictive of Postoperative Outcome

Vitreomacular interface

In a retrospective case series with a follow-up observation period of 24 months, Byon et al. reported on 62 eyes with a visual acuity of ≥ 0.5. They subdivided ERM cases into those with global attachment (GA) and those with partial attachment (PA), as well as those with and without vitreomacular traction (VMT) (▶ **Fig. 2 a – c**). Overall, changes in ERM configuration were observed in 24 eyes (39%); these included some changes that regressed spontaneously. During the 24-month period, 11 out of 33 eyes (33%) showed a progression from the GA type to the PA type. Four ERMs (6%) regressed spontaneously from the PA type (n = 3) and the VMT type (n = 1); in these cases, an improvement in the patient's vision was observed. Out of the 62 eyes, 4 eyes with an intact ellipsoid zone (EZ) and PA-type configuration developed a weakened or disrupted zone with simultaneous loss of visual acuity of more than 2 lines [15].

In a retrospective case control study of ERM patients with a visual acuity ≥ 0.5, the clinical picture progressed during the 31-month follow-up observation period in 15 out of 112 patients (13%). These patients showed a loss of visual acuity ≥ 2 lines. In patients who experienced progression, a change in ERM configuration from GA type to PA type occurred more frequently than in the control group (with no loss of visual acuity) [25]. These results imply that ERM probably begins as the GA type, then progresses to the more unstable PA type.

The vitreoretinal adhesion appears to influence the progression of ERMs. In a study by Byon et al., it was shown that progression and loss of visual acuity occurred in 4 out of 10 eyes (40%) that had vitreoretinal adhesion on initial presentation, compared with only 2 out of 52 eyes that had posterior vitreous detachment (PVD) (3.8%). The authors postulated that this may have been due to an increase in proinflammatory factors in the eyes that had vitreomacular or vitreopapillary adhesions [15].

Central foveal thickness (CFT) and related measurements

Central foveal thickness (CFT) has been investigated in numerous studies, leading to differing results. A systematic review of 10 studies found no correlation between preoperative CFT and postoperative visual acuity [18]. Likewise, a multiple regression analysis by Kim et al. did not find any correlation in their retrospective case series [26]. In contrast, a systematic review from 2017 demonstrated a correlation between an increased initial CFT and poorer postoperative visual acuity [27].

Overall, in most of the studies analyzed, there was no statistically significant correlation between best-corrected visual acuity (BCVA) at 6 months [21, 28, 29], 12 months [30 – 33], or 24 months [34, 35] after surgery.

Foveal contour and morphology

There are scarcely any indications of a correlation between preoperative foveal contour and postoperative visual acuity. Scheerlinck et al. [18] were not able to determine any such correlation in their systematic review. Furthermore, Ozdek et al. were unable to determine a correlation at 24 months after surgery. In a large-scale, retrospective, multicentric study, they analyzed 634 cases and found a statistically insignificant trend towards better visual acuity in patients with a "foveal herniation" compared to patients with diffuse or pseudohole foveal morphologies [35].

Zeyer et al. discovered in a retrospective study that eyes with a preoperative convex foveal contour showed an average improvement in visual acuity of 2.4 lines at 12 months after surgery compared to 0.6 lines in eyes with a flat or concave contour [36].

