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Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.ijceo.org

Original Research Article

Outcome of cataract surgery in patients less than three years of age

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ARTICLE INFO

Article history:
Received 03-03-2024
Accepted 06-11-2024
Available online 21-02-2025

Keywords:
Pediatric cataract
Primary posterior capsulotomy
Anterior vitectomy
Less than three years

ABSTRACT

Objective: To evaluate the outcomes of cataract surgery in children younger than three years, specifically surgical techniques, complications, and postoperative visual acuity.
Materials and Methods: This prospective observational study was conducted at Kasturba Hospital, Manipal, between September 2017 and August 2019. Children under three years old undergoing cataract surgery with at least six months of postoperative follow-up were enrolled. Data collected included surgical procedures, patient demographics, and outcomes, which were analyzed using descriptive statistics.
Results: The study included 60 eyes of 37 patients. Bilateral cataracts were present in 62.16% of patients, and congenital cataracts were the most common (56.75%). The most frequent surgical techniques were lens aspiration with posterior primary capsulotomy, anterior vitrectomy, and peripheral iridectomy. Intraocular lens (IOL) implantation was performed in 61.66% of eyes. Postoperative optical rehabilitation consisted of IOLs (61.66%), aphakic glasses (33.34%), and contact lenses (5%). Visual acuity improved in 50% of eyes postoperatively. Complications were observed in 33.33% of eyes, with posterior capsular opacification being the most common (16.67%). Glaucoma was rare (1.67%). The study's limitations included a small sample size and variations in surgical techniques among the four surgeons.
Conclusions: Lens aspiration with primary posterior capsulotomy and anterior vitrectomy, with or without IOL implantation, appears to be a safe and effective procedure for pediatric cataracts in children under three, demonstrating notable postoperative visual improvement. Larger, standardized studies are necessary to validate these findings and optimize surgical techniques.

1. Introduction

The management of cataracts in children is a complex procedure, given the distinct features of pediatric eyes as compared to adult eyes. Unique features such as reduced rigidity of the sclera, increased capsular elasticity, and higher vitreous pressure are the chief factors that complicate the process of cataract extraction in children.[1–3] These aspects, combined with a higher incidence of post-operative inflammation, posterior capsular opacification, a constantly changing refractive state, frequent requirement of secondary surgeries, and the inherent risk of amblyopia, all influence the final visual outcome.[4] Previously, numerous crude surgical techniques like needling along with lens aspiration and optical iridectomy were employed for cataract surgery in children.[5] Phaco-aspiration with primary posterior capsulotomy (PPC) with or without anterior vitrectomy (AV) and capsular bag implantation/optic capture of intraocular lens is today the most accepted technique for the management of pediatric cataracts.[6]

Hence, we conducted this study to evaluate the outcome of cataract surgery in children aged less than three years and the post-surgical outcomes.

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https://doi.org/10.18231/j.ijceo.2025.022

2. Materials and Methods

This was a prospective observational study conducted from September 2017 to August 2019. After discussion with the statistician, it was decided that the study would be a time-bound study including as many patients as possible who would fit into the inclusion criteria within the study period of 2 years.

The study included patients aged less than three years who underwent/ are undergoing cataract surgery at Kasturba Hospital, Manipal.

Patients above the age of three years and Patients whose parents refuse to give consent, as well as those patients who do not have a minimum follow-up period of 6 months post-operatively were excluded from the study.

2.1. Procedure

After obtaining permission from the Institutional Ethics Committee to conduct the study, case records of children aged less than three years operated for pediatric cataracts from January 2010 to September 2017 were studied. In addition, children with pediatric cataracts aged less than three years coming for ophthalmic evaluation and treatment from October 2017 to October 2019 were included in the study. Their parents were briefed about the objective of the study, and after getting their written informed consent, their child was recruited into the study. Patient demographics were recorded in a proforma, and a detailed history and ophthalmic evaluation were done. Details regarding the technique of surgery employed, and the type of optical rehabilitation used were documented. All patients underwent lens aspiration with primary posterior capsulotomy (PPC) and anterior vitrectomy (AV). The patients were operated by 4 senior ophthalmologists, who regularly perform pediatric cataract surgery in our department. The SRK-T formula was used to calculate the IOL power in our study.

2.2. Statistical analysis

The data was analysed using descriptive statistics, where frequency and percentage were used to summarize categorical variables. The Chi-square test was used to compare categorical variables among the groups. A p-value of <0.05 was considered statistically significant. The analysis was done using Statistical Package for the Social Sciences (SPSS) version 15.

