

Lens capsular flap in the management of posterior retinal hole associated retinal detachment in high myopic eyes with previous internal limiting membrane peeling

3 case reports

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Abstract

Rationale: Managing retinal detachment due to posterior retinal holes is problematic since standard laser retinopexy or scleral buckling may be difficult to apply and may have brought serious complication. Another surgical method in treating posterior hole related retinal detachment is desired.

Patient concerns: Three high myopia patients with previous vitrectomy and membrane peeling history suffered from blurred vision and retinal detachment due to posterior pole retinal holes was diagnosed.

Diagnoses: Patient diagnosed retinal detachment due to posterior retinal holes either as paracentral retinal breaks or macular hole from both indirect ophthalmoscope exam and fundus photography

Interventions: The patient underwent lens capsular flap insertion into all the retinal holes, along with gas tamponade or silicone oil tamponade. No laser retinopexy was performed around the retinal holes.

Outcomes: Of 3 included patients, 1 patient had insertion of the lens capsular flap, an incomplete air-fluid exchange, and 24% sulfur hexafluoride gas tamponade. The other 2 patients, after lens capsular flap insertion, had air-fluid exchange and subretinal fluid drainage with extrusion via soft needle through superior drainage retinotomy and silicon oil tamponade. The retinal holes of all eyes were sealed with retina attached postoperatively.

Lessons: Lens capsular flap is effective in sealing posterior retinal holes and treating the associated retinal detachment without the complication resulting from laser retinopexy, especially in eyes without sufficient internal limiting membrane (ILM) tissue due to previous ILM peeling.

Abbreviations: RD = retinal detachment, MHRD = macular hole associated retinal detachment, ILM = internal limiting membrane, OCT = optical coherence tomography, ICG = indocyanine green.

Keywords: lens capsular flap, posterior retinal hole, retinal detachment

1. Introduction

Retinal detachment (RD) caused by posterior retinal holes is more often seen in macular hole associated retinal detachment

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(MHRD) in high myopia eyes. Other than macular hole, the paracentral retinal holes are often seen in either paravascular or juxtapapillary breaks related to pathologic myopia,^[1,2] or are secondary found in difficult cases such as proliferative diabetic retinopathy (PDR) complicated with combined tractional and rhegmatogenous retinal detachment (CTRDR). Vitrectomy with air-fluid exchange, accompanied by laser retinopexy and either gas or silicone oil tamponade nowadays are often used to treat retinal breaks associated rhegmatogenous retinal detachment (RRD). However, for those retinal holes located within posterior pole, direct laser application may not only induce permanent central visual field defect, the laser scar may enlarge and threaten the central vision further. For MHRD, it is well known by using internal limiting membrane (ILM) flap either in fashion as inverted flap or free ILM insertion the macular hole could be closed effectively with retinal reattached successfully.^[3,4]

However, for those patients who had received ILM peeling surgery before and developed retinal detachment due to posterior holes, it is a surgical problem since there was no sufficient ILM tissue to seal all the breaks. Here we report a novel surgical technique by using lens capsular flap transplantation over the posterior retinal holes instead of laser retinopexy or ILM insertion to successfully treat retinal detachment.

2. Methods

This was a retrospective, case-series study conducted at Changhua Christian Hospital. The study was approved by the Ethics Committee and Research Board of Changhua Christian Hospital, and all procedures adhered to the Declaration of Helsinki. Informed written consent was obtained from the patient for publication of this case report and accompanying images.

We included patients with RD due to posterior retinal holes and had received surgical repair from July 2018 to December 2018. Eyes with RD due to peripheral retinal breaks outside the equator were excluded. All of the cases underwent standard pars plana vitrectomy using the lens capsular flap technique, accompanied by either long-acting gas or silicone oil tamponade without laser retinopexy. All of the patients underwent thorough ophthalmological examinations including slit lamp and indirect ophthalmoscopy examinations, color fundus photography, and spectral-domain optical coherence tomography (OCT) (Heidelberg Spectralis, Germany) preoperatively and postoperatively. Data including age, gender, and Snellen best-corrected visual acuity (BCVA) were recorded. Infrared-autofluorescence imaging (HRA, Retinal Angiograph; Heidelberg Engineering, Heidelberg, Germany) and spectral-domain OCT were used at the follow-up to check whether the holes had been closed by the capsular flaps.