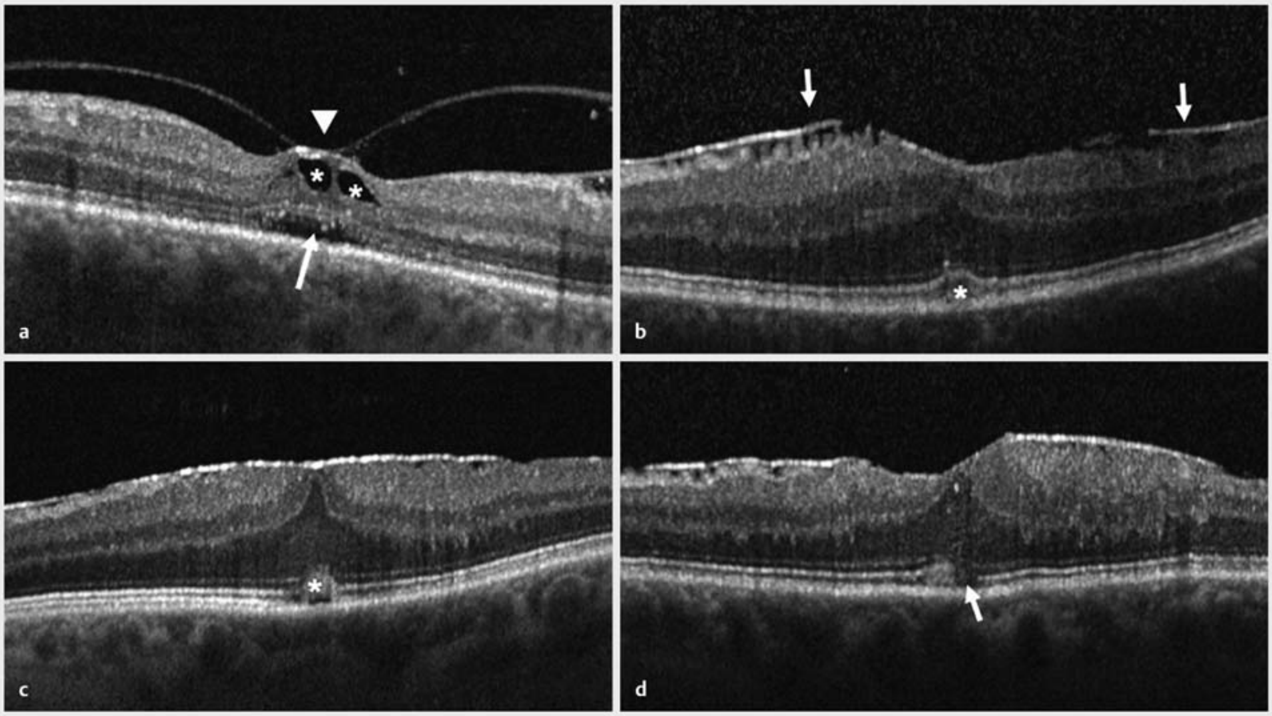
In a retrospective study, Kinoshita et al. subdivided the macular morphology into the categories of diffuse edema, cystoid macular edema, pseudo-lamellar hole, and vitreomacular traction (▶ **Fig. 1 d**; ▶ **Fig. 2 a**). With the exception of the pseudo-lamellar holes, each of these groups showed a significant postoperative improvement in visual acuity. However, the length of observation periods differed (20.5 ± 14.6 months), and the study does not appear to have made a distinction between lamellar holes and pseudoholes [13]. In their prospective study, Inoue et al. did not observe any correlation between preoperative pseudoholes and postoperative visual acuity at 12 months after surgery [32]. Another retrospective study did not show any correlation between BCVA and preoperative intraretinal cystoid fluid accumulation. The absence of such a correlation may be due to the fact that cystoid fluid accumulation often does not completely regress after surgery [37].

Govetto Staging and Ectopic Inner Foveal Layers (EIFLs)

An OCT-based classification of ERM and macular morphology, proposed recently by Govetto et al., is being increasingly used in the literature (▶ **Fig. 1**). Govetto stages 1 to 4 are associated with a poorer initial BCVA as the stages become more advanced. Govetto et al. also described EIFLs and presented the hypothesis that ERM-induced centripetal traction either displaces the inner retinal layers towards the fovea or induces proliferation due to Müller cell damage and the secondary stimulation of repair pathways. Interestingly, OCT angiography confirms that Govetto stage 2 and 3 ERMs show almost a complete loss of the foveal avascular zone due to the vascularity of the EIFL [20].

