Surgical Technique

Posterior polar cataract: Hydrodissection and nucleus rotation in manual small-incision cataract surgery not a taboo with proper fluidics

Ravindra M S, Jatinder Bali[1], Deepthi C Adarsh[2], Ojasvini Bali[3]

A posterior polar cataract is a discoid posterior polar plaque-like cataract with a thin and fragile to absent posterior capsule with adherent acellular opacity to the capsule reported in the literature. It is a stationary or slowly progressive opacity. A higher risk of complications such as posterior capsular tear and nucleus drop makes this a challenging surgery. The techniques described in the literature include bimanual irrigation aspiration, leaving the plaque for later Yag, bimanual micro phaco, Lambda technique with dry aspiration, Phaco if opacity <4 mm and soft nucleus, pars plana vitrectomy (PPV), pars plana lensectomy (PPL) if opacity >4 mm and soft nucleus, intra-capsular cataract extraction (ICCE) and scleral fixated intraocular lens (IOL) if opacity >4 mm with the hard nucleus, viscodissection, 3 ports PPL, PPV, low parameters phaco, modified epinucleus removal, inverse horse-shoe technique, standard phacoemulsification, chip and flip for soft cataracts, stop and chop for hard cataracts, layer-by-layer phacoemulsification, standard lens aspiration, pars plicata posterior vitrecto-rhexis, manual small-incision cataract surgery, and conventional extracapsular extraction. A posterior capsule rupture rate of 0 to 36% is reported in different series for cataract extraction. To prevent this dreaded complication, surgeons used many modifications. Minimal hydrodissection in posterior polar cataract extraction was described by Fine *et al*. The authors describe a technique of low flow manual small-incision cataract surgery with minimal hydrodissection and nucleus rotation with no associated posterior capsule rent. This demonstrates that if the fluidics is understood and corrected, then minimal hydrodissection and nucleus rotation is not taboo in posterior polar cataract extraction by manual small-incision cataract surgery.

Key words: Hydrodissection, manual small-incision cataract surgery, nucleus rotation, posterior polar cataract

Video available on: www.ijo.in

Access this article online

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_1588_22

Quick Response Code:

A posterior polar cataract is a discoid posterior polar plaque-like cataract with the accumulation of extracellular material. It is believed to develop from dysplastic lens fibers experiencing increased degenerative changes while migrating posteriorly from the lens equator.

Posterior polar cataract removal is associated with a higher complication rate.[1] A high incidence of posterior capsule rupture has been postulated to be due to either tightly adherent plaque in an otherwise normal capsule or a thin posterior capsule, which ruptures with minimal trauma. Cortical cleaving hydrodissection was conventionally considered a contraindication in posterior polar cataracts as the hydraulic pressure can cause posterior capsule rupture during hydrodissection.[1,2] To overcome this, Fine *et al*.[3] performed minimal hydrodissection in multiple quadrants without, allowing the wave to transmit across the posterior capsule and conducting hydrodelineation to separate the nucleus from the cortex, whereas Allen and Wood used viscodissection to dissect only the peripheral cortex from the capsule and Lee did not use hydrodissection at all. Nuclear rotation was considered contraindicated as the margins of the opacity could act as a trephine and cause a posterior capsular tear.[1,4] Capsular separating hydrodissection followed by nuclear rotation is a possibility in low fluidic manual small-incision cataract surgery (MSICS) even in posterior polar cataracts. The use of controlled hydrodissection and nuclear rotation gave excellent results in posterior polar cataracts. The authors describe the surgical technique of manual small-incision cataract surgery with controlled hydrodissection and nuclear rotation to improve the safety of cataract surgery.

