



Management of Congenital Cataract Surgery in Critical Situations

Dr. Md. Nasimul Gani Chowdhury¹, Dr. Afrina Khanam², Jannatun Noor^{3*}, Dr. MD Iftekhhar Shamim⁴, Dr. Farzana Akter Chowdhury⁵, Dr. Tasmin Akter⁶, Dr. Sharmin Akther⁶, Dr. Kazi Tahmina Akter⁷, Dr. MD Shakibul Alam⁸, Dr. Nazia Alam⁹

Abstract

Purpose: To assess the safety and efficacy of 'In Sulcus' placement of soft foldable IOL in case of surgical constraint in children with congenital cataract.

Methods: 80 pseudophakic eyes of 40 children with bilateral congenital cataract were retrospectively reviewed. All the patients were planned for In Bag placement of IOL but due to surgical constraints In Sulcus placement of single piece IOL were done. The age range of patients was 1 to 3 years. All the patients were reviewed for at least up to 2 years with frequent intervals. Visual function, refractive status, anterior chamber depth, pupil reaction, IOL position, IOL capturing, IOP and fundus changes were assessed in different follow up.

Results: No significant adverse effects were seen in visual function, refraction, anterior chamber depth, pupil reaction, IOL capturing, IOP and optic disc changes 'In Sulcus' placement of soft foldable IOL in children.

Conclusion: Soft foldable IOL can be placed safely in sulcus in case of surgical constraint in children with congenital cataract.

Keywords: Congenital Cataract; Single Piece IOL; Soft Foldable IOL; Sulcus Placement in Children

Introduction

Most cases of congenital cataract can be treated, and they can be unilateral or bilateral [1]. This cataract may be associated with microcornea [2,3], microphthalmos, thick anterior capsular calcification attached with posterior capsular calcification, posterior capsular dehiscence or hole. These important associations present the surgeon with challenging intraoperative problems, and patients need to be kept aphakic. High power convex lenses used for aphakic management cause discomfort and spectacle intolerance. Moreover, it is impossible to obtain binocular function. Thus, the final surgical result is undesired amblyopia.

The feasibility of intraocular lens implantation in pediatric eyes has long been established [4,5]. The major advantage of an IOL is that it provides permanently continuous correction of aphakia, which is important in preventing amblyopia and fostering normal visual development in young children [6]. Placement of a posterior chamber IOL into the capsular bag is preferred as it results in a close-to-normal position. In some cases, due to surgical constraints, the IOL is inserted into the ciliary sulcus with the premise of sufficient support of the remaining lens capsule [7-11]. Ciliary sulcus fixation of IOL in pediatric eyes has been proven to be reasonably safe

Affiliation:

¹Professor and Chief Consultant, Department of Paediatric Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

²Consultant, Grameen GC Eye Hospital, Bogura, Bangladesh

³Lecturer, Institute of Community Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁴Associate Consultant, Anesthesia, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁵Consultant, Department of Paediatric Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁶Assistant Surgeon, Department of Paediatric Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁷Consultant, Department of Cataract, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

⁸Senior Assistant Surgeon, Anesthesia, Chittagong Eye Infirmary and Training Complex

⁹Assistant Surgeon, Anesthesia, Chittagong Eye Infirmary and Training Complex

*Corresponding author:

Jannatun Noor, Lecturer, Institute of Community Ophthalmology, Chittagong Eye Infirmary and Training Complex, Chattogram, Bangladesh

Citation: Dr. Md. Nasimul Gani Chowdhury, Dr. Afrina Khanam, Jannatun Noor, Dr. MD Iftekhhar Shamim, Dr. Farzana Akter Chowdhury, Dr. Tasmin Akter, Dr. Sharmin Akther, Dr. Kazi Tahmina Akter, Dr. MD Shakibul Alam, Dr. Nazia Alam. Management of Congenital Cataract Surgery in Critical Situations. Journal of Ophthalmology and Research. 9 (2026): 85-89.

Received: October 09, 2026

Accepted: October 14, 2026

Published: October 21, 2026

and effective over the short-term according to several studies [5,12].

There were conflicting results for single-piece IOL implantation in the sulcus [10]. Despite this, single-piece IOL implantation in ciliary sulcus following posterior capsular rupture is gaining popularity [9,13]. This is partly due to lower availability of 3-piece IOLs. Several studies have reported the safety and appropriate centration of single-piece IOL in the sulcus [13,14] that are inconsistent with the results of other studies [15].

Hence, the purpose of the study was to assess the safety and efficacy of soft foldable single piece IOL implantation In Sulcus in children with these critical associations creating surgical constraints.

