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Closure of Full-thickness Macular Hole after Pars Plana Vitrectomy (23G) with Cataract Phacoemulsification, Artificial Intraocular Lens Implantation, and Silicone Oil Administration Due to Rhegmatogenous Retinal Detachment in the Right Eye in a 67-year-old Patient – a Case Report

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Summary: Macular holes pose a significant threat to central vision, necessitating precise diagnosis and intervention with an occurrence of 1 per 1000 patients over the age of 55. This manuscript presents a case study of a 66-year-old man with a retinal detachment in the right eye and full-wall macular hole.
The patient underwent a multi-step surgical intervention involving pars plana vitrectomy, internal limiting membrane peeling with silicone oil tamponade, retinal endophotocoagulation, and administration and removal of the perfluorocarbon liquid DK-line in the first step. The second stage of treatment comprised silicone oil removal via posterior access vitrectomy, injection of 25% SF6 into the right eye, and treatment of intraoperatively found macular hole with an inverted flap method.
The case underscores the association between macular hole and rhegmatogenous retinal detachment, with potential iatrogenic causes during vitrectomy. The inverted internal limiting membrane flap technique emerged as a superior strategy for managing full-thickness macular holes, demonstrating high closure rates and improved visual acuity postoperatively. This case study contributes to the evolving understanding of macular hole pathogenesis and reinforces the significance of tailored surgical approaches for optimal patient outcomes.

Key words: full-thickness macular hole (FTMH), rhegmatogenous retinal detachment, posterior vitrectomy.

Background

Macular hole (MH) is a vitreoretinal interface disease characterized by a partial or full-thickness neurosensory retinal defect in the center region of the macula, which results in a significant loss of central vision.

Currently, clinical diagnosis and post-treatment follow-up are based on clinical assessment and optical coherence tomography (OCT) [1]. Donald Gass described a four-point clinical scale for assessing the severity of macular hole severity in the 1990s, which is still in use [2]. The Modified Gass Classification System of Macular Holes is presented in Table I.

Stage	Description
1a	Yellow spot with loss of foveal depression, no vitreous separation
1b	Yellow ring with loss of foveal depression, no vitreous separation
2	Small full-thickness macular hole < 400 microns
3	Full-thickness macular hole > 400 microns, no vitreous separation
4	Full-thickness macular hole < 400 microns, complete vitreous separation

Tab. I. Modified Gass Classification System of Macular Holes.

In the case of full-wall MHs, OCT assesses the size of the hole, the cause (primary or secondary) and the presence of vitreomacular traction (VMT) [3]. Surgery is usually recommended at Gass grade 2–4.

Case presentation

The 66-year-old man, complaining of worsened vision for 5 weeks, was admitted to the tertiary reference ophthalmology center on an elective basis for a planned procedure of vitrectomy. The history of previous intraocular procedures was negative. The patient was treated for hypertension and ischemic heart disease.

A full ophthalmic examination was performed. The visual clarity (VA) in the left eye was 5/5 and 1/50 in the right eye. Intraocular pressure measured using the applanation method was within the normal range in both eyes. The anterior segment exa-

mination revealed floaters and tobacco dust in the vitreous body in the right eye. The lenses in both eyes were cloudy. A fundus examination showed poor condition of the retina with numerous retinal breaks and lattice degeneration. Moreover, retinal detachment with macular involvement and tear at 8 o'clock were found.

In his right eye with cataract and retinal detachment pars plana vitrectomy, internal limiting membrane (ILM) peeling with silicone oil tamponade, retinal endophotocoagulation and administration and removal of DK-line were performed combined with phacoemulsification and intraocular lens implantation under retrobulbar anesthesia.

On examination on the day of discharge, the tonus in both eyes was normal. The retina was without features of detachment. VA in the right eye was 2/50. The patient, in good local and general condition, was discharged on the second postoperative day with recommendations for postoperative consultation after 10 days, sparing lifestyle, and taking topical medications (Fig. 1. and Fig. 2.).