Surgical Technique

Topical proparacaine hydrochloride 0.5% eye drops and preservative-free lignocaine 1% intracameral infusion anesthesia were used in all surgeries. Proparacaine is preserved in a refrigerator at around 4°C. A fresh eye drop bottle was

Department of Ophthalmology, Medical Director, Karthik Netralaya Institute of Ophthalmology Private Limited, Bangalore, Karnataka, [1]Ophthalmologist In-Charge, Narela Polyclinic, North Delhi Municipal Corporation, Delhi, [2]Cornea and Refractive Surgery Services, Department of Ophthalmology, Karthik Netralaya Institute of Ophthalmology Private Limited, Bangalore, Karnataka, [3]Department of Medicine, Maulana Azad Medical College, Delhi, India

Correspondence to: Dr. Jatinder Bali, 55-D, Third Floor, DDA FLATS, Kalidas Road, Gulabibagh, Delhi - 110 007, India. E-mail: drjatinderbali@gmail.com

Received: 30-Jun-2022 Revision: 09-Aug-2022
Accepted: 07-Sep-2022 Published 25-Oct-2022

Cite this article as: Ravindra MS, Bali J, Adarsh DC, Bali O. Posterior polar cataract: Hydrodissection and nucleus rotation in manual small-incision cataract surgery not a taboo with proper fluidics. Indian J Ophthalmol 2022;70:4051-3.

opened each day. The 1% lignocaine ampoule was autoclaved as a part of each cataract set and loaded into a 2 mL syringe by the scrubbed assistant. About 0.2 mL was infused into the anterior chamber, keeping the cannula tip close to the iris and pupil. HPMC coating prevents its exposure to the corneal endothelium.

The 2.8 mm Keratome was used to create a direct sclero-corneal tunnel incision, commencing at 1 mm behind the limbus on the steep axis. No separate conjunctival and Tenon's flaps were raised and the keratome directly entered the tissues. Hydroxypropyl methylcellulose 2% (HPMC) HPMC was infused into the anterior chamber (AC) and the aqueous humor was replaced. It was ensured that the AC was not unduly deepened and that the IOP remained in the physiological range. The lens-zonule diaphragm was not pushed backward. The rhexis of adequate size was performed using the "tunnel floor entry technique" with a 26 g needle cystitome. The one-third of the bevel tip was bent to 45 degrees. As the limbal and corneal portion of the tunnel remains closed during the procedure, the viscoelastic does not exude, and the AC depth is maintained. After the rhexis, some amount of HPMC in AC was replaced with balanced salt saline (BSS). Using a modified 27 G cannula, with 1.5 mm of tip bent to 45 degrees, a capsular separating hydrodissection was performed as shown in the accompanying video and Fig. 1. About 0.2 mL of BSS was needed in a majority of eyes. The tip of the cannula was positioned under the left edge of the rhexis, and moved up gently to reach the plane between the anterior capsule and peripheral cortex. A slow but continuous infusion of BSS separated the capsule from the cortex, and the fluid wave migrated to the posterior subcapsular zone. The tip was directed laterally and downward, aiming at the equator. The cortex is not to be disturbed. If the fluid wave is not seen, the anterior capsule can be minimally lifted to create additional space. The cannula should not be passed deeper, and the tip should be less than a millimeter inside the edge of the rhexis. The fluid wave can gently be allowed to pass across the posterior pole to the other side in a majority of cases. In clinically suspected pre-existing dehiscence of the posterior capsule, the fluid wave is allowed to stop at the edge of the capsular opacity, and a second wave is generated from the opposite side. The waves should not be allowed to pool, stagnate, and become bulky so that the posterior capsule is not stretched. If the dissection is not complete, it can be restarted in another sector. We need to ensure that there is no air in the cannula, hub or barrel of the syringe, or the syringe is loaded with visco earlier, as there could be a sudden gush of fluid due to changes in the resistance to the passage of different materials with different viscosities. This hydrodissection can be seen to lift the cortical opacity upward, leaving the clear central capsular zone exposed. Once this occurs, the hydrodissection is stopped as the hydrostatic pressure by continued hydrodissection can directly act on the exposed posterior capsule. It is very important not to inject excess fluid at this time, and that the pressure in the AC is as low as possible and not greater than the intra-vitreal pressure. Higher pressures in the bag at this time will directly act on the exposed posterior capsule and can tear the central capsule. A small learning curve is involved. The fluid wave has to be controlled. This can be practiced in other morphology immature cataracts to get the feel of when to stop injecting the fluid. When in doubt, it is better to stop and use a smaller aliquot of fluid. The rotation of the nucleus within the capsular bag is generally not advocated in posterior polar cataract (PPC) and even posterior subcapsular cataract (PSCC). However, in this technique of segmental hydrodissection, as the cortex is completely separated from the capsule, safe nuclear rotation can be performed as a routine. It should be ensured that the viscoelastic in the AC is not overfilled, and the lens zonule-posterior capsule is not unduly stretched backward. A very gentle tap on the edge of the nucleus will release the fluid trapped in the posterior capsular bag. Higher positive pressure in AC pushes the capsule and zonules backward, putting a stretch on the posterior capsule and the zonules. A deep AC will also increase the hydrostatic pressure on the anterior capsule and this pressure is transmitted to the lens and lens pressure on the posterior capsule. These pressures cumulatively make the nucleus rotation difficult and risky.