2.1. Surgical technique

Pars plana vitrectomy using the Constellation (Alcon Laboratories, Inc., Fort Worth, TX), 25 gauge, valved system was performed on the patients. Further removal of peripheral vitreous and checking for possible peripheral retinal breaks were performed followed by identifying the posterior retinal holes. Indocyanine green (ICG) solution (25 mg ICG in 15 ml 5% glucose water solution, final concentration = 1.7 mg/mL) was then applied at the posterior pole to check whether there was residual ILM around the retinal holes. If the ILM around the retinal holes was completely removed in the previous surgery, or if there was insufficient ILM around the hole for an inverted ILM flap, we proceeded to harvest the anterior capsule. In phakic eyes, phacoemulsification was performed, and the anterior capsule from circular capsulorhexis was saved for later use to insert into the retinal holes. In eyes with previous cataract surgery, a limbal wound about 2.2 mm in size was created, followed by injection of Viscoat (Alcon Laboratories, Inc., Fort Worth, TX); a bent 27-gauge needle was used to create a radial cut at the margin of previous capsulorhexis. Capsular forceps were then used to harvest a circular shaped, often fibrotic anterior capsule for later insertion. The anterior capsule flap was then stained with ICG solution to improve flap visualization during the insertion process and was cut into several pieces and trimmed into an appropriate

size to fit the retinal holes. The lens capsular flap was carefully inserted into the retinal holes. The size of the lens capsular flap is made a little larger than the hole, allowing it to be affixed and remain stabilized. For larger holes, in which a single lens capsular flap is unable to remain stably plugged, multiple pieces of lens capsular flap may be used. In such situations, the flaps can overlap each other and stay stabilized within the hole as previously described.^[4] For eyes with shallow retinal detachment, an incomplete air-fluid exchange was performed without drainage of subretinal fluid to prevent displacement of the capsular flaps. For eyes with bullous retinal detachment, air-fluid exchange with extrusion soft needle through the drainage retinotomy at the superior aspect of the retina was performed. No laser was applied around the posterior retinal holes. Long-acting gas or silicon oil was used for the tamponade. Patients were asked to keep a prone position for 1 week. Patients with silicon oil tamponade had the silicon oil removed 2 months later.

3. Case reports

The 3 highly myopic eyes with previous ILM peeling that had RD secondary to posterior retinal holes were included in this series. There were 4 paracentral retinal holes and 2 macular holes altogether in the 3 patients. The operations were performed by 2 experienced surgeons (SNC and CMY). The retina was reattached and all the retinal holes closed postoperatively in all 3 eyes. The demographic data of the patients is shown in Table 1.

3.1. Case 1

A 53-year-old highly myopic male patient (case 1, axial length: 30.1 mm) had giant tear retinal detachment in the right eye, and had undergone encircling buckle, vitrectomy, silicon oil tamponade, phacoemulsification, and posterior intraocular lens implantation at other hospitals. He then developed macular pucker and had silicon oil removal along with peeling of epiretinal membrane and ILM 1 year after. Unfortunately, he complained of central scotoma over the right eye 2 weeks after the surgery. Fundus photography showed posterior retinal detachment (Fig. 1A). OCT revealed a small retinal hole located superotemporal to the fovea, within the vascular arcade (Fig. 1B). He then received another surgery for retinal detachment repair. During the surgery, a more extensive retinal detachment at the posterior pole and 2 more retinal holes within the vascular arcade were identified. ILM plugs for the holes were initially planned. However, there was insufficient ILM tissue left to plug the holes, due to prior macular pucker surgery. We, therefore, harvested a circular shaped, fibrotic anterior lens capsule through a limbal wound. The anterior capsule was stained with ICG for better

Table 1
Demographic data of patients.

Case/age/sex/eye	Axia length (mm)	Previous history	Condition	Number of posterior retinal holes	Tamponade agents	Best-corrected visual acuity	
						Initial	Final
1/51/M/OD	31.2	Giant tear RRD, macular pucker	Recurrent RRD	3, paracentral holes	24%SF6	20/800	20/400
2/58/F/OD	30.9	Foveoschisis	New onset RRD with PVR	2, paracentral holes	Silicone oil	HM 30cm	20/800
3/66/F/OS	29.8	MHRD	Persistent MHRD with MH open	1, macular hole	Silicone oil	CF 30cm	20/800

F = female, M = male, PVR = proliferative vitreoretinopathy, RRD = rhegmatogenous retinal detachment, SF6 = sulfur hexafluoride, MHRD = macular hole associated retinal detachment, CF = counting finger, HM = hand motion.

