

Case Report **Cataract**

Optic capture of the intraocular lens in posterior capsular rupture

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ABSTRACT

A 67-year-old female had a left eye posterior polar cataract (PPC) with a thin intact posterior capsule (PC) with nuclear sclerosis grade V (as per the lens opacities classification system III) and an intraocular lens (IOL) in the sulcus with an absent PC in the right eye. On examination, her best-corrected visual acuity (BCVA) was 6/6 (+1.00/+1.50 × 10) and 6/60 (plano) for right eye (OD) and left eye (OS), respectively. She underwent left eye phacoemulsification cataract surgery, and intraoperatively, capsular rupture occurred which was noticed before completion of the last quadrant. No vitreous leakage occurred, and a three-piece IOL was implanted in the sulcus and an optic capture was done. At one-month follow-up, her left BCVA was 6/6 (0.50 DS/+1.25 × 10) with normal IOP, and the IOL was well centered with an oval-shaped anterior capsule covering the optic anteriorly, and a ruptured PC was seen as two parallel lines. We have discussed various important steps in the management of PPC and posterior capsular rent in this paper with the illustrative image of an optic capture of the three-piece IOL in posterior capsular rupture.

Keywords: Optic capture, Posterior capsular rent, Posterior polar cataract, Sulcus implantation of IOL, Three-piece intraocular lens

INTRODUCTION

Posterior polar cataract (PPC) is a congenital condition where the opacity occurs in the posterior pole of the lens, sometimes adhering to the posterior capsule (PC).^[1] Cataract surgery is challenging in these cases, as the PC might be thinned or adherent to the polar nuclear opacity, or there could be a pre-existing posterior capsular rupture (PCR) associated with it.^[1] We describe a case of an intraocular lens (IOL), which is optic captured [Figure 1] by the anterior capsule after being implanted in the sulcus during the intraoperative posterior capsular rupture in PPC.

CASE REPORT

A 67-year-old female had a left eye PPC with a thin intact PC adherent to it along with the nuclear opacity grade V as per the lens opacities classification system III^[2] [Figure 2a]. The size of the PPC was approximately 4 mm measured using slit-lamp caliber. Her right eye had an IOL in the sulcus with an absent PC, indicating the previous complicated cataract surgery. On examination, her best-corrected visual acuity was 6/6 (+1.00/+1.50 DC × 10) and 6/60 (plano) for OD and OS, respectively, with normal intraocular pressure. She underwent left-eye phacoemulsification cataract surgery under topical anesthesia. Phacoemulsification in

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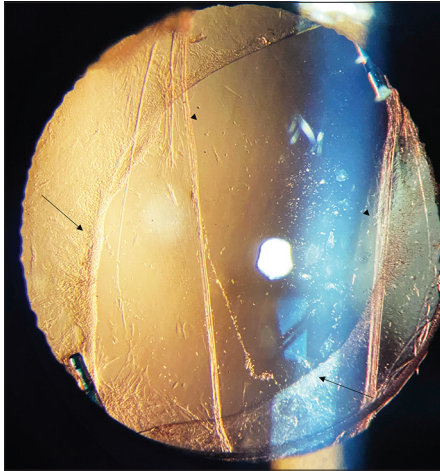


Figure 1: The follow-up image of sulcus implanted three-piece intraocular lens with the haptic in the sulcus and optics captured (arrow line) and the margin of the ruptured posterior capsule seen as two parallel lines (arrow head).

this complicated case of PPC with denser nuclear opacity was carried out with many important precautions^[1,3] such as (i) ideal-sized rhexis (approximately 5 mm, [Figure 2b]) and (ii) hydrodelineation was performed without hydrodissection [Figure 2c]. (iii) Slow motion phacoemulsification^[4] of the nucleus was performed with low parameters such as bottle height ~60 mmHg, vacuum ~200 mmHg, and phaco ultrasonic power ~50%. We have done sculpting of the nucleus into multiple quadrants [Figure 2d], and quadrant removal is done. Intraoperatively, posterior capsular rent (PCR) was noticed before emulsifying the last piece [Figure 2e]. Intraoperative PCR is a known complication in PPC.^[1] We suspect that this capsular rupture happened due to the inadvertent movement of the nucleus. During this stage, we injected hydroxypropyl methyl cellulose (HPMC 2%) into the anterior chamber without collapsing the chamber before the removal of the phaco probe out of the eye. Injection of HPMC 2% in this situation will help to maintain the chamber while also pushing the anterior phase of the vitreous into the vitreous

