

Effect of Foveal Herniation on Surgical Outcomes of Idiopathic Epiretinal Membrane Peeling: A Challenging Presentation

Auswirkung der fovealen Herniation auf die chirurgischen Ergebnisse bei der Entfernung idiopathischer epiretinaler Membranen: Eine herausfordernde Präsentation

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ABSTRACT

Purpose The aim of this report is to describe the visual symptoms and spectral-domain optical coherence tomography (SD-OCT) findings associated with foveal herniation with epiretinal membrane and to evaluate the postoperative visual, anatomical, and surgical outcomes.

Background Foveal herniation occurs when neuroretinal tissue protrudes through and above the level of an epiretinal membrane. The pathogenesis of foveal herniation is still unknown, though it is likely attributable to the centripetal contraction of the epiretinal membrane (ERM). Moreover, thinning of the prefoveal internal limiting membrane (ILM) may further exacerbate this process by reducing the structural support for the retina in that area. In the literature, foveal herniation with ERM is rare and usually described as unilateral. Most cases present a good visual outcome after surgical intervention.

Case Description We describe the case of a 37-year-old Caucasian male patient, without any previous ocular history, who presented with metamorphopsia and a sustained reduction visual acuity to his left eye that had persisted for several months. The baseline best-corrected visual acuity (BCVA) was recorded as 0.05 decimals. Anterior segment examination was unremarkable, while dilated funduscopy revealed an ERM with a concentric ring of foveal tissue prolapse. SD-OCT showed the foveal tissue protruding through and above the ERM, demonstrating the severe foveal herniation. A diagnosis of idiopathic ERM with foveal herniation was established based on these findings. Subsequently, the patient was scheduled for surgical intervention to undergo pars-plana vitrectomy with ERM peeling. After the surgery, the patient experienced progressive restoration of the foveal anatomy and an improvement of vision to 0.6 decimals from baseline at 3 months.

Conclusion This case report shows a rare finding of foveal herniation with ERM. This atypical presentation is of important clinical relevance in drawing clinicians' attention to the possibility of these findings, with the goal to prevent erro-

neous diagnosis and unnecessary treatments. We demonstrate the visual improvement and gradual resolution of foveal herniation with SD-OCT images after ERM removal, and the images show that it may take a few months for the foveal bulge to decrease in height. When the outer retinal layers are normal, visual recovery, though delayed, is appreciable.

ZUSAMMENFASSUNG

Zweck Das Ziel dieses Berichts ist es, die visuellen Symptome und die Befunde der spektral-domänen-optischen Kohärenztomographie (SD-OCT) zu beschreiben, die mit einer fovealen Herniation bei epiretinaler Membran verbunden sind, sowie die postoperativen visuellen, anatomischen und chirurgischen Ergebnisse zu bewerten.

Hintergrund Eine foveale Herniation tritt auf, wenn neuroretinales Gewebe durch und über die Ebene einer epiretinalen Membran (ERM) hervortritt. Die Pathogenese der fovealen Herniation ist noch unbekannt, wird jedoch wahrscheinlich der zentripetalen Kontraktion der epiretinalen Membran zugeschrieben. Darüber hinaus kann eine Ausdünnung der präveolären inneren Grenzmembran (ILM) diesen Prozess weiter verschlimmern, da sie die strukturelle Unterstützung der Netzhaut in diesem Bereich verringert. In der Literatur ist die foveale Herniation mit ERM selten und wird in der Regel als unilateral beschrieben. Die meisten Fälle zeigen ein gutes visuelles Ergebnis nach chirurgischem Eingriff.

Fallbeschreibung Wir beschreiben den Fall eines 37-jährigen kaukasischen Mannes ohne vorherige Augenanamnese, der mit Metamorphopsien und einer anhaltenden Reduktion der