In a later retrospective study, Govetto et al. [4] determined that EIFLs persisted after surgery in 91% of cases. According to a multivariate analysis, EIFL thickness, defined as the area between the outer nuclear layer and the ILM (ONL–ILM), was associated with poorer preoperative visual acuity regardless of the CFT. However, the observed postoperative thinning did not correlate to an improvement in visual acuity. In the end, it was hypothesized that the presence of EIFLs is associated with a significantly poorer prognosis.

Moreover, it has been shown that Govetto stage 4 ERMs have poorer visual acuity outcomes than stage 3 ERMs, even though



▶ **Fig. 2** Representative examples of ERM-associated OCT findings. **a** Vitreomacular traction: marked with an arrowhead, intraretinal cavities: marked with stars, neurosensory detachment: marked with an arrow. **b** Partial adhesion: marked with arrows, cotton wool spot: marked with a star. **c** Global adhesion; cotton wool spot: marked with a star. **d** Disruption to the integrity of the interdigitation zone (IZ) and ellipsoid zone (EZ), discontinuity of IZ and EZ marked with an arrow.

EIFLs are present in both cases [4]. This implies that the disruption of other retinal layers has additional prognostic significance. Gonzalez-Saldivar et al. [38] confirmed the negative prognostic significance of EIFLs in Govetto stage 3 to 4 ERMs. In a retrospective analysis, they reported that the postoperative visual acuity after 12 months was better than the initial visual acuity in all stages. However, the improvement was only statistically significant in stage 2 ERMs. Moreover, the final visual acuity in stage 4 eyes was significantly poorer than in stage 3 eyes.

Other Inner Retinal Layers

There is little consensus in the literature regarding the use of other internal retinal layers as prognostic markers. The multicentric, retrospective, DREAM study established that a severe disorganization of retinal inner layers (DRIL) was associated with a significantly smaller improvement in visual acuity after 12 months compared to the absence of DRIL or only slight DRIL [39]. However, a retrospective study by Fernandes et al. [33] did not find any correlation between the severity of the initial DRIL and the BCVA after 12 months, although the severity of the DRIL decreased in more than 50% of patients over the same time period.

In their systematic review, Miguel and Legris discovered that a thinner ganglion cell–inner plexiform layer (GC–IPL) at the start of the study was associated with a greater improvement in postoperative BCVA [27]. In their prospective study, Kim et al. discovered that among all of the parafoveal layers, only the thickness of the GC–IPL and the inner nuclear layer (INL) were negatively associated with a postoperative improvement in visual acuity; only the INL association persisted in the multivariate analysis [40]. In another prospective study, Zou et al. investigated the relationship between initial BCVA and the thickness of seven retinal layers in the foveal, parafoveal, and perifoveal regions. Multiple linear regression analysis showed that the INL in all regions was associated with the visual acuity at the start of the study. In patients whose visual acuity had improved by more than 2 lines 6 months after the operation, there was a statistically significant correlation between visual acuity and the INL. In contrast, no correlation could be found for any of the other retinal layers [41].

Integrity of the Ellipsoid Zone (EZ)

On OCT, the EZ appears as a hyperreflective band in the outer retina. It represents the ellipsoid part of the inner photoreceptor segment [30].

In the literature, data from numerous retrospective and prospective studies indicates that disruption or absence of the EZ at the start of the study may be predictive of a poorer postoperative visual acuity at 6 to 12 months [26, 32] (▶ **Fig. 2 d**).

It is worth noting that in 18–36% of patients, the EZ defect was found to have resolved after 6 months and 12 months. Visual recovery was significantly better in this patient subgroup. The authors also showed that no further improvement could be expected after a follow-up observation period of 12 months [35].

Integrity of the Interdigitation Zone (IZ)

On OCT, the interdigitation zone (IZ) appears as another hyperreflective line between the EZ and the RPE [30]. It represents the part of the outer segments of the cone that is engulfed by apical RPE cell processes (▶ **Fig. 2 d)**. In many studies, this is referred to using the older term: cone outer segment tips line. Analogous to the EZ, disruption of the IZ is considered to be an indicator for photoreceptor damage; studies describe this in both qualitative and quantitative terms.