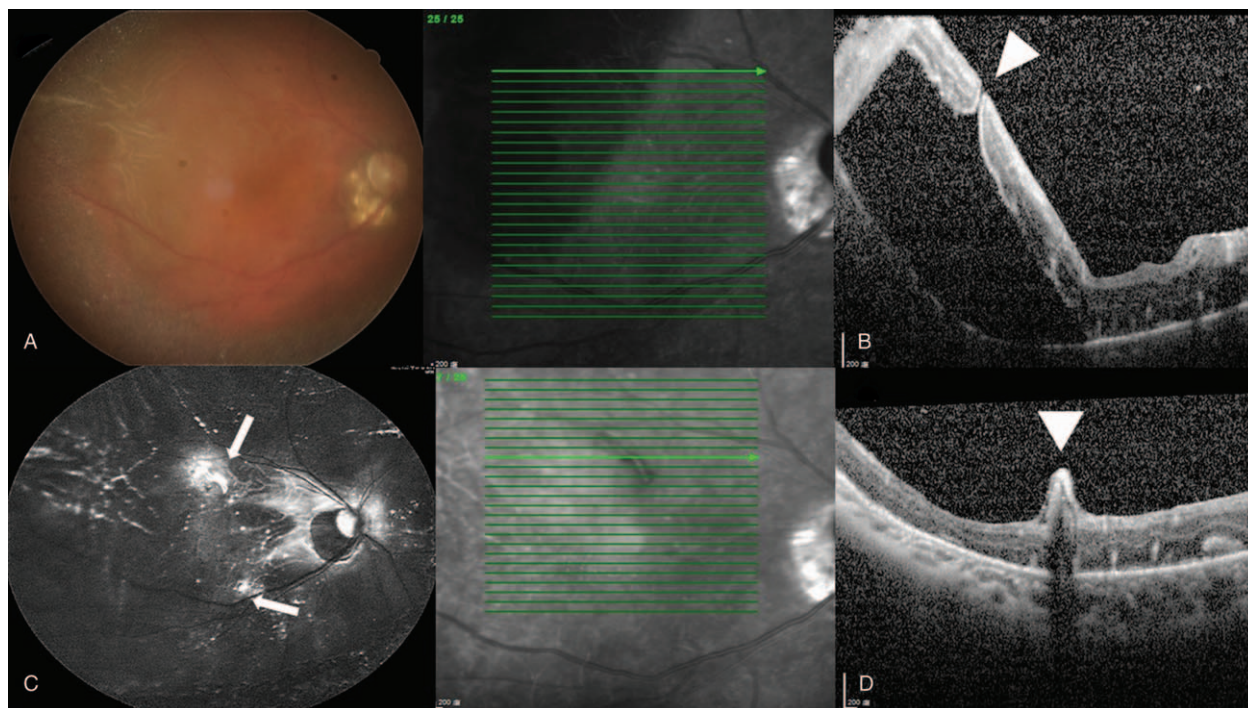


Figure 1. Example of lens capsular flap in treatment of retinal detachment due to paracentral retinal holes (Case 1). (A) Preoperative color fundus showed retinal detachment with macular involvement. (B) OCT showed retinal detachment and a paracentral retinal hole at temporal upper aspect to the macula OCT (arrow head). (C) Postoperatively, infrared autofluorescence image showed hyperfluorescent spots at posterior pole corresponding to area of retinal holes plugged by indocyanine green stained lens capsule tissue (arrows). (D) Postoperative OCT showed the retina reattached and the lens capsular flap were plugged into the retinal holes (arrow heads). OCT=optical coherence tomography.

visualization, cut into several small pieces, and inserted into the identified retinal holes. Autologous blood was applied over the surface to further stabilize the inserted capsular flap. Incomplete air fluid exchanged without drainage of subretinal fluid was then performed, followed by infusion of 24% sulfur hexafluoride. The patient was instructed to maintain a prone position after the operation for 1 week. (see Supplemental Video, which demonstrates the surgical technique of using lens capsular flap to treat retinal detachment, <http://links.lww.com/MD/D109>).

Two weeks later, postoperative infrared autofluorescence imaging showed hyperfluorescent spots of the capsular plugs corresponding to the sites of the original retinal holes (Fig. 1C). OCT showed the retina had reattached and that the lens capsular plug was identified at the site of previous retinal holes (Fig. 1D). His visual acuity was 20/400 and the retina remained attached.