Sehschärfe am linken Auge vorstellig wurde, die über mehrere Monate bestanden hatte. Die bestkorrigierte Sehschärfe (BCVA) zu Beginn wurde mit 0,05 Dezimalen dokumentiert. Die Untersuchung des vorderen Augenabschnitts war unauffällig, während die erweiterte Fundoskopie eine epiretinale Membran mit einem konzentrischen Ring aus vorgewölbtem fovealem Gewebe zeigte. Die SD-OCT zeigte, dass das foveale Gewebe durch und über die ERM hervortrat, was die schwere foveale Herniation demonstrierte. Auf Grundlage dieser Befunde wurde eine Diagnose einer idiopathischen ERM mit fovealer Herniation gestellt. Anschließend wurde der Patient für einen chirurgischen Eingriff eingeplant, bei dem eine Pars-plana-Vitrektomie mit ERM-Peeling durchgeführt wurde. Nach der Operation erlebte der Patient eine fortschreitende Wiederherstellung der fovealen Anatomie und eine Verbesserung der Sehschärfe auf 0,6 Dezimalen im Vergleich zum Ausgangswert nach 3 Monaten.

Fazit Dieser Fallbericht zeigt eine seltene Befundkonstellation einer fovealen Herniation mit ERM. Diese atypische Präsentation hat eine wichtige klinische Relevanz, da sie die Aufmerksamkeit der Kliniker auf die Möglichkeit dieser Befunde lenkt, um Fehldiagnosen und unnötige Behandlungen zu vermeiden. Wir demonstrieren die visuelle Verbesserung und die allmähliche Rückbildung der fovealen Herniation anhand von SD-OCT-Bildern nach Entfernung der ERM. Die Bilder zeigen, dass es einige Monate dauern kann, bis die Höhe des fovealen Vorwölbens abnimmt. Wenn die äußeren Netzhautschichten normal sind, ist die visuelle Erholung, obwohl verzögert, dennoch bemerkenswert.

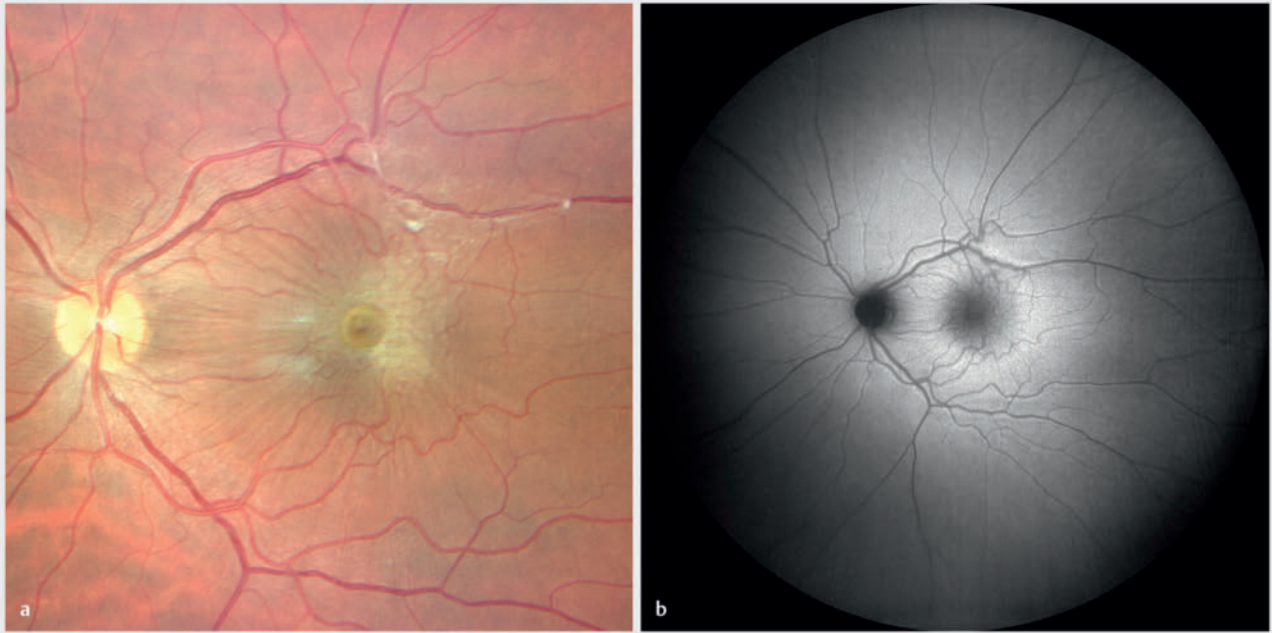
Introduction

Epiretinal membranes in younger patients are often thicker and more firm compared to elderly. Surgical removal of these membranes, especially when they cause retinal distortion over the macula, is usually recommended [1]. Foveal herniation occurs when neuroretinal tissue protrudes through and above the level of an epiretinal membrane, usually from a small central defect in a taut membrane, causing irregularities in the inner retinal architecture. The pathogenesis of foveal herniation is still unknown, though it is likely attributable to the centripetal contraction of the epiretinal membrane (ERM). Moreover, the thinning of the prefoveolar internal limiting membrane (ILM) may further exacerbate this process by reducing the structural support for the retina in that area [2,3].

