Anterior capsulorrhexis is one of the most challenging step in pediatric cataract surgery. There are increased chances of anterior capsulorrhexis extension (ACE) in children because of the high elasticity of the anterior capsule and positive vitreous pressure in children, as compared to adults. In-the-bag intraocular lens (IOL) implantation is considered to be a standard technique of IOL implantation in children. However, in cases of ACE, even if the IOL is implanted in the bag there are increased chances of migration of the IOL from the capsular bag through deficient anterior capsulorrhexis margin, leading to pupillary capture of IOL optic, iritis, postoperative glaucoma, and posterior capsular opacification (PCO).

In young children, PCO is observed in almost all cases. Primary posterior capsulorrhexis (PPC) with anterior vitrectomy (AV) is now routinely performed in young children to prevent such complication. This PPC can also be used to perform posterior optic buttonholing (POBH), which theoretically reduces chances of pupillary capture and other complications. POBH was first described by Gimbel to prevent secondary membrane formation in children after cataract surgery. POBH has been reported to be a good technique of IOL implantation as it prevents the formation of PCO by the retrolental lens epithelial cell migration and reduces capsular fibrosis. Vasavada et al. have also reported reduced chances of PCO and other complications in children, where POBH was performed.

Due to a higher learning curve of anterior capsulorrhexis in pediatric patients for beginners, we often come across ACE during surgery by fellows in training and even by experienced faculty at occasions. In these cases of ACE, POBH with AV might be a feasible option.

The study aimed to evaluate the intra- and postoperative complications of IOL implantation with POBH in children who underwent phacoemulsification irrigation/aspiration with or without PPC and AV for congenital/developmental cataract and had intraoperative ACE.

**Surgical Technique**

All surgeries were performed under general anesthesia. Two side ports were created at 10 and 2 o’clock positions at the

---

**Key words:** Anterior capsulorrhexis extension, pediatric cataract, POBH
limbus. A 3.2 mm clear corneal keratome incision was made at 12 o’clock. Anterior chamber was then filled with ophthalmic viscosurgical devices (OVDs). Anterior capsulorrhexis of 5.5–6 mm was performed using Utrata capsulorrhexis forceps. Lens matter aspiration was done by phacoaspiration or bimanual irrigation/aspiration. Central 4–5 mm PPC was created by using vitrectorhexis and minimal core AV was performed. A three-piece hydrophobic acrylic IOL was injected and placed in the capsular bag or sulcus; the optic of IOL was gently pushed behind the PPC and was buttonholed by slight sideways tilting movement. Complete optic capture was confirmed by the ellipsoid pattern of the posterior capsule. The side port incisions and keratome incision were sutured with a 10-0 polyglactin suture. Intracameral moxifloxacin was injected and wound was hydrated. Intraoperative complications, if any, were noted. Fig. 1 and Video 1 show the different steps of POBH in a case of ACE during pediatric cataract surgery.

Postoperatively, all patients were advised topical moxifloxacin 0.5% eyedrops 4 times a day for a week, topical prednisolone 1.0% eyedrops 10 times a day in tapering doses for 6 weeks, and homatropine 2.0% eyedrops 2 times a day for 2 weeks.

Patients were followed up at day 1, 1 month, and 6 months. At each follow-up visit, anterior segment examination was done by table mounted or handheld slit lamp to look for signs of ocular inflammation, IOL position, IOL centration, and PCO. Intraocular pressure (IOP) was measured either with a tonopen (I-care Tonometer) or with a Perkins tonometer if child was taken for other eye surgery. Heightened postoperative inflammation was considered if anterior chamber cells or flare >+2 and raised IOP was considered if measured IOP >22 mm of Hg. Decentration of IOL was defined when the distance of the center of IOL from the center of cornea was more than 2 mm on any side and/or IOL optic edge was visible in 4 mm dilated pupil. Tilt was noted if any edge of the optic was out of PPC margin or anterior capsulorrhexis margin.

Results

A total of 25 eyes of age $<5$ years were included in this retrospective analysis. Legal guardians of all children gave informed consent for inclusion in this study and ethical approval was obtained from the institutional review board. The written informed consent was taken from the guardians before surgery regarding the treatment and for potential use of data for future research purpose.

Each child presented with congenital or developmental cataract. All of them underwent phacoemulsification irrigation/aspiration with PPC and AV at a tertiary eye care center and experienced ACE during the surgery. All these cases underwent IOL implantation with POBH.

Total number of eyes of children $<5$ years with congenital/developmental cataract operated during the study period (April 2018 to March 2019) were 306 out of which 25 eyes (8.16%), underwent POBH due to ACE. The mean age of children was 32.96 ± 20.76 months (median = 24 months, range = 3–60 months), and there were 16 boys and 9 girls in this study. Table 1 shows the demographic and clinical details of children who developed ACE and were managed by the above-mentioned technique.