3.2. Case 2

A 65-year-old highly myopic female patient had had previous cataract operation, vitrectomy and ILM peeling for foveoschisis of her right eye 4 years ago. She developed intraocular lens dislocation 5 years later and had vitrectomy and intraocular lens suturing performed. Unfortunately, sudden onset of blurred vision of the right eye occurred to her 1 month later. Total retinal detachment, choroidal detachment and mild proliferative vitreoretinopathy (PVR) were noted at our clinic. Another vitrectomy was arranged. During the surgery, 1 macular hole and another small retinal hole nasal upper to the fovea were noted. After further trimming of the peripheral vitreous and peeling of the PVR membrane, the anterior capsule was harvested, since

there was no ILM left at the posterior pole noted in the ICG staining. The fibrotic anterior capsular flaps were then plugged into the 2 retinal holes, followed by air-fluid exchange and subretinal fluid drainage with extrusion soft tip through a drainage retinotomy at the upper part of the retina. Silicon oil was infused at the end of surgery as tamponade. Her vision improved from hand motion to 20/800. Silicon oil was removed 2 months later, with the retina remaining attached and retinal breaks sealed.

3.3. Case 3

A 66-year-old myopic female patient had macular hole with retinal detachment in the left eye. She had received vitrectomy and air-fluid exchange at another hospital without success. At our clinic, her visual acuity of left eye was only counting finger at 30 cm and a persistent macular hole with retinal detachment and choroidal detachment were noted from OCT (Fig. 2A).

Besides, cataract of the left eye was also noted. We then performed phacoemulsification, placement of posterior chamber intraocular lens, and vitrectomy (Fig. 2B). After vitrectomy, it is found that only ILM shreds could be obtained. We then cut the anterior lens capsule into several small pieces and plugged multiple lens capsular flaps into the macular hole (Fig. 2C, D, E). Air-fluid exchange through the peripheral drainage retinotomy was then performed and silicon oil was infused at the end of surgery. Two weeks postoperatively, fundus photography showed reattached retina (Fig. 2F), and OCT showed that the macular hole had closed, and the presence of the capsular flap (Fig. 2E). Silicon oil was removed 2 months later with visual acuity improved to 20/800.