In several retrospective studies, there appears to be a correlation between the presence and increasing length of preoperative IZ disruption and poorer postoperative visual acuity at 6 months [29], 12 months [30], and 24 months [34]. It should be noted, however, that Fernandes et al. [33] found a correlation for both IZ and EZ in the univariate analysis, but only an IZ correlation in the multivariate analysis. This indicates that patients with an intact EZ may still have a poor outcome if they have a disrupted IZ. Itoh et al. [30] also found a correlation between postoperative visual acuity and IZ disruption, but not EZ disruption. Shimozono et al. hypothesized that the IZ is more susceptible than the EZ to damage induced by ERM traction [29]. There are several indications that IZ defects can resolve postoperatively in a minority of patients [34].

Other Outer Retinal Layers and Length of Photoreceptor Outer Segment (PROS)

Other potential OCT markers in the outer retina may be located in the outer foveal and parafoveal layers [photoreceptor outer segment (PROS), ONL] [18, 33]. Of these layers, a correlation with postoperative visual acuity has only been demonstrated for the length of the PROS.

Shiono et al. [28] showed that it can be difficult to distinguish between EZ and IZ defects if there are artefacts caused by intraretinal fluid and cataracts. For this reason, they proposed to determine the PROS length as a quantitative evaluation of the photoreceptor layer [28]. In a prospective study, the multiple regression analysis found a positive correlation between PROS length and postoperative BCVA after 6 months. However, a similar correlation could not be found for thickness of the outer fovea (from the external limiting membrane to the RPE) or for thickness of the ONL [28]. Using multiple regression analysis, Kinoshita et al. [42] determined that there was a correlation between better visual acuity after 24 months and a longer baseline PROS length. They also analyzed ONL thickness but did not find any correlations for this parameter. In another retrospective analysis, Hashimoto et al. [43] discovered that postoperative recovery of visual acuity had a positive correlation with recovery of the PROS length.

Central Bouquet Anomaly (CBA)

The central bouquet is a subfoveal area around 100 µm in size consisting of a dense accumulation of cones and Müller cells (▶ **Fig. 1 b**; ▶ **Fig. 2 b, c**). It is affected by tractive changes caused by ERM. Govetto et al. undertook a grading of central bouquet anomalies (CBAs) and showed that the initial BCVA decreased with increasing CBA grade. Moreover, they showed that the CBA tended to be associated with a Govetto stage 2 ERM, and that it was negatively correlated to the presence of an EIFL [44]. This has been confirmed by Ortoli et al. [21]. It has been hypothesized that the EIFL protects against CBA by reducing the traction of the outer fovea [44].

CBA has been less well studied than IZ/EZ, but the limited results that are currently available do not seem to indicate that it has a significant role for prognosis. This is not surprising, considering the negative correlation with the EIFL. The retrospective Brinkmann et al. [45] study established that 68% of eyes with CBA show postoperative improvement within their classification subgroup.

Ortoli et al. described a postoperative resolution of CBA in 97.7% of eyes. However, no correlation could be found between the presence or grade of preoperative CBA and postoperative visual acuity after 6 months [21]. Other studies have shown a postoperative resolution of grade 1 CBA [4, 31].

Importance of Internal Limiting Membrane Peeling

The significance of the ILM in ERM pathogenesis remains to be fully elucidated. It is suspected that the ILM, as a structure adjacent to the vitreous body, offers the ERM cells a kind of guide structure that defines their final position and morphology [23].

Based on this assumption, surgically removing the ILM may have a prophylactic benefit as regards to ERM formation. This assumption has been upheld by several authors who have described cases of previous rhegmatogenic retinal detachment in which an ERM did not form postoperatively if the ILM had been surgically removed during treatment of the retinal detachment [46, 47].