Postoperative complications

No significant complications were observed in any of the patients, except heightened postoperative inflammation in three patients and transient mild corneal edema in two patients. This inflammation reduced within 1 week with routine anti-inflammatory drops. Mild corneal edema also subsided in all these patients in the first follow-up. No rise in IOP was observed in any of the eyes. No other postoperative complications were observed. ACE carries a high incidence of various postoperative complications, such as chronic anterior segment inflammation, iris optic capture of IOL, and IOL tilt or decentration. These complications were not observed in the patients included in our study. In 24 children, both IOL haptics were in the capsular bag, while IOL optic behind the PPC margin. In one child, part of IOL optic was out of PPC margin. PCO was seen in that one patient at 6 months follow-up with mild IOL tilt, while the rest 24 eyes had no PCO formation and adequate IOL centration. Table 2 shows the detailed postoperative complications of POBH in extended anterior capsulorrhexis during pediatric cataract surgery at every follow-up.

Discussion

An adequate size central stable anterior capsulotomy is important for in-the-bag IOL implantation and also for its long-term safety, stability, and optical quality.[7] High elasticity of the anterior capsule in children makes the anterior capsulorrhexis a difficult step leading to chances of run-away of capsulorrhexis even with experienced surgeons.[1] Manual continuous curvilinear capsulorrhexis is considered to be the standard technique for capsulotomy in pediatric cataract surgery, but it also has a long learning curve especially for young surgeons.[1,2]

Carifi et al.[8] reported a high incidence of intraoperative complications in anterior capsular tear in cataract surgery,

Figure 1: Sequential images of different steps of POBH in pediatric cataract with extended anterior capsulorrhexis. (a) Extended anterior capsulorrhexis at 2 clock hours (black arrow), (b) IOL implantation in the bag, (c) PPC with AV done, and (d) POBH done and confirmed with the spindle configuration of posterior capsulorrhexis margin (black arrow)
along with need of secondary interventions. In this study, we noted 25 eyes with ACE. Jeng et al. had reported ACE in 10% children (mean age: 6.4 years) with the use of cohesive OVDs and higher occurrence with the use of dispersive OVDs.[14] In our series, incidence of ACE was 8.16%. We performed IOL implantation with POBH in these eyes to ensure the stability of lens and reduce the chances of other postoperative complications. This resulted in less postoperative complications and no secondary interventions.

Gimbel and Debroff had first described technique of POBH for pediatric cataract surgery for prevention of PCO.[3] POBH is also considered as a safer technique for stability of IOL in cases of pediatric traumatic cataracts, high myopes, and pseudoexfoliation. Our study adds on the current literature as a different/new indication of POBH in pediatric cataract surgery complicated by ACE.

Stifter E et al. have reported significantly lower postoperative anterior chamber reaction and low increase in IOP in eyes, where POBH was done than in-the-bag implantation.[9] Our results were similar to this study with minimal inflammation only in three patients. None of the patients developed increase IOP in our study. The rate of PCO formation in cases of POBH was found to be significantly less in different studies as the lens epithelial cells migration are inhibited from accessing the retrolental space.[3,5,9]

In this study, as there was already a compromised anterior capsulorrhexis, the likelihood of further complications was high.[9] POBH was performed in all cases after IOL implantation. There was no significant anterior chamber reaction and postoperative increase of IOP was not observed in our study. Nihlani et al. had reported more number of complications in sulcus IOL than in the bag IOL in pediatric cataract surgery with major complications like corneal edema (54% vs 19%, P = 0.04) and postoperative ocular inflammation (92% vs 31%, P < 0.05) in immediate postoperative period.[10] Late inflammation at 6 months developed in one eye, and glaucoma developed in two eyes with sulcus IOLs in their series. However, in our series, all patients had quiet eyes with normal IOP at 6 month follow-up.

The other outcome of this study was IOL stability and incidence of PCO. Of the 25 eyes under the study, only one patient had developed PCO at 6 months follow-up with mild tilt, which could be attributed to improper capture of IOL.[11] while the rest 24 eyes had no PCO formation and adequate IOL centration. Decentration of the IOL was reported in 4.55% in sulcus implanted IOL in a study done by Liu JH et al.,[12] while in our series, there was no decentration.

There are a few limitations of this study as follows: retrospective study design, less number of study population, and no comparative data with any other technique of IOL implantation.

**Conclusion**

We have also used Utrata forceps for anterior capsulorrhexis in our series. Though it is fine to use Utrata forceps by experienced surgeons, for trainees, the risk of ACE might be higher and can be reduced using pediatric microrhexis forceps. However, this study holds promising results as an alternative to standard in-the-bag IOL implantation in the cases of extended capsulorrhexis.