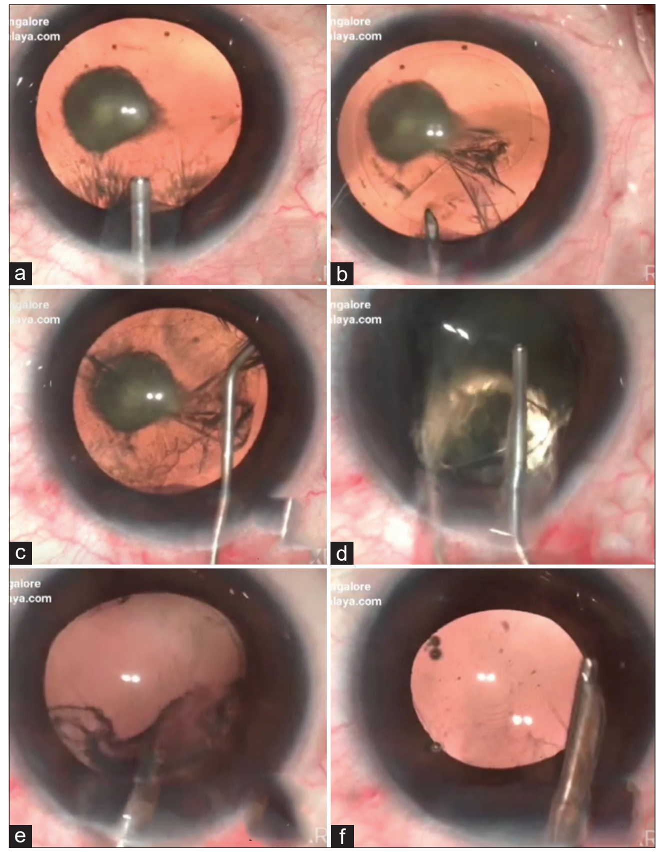

Figure 1: Collage of the technique. (a) Injecting the viscoelastic agent. (b) Continuous curvilinear capsulorhexis. (c) Hydrodissection. (d) Nucleus removal. (e) Cortical cleanup. (f) Multifocal lens implanted in the bag

Table 1: Incidence of posterior capsule rent in posterior polar cataract in comparison to other morphology cataracts by this technique

	Mature cataract	Posterior polar cataract
Total operated	337	24
Posterior capsule rent	7	0

Performing a capsular separating hydrodissection and avoiding any form of hydrodelineation leave the epinucleus fully attached to the nucleus. The rotation occurs in a plane between the epinucleus and cortex, and the epinucleus is removed along with the nucleus. There is no separate epinuclear management, and the associated risk factors minimize the stress on the posterior capsule. It can be utilized for all grades of posterior polar cataracts. Epinucleus management is always known to be the toughest. The nucleus epinucleus mass is lifted and rotated out of the capsular bag, bisected with a 25 G cannula or a cystitome depending on the hardness of the nucleus, and extracted from AC by the visco sandwich technique. The hemi nucleus was supported on a mini-vectis and sandwiched with a 25 g cannula, mounted on a 2 mL luerlock syringe, containing HPMC. HPMC was continuously infused into the AC in front of the nucleus as the latter is being sandwiched out of the eyes.

In our experience, all the posterior subcapsular, as well as polar cataracts, were lifted from the posterior capsule by this segmental truly capsular separating hydrodissection. In some cases, circular or irregular fibrotic opacities were noted in the posterior capsule at and around the central posterior cataracts, indicating that the cataract was adherent to the posterior capsule. Some of them are stubborn and do not yield to physical removal by polishing or hydroplaning. It was observed that stubborn fibrotic leftover opacities do not affect visual performance as much as delayed cellular posterior capsular opacification (PCO), and if required can be dealt with using neodymium-doped yttrium aluminum garnet (Nd:YAG) laser capsulotomy.