In a retrospective analysis, Forlini et al. investigated 159 patients who had been treated with ppV due to retinal detachment [48]. In 78 eyes, ILM peeling was performed in addition to ppV. Whilst ERMs developed postoperatively in 9% of patients in the cohort that underwent ILM peeling, this figure rose to 31% of patients in the cohort that did not undergo ILM peeling ($p = 0.001$). Similarly, in a multivariate analysis of different endotamponades, the risk was reduced significantly by 75% in the peeling cohort compared to the cohort with no peeling. Moreover, postoperative visual acuity was significantly better in the cohort with peeling (0.32) compared to the cohort without peeling (0.16; $p = 0.01$).

This clear correlation becomes even more evident if we consider that the peeling cohort in the Forlini et al. study contained a larger proportion of eyes with risk factors for developing an ERM than did the cohort without peeling. Thus, 24 out of 78 patients in the peeling group had suffered vitreous hemorrhage or proliferative vitreoretinopathy in the eye that was included in the study. As these diseases can promote ERM formation, they should be taken into account when considering whether or not to perform ppV with ILM peeling [48].

In a previously published retrospective analysis of 135 eyes that had undergone vitrectomy due to retinal detachment, Nam and Kim reported no cases of postoperative ERMs occurring in the subgroup of patients who had undergone ILM peeling. In contrast, ERMs developed in 21.5% of the group of patients who had not undergone ILM peeling. In this study, all of the patients underwent ppV with gas injection [46].

In a study by Aras et al., 42 eyes that had been treated for retinal detachment with silicone oil were observed over a period of around 25 weeks. The authors described a 27 % rate of postoperative ERMs in the patients who had not undergone peeling. The outcome was markedly different in patients who underwent ILM peeling during vitrectomy; none of the patients in this group developed an ERM [47].

Forlini et al. have postulated that the reduced occurrence of ERMs after ILM peeling is due to the fact that RPE cells need to be anchored to a basal membrane in order to proliferate and form an ERM. The ILM functions as a basal membrane for the Müller cells in the retina. ILM peeling prevents detached RPE cells from accumulating and proliferating epiretinally; this in turn prevents the formation of an ERM [48].

The studies presented here demonstrate that there is a clear benefit to removing the ILM as part of treatment for a detached retina. However, it should be noted that peeling can be technically challenging in eyes with retinal detachment, especially when the detachment affects the macula. For this reason, the indication for prophylactic peeling should also depend on the experience of the surgeon who is to perform it.

Risks of Surgery

In a case series of 1131 eyes in which an ERM was treated by vitrectomy and peeling, intraoperative complications occurred in 9.8 % of cases. The most common adverse events associated with this procedure were iatrogenic retinal tears (4.9 %), iatrogenic retinal trauma (1 %), and intraoperative lens touch (1 %). In procedures performed without a cataract operation, complications occurred in 8.1 % of cases. In 3 % of cases, another ERM operation was required 5.5 months after the primary operation. In 1 % of cases, retinal detachment occurred 3.2 months after the operation [22]. However, other studies have shown higher rates of postoperative retinal detachment. For example, in a case series of 362 eyes, Guillaubey et al. reported retinal detachment after 70 days following an ERM operation in 9 eyes (2.5 %) [49]. The overall rate of endophthalmitis after vitrectomy is low, with an incidence ranging from 0.14 to 0.84 reported in the literature [50].

Summary

An ERM is one of the most common retinal diseases. It occurs in 35 to 50 % of the population, and its incidence increases with age.

As well as subjective symptoms such as metamorphopsia, aniseikonia, or loss of visual acuity, changes can also be observed on OCT. On OCT, an ERM manifests as a hyperreflective membrane on the surface of the retina. In severe cases, it can also be diagnosed clinically using fundoscopy. A new OCT-based classification proposed by Govetto et al. can be used to determine the prognosis for postoperative visual acuity [20].

Other retinal findings, such as an increase in central foveal thickness or the presence of an EIFL accompanying the ERM, can also influence postoperative outcome.

Vitrectomy with peeling of the ERM represents the gold standard for surgical treatment. Based on the current literature, ILM peeling can also be recommended.

Conflict of Interest

The authors declare that they have no conflict of interest.

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