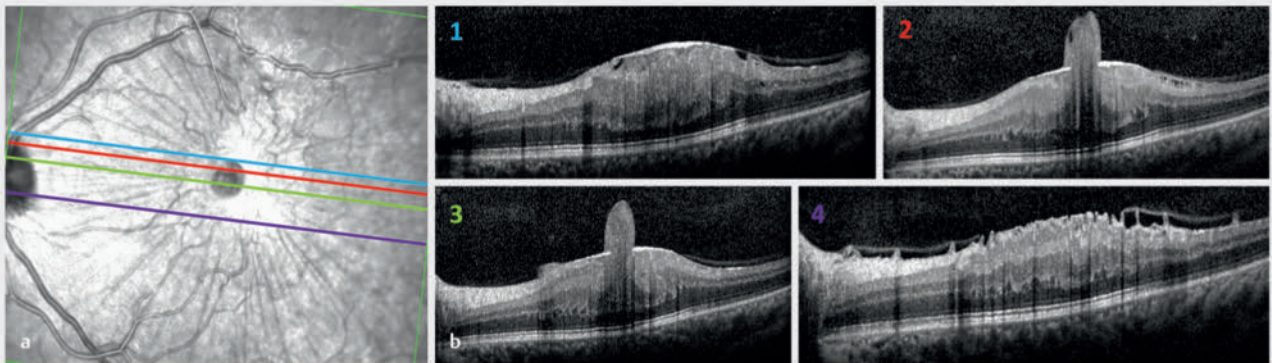
The aim of this report is to describe the visual symptoms and spectral-domain optical coherence tomography (SD-OCT) findings associated with foveal herniation with idiopathic epiretinal membrane and to evaluate the postoperative visual, anatomical, and surgical outcomes.

Case Presentation

We present the case of a 37-year-old Caucasian male with no prior ocular history, who came to us reporting metamorphopsia and a persistent decrease in visual acuity in his left eye, which had been ongoing for several months. At the time of initial examination, his left eye best-corrected visual acuity (BCVA) was documented as 0.05 decimal. Anterior segment examination of the left eye appeared within normal limits; however, dilated funduscopy revealed the presence of an epiretinal membrane accompanied by a notable concentric ring of foveal tissue prolapse (► Fig. 1 a). Fundus autofluorescence showed a marked hypofluorescence in the foveal region (► Fig. 1 b). SD-OCT imaging was performed, which showed significant foveal tissue protruding through and above the ERM, indicating severe foveal herniation of the ganglion cell complex without marked alterations of the outer retinal segments (► Fig. 2). Based on these clinical and imaging findings, the patient was diagnosed with idiopathic ERM with associated foveal herniation. To address this condition, the patient was scheduled for a surgical intervention involving 25-gauge pars-plana vitrectomy with ERM peeling and air tamponade. A meticulous flower petal peeling technique was applied in order to minimize traction on the foveal tissue. Postoperatively, the patient demonstrated a gradual restoration of normal foveal anatomy (► Fig. 3), accompa-



► **Fig. 1** a Fundus photography of the left eye revealing central foveal alteration. b Fundus autofluorescence showing a marked hypofluorescence in the foveal region.



► **Fig. 2** a Infrared image showing retinal wrinkles at the posterior pole. b Different SD-OCT scans showing the foveal tissue protruding through and above the epiretinal membrane, demonstrating the severe foveal herniation.