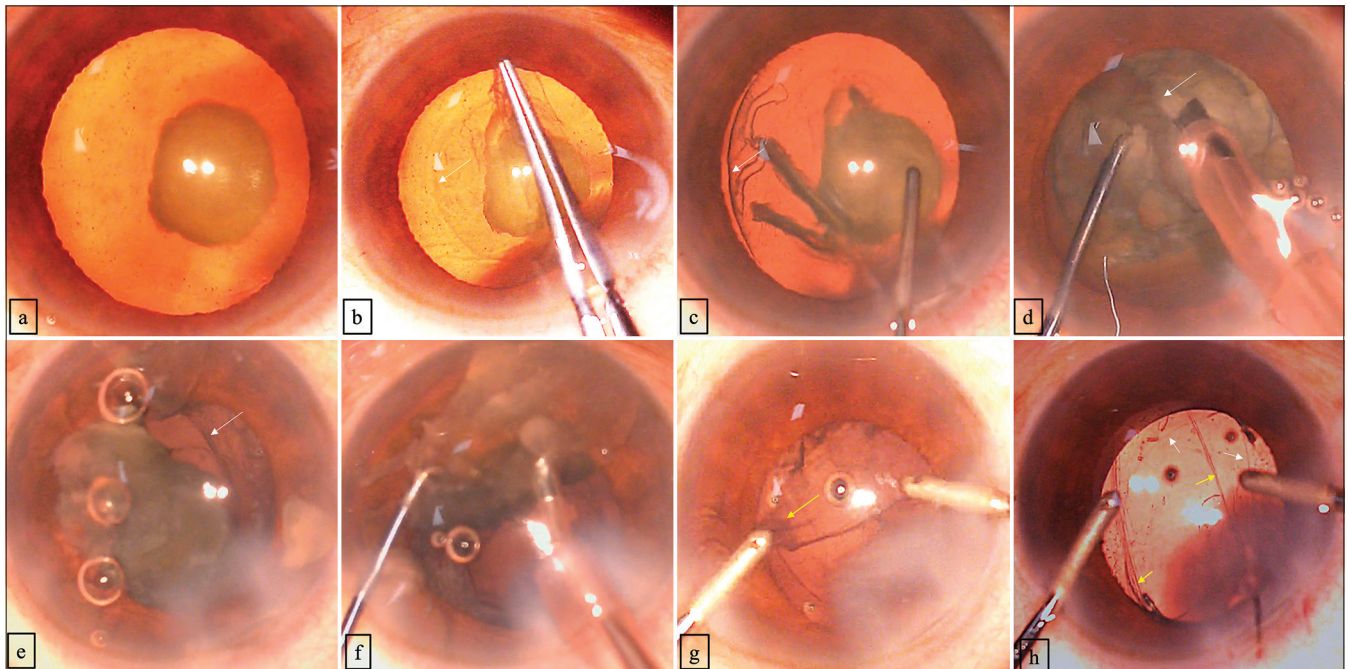


Figure 2: (a-h) The various important steps in the management of PPC with intraoperative PCR. (a) The nuclear opacity grade V with PPC without any pre-existing PCR. (b) The ideal size rhexis of approximately 5 mm. (c) The limited hydrodelineation without hydrodissection using a 23 G irrigation cannula. (d) The breaking of the nucleus into multiple quadrants without attempting to rotate the nucleus. (e) The visualization of the linear posterior capsular rupture indicated by the white arrow. (f) The completion of removing lens material by slow parameters phacoemulsification in the anterior chamber above the iris plane. (g) The removal of the cortical matter from the capsule. (h) The implantation of a three-piece IOL in the sulcus, with optic capture being done using the same I and A (irrigation aspiration cannula), the white arrow shows the margin of the anterior capsule and the yellow arrow shows the margin of the linear posterior capsular rent.

cavity and protecting it from disruption. It will also plug the rent in the PC.^[3] We then assessed the current situation of the surgery and found that one last quadrant of the nucleus was remaining with the cortical tissue, but no vitreous prolapse (no disruption of the anterior hyaloid phase). Our next aim in this scenario was (i) to remove the last quadrant of the nucleus without dropping it into the vitreous cavity. (ii) Removal of the cortex without further extension of the PCR. (iii) Preserving and assessing the adequate capsular support for IOL (three-piece) implantation in the sulcus. Alerting the entire operation theatre (OT) team is very important for further arrangements, like the arrangement of the anterior vitrectomy cutter in case of the anticipated vitreous prolapse. (ii) Arrangement of the three-piece lens for sulcus placement and (iii) availability of injection triamcinolone for better visualization of the vitreous in cases of prolapse.^[5,6] However, in our case, vitreous prolapse was prevented due to the timely detection of the PCR and also by the timely injection of HPMC 2%. The last nucleus quadrant was brought to the anterior chamber using the Y rotator and removed completely by phacoemulsification [Figure 2f]. Cortex removal^[3] was done again under low parameters such as bottle height 60 mmHg, vacuum 200 mmHg, and removal of the cortex was done mostly mechanically by holding the cortex through aspiration port (in the left side) by creating vacuum and pulling the cortex sheet toward the rent to separate it (as indicated by the yellow arrow in [Figure 2g], its direction indicates the direction of the pulling movement). Sideways movements of the cortex sheet may result in further extension of the PCR and are thus to be avoided. In cases of posterior capsular rupture with adequate anterior capsular support, single-piece lens implantation has to be avoided as it causes rubbing of the iris, which leads to iris pigment release, and also causes IOL displacement.^[7] A three-piece IOL was implanted in the sulcus [Figure 2h]. For better stability of the chamber, we put a single suture in the main incision using 10-0 nylon after IOL implantation. There was no disruption of the vitreous phase till this stage; hence, the viscoelastic was gently removed using the same I and A (irrigation and aspiration) port under low parameters such as 60 mmHg bottle height and 250 mmHg vacuum. The optic capture was done by nudging the edge of the optics using the same IA port [Figure 2h], that is, buttoning the optics into the anterior capsular rhexis.^[6] At the one-month follow-up, her left BCVA was 6/6 (0.50 DS/+1.25 × 10) with normal IOP, and the IOL was well centered with an oval-shaped anterior capsule covering the optic anteriorly, and a ruptured PC was seen as two parallel lines [Figure 1].