3. Observation & Results

60 eyes of 37 patients were included in the study, of which 18 (48.64%) were female. 23 children (62.16%) had cataracts in both eyes, and the remaining 14 (37.84%) had unilateral cataracts. 16 patients (43.24%) were less than 1 year old at the time of presentation, 5 (13.52%) were between 1 and 2 years of age, and 16 (43.24%) children were aged between 2 to 3 years.

6 children (16.2%) were born of a consanguineous marriage. TORCH titres were positive in 4 children (10.8%). (Table 1)

Table 1: Patient information

	Number (n)	Percentage (%)
Gender		
Male	19	51.36%
Female	18	48.64%
Age at Presentation		
<1 years	16	43.24%
1-2 years	5	13.52%
2-3 years	16	43.24%
Consanguinity		
Present	6	16.2%
Absent	31	83.8%
Antenatal Health TORCH titers		
Positive	4	10.8%

21 children (56.75%) had congenital cataracts (cataract present <1 year of birth), 11 children (29.72%) had developmental cataracts (cataract developing after >1 year of birth), 3 (8.1%) had traumatic cataract and the remaining 2 (5.4%) had complicated cataract.

19 eyes (31.66%) were operated on before the age of 1 year, 11 eyes (18.34%) were operated on between 1-2 years of age, and 30 eyes (50%) were operated between age 2-3 years.

37 eyes (61.66%) underwent lens aspiration with posterior primary capsulotomy, anterior vitrectomy, peripheral iridectomy, and primary IOL implantation. IOL was not implanted in 23 eyes (38.34%). There was no difference in outcomes in both the groups.

Optical rehabilitation was done with the help of aphakic glasses in 20 eyes (33.34%), contact lenses in 3 eyes (5%), and IOLs in 37 eyes (61.66%). Rigid IOLs were used in 6 eyes (16.21%), hydrophobic foldable IOLs in 28 eyes (75.67%), and hydrophilic foldable IOLs in 3 eyes (8.12%).

Lea symbol charts were used to test visual acuity. The best corrected visual acuity improved post-operatively in 30 eyes (50%) and remained unchanged in 3 eyes (5%). The visual acuity could not be assessed in 36 eyes (45%) due to young age and inability to follow commands/read.

20 eyes (33.33%) developed complications post-operatively, 50% of which occurred within 3 months of surgery, and the rest after 3 months of surgery. 10 eyes (16.67%) developed posterior capsular opacification (PCO), 5 (8.33%) developed uveitis, 1 (1.67%) developed glaucoma, 3 (5%) developed both uveitis and PCO, and 1 (1.67%) had both PCO and glaucoma. As a result of these complications, 5 eyes underwent YAG capsulotomy, and 3 eyes underwent membranectomy. No association could be

deduced between the surgical technique employed and the requirement of secondary procedures.

4. Discussion

In our study, 60 eyes of 37 patients, of which 18 were female. 23 children (62.16%) had cataracts in both eyes, and the remaining 14 (37.84%) had unilateral cataract. The Infant Aphakia Treatment Study included 114 children with unilateral cataract, of which 60 (52.63%) were females.[7] Gogate et al studied 129 children with bilateral cataracts, of which 74 (57.36%) were male.[8]

The minimum follow-up period required for inclusion in our study was 6 months. Negalur M and colleagues studied infants less than 6 months of age, with a minimum follow-up period of 3 years.[9]

21 children (56.75%) had congenital cataracts (cataract present <1 year of birth), 11 children (29.72%) had developmental cataracts (cataract developing after >1 year of birth), 3 (8.1%) had traumatic cataract and the remaining 2 (5.4%) had complicated cataract. Of the 258 eyes studied by Gogate et al, 32 (12.4%) had congenital cataract, 98 (38%) had developmental cataract, 4 (1.6%) had subluxated cataractous lenses, 8 (3.1%) had complicated cataracts and 116 (45%) were 'congenital/developmental' cataracts, which included mature white cataracts with no dependable morphology or history regarding the onset and/or progression of the cataract.[8]

In our study, 19 eyes (31.66%) were operated on before the age of 1 year, 11 eyes (18.34%) were operated on between 1-2 years of age, and 30 eyes (50%) were operated between age 2-3 years. The age at which the child presents to the hospital can influence the visual outcome, particularly in developing countries like India. A prospective multicenter study from India recruited patients from 9 eye hospitals across 8 states in India and investigated the age at which cataract was recognized and the age at which they came for surgery. 780 children were studied, of which 227 (40%) children were identified to have cataract within 1 year of birth. Of these, 71 (12.4%) were identified in the first 28 days of life. 51% of these 227 children underwent surgery in their first year of life, 19.4% between 1 and 3 years. More than 67% of congenital cataracts were recognized within 1 year of birth. However, the inability to recognize a cataract, or minor diminution of vision not affecting the child's activities, are some of the factors because of which these children sought help at a later date. Half of the surgeries were performed more than 1 year after birth.[10]