**Financial support and sponsorship**

Nil.

---

**Table 1: Demographic details and clinical profile of children who underwent for POBH**

| Variables                                             | Number/ mean±SD                      |
|-------------------------------------------------------|--------------------------------------|
| Total number of congenital/developmental cataract operated in study duration     | 1470                                 |
| Number of eyes in children <5 years of age             | 306                                  |
| Number of eyes with extended capsulorrhexis managed with POBH | 25 (25/306, 8.16%)                  |
| Male/Female                                           | 16/9                                 |
| Right eye/Left eye                                     | 14/11                                |
| Strabismus/nystagmus                                   | 7                                    |
| Mean age at the time of surgery                        | 32.96±20.76 months (median=24 months, range=3 months to 60 months) |
| Mean follow-up time                                    | 7.02±2.64 months                     |
| Preoperative visual acuity                             | 2.12±0.69 log MAR                     |
| Postoperative visual acuity                            | 1.38±0.49 log MAR                     |
| Mean IOL power                                         | 23.40±3.61 D                         |
| Preoperative mean IOP                                  | 14.24±2.90 mm Hg                      |
| Postoperative mean IOP                                 | 15.6±2.69 mm Hg                       |

**Table 2: Postoperative complications of POBH in extended anterior capsulorrhexis during pediatric cataract surgery at every follow-up**

| Postoperative complications | At day-1 | 1 month | 6 month |
|-----------------------------|---------|---------|---------|
| Anterior chamber inflammation >+2 | 3 | 0 | 0 |
| Corneal edema                | 2 | 0 | 0 |
| IOP rise                     | 0 | 0 | 0 |
| IOL decentration             | 0 | 0 | 0 |
| IOL tilt                     | 0 | 0 | 1 |
| PCO                          | 0 | 0 | 1 |
| Secondary intervention       | 0 | 0 | 0 |

POBH: Posterior optic buttonholing, IOL: Intraocular lens, IOP: Intraocular pressure

---
Conflicts of interest
There are no conflicts of interest.

References
1. Wilson ME. Anterior capsule management for pediatric intraocular lens implantation. J Pediatr Ophthalmol Strabismus 1999;36:314-9.
2. Kemp PS, Oetting TA. Stability and safety of MA50 intraocular lens placed in the sulcus. Eye (Lond) 2015;29:1438-41.
3. Gimbel HV, DeBroff BM. Posterior capsulorrhexis with optic capture: Maintaining a clear visual axis after pediatric cataract surgery. J Cataract Refract Surg 1994;20:658-64.
4. Menapace R. Posterior capsulorrhexis combined with optic buttonholing: An alternative to standard in-the-bag implantation of sharp-edged intraocular lenses? A critical analysis of 1000 consecutive cases. Graefes Arch Clin Exp Ophthalmol 2008;246:787-801.
5. Vasavada AR, Vasavada V, Shah SK, Trivedi RH, Vasavada VA, Vasavada SA, et al. Postoperative outcomes of intraocular lens implantation in the bag versus posterior optic capture in pediatric cataract surgery. J Cataract Refract Surg 2017;43:1177-83.
6. Jeng BH, Hoyt CS, McLeod SD. Completion rate of continuous curvilinear capsulorhexis in pediatric cataract surgery using different viscoelastic materials. J Cataract Refract Surg 2004;30:85-8.
7. Guo S, Wagner RS, Caputo A. Management of the anterior and posterior lens capsules and vitreous in pediatric cataract surgery. J Pediatr Ophthalmol Strabismus 2004;41:330-7.
8. Carifi G, Miller MH, Fitsas C, Zygoura V, Deshmukh RR, Kopsachilis N, et al. Complications and outcomes of phacoemulsification cataract surgery complicated by anterior capsule tear. Am J Ophthalmol 2015;159:463-9.
9. Stifter E, Menapace R, Krieschbaum K, Vock L, Luksch A. Effect of primary posterior continuous curvilinear capsulorhexis with and without posterior optic buttonholing on postoperative anterior chamber flare. J Cataract Refract Surg 2009;35:480-4.
10. Nihalani BR, Vanderveen DK. Secondary intraocular lens implantation after pediatric aphakia. J AAPOS 2011;15:435-40.
11. Tappin MJ, Larkin DF. Factors leading to lens implant decentration and exchange. Eye 2000;14:773-6.
12. Liu JH, Li SF, Deng GD, Jiao YH, Lu H. Outcomes of secondary sulcus intraocular lens implantation in unilateral anterior persistent fetal vasculature. Int J Ophthalmol 2019;12:592-6.