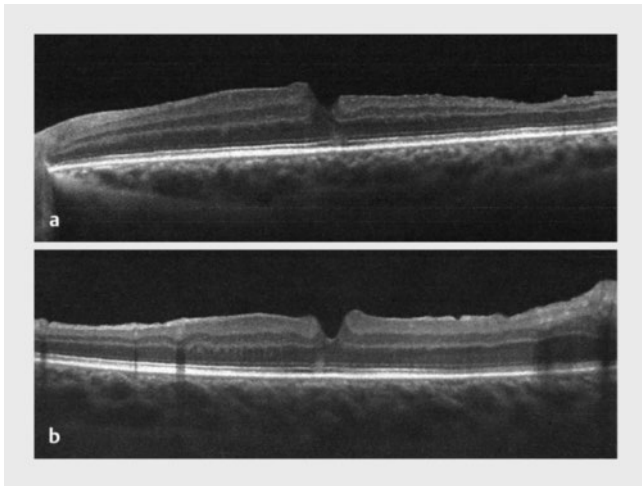
nied by a marked improvement in visual function. Three months after surgery, BCVA improved to 0.6 decimal, and to 0.8 decimals at 12 months, indicating a significant recovery from the preoperative condition.

Discussion

This case report shows a rare finding of foveal herniation with idiopathic epiretinal membrane. The patient's follow-up demonstrates visual improvement and gradual resolution of foveal herniation after ERM peeling and shows that it may take few months

for the foveal bulge to decrease in height. Notably, this case highlights the fact that when the outer retinal layers remain intact or with only mild alteration, delayed but notable visual recovery is achievable.

Herniation of retinal tissue through a small epiretinal membrane hole is a relatively rare finding and was first reported in 2011 by Francis et al. as a perifoveal circumferential contraction of the ERM and the subsequent prolapse of the foveola centrally [3]. In the literature, foveal herniation with ERM is rare, usually described as unilateral, and information about the characteristics of this entity and the postoperative outcomes after ERM peeling sur-



► **Fig. 3** Horizontal (a) and vertical (b) macular SD-OCT scans at 3 months postoperatively.

gery is limited. Most cases present a good visual outcome after surgical intervention [4]. The pathogenesis of foveal herniation remains unclear; however, our findings suggest that the protrusion of foveal tissue and the ganglion cell complex observed in this case may result from retinal edema due to traction exerted by the ERM. This traction likely induces herniation in areas not covered by the membrane.

Our patient experienced a remarkable improvement in BCVA (from 0.05 to 0.6 decimals) following ERM peeling. In the literature, various prognostic factors have been identified in relation to visual acuity outcomes after idiopathic ERM peeling. Key factors include preoperative visual acuity, symptom duration, and SD-OCT findings such as retinal thickness and the integrity of outer retinal layers [5–8]. In our case, foveal herniation was limited to the inner retinal layers and ganglion cell complex with an intact outer retina, so we attribute the favorable postoperative visual outcome primarily to the preoperative integrity of the outer retinal layers, as shown on the baseline SD-OCT scans, including an intact and uninterrupted ellipsoid zone. Also, in a case similar to ours, Oellers and Elliot suggested that a substantial visual improvement following membrane peeling with foveal herniation may be explained by the combination of an intact outer retina and the postoperative normalization of the inner retinal layer anatomy [9]. Another factor that might be crucial for visual recovery is the ERM peeling technique. In our case, the meticulous flower petal peeling technique was applied in order to minimize traction on the foveal tissue. This technique involves segmenting the ERM into multiple small “petals,” initiating peripherally to the fovea and gradually advancing toward it. We believe that this meth-

od allows for controlled and sectional removal peeling of the ERM around the fovea, reducing the risk of additional stress or focal traction on the foveal protruding tissue. By carefully avoiding direct manipulation of the foveal region, the flower petal peeling technique can potentially reduce the risk of exacerbating the herniation and support a more favorable visual outcome.

In conclusion, this case report shows a rare finding of foveal herniation with ERM. This atypical presentation has an important clinical relevance in order to give knowledge to clinicians about the possibility of these findings, with the goal to prevent erroneous diagnosis and unnecessary treatments. We demonstrate the visual improvement and gradual resolution of foveal herniation with SD-OCT images after ERM removal, and the images convey that it may take a few months for the foveal bulge to decrease in height. When the outer retinal layers are normal, visual recovery, though delayed, is appreciable.

Conflict of Interest

The authors declare that they have no conflict of interest.

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