Case Reports in Ophthalmology

Case Rep Ophthalmol 2024;15:394–398
DOI: 10.1159/000535795
Received: November 8, 2023
Accepted: December 5, 2023
Published online: April 25, 2024

Case Report

Viscoelastics Enable Dissection of Anterior Closed Funnels in Proliferative Vitreoretinopathy: A Retrospective Case Series

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Keywords
Complex retinal detachments · Pars plana vitrectomy · Proliferative vitreoretinopathy · Ophthalmic viscous devices · Case series

Abstract
Introduction: The present study aimed to describe a case series of patients in which a cohesive ophthalmic viscous device (OVD) was used to viscodissect and posteriorly displace the retina in cases of total retinal detachment complicated by proliferative vitreoretinopathy, operated with minimally invasive pars plana vitrectomy. ***Case Presentations:*** Three patients with a mean age of 67 years were included in the present study. One eye was aphakic, while the others were pseudophakic. OVD injection was performed through the limbus in the aphakic eye and via pars plana in the pseudophakic eyes. In all cases, the OVD injection led to a posterior displacement of the detached retina with a smooth dissection. No complications related to the surgery were observed. At the last follow-up visit, the retina was attached in all cases, with an improvement in visual acuity. ***Conclusion:*** To conclude, the injection of a cohesive OVD anterior to the detached retina allowed to posteriorize and viscodissect to some extent the retina, facilitating the implant of trocars.

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Introduction

Proliferative vitreoretinopathy (PVR) complicates 5–10% of primary rhegmatogenous retinal detachment (RRD) surgeries and accounts for approximately 75% of all primary surgical failures [1]. Many adjunctive tools have been developed to facilitate PVR surgery. One of the first was the use of perfluorocarbon liquids (PFCLs) [2, 3]. However, its low viscosity leads to a propensity of the PFCL to move subretinally through even small retinal defects. Ophthalmic viscous devices (OVDs) are a class of non-active, transparent, gel-like chemical compounds with viscoelastic properties. Moreover, cohesive OVDs present a high surface tension and viscosity, with an intramolecular adhesion that is particularly useful to create and maintain a defined surgical space [4]. Herein, we describe a case series of patients in which sodium hyaluronate (Healon®) was used as an adjunctive intraoperative tool to safely separate the retina from anterior structures and facilitate the removal of retinal membranes in cases of complex total retinal detachment treated with pars plana vitrectomy (PPV).

Case Presentations

The operative records of patients with total RRD with complex anterior PVR who underwent PPV at Arcispedale Santa Maria Nuova – Ophthalmology Unit between March 2020 and March 2021 were retrospectively reviewed. The study protocol adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants. Ethical approval from the local Institutional Review Board was not required for this study. We included in this case series patients in which OVD was used to initiate the anterior dissection of the retina with a minimum follow-up of 6 months. Each patient underwent a preoperative comprehensive eye examination including best-corrected visual acuity assessment reported in logMAR, slit lamp examination of the anterior segment, indirect ophthalmoscopy, and Goldmann applanation tonometer. Patients were evaluated at least on postoperative day 1, weeks 1 and 2, and months 1, 2, 3, 6, and 8.

Three cases of patients with total RRD with anterior PVR who underwent PPV with the use of OVD to initiate the anterior dissection of the retina were included in the present case series. The mean follow-up was 7 ± 1 months, and the mean age at presentation was 67 ± 8.5 years. At the baseline evaluation, the mean logMAR equivalent was 2.73 ± 0.09. Patients' characteristics are described in Table 1.

All operations were performed by the same surgeon (DI). In all patients, a standard 23 G three-port PPV was performed using a 25 G chandelier illumination system (Synergetics Inc., St. Charles, MO, USA).

The first patient (patient 1) was referred to our clinic with a closed funnel detachment extending to the iris plane with PVR grade C-A 12 [5], hemorrhagic choroidal detachments, and corneal decompensation. Surgery started with the drainage of the suprachoroidal hemorrhages followed by the placement of a temporary Eckardt keratoprosthesis (DORC, Zuidland, The Netherlands). Hyaluronic acid (Healon®; 1% sodium hyaluronate – Johnson and Johnson Surgical Vision Inc., Santa Ana, CA, USA) was injected using a 25 G soft-tipped cannula through a limbal approach, to push the retina posteriorly and facilitate the identification and visualization of dissection planes. Once the anterior proliferation was surgically released, and the retina was sufficiently mobile, a small bubble of PFCL was used to stabilize the posterior pole. Finally, the remaining procedures were completed. A video of the surgical procedure is available (online suppl. Digital Content Video 1; for all online suppl. material, see https://doi.org/10.1159/000535795).