Methods

This retrospective observational study was carried out on 80 eyes of 40 children, each aged between 1 and 3 years, who had been diagnosed with bilateral congenital cataract prior to the study. All surgeries were conducted at the Chittagong Eye Infirmary & Training Complex (CEITC) in Chattogram from January 2018 to January 2023. The data included information on the age at which surgery was performed, the child's sex, preoperative axial length measurements, challenges encountered during surgery such as membranous cataract, anterior capsular calcification, attached anterior and posterior capsular calcified opacities, posterior capsular dehiscence or hole, post-operative visual function, refraction, anterior chamber depth, pigment dispersion, iris bowing, pupil reaction, intraocular lens (IOL) position, IOL capturing, intraocular pressure (IOP), and changes in the fundus. Cases involving unilateral or traumatic cataract, microcornea, or follow-up periods shorter than two years were excluded from the study. All surgeries were performed under general anesthesia by a single experienced pediatric ophthalmologist.

Preoperative examinations included visual assessment using the CSM method, slit lamp biomicroscopy, direct and indirect ophthalmoscopy after full dilation, and B-scan ultrasonography. For intraocular lens (IOL) power calculations, the axial length was measured using the Ocuscan machine, following the method proposed by Dahan E and Drusedau MU [16]. A 20% under-correction was applied for children under two years of age, while a 10% under-correction was used for those older than two years.

All patients were operated on under general anesthesia with spontaneous breathing. Corneal tunnels were created at the 11 and 2 o'clock positions using an MVR blade. Pupil dilation was achieved by injecting adrenaline into the anterior chamber. The anterior capsule of the lens was stained with Trypan blue. A continuous curvilinear capsulorhexis (CCC) was performed using 25G ILM forceps (Alcon). An automated I/A hand piece with an Optikon R-Evo Smart machine was

used for irrigation and aspiration in all cases. Each patient was planned for in-the-bag placement of a soft, foldable, single-piece IOL, but due to surgical constraints, in-sulcus placement was performed. An automated vitrectomy machine was used for both the primary posterior capsulectomy (PPC) and the anterior vitrectomy (AVT). Corneal tunnels were sealed with 10-0 nylon. Each patient received a subconjunctival injection of Dexamethasone (2 mg) and Gentamicin (5 mg). The eye was kept covered until the first post-operative assessment. All patients were released from the hospital the day after surgery and were re-evaluated at intervals of one week, one month, and three months. Antibiotic eye drops were used for up to one month. Steroid eye drops were applied and gradually reduced over the subsequent eight weeks. Systemic steroids (1 mg/kg body weight) were given in a tapering dose orally. All corneal sutures were removed after one and a half months of surgery under total intravenous anesthesia with ketamine. Intraocular pressure (IOP) was measured using Perkins tonometry during suture removal. Refraction and spectacle prescription were provided after one week. Post-operative visual assessments were conducted using the CSM method and Cardiff acuity cards. Pupil reaction and IOL position were assessed during each follow-up visit. Fundoscopy was performed at each follow-up visit after one month of surgery. Anterior chamber depth was measured using the Van Herick method at each follow-up.

Statistical analysis was performed using SPSS software version 16.0. The normality of the data was assessed using the P-value. A P-value less than 0.05 was considered statistically significant.

Result

80 pseudophakic eyes of 40 children underwent cataract surgeries under general anesthesia were included in this study. The age range was 1 year to 3 years. The average age was 24±4 months. The follow-up range was 2 years to 4 years. 24 (60%) of the cases were male and 16 (40%) of the cases were female.

In Sulcus placement was done due to surgical constraints. These surgical constraints are large pre-existing posterior capsular holes in 46 eyes (57.5%), membranous cataract in 24 eyes (30%) and anterior and posterior capsular calcified opacification in 10 eyes (12.5%).

Repeated shallowing of the anterior chamber was the troublesome intra-operative challenges of the cataract surgery in soft foldable IOL implantation in sulcus placement in all

Table 1: Age distribution according to IOL placement

Age at surgery	Number of patients (%)
1-2 years	12 (30%)
2-3 years	28 (70%)

cases. Suturing was done in every case, even in side-port.

Post-operatively Anterior chamber depth was found normal assessed by Van Herrick method. Iris bowing & correctopia was seen in 8 eyes of 8 patients (10%).