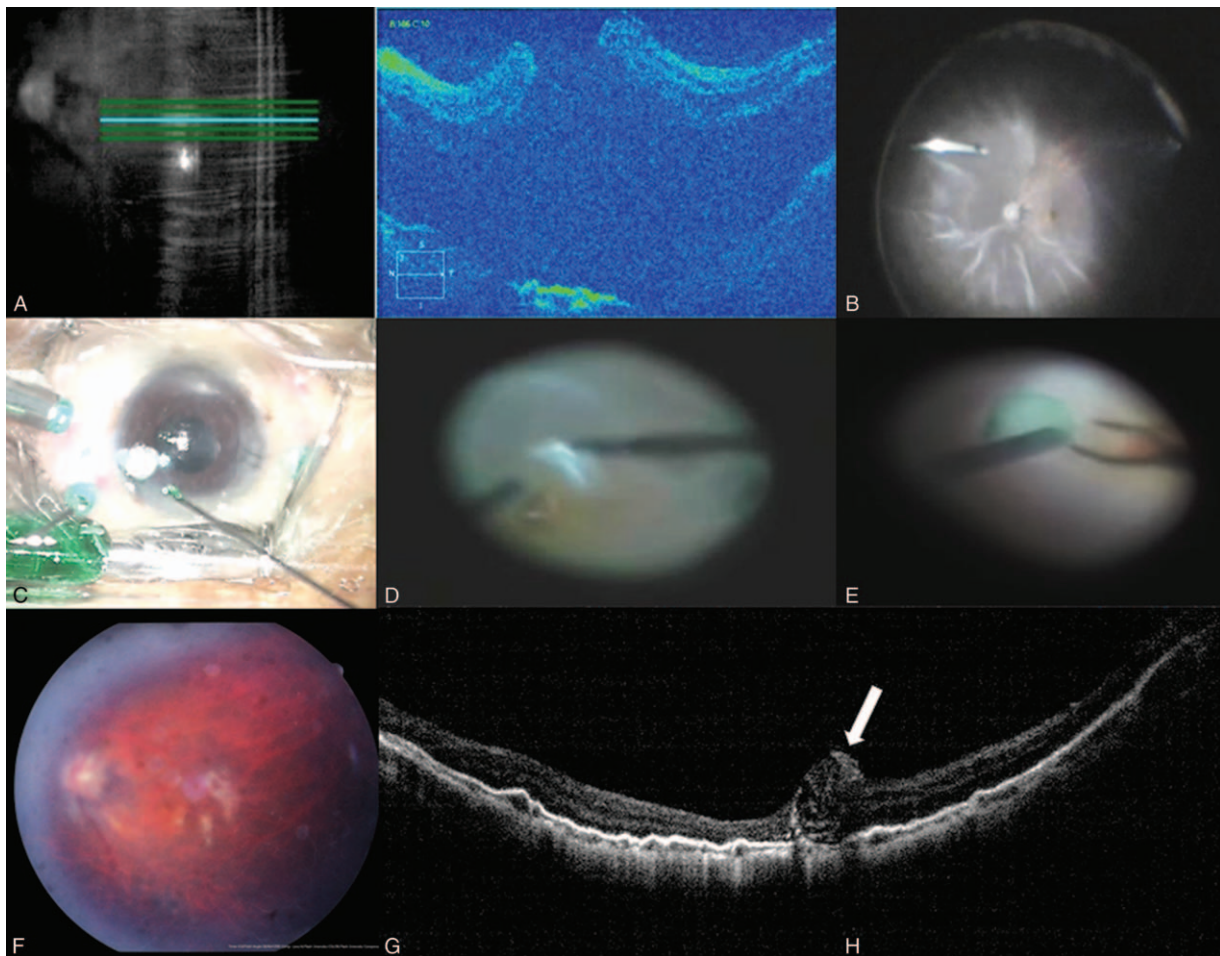


Figure 2. Example of lens capsular flap in treatment of retinal detachment due to macular hole (Case 3). (A&B) Preoperative OCT and intraoperative fundus photography showed a persistent macular hole with associated retinal detachment. (C) During operation, phacoemulsification, and harvest anterior lens capsule were performed. (D) lens capsular flaps were plugged into the macular hole (E&F) Two weeks postoperatively, fundus photography and OCT showed closed macular hole, reattached retina and the presence of the capsular flap (arrow). OCT=optical coherence tomography.

4. Discussion

Posterior retinal holes within the arcade, including macular hole and paracentral retinal holes, are more often noted in eyes with high myopia or recurrent RD cases with PVR membrane formation. Recently, ILM peeling in macular surgery has also been noted to be complicated with paracentral retinal holes.^[5] Though posterior retinal holes are seldom associated with retinal detachment, they may happen when there is abnormal vitreoretinal traction on the breaks or in eyes with elongated axial length, in which case the adhesive force of the retinal pigment epithelium is weak.

Conventionally, using laser photocoagulation in surgery of retinal detachment, the retinal breaks are not actually closed. Laser photocoagulation for posterior retinal holes, especially for macular holes, is not always applicable. Progressive enlargement of laser scars within posterior pole may threaten the central visual field. In addition, in highly myopic eyes with diffuse atrophic patches, the retina is rigid and difficult to flatten intraoperatively. On the other hand, using flap technique for closing the posterior retinal holes would recover retinal anatomical structure and prevent further PVR change due to intravitreal migration of retinal pigment epithelial cells from exposed retinal pigment epithelium within the retinal holes.^[6]

To close posterior retinal holes, inverted ILM flap and air-fluid exchange have been shown to be effective in closing the macular holes in highly myopic eyes with macular hole associated retinal detachment, without the use of laser.^[3] This technique has recently been proved to successfully treat retinal detachment with posterior paracentral retinal holes.^[7-9] However, in eyes with previous ILM peeling, this method may not be applicable, since there is no ILM around the breaks available. Free ILM flap transplantation, either single or multiple pieces^[4] may be used instead to close the holes; however, it is difficult to harvest free ILM flaps in eyes with previous ILM peeling and air-fluid exchange. The lens capsular flap, in this condition, thus would be a useful alternative. In our prior study, we have shown lens capsular flap to be effective in closing persistent macular holes, in eyes with previous ILM peeling.^[10,11] In addition to ILM flap, autologous neurosensory retinal free flap transplantation has recently been used to treat chronic retinal detachment.^[12] This surgical technique may be an alternative when ILM flap is unavailable. However, harvesting neurosensory retinal flaps often require retinectomy, which may be a concern for secondary PVR formation near the site of retinectomy and may carry the risk of recurrent RD. Furthermore, for retinal detachment limited

at posterior pole, performing retinectomy near posterior pole not appropriate and may result in permanent central visual field defect. As compared to either free ILM flaps or neurosensory retinal flaps, there are several advantages of lens anterior capsule flaps. First, they are easier to harvest, in eyes either with or without previous cataract surgery. Second, the anterior lens capsule is more rigid and easy to plug into the small retinal breaks and stay stabilized without the help of perfluorocarbon. The plugging technique may only be used in eyes with smaller retinal breaks. For a large hole, perfluorocarbon liquid assistance may be necessary to help stabilize the capsular flap and air-fluid exchange. Third, no need for new retinectomy is required and the risk of PVR formation is therefore minimized.

In conclusion, the free lens capsular flap transplantation technique may offer advantages over traditional laser retinopexy in sealing retinal holes, without leaving paracentral scotoma, in eyes with previous ILM peeling. The surgical outcome is successful. However, long-term surgical outcome is needed further.

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