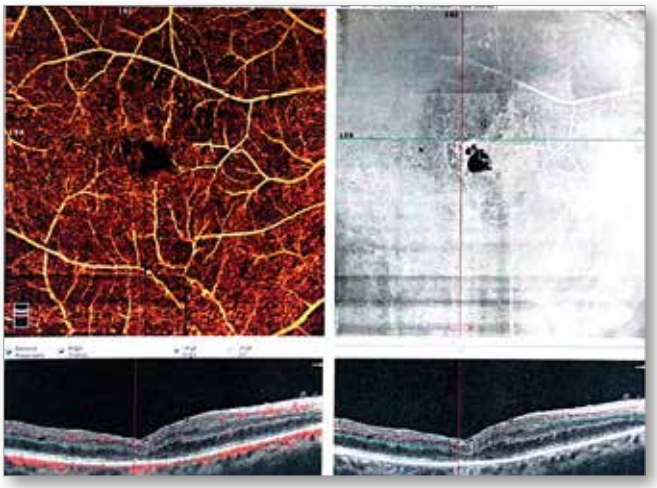

Fig. 1. Optical coherence tomography of the right eye showing the results of inverted flap technique 3 months after the procedure.

Fig. 2. Fundus photographs acquired 3 months after the inverted flap procedure.

First procedure – 5th of July 2023

A posterior vitrectomy (23G) was performed. Cataract phacoemulsification with artificial lens implantation was performed. Axial length was 25.44 mm; thus the power of the intraocular lens was calculated using the Holladay 1 formula. The ILM around the MH was partially removed. Retinal endolaser treatment and silicone oil endotamponade of the right eye were performed.

Second procedure – 3rd of October 2023

Removal of silicone oil from the eyeball via posterior access vitrectomy and injection of 25% SF6 into the right eye were performed. Intraoperatively, a hole in the macula was found, which was treated with an inverted flap method using ILM remaining after partial ILM peeling performed during the previous procedure (Fig. 3.). Final VA in the right eye was 2/50.

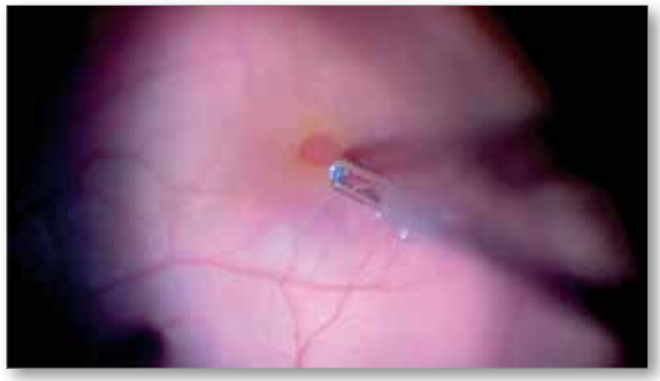

Fig. 3. Intraoperative photograph presenting application of the inverted flap technique.

Discussion

Macular Hole associated with rhegmatogenous retinal detachment (RRD) is observed in 1–4% of patients with RRD [4, 5]. Although the pathogenesis of MH in RRD remains uncertain, it may be the result of three mechanisms. Firstly, in pathological myopia, MH may be the causative break leading to detachment. Another possibility is RRD attributable to a peripheral break with a secondary MH, which may occur either before or as a result of the detachment process itself. In the lack of tangential traction, a mechanism for the genesis of MH has been proposed: cystoid macular edema (CME) [6]. A hole in the macula may also develop as an undesirable consequence of vitrectomy. In vitrectomy surgery, iatrogenic trauma is another cause of MH development. Iatrogenic trauma may result from direct instrument contact, traction-induced MH during ILM or ERM peeling, or direct contact between the macula and a high-velocity air or infusion fluid jet [7]. Additionally, the residual tractional forces after pars plana vitrectomy (PPV) for RD repair may have been the cause of MH formation in certain cases due to the contraction of residual vitreous [6].