Increased inflammation was seen in 36 eyes (45%) on 1st post-operative day and resolved by topical & systemic steroids. On the 1st post-operative day, corneal oedema was seen in 36 eyes (45%) due to eventful surgeries. 6 eyes of 6 patients (7.5%) developed thick membrane and membranectomies were done later on. No pupillary optic capture of IOL was recorded.

Visual assessment revealed central, steady, and maintained in 20% of cases and central, steady, and unmaintained in 60% of cases; Cardiff acuity cards revealed 6/60 to 6/24 vision in the remaining cases, with the average residual hypermetropia being +5.00D above 1 year and +4.00D above 2 years, which decreased to +4.00D and +3.00D after 1 year respectively.

Table 2: Post-operative complications

Complications	Number of eyes (%)
Corneal oedema	36 (45%)
Increased inflammation	36 (45%)
Fibrinous membrane formation	20 (25%)
Decentered IOL	4 (5%)
Iris bowing and correctopia	8 (10%)
Increased IOP	6 (7.5%)
Optic disc changes	2 (2.5%)

6 eyes of 6 cases (7.5%) showed increased IOP which was managed conservatively. In the rest of the cases IOP were within normal limit (11 ± 3.35 mm of Hg). No significant optic disc changes were noticed except in 2 cases which showed advanced cupping. Peripheral retina and vitreous were normal in all cases.

The most frequent cause of visual loss was amblyopia caused by stimulation deprivation. Amblyopia was more pronounced in the second fellow eye. This marked amblyopia in second eye was due to competitive inhibition because of delaying surgery.

Discussion

In cataract surgery, the implantation of an intraocular lens (IOL) in the capsular bag is a prerequisite for a successful procedure. The ciliary sulcus becomes an alternative to approximate an in-the-bag position when the capsular bag is violated [8,17]. Because of its anatomical feature, the ciliary sulcus is a good site for IOL implantation after capsular rupture [18]. Large optics and thin haptics to lessen IOL decentration and enhance retinal visibility in the event of a

vitrectomy due to complications, as well as less scratching of the posterior iris surface, are characteristics of an appropriate IOL for sulcus implantation. The material, IOL thickness and size, implantation method, and haptics angle all had an impact on the iris alternation caused by contact [19]. Keeping an eye on these variables may help minimize complications.

The three-piece intraocular lens or the single-piece PMMA rigid intraocular lens are currently the recommended intraocular lenses to be inserted into the sulcus [20,21]. The main reason for this is that three-piece IOLs and single-piece PMMA rigid IOLs are made to be more stable in the sulcus due to their large optic diameters and long haptics, which are essential to maintain stability in the sulcus. Intraocular lens designs are still developing, and single-piece IOLs' optic diameters and total lengths already resemble those of three-piece IOLs. Three-piece IOLs are stable during surgery, but their tiny haptics act like wires. If it is not positioned correctly, its end could result in hyphemia, repeated iridocyclitis, and increased iris irritation. Even if a single-piece IOL varies during surgery, it eventually stabilizes and there is no risk of iris irritation, iridocyclitis, or hyphemia because of its blunt and spherical end.

Several studies discouraged the use of a single-piece foldable IOL in sulcus implantation [17,22,23] due to its increased complications, such as increased inflammation and IOP. This was because the old designed single piece IOL was undersized for ciliary sulcus placement, square edge optic, thick haptics and unpolished side walls. In modern times, they don't occur since contemporary single-piece IOLs have a big optic size of 6 mm diameter without angulation, which reduces the possibility of iris chafing and irritation. Additionally, IOL decentration and IOL tilt are currently declining due to its total size of 13 mm. Additionally, the polished side walls and circular edges of the contemporary single-piece IOL lessen the possibility of pigment dispersion.

Postoperative IOP rise is a concern after IOL implantation in children. The exact mechanism of postoperative IOP rise after soft IOL implantation in children is still unknown. This may be due to surgical trauma during operative procedure, increased inflammation, pigment release, debris deposition and mechanical deformation of the trabecular meshwork [24,25].

Another demand for any sulcus implanted IOLs is to keep its central and steady positioning as decentered IOL with its optic edge visible within the pupillary space may result in glare symptoms [26]. In our study IOL decentration with single piece IOL was not significant (4 eyes, 5%), so these sorts of complications were not noticed.