37 eyes (61.66%) underwent lens aspiration with posterior primary capsulotomy, anterior vitrectomy, peripheral iridectomy, and primary IOL implantation. IOL was not implanted in 23 eyes (38.34%). Shenoy BH et al assessed the outcomes of secondary IOL implantation in 104 children – 70 with bilateral cataract and 34 with unilateral cataract.[9] In a study done by Gogate PM et al., the most done cataract surgery was phacoaspiration with posterior chamber intraocular lens implantation.[8]

Optical rehabilitation was done with the help of aphakic glasses in 20 eyes (33.34%), contact lenses in 3 eyes (5%), and IOLs in 37 eyes (61.66%). Vasavada and co-workers compared 60 children within 2 years of age with bilateral cataract after cataract surgery, out of whom 30 children received an IOL for optical correction and the remaining half were left aphakic. Of these 30 aphakic children, 5 were lost to follow-up, and only 13 of the remaining 25 children were compliant with contact lens usage for the correction of the residual refractive error.[11]

Rigid IOLs were used in 6 eyes (16.21%), hydrophobic foldable IOLs in 28 eyes (75.67%), and hydrophilic foldable IOLs in 3 eyes (8.12%). A study conducted by Mahmoud Reza et al in 2009 found that hydrophilic acrylic IOLs compared well with PMMA IOLs, in children who underwent lens removal with PPC and AV. They also developed fewer complications, with good clarity of visual axis.[12] Given limited data, our study could not conclusively associate the material of the IOL with the development of complications.

20 eyes (33.33%) developed complications post-operatively, 50% of which occurred within 3 months of surgery, and the rest after 3 months of surgery. 10 eyes (16.67%) developed posterior capsular opacification (PCO), 5 (8.33%) developed uveitis, 1 (1.67%) developed glaucoma, 3 (5%) developed both uveitis and PCO, and 1 (1.67%) had both PCO and glaucoma. This is like the findings by Khanna RC et al., where PCO was also the most common complication following surgery in 27.4% of eyes.[13] Gogate PM et al., had PCO in 63.2% of patients.[8] This would suggest that PCO is a significant cause of postoperative visual morbidity requiring long-term follow-up of these patients. Despite the younger age of most children in our study, glaucoma was seen in only 3 eyes out of 79 eyes. On the contrary, in the IATS, 10 of the 114 eyes had developed glaucoma by the end of one year.[14]

The SRK-T formula was used to calculate the IOL power in our study. No refractive surprises were found but there could be bias as we could not record vision in 36 of the 79 eyes. In a study published by Vasavada et al in 2016, where a comparison was made of the accuracy of modern intraocular lens (IOL) power calculation formulae in pediatric eyes. They found that SRK/T and the Holladay 2 formulae had the least prediction error.[12] In the Infant Aphakia Treatment Study, the Holladay 1 formula was used to calculate IOL power. Infants aged less than 4-6 weeks were under-corrected by 8 D, and those more than 6 weeks were under-corrected by 6 D.[7] In this study, we followed the rule of 7 by Enyedi et al.[15]

Our study has performed analysis on pediatric IOL implantation, which is seldom assessed below the age of 3 years. Our data was insufficient to analyse any

association between the age of the child at surgery and the development of complications and between the type of optical rehabilitation and the development of complications or the necessity of secondary procedures.

5. Conclusion

Our study concluded that lens aspiration with primary posterior capsulotomy, anterior vitrectomy, and peripheral iridectomy, with or without IOL implantation is a safe procedure, associated with the least complications and improved post-operative visual outcome. Posterior capsular opacification is the most common post-operative complication that develops in these patients.

Our findings align with previous studies regarding the demographics of pediatric cataract patients and the prevalence of complications such as PCO. The timing of surgery and choice of optical correction play crucial roles in visual outcomes. Despite advancements in surgical techniques and IOL materials, complications still occur, emphasizing the need for long-term follow-up in these patients.

6. Limitations

The study's limitations include a small sample size and variations in surgical techniques among different surgeons, limiting the generalizability of the findings. Further research with larger sample sizes and standardized procedures is warranted to validate these results.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Pai VH, Trivedi D, Shetty SS. Outcome of cataract surgery in patients less than three years of age. *Indian J Clin Exp Ophthalmol* 2025;11(1):128-131.