DISCUSSION

PPC is a congenital condition that has an onion skin peel appearance at the posterior pole and may be associated with

PC dehiscence.^[1,4] Cataract surgery is challenging in this condition due to the chance of posterior capsular rupture and its associated risks. There are many special precautions that need to be taken during the cataract surgery, like an ideal capsular rhexis of approximately 5 mm in diameter, direct hydrodelineation without hydrodissection or limited hydro or viscodissection, avoiding rotation of the nucleus, slow-motion phacoemulsification, a special sculpting or cracking technique for the nucleus such as trident,^[8] lambda λ,^[9] sideways sculpting,^[10] two Y- crushing technique,^[11] and avoiding polishing the capsule. The management of any posterior capsular rupture during phacoemulsification of cataract surgery involves different strategies at different time points of the surgery, that is, (i) at the time of hydrodissection; (ii) quadrant removal; and (iii) cortex removal

PCR management at different parts of surgery

In all the steps, the main objective for the surgeon is to debulk or remove the lens matter completely or as much as possible and preserve the capsular support for the IOL implantation.

If PCR occurs at the time of hydrodissection

Phacoemulsification surgery can be converted into small-incision cataract surgery (SICS) or extracapsular cataract surgery (ECCE) to extract the nucleus without letting it go down. Sometimes, an impending dropping nucleus can be brought into the anterior chamber by the posterior-assisted levitation technique.^[6]

If PCR occurs at the time of quadrant removal

Maximum debulking or removal of the nucleus material without dropping into the vitreous cavity is the main objective at this stage that can be achieved sometime with the phacoemulsification only without converting into SICS or ECCE. The nucleus could be brought into the anterior chamber using viscoelastic material and other intraocular blunt instruments like the Y rotator, emulsifying it, or using the IOL scaffolding method, where the IOL will be passed below the lens particles and can be implanted into the sulcus, and then safely finish the phacoemulsification of the nucleus above the IOL.^[6]

If PCR occurs at the time of cortex removal

PCR occurring at the time of cortex removal could be due to the surge or when the aspiration port touches the posterior capsule inadvertently. As there is no nucleus left over in this situation, management of the PCR at this stage is quite easy. The smaller rent in the posterior capsular can be converted into a small round posterior capsular rhexis. In cases of larger

rent, sulcus placement of the lens is the only option if there is adequate anterior capsular support.

In all the above steps, the anterior chamber should not be collapsed^[3,5,6] at any point to avoid vitreous anterior phase disruption. This can be prevented by injecting viscoelastic (preferably dispersive like HPMC 2%) into the anterior chamber before removing any irrigation source from the eye. Ophthalmic viscosurgical devices (OVDs) are the essential component for cataract surgeries. Based on the rheological property, OVD is of three types, namely, dispersive (low viscosity), cohesive (high viscosity), and viscoadaptives.^[12] Dispersives are having low viscosity substances (e.g., HPMC 2%, Chondroitin sulphate) which are used to coat the endothelium. They are preferably used to seal the posterior capsular rupture.^[12] In the case of PCR detection, the operating surgeon should alert the entire team to be ready with the anterior vitrectomy cutter, the adjusted power calculation of three-piece IOL^[7] according to “the rule of 9” (e.g., if the pre-operative IOL power was determined to be 18–27 D, then the adjusted three-piece IOL would be reduced by 0.5 D), making available other drugs such as injection triamcinolone to stain the vitreous and extra-viscoelastic materials, especially HPMC 2%. Three-piece IOLs are preferred to implant in case of PCR in the sulcus in the presence of adequate anterior capsular support.^[7] Foldable three-piece IOL consists of central optic part made up of hydrophobic acrylic foldable materials of 6 mm in diameter and two haptics are made up of monofilament polymethylmethacrylate. The total length of the IOL is 13 mm. The foldable three-piece IOL can be injected through the main incision of approximately 2.8 mm. The phaco parameters should be reduced in the case of PCR (slow motion phacoemulsification), like irrigation bottle height to be around 50–60 mmHg, ultrasonic phaco power to be around 50–60%, vacuum to be 200–250 mmHg, and flow rate to be 20–30 mL/min. The anterior cutter rate could be approximately 800–1000 cycles per min.^[3,5,6]

CONCLUSION

The PPC has to be managed with special precautions due to the anticipated high risk of PCR. The timely identification of the PCR and appropriate management of the PCR at different stages of the cataract surgery will help reduce further complications and thus improve the overall outcome of the patient.

Ethical approval

The Institutional Review Board approval is not required.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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