We noticed both corneal oedema and increased inflammation in 36 cases (45%), membrane formation in 20 cases (25%) in 1st post-operative day. This was because these

surgeries were eventful due to pre-existing posterior capsular hole and huge vitreous prolapse which prolonged duration of surgery. Iris bowing and correctopia were noticed in 8 eyes of 8 patients (10%). This correctopia was due to vitreous tag which could not be managed properly intra-operatively because of eventful cataract surgeries. Anterior vitrectomies were done in these cases under general anesthesia later on. We noticed no pigment dispersion and iris transillumination defect after surgery in the follow up period. In our study cup-disc ratio and neuro-retinal rim were found to be normal in all patients except in 2 cases (2.5%) which showed advanced cupping. This was due to treatment in compliance post-operatively. Peripheral retina reveals no abnormalities.

The major concern of IOL implantation in sulcus is rise of IOP post-operatively, which may cause watering, photophobia, blepharospasm, decrease corneal clarity, increase corneal diameter and optic disc changes. We faced challenges in 4 eyes of 4 patients with IOP rise which were managed conservatively. There were no pupillary optic captures of the IOL in our study. This was because we did not apply atropine eye drops after surgery. Instead, to keep the pupil mobile and reactive, we used a topical mixture of phenylephrine and tropicamide. In our series 6 eyes of 6 patients (7.5%) developed thick retrolental membrane formation causing obscuration of visual axis. Later, membranectomies were done again under general anesthesia.

Bar-Sela and Fleissig [27] concluded in their study on sulcus implantation of single-piece acrylic IOL designed for both in-the-bag and sulcus positioning that a properly constructed single-piece acrylic IOL may be placed in the ciliary sulcus during phacoemulsification with PCT [28]. There is no debate in current available literature regarding the visual outcomes of implanting a single-piece IOL in the sulcus [9,17]. Visual acuity remained excellent for those with stable sulcus IOLs because it maintained the advantages of a small incision surgery with good postoperative visual results [14]. Additionally, the near proximity of the sulcus with the bag provides a good option when the posterior capsule gets compromised [10,20,21]. Similar papers showed a good visual outcome for majority of eyes implanted with sulcus single-piece IOL with at least 20/40 or better in all eyes [10,15,22]. The cumulative incidences of postoperative inflammation between single-piece and three-piece IOLs showed no sufficient evidence to conclude that there is a significant difference between the two groups [17]. It may even be more advantageous than implanting a three-piece IOL in the same location, resulting in a shorter surgical duration [29]. In order to apply surgical knowledge in these difficult problems of pediatric cataract surgery, well-functioning mechanical support is necessary.

Our study's short follow-up period, comparatively small patient population, and infrequent IOP measurements were

its limitations. It is advised to conduct additional long-term follow-up studies with enough patients and detailed anterior segment ultrasound biomicroscopic analysis (UBM).

Conclusion

Soft foldable IOL can be placed safely in sulcus in case of surgical constraint in children with congenital cataract

Conflicts of Interest: None.

Financial Support: None

Acknowledgements:

Ahmedur Rahman Research Center of Chittagong Eye Infirmary and Training Complex.

References

1. Grałek M, Kanigowska K, Seroczyńska M. Cataract in children—not only an ophthalmological problem. *Medycyna Wieku Rozwojowego* 11 (2007): 227-230.
2. Oshika T, Matsuki N, Endo T, et al. Long-term outcomes of congenital cataract surgery in eyes with microcornea operated within the first year of life. *Scientific Reports* 16 (2026): 20727.
3. Chattannavar G, Lasrado AS, Kekunnaya R. Pediatric cataract surgery in congenital anterior segment dysmorphology: An overview. *Taiwan Journal of Ophthalmology* 15 (2025): 419-427.
4. Zwaan J, Mullaney PB, Awad A, et al. Pediatric intraocular lens implantation. Surgical results and complications in more than 300 patients. *Ophthalmology* 105 (1998): 112-118.
5. Lalwani S, Kekunnaya R. Secondary intraocular lens implantation (IOL) in children—what, why, when, and how? *Seminars in Ophthalmology* 38 (2023): 255-264.
6. Infant Aphakia Treatment Study Group, Lambert SR, Lynn MJ, et al. Comparison of contact lens and intraocular lens correction of monocular aphakia during infancy: A randomized clinical trial of HOTV optotype acuity at age 4.5 years and clinical findings at age 5 years. *JAMA Ophthalmology* 132 (2014): 676-682.
7. Brady KM, Atkinson CS, Kilty LA, et al. Cataract surgery and intraocular lens implantation in children. *American Journal of Ophthalmology* 120 (1995): 1-9.
8. Petrić I, Mandić Z, Lacmanović Loncar V, et al. Sulcus fixation of a foldable acrylic intraocular lens. *Acta Medica Croatica: Casopis Hrvatske Akademije Medicinskih Znanosti* 60 (2006): 137-140.
9. Chang DF, Masket S, Miller KM, et al. Complications of sulcus placement of single-piece acrylic intraocular

