COMPLEX MYOPIC MHRD: MEMBRANES AND TRANSPLANTS


In the last installment of this three-part series, we describe the latest techniques for managing challenging retinal detachments.

BY CARLOS MATEO, MD, AND ANNIKEN BURÉS-JELSTRUP, MD

Macular hole retinal detachments (MHRD) are a significant challenge in vitreoretinal surgery, with high myopia and the presence of a posterior staphyloma the predominant causes. In RDs originating from the posterior pole, retinal breaks other than the MH may be responsible, such as full-thickness tears along the vascular arcades or within areas of chorioretinal atrophy—particularly around the optic disc—which can be difficult to identify.

In addition to the macular buckling technique, several alternative surgical strategies have proven highly effective for achieving both MH closure and retinal reattachment.

ILM DISSECTION AND INVERTED FLAP TECHNIQUE

First described in 2016 by Michalewska et al for large MHs, the inverted internal limiting membrane (ILM) flap technique has demonstrated a clear superiority over complete ILM removal in terms of MH closure rates and retinal reattachment in various series published in 2016 and 2017.[1-5] Creating an inverted flap when the retina is detached can be cumbersome due to two main challenges:

- During staining, the dye tends to enter the subretinal space, impairing ILM visualization and increasing the risk of retinal pigment epithelium (RPE) toxicity.
- Performing the initial "pinch" maneuver to start the ILM peel on a detached, mobile retina can be technically difficult and traumatic.

To address these issues, a modified technique was described in 2023: Following pars plana vitrectomy (PPV), perfluorocarbon liquid (PFCL) is injected to displace the subretinal fluid peripherally. Using high magnification and a 41-gauge cannula, a partial drainage of subretinal fluid can be performed through the MH. Staining is then achieved by injecting dye with a soft-tip cannula between the retina and the PFCL, which allows almost instantaneous staining without subretinal dye migration. The inverted flap can then be prepared and positioned over the MH. This approach avoids the need for additional posterior retinotomies.[6]

The inverted ILM flap technique has become the first-line surgical approach for MHRD associated with high myopia.

AUTOLOGOUS RETINAL TRANSPLANTATION

In 2016, Grewal and Mahmoud introduced the concept of autologous retinal transplantation (ART) for the treatment of large refractory MHs (Figure 1).[7] Subsequently, 15% of the patients included in the ART Global Consortium Study had a MHRD that had failed to close after surgery. After ART, 95% of these patients achieved MH closure (complete closure in 68.4% and a small eccentric defect in 26.3%).[7] Reported complications included graft dislocation, redetachment in four eyes, and the presence of subretinal PFCL in two eyes.[8]

A controversial aspect of ART has been whether the graft becomes reperfused. Tabandeh reported two cases that demonstrated vascular reperfusion of large ART grafts,[9] and Kitahata et al documented vascularization in 34.6% of 26 eyes.[10] Conversely, Takeuchi et al observed no changes in fixation points using microperimetry or in absolute scotoma size in cases of very large MHs.[11]

During the initial surgical steps, it is important to estimate the MH size to harvest a graft approximately 25% larger, compensating for postoperative graft contraction. This can be facilitated by placing a Finesse Flex Loop (Alcon) over the MH to estimate its diameter and then transferring the measurement to the peripheral retina (ART is typically harvested from the superior peripheral retina).

Some surgeons prefer to apply diathermy around the donor site to minimize bleeding, although excessive coagulation may devitalize the edges. Maintaining the graft's orientation is crucial. While some surgeons deliver the graft under PFCL to facilitate a correct placement, others prefer to lift the graft and place it directly over the MH, use forceps to position the graft, and stabilize it over the MH using PFCL. (The latter option could avoid potential photoreceptor trauma because the graft is not being dragged into position.) The final exchange with the chosen tamponade agent—either gas or silicone oil—is critical to prevent graft displacement.

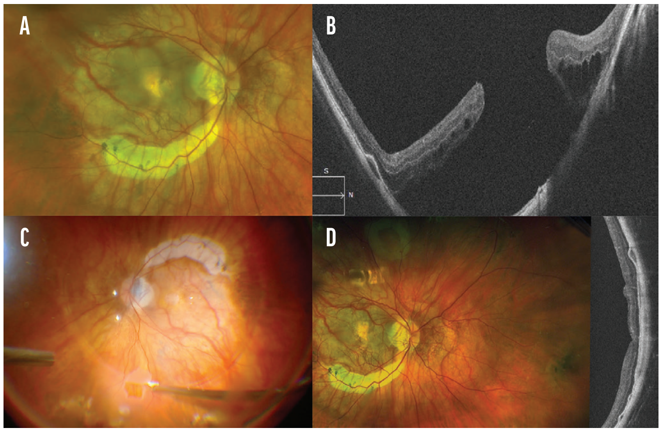

Figure 1. This eye with high myopia has a large MHRD confined to the macular area (A). Structural OCT shows the central size of the MH (B). Intraoperative imaging with PFCL after creating a peripheral localized RD and cutting the ART that will then be moved to the MH under PFCL (C). Postoperatively, the retina is reattached, and the MH is closed on OCT (D).