The inverted ILM flap technique appears to be an effective surgical strategy, especially for the repair of large idiopathic and secondary full-thickness macular holes (FTMH) [8, 9]. The core vitrectomy, membrane staining (such as trypan blue, indocyanine green, or brilliant blue G), peeling of the epiretinal membrane (ERM), ILM peeling circularly for about two disc diameters around the hole, covering of the hole with an inverted ILM flap, and air or sulfur hexafluoride (SF6) or perfluoropropane (C3F8) gas tamponade are the surgical steps of the classic inverted ILM flap technique [10]. The ILM flap technique is reported to provide a high closure rate (98–92%) and good postoperative visual acuity 12 months after surgery (0.28–0.51 LogMAR) in FTMH [10, 11]. Thus, it is currently the preferred surgical technique of many vitreoretinal surgeons for the management of MHs which may produce good functional results, as shown in the present case.

Conclusion

The surgical procedure using the inverted flap technique is an effective, recognized surgical method that allows the preservation of useful visual function.

Disclosure
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References:

1. Macular Hole - StatPearls - NCBI Bookshelf. Accessed January 4, 2024. https://www.ncbi.nlm.nih.gov/books/NBK559200/.
2. GASS JD: *Reappraisal of biomicroscopic classification of stages of development of a macular hole*. American Journal of Ophthalmology. 1995; 119(6): 752–759. doi:10.1016/s0002-9394(14)72781-3.
3. Duker JS, Kaiser PK, Binder S, et al.: *The International Vitreomacular Traction Study Group classification of vitreomacular adhesion, traction, and Macular Hole*. Ophthalmology. 2013; 120(12): 2611–2619. doi:10.1016/j.ophtha.2013.07.042.
4. Martins Melo I, Jhaveri A, Bansal A, et al.: *Pathophysiology of secondary macular hole in Rhegmatogenous Retinal Detachment*. Investigative Opthalmology & Amp; Visual Science. 2023; 64(13): 12. doi:10.1167/iovs.64.13.12.
5. Kim DY, Jo YJ, Kim J-Y, et al.: *Surgical outcomes of vitrectomy for macular hole-induced retinal detachment according to various surgical methods: A multicenter retrospective study*. Seminars in Ophthalmology. 2021; 36(8): 728–733. doi:10.1080/08820538.2021.1900288.
6. Medina CA, Ortiz AG, Relhan N, et al.: *Macular Hole After Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment*. Retina. 2017 Jun; 37(6): 1065–1072. doi: 10.1097/IAE.0000000000001351. PMID: 27755378; PMCID: PMC5388588.
7. Brouzas D, Dettoraki M, Lavaris A, et al.: *Postoperative eccentric macular holes after vitrectomy and internal limiting membrane peeling*. International Ophthalmology. 2016; 37(3): 643–648. doi:10.1007/s10792-016-0320-6.
8. Yuan J, Zhang L-L, Lu Y-J, et al.: *Vitrectomy with internal limiting membrane peeling versus inverted internal limiting membrane flap technique for macular hole-induced retinal detachment: A systematic review of literature and meta-analysis*. BMC Ophthalmology. 2017; 17(1). doi:10.1186/s12886-017-0619-8.
9. Silva N, Ferreira A, Nawrocka (vel Michalewska) ZA, et al.: *Inverted internal limiting membrane flap technique: Is it the best option for macular holes?* Clinical Ophthalmology. 2021; Vol. 15: 3295–3303. doi:10.2147/opth.s284614.
10. Michalewska Z, Michalewski J, Adelman RA, et al.*: Inverted internal limiting membrane flap technique for large macular holes*. Ophthalmology. 2010; 117(10): 2018–2025. doi:10.1016/j.ophtha.2010.02.011.
11. Yamashita T, Sakamoto T, Terasaki H, et al.: *Best surgical technique and outcomes for large macular holes: Retrospective Multicentre Study in Japan*. Acta Ophthalmologica. 2018; 96(8). doi:10.1111/aos.13795.

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