Patient 2 and patient 3 had total retinal detachments with PVR grade C-A 12. After placing a single trocar at 3 mm post-limbus, Healon® was injected continuously through the trocar

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Table 1. Baseline characteristics

Baseline characteristics	Patient 1	Patient 2	Patient 3
Age	76	58	67
Gender	Male	Male	Female
Etiology	Penetrating trauma	Chronic retinal detachment	Chronic retinal detachment
Eye	Left	Right	Left
Extension of retinal detachment	Total funnel	Total funnel	Total funnel
PVR grade	C-A 12	C-A 12	C-A 12
Intraocular pressure, mm Hg	11	9	12
BCVA (logMAR)	2.8	2.6	2.6
Lens status	Aphakic	Pseudophakic	Pseudophakic

BCVA, best-corrected visual acuity; PVR, proliferative vitreoretinopathy.

beneath the iris plane and the lens plane to obtain a posterior displacement of the retina over 360°. Once the space was sufficient to allow a good inspection of the remaining pars plana, the other trocars were safely inserted. In all three cases, silicone oil (Siluron Xtra® Fluoron, Ulm, Germany) was used as endotamponade.

Overall, no intraoperative adverse events were recorded. Silicone oil was removed in all patients at 3 months. At the last follow-up visit, the retina was attached in all cases, and the mean best-corrected visual acuity was 0.76 ± 0.09. Intra- and postoperative characteristics are described in Table 2. The CARE Checklist has been completed by the authors for this case report, attached as online supplementary material.

Discussion

In the present study, we describe the first intraoperative use of cohesive OVD to displace anterior and posterior closed funnel retinal detachments. The use of cohesive OVD (Healon®) injected in the vitreous cavity via a limbal approach in patient 1 and via a pars plana approach in patients 2 and 3 pushed the retina back safely and allowed clear visualization of the pars plana for the positioning of the remaining trocars. It also facilitated the initial dissection of anteriorly placed membranes exerting on the retina some tangential traction, stabilizing the retinal surface, and facilitating visualization of the dissection planes. The ability of Healon® to viscodissect atraumatically the retino-retinal adherences was a crucial step. PFCL is frequently used to stabilize the posterior retina, while the PVR membranes are dissected. In cases of retinal detachment with severe retinal contraction such as a “funnel” detachment, premature use of PFCL is associated with the risk of subretinal migration of PFCL through a retina break held open by the PVR membrane. Thus, the rheological properties of cohesive OVDs might be useful in the surgical management of PVR and an appropriate substitute for PFCL. In 1981, Stenkula and Tornquist described the use of Healon® in the vitreous cavity as a temporary endotamponade to help in the treatment of retinal detachments with scleral buckling [6].

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Table 2. Anatomic and visual outcomes

Surgical approach and outcomes	Patient 1	Patient 2	Patient 3
Needle gauge	23	23	23
Surgical approach	Limbal	3 mm from the limbus	3 mm from the limbus
Choroidal drainage	Yes	No	No
Tamponade	Silicone oil	Silicone oil	Silicone oil
Follow-up, months	6	7	8
BCVA (logMAR) at the last follow-up	0.9	0.7	0.7
Silicone oil status at the last follow-up	Out	Out	Out
Surgeries, *n*	3	2	2
Complications	None	None	None
Retinal status at the last follow-up	Attached	Attached	Attached

BCVA, best-corrected visual acuity.

Moreover, Crafoord and Stenkula reported the possibility of using a type of sodium hyaluronate that is 10-fold more viscous than Healon® (Healon GV; Abbott Medical Optics, Inc), which facilitated safer dissection in cases of membranes firmly attached to the retina [7]. Given these considerations, the described technique may be used also with an OVD with higher surface tension and viscosity with good pseudo-plasticity. Grigorian et al. [8] emphasized the safety and efficacy of viscodissection during surgery in patients with proliferative diabetic retinopathy.

In the described technique, the injection of Healon® was possible through a small-gauge soft-tipped cannula, while the high viscosity combined with its high surface tension makes this device strongly entangled, reducing the risk of passage through any possible unseen retinal tear when injected more posteriorly; moreover, its optimal transparency allowed visualization of the retina during the operation. Furthermore, it can be easily removed through active aspiration with the cutter.

To summarize, to our knowledge, the use of OVD has never been reported in cases of total retinal detachment (funnel-shaped) complicated with PVR treated with PPV. Our technique showed a safe and effective intraoperative use of Healon® to perform a smooth viscodissection in cases of total retinal detachment, contemporarily allowing a good visualization of the retina and creating space for a safer trocar implant in cases treated with minimally invasive vitrectomy. To conclude, in cases of total retinal detachment complicated with antero-posterior PVR, the injection of a cohesive OVD anterior to the detached retina allows to posteriorize and viscodissect to some extent the retina, allowing a good visualization of the retina and creating space for a safer trocar implant in cases treated with minimally invasive vitrectomy.

Statement of Ethics

This study was conducted according to the tenets of the Declaration of Helsinki. This retrospective review of patient data did not require ethical approval in accordance with local/national guidelines. Written informed consent was obtained from the patient for publication of the details of their medical case and any accompanying images.

Conflict of Interest Statement

The authors declare that they have no competing interests.

Funding Sources

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

Dr. Danilo Iannetta – conceptualizing, performing surgery, writing the manuscript, and approving final manuscript; Prof. Marc D. de Smet – conceptualizing, writing the manuscript, and approving final manuscript; Dr. Nicola Valsecchi – writing the manuscript and approving final manuscript; Prof. Luigi Fontana and Prof. Jay Chhablani – writing, reviewing the manuscript, and approving final manuscript.

Data Availability Statement

The datasets generated during the current study are not publicly available due to protection of the patient's personal information but are available from the corresponding author on request.

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