- lenses. Recommendations for backup IOL implantation following posterior capsule rupture. *Journal of Cataract and Refractive Surgery* 35 (2009): 1445-1458.
10. Mohebbi M, Bashiri S, Mohammadi S, et al. Outcome of single-piece intraocular lens sulcus implantation following posterior capsular rupture during phacoemulsification. *Journal of Ophthalmic and Vision Research* 12 (2017): 275.
 11. Zhao J, Yu J, Wang T, et al. Ciliary sulcus implantation of intraocular lens in manual small incision cataract surgery complicated by large posterior capsule rupture. *Experimental and Therapeutic Medicine* (2018).
 12. Trivedi RH, Wilson ME, Facciani J. Secondary intraocular lens implantation for pediatric aphakia. *Journal of American Association for Pediatric Ophthalmology and Strabismus* 9 (2005): 346-352.
 13. Taskapili M, Engin G, Kaya G, et al. Single-piece foldable acrylic intraocular lens implantation in the sulcus in eyes with posterior capsule tear during phacoemulsification. *Journal of Cataract and Refractive Surgery* 31 (2005): 1593-1597.
 14. Taskapili M, Gulkilik G, Kocabora MS, et al. Comparison of sulcus implantation of single-piece hydrophilic foldable acrylic and polymethylmethacrylate intraocular lenses in eyes with posterior capsule tear during phacoemulsification surgery. *European Journal of Ophthalmology* 17 (2007): 595-600.
 15. Uy HS, Chan PST. Pigment release and secondary glaucoma after implantation of single-piece acrylic intraocular lenses in the ciliary sulcus. *American Journal of Ophthalmology* 142 (2006): 330-332.
 16. Dahan E, Drusedau MUH. Choice of lens and dioptric power in pediatric pseudophakia. *Journal of Cataract and Refractive Surgery* 23 (1997): 618-623.
 17. Torrefranca AB, Florcruz NVDG, Carino NS, et al. Single-piece foldable intraocular lenses versus three-piece intraocular lenses in the sulcus following posterior capsular rupture in a Philippine tertiary hospital. *Acta Medica Philippina* 58 (2024): 67-73.
 18. Wagoner MD, Cox TA, Ariyasu RG, et al. Intraocular lens implantation in the absence of capsular support. *Ophthalmology* 110 (2003): 840-859.
 19. Ballin N, Weiss DM. Pigment dispersion and intraocular pressure elevation in pseudophakia. *Annals of Ophthalmology* 14 (1982): 627-630.
 20. Chang SH, Wu WC, Wu SC. Late-onset secondary pigmentary glaucoma following foldable intraocular lenses implantation in the ciliary sulcus: A long-term follow-up study. *BMC Ophthalmology* 13 (2013): 22.
 21. Mehta R, Aref AA. Intraocular lens implantation in the ciliary sulcus: Challenges and risks. *Clinical Ophthalmology* 13 (2019): 2317-2323.
 22. Renieri G, Herzog D, Niemann S, et al. Sulcus implantation of a single-piece foldable acrylic intraocular lens after posterior capsular rupture in cataract surgery. *European Journal of Ophthalmology* 22 (2012): 950-955.
 23. Wintle R, Austin M. Pigment dispersion with elevated intraocular pressure after AcrySof intraocular lens implantation in the ciliary sulcus. *Journal of Cataract and Refractive Surgery* 27 (2001): 642-644.
 24. *Ophthalmic Pearls Glaucoma.*
 25. Dietze J, Blair K, Zeppieri M, et al. *Glaucoma (Nursing)* (2024).
 26. Mamalis N. Sulcus placement of single-piece acrylic intraocular lenses. *Journal of Cataract and Refractive Surgery* 35 (2009): 1327-1328.
 27. Bar-Sela SM, Fleissig E. Intermediate term follow-up after a single-piece-acrylic intraocular lens implantation in the ciliary sulcus—a cross-sectional study (2013).
 28. Kumar S, Shilpy N, Gupta RK. Sulcus implantation of single-piece foldable acrylic intraocular lens after posterior capsule tear during phacoemulsification. *Journal of Clinical Ophthalmology and Research* 10 (2022): 110-113.
 29. Sharon T, Lippin N, Yehezkeli V, et al. Safety of one-piece hydrophilic acrylic intraocular lenses in the ciliary sulcus. *Journal of Clinical Medicine* 14 (2025): 1972.



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)