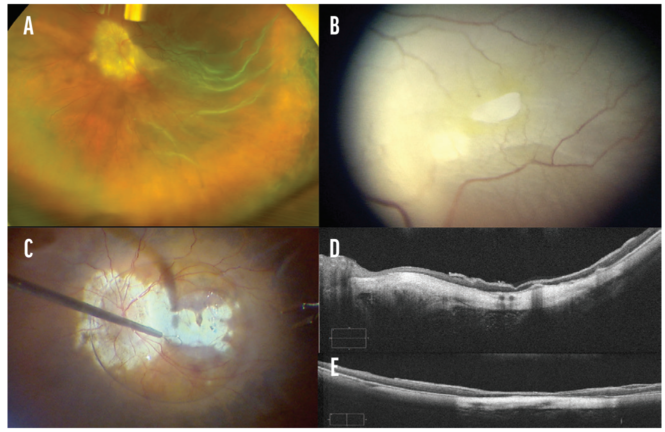

Figure 2. A total RD is caused by a large MH (A). Intraoperatively, the hole has atrophic areas seen through the translucent detached retina (B). The HAM is stabilized under PFCL, and the surgeon centers and unrolls the HAM (C). Horizontal (D) and vertical (E) OCT scans crossing the foveal center show the centered HAM.

HUMAN AMNIOTIC MEMBRANE

In 2011, Kiilgaard et al used subretinal human amniotic membrane (HAM) in animal studies as a substitute for damaged RPE and Bruch membrane.[12] Later, Rizzo et al applied small, cryopreserved HAM implants subretinally without specific orientation to promote MH closure.[13] In 2019, Caporossi et al reported a 94% closure rate in highly myopic eyes (mean axial length 30.89 mm) using subretinal HAM placed with chorion-RPE orientation. Importantly, 69% of eyes demonstrated visual improvement, with BCVA better than 20/63 in 56% of eyes.[14]

The technique involves preparing a HAM disc (1 to 2 mm in diameter, depending on MH size) and positioning it beneath the MH edges (Figure 2). Mechanical elevation of the edges is often necessary to insert the implant and prevent its loss during fluid-air exchange. In cases of MHRD, once the HAM is placed subretinally (preferably with the chorion facing the RPE), it should be stabilized with PFCL to prevent subretinal displacement. Subretinal fluid should then be drained either through a peripheral retinal break or a small, intentionally created peripheral retinotomy.[15]

In 2020, Moharram et al reported the use of a large epiretinal HAM patch in 14 eyes with MHRD, achieving MH closure and retinal reattachment in 93% of cases.[16] In 2021, Garcin et al applied the same technique in two groups—those with large MHs and those with MHRD—achieving 80% hole closure and 100% retinal reattachment, respectively.[17]

Whether the optimal form of HAM is cryopreserved or lyophilized remains unclear. Cryopreserved HAM is stored at very low temperatures (-80°C to -196°C), preserving histological integrity but showing some basal lamina and stromal protein degradation after 3 months. Conversely, lyophilized HAM is thinner, can be stored at room temperature, and is immediately available. Regarding growth factors, Allen et al demonstrated that dried HAM retained higher concentrations of growth factors compared with cryopreserved HAM when a modified preservation process was used.[18] Orientation also remains controversial—whether the chorionic side should face upward or toward the RPE. Cryopreserved HAM shows greater adherence on its chorionic surface, so many surgeons prefer placing this surface toward the RPE to enhance adherence and reduce the risk of implant displacement during the final fluid-air exchange.

THE BENEFITS OF MH COVERAGE

MHRD remains one of the most complex scenarios in vitreoretinal surgery, particularly in highly myopic eyes with posterior staphyloma. Recent advances such as the inverted ILM flap technique, ART, and HAM implantation provide effective alternatives for achieving both MH closure and retinal reattachment in challenging cases. However, we still have barriers to overcome, including the need to achieve not only closure and retinal reattachment, but also complete restoration of the retinal layers.

Careful patient selection, meticulous surgical technique, and awareness of potential complications are essential to optimize outcomes. As instrumentation and adjuncts evolve, these strategies may further improve both anatomic success and functional recovery in eyes with MHRD. ■

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CARLOS MATEO, MD
- Vitreoretinal Surgeon, Vitreoretinal Department, Instituto de Microcirugía Ocular Barcelona, Miranza-Veonet, Barcelona, Spain
- Co-founder, Instituto de Microcirugía Ocular, Barcelona, Spain
- Adjunct Professor, Postgraduate Program in Medical and Surgical Retina, Universitat Autònoma de Barcelona, Barcelona, Spain
- carlosmateo@me.com; carlos.mateo@imo.es
- Financial disclosure: None

ANNIKEN BURÉS-JELSTRUP, MD
- Vitreoretinal and Uveitis Department and Head of the Teaching Department, Instituto de Microcirugía Ocular Barcelona, Miranza-Veonet, Barcelona, Spain
- Adjunct Professor, Postgraduate Program in Medical and Surgical Retina, Universitat Autònoma de Barcelona, Barcelona, Spain
- anniken.bures@imo.es
- Financial disclosure: None

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