Removal of the epinuclear bowl along with the nucleus in this technique appeared to be a unique feature toward increased safety. With this technique, it was very easy to aspirate the cortical material using a Simcoe irrigation aspiration cannula mounted on a silicone bulb filled with BSS. There was no continuous and pressurized flow of BSS so that not only aspiration but also infusion was minutely controlled. In this low fluidics technique, the AC is not deepened at all so that a sudden shallowing never occurs. The Simcoe cannula holds the anterior leaf of the cortex, and a sector-shaped equatorial and posterior cortex is aspirated. As the radial pull exerts acts focally on a small segment of the equator and then the PC, a tangential cortex pull can be performed in critical situations, especially if the zonular weakness or dehiscence is noted. This minimizes the traction on the posterior capsule and zonules. The total amount of BSS needed for the whole surgery is less than 20 to 50 mL. The key to this technique is low flow, low pressures, and stable but not deep AC. The intraocular lens (IOL) is implanted into the capsular bag as shown in the video.

Results

The results from the single surgeon (MSR) were used for comparison using this technique as shown in Table 1.

The corrected rate for posterior capsular rent was 2.07 per 100 cases for mature cataracts and 0.0 per 100 cases for posterior polar cataracts using MSICS ($X^2 = 34.31$, $P = 0.00$, Chi-square test).

Discussion

Different techniques have been used and several modifications have been suggested by different surgeons to prevent posterior capsule tear in posterior subcapsular and capsular cataracts. All such studies have small numbers, and therefore comparisons of the techniques are challenging. Osher *et al*. reported a capsule rupture incidence of 26% in their series of 31 cases and Vasavada and Singh reported it to be 36% in 22 cases, whereas the figure from Salahuddin *et al*. was 7.1% in 28 eyes.[1,5-7] No posterior capsule rent was reported in the current retrospective analysis of 24 cases. A similar technique was described using viscodissection in phacoemulsification by Siatri and Moghimi and they also reported that there were no posterior capsule ruptures in their series of 38 eyes.[8] There are no absolute contraindications of this technique. Caution may be exercised in the presence of a white dot sign or Daljeet Singh Sign, which was considered to signify the presence of one or several white dots near the edge of the polar cataract. The technique was safely used by authors in this condition also.[9] Larger studies or pooled data may be able to provide better generalizability. The current analysis matches the numbers from the previous series in size and demonstrates that this is a safe technique.

Conclusion

This study shows that the technique of capsular separating hydrodissection is safe and repeatable, and gives excellent results if the dynamics of minimalistic fluidics are understood and implemented.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kalantan H. Posterior polar cataract: A review. Saudi J Ophthalmol 2012;26:41-9.
2. Vasavada AR, Singh R. Phacoemulsification with posterior polar cataract. J Cataract Refract Surg 1999;25:238-45.
3. Fine IH, Packer M, Hoffman RS. Management of posterior polar cataract. J Cataract Refract Surg2003;29:16-9.
4. Allen D, Wood C. Minimizing risk to the capsule during surgery for posterior polar cataract. J Cataract Refract Surg2002;28:742-4.
5. Osher RH, Yu BC, Koch DD. Posterior polar cataracts: A predisposition to intraoperative posterior capsular rupture. J Cataract Refract Surg1990;16:157-62.
6. Vasavada AR, Singh R. Phacoemulsification with posterior polar cataract. J Cataract Refract Surg1999;25:238-45.
7. Salahuddin. Inverse horse-shoe technique for the phacoemulsification of posterior polar cataract. Can J Ophthalmol 2010;45:154-6.
8. Siatiri H, Moghimi S. Posterior polar cataract: Minimizing risk of posterior capsule rupture. Eye 2006;20:814-6.
9. Shah D, Damani T, Punamia R, Gokharu S. Posterior polar cataract with an occult posterior capsular rent: A rare catch. Indian JOphthalmol Case Rep 2022;2:267.