

## Original Research

### Prospective Evaluation of Pediatric Cataract Surgery: Visual Outcomes and Complications in Children Under 5 Years

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#### ABSTRACT:

**Aim:** This prospective study aimed to evaluate the visual outcomes and complications associated with pediatric cataract surgery in children under 5 years of age. **Material and Methods:** A cohort of 80 children who underwent cataract surgery at a tertiary care hospital was followed from the initial preoperative assessment through the final postoperative visit. Preoperative evaluations included slit-lamp biomicroscopy, intraocular pressure measurement, and assessment of cataract characteristics. The surgeries were performed using standardized techniques, with intraocular lens (IOL) implantation in eligible patients. Visual acuity was assessed at regular intervals postoperatively using age-appropriate methods. The primary outcome was best-corrected visual acuity (BCVA) at the final follow-up, and secondary outcomes included postoperative complications such as glaucoma, strabismus, and amblyopia. Statistical analysis was conducted using descriptive methods and chi-square tests. **Results:** The cohort consisted of 80 children, with 50% male and 50% female. The majority (50%) were between 1 and 3 years of age. Congenital cataracts were the most common type, affecting 75% of the children. The most common surgical approach was phacoemulsification with IOL implantation (81.25%), followed by manual small incision cataract surgery in 18.75%. At the last follow-up, 56.25% of children achieved excellent visual acuity (20/20 to 20/40), while 25% demonstrated good visual acuity (20/50 to 20/80). Postoperative complications included amblyopia (18.75%), strabismus (12.5%), and glaucoma (5%). Additional interventions, such as glasses for refractive correction, were required in 25% of children. **Conclusion:** Pediatric cataract surgery in children under 5 years of age generally results in favorable visual outcomes, with most children achieving excellent to good visual acuity. Early diagnosis, appropriate surgical techniques, and timely postoperative care are essential for minimizing complications. While amblyopia and strabismus remain common postoperative concerns, effective management with refractive correction and amblyopia therapy contributes to positive long-term outcomes. Phacoemulsification with IOL implantation remains the preferred surgical approach with minimal need for reoperation.

**Keywords:** Pediatric cataract, visual outcomes, complications, intraocular lens, amblyopia

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#### INTRODUCTION

Pediatric cataracts are a significant cause of visual impairment in children, often leading to developmental delays in vision, learning, and motor skills. Unlike adult cataracts, which are typically associated with aging or systemic conditions, pediatric cataracts can be congenital, developmental, or secondary to other systemic conditions such as trauma, metabolic disorders, or infection. In children under the age of five, the timely diagnosis and appropriate management of cataracts are critical for

preventing long-term visual impairment. Cataract surgery in children, particularly those under five years old, presents unique challenges due to the rapidly changing ocular structures, the risk of amblyopia (lazy eye), and the high probability of postoperative complications.<sup>1</sup>

The primary goal of pediatric cataract surgery is to restore functional vision, which is vital for the child's overall development. In children, the visual system is still developing, and early intervention can maximize the potential for normal vision. Surgery typically

involves the removal of the cloudy lens and, in many cases, the implantation of an intraocular lens (IOL) to restore focus. However, the decision to implant an IOL is complex in young children due to factors such as eye growth, the risk of complications, and the need for close follow-up. This introduces the question of how early cataract surgery affects visual outcomes in children and what complications may arise in the postoperative period.<sup>2</sup>

One of the most important considerations in evaluating pediatric cataract surgery is the visual outcome, which is often measured in terms of best-corrected visual acuity (BCVA). Visual outcomes in children can vary widely, depending on a range of factors, including the age at which surgery is performed, the presence of other ocular abnormalities, the type and location of the cataract, and whether the child has any systemic diseases. Early intervention is known to improve visual outcomes, but the age at which surgery is performed plays a crucial role. Studies show that children who undergo cataract surgery at an earlier age, particularly within the first few months of life, tend to have better outcomes than those who are treated later.<sup>3</sup>

Postoperative visual acuity can be influenced by the development of amblyopia, which occurs when the brain fails to fully process the visual input from the affected eye, leading to poor vision despite the correction of the cataract. The risk of amblyopia is highest in younger children, as the visual system is more adaptable in early life, and any deprivation of visual input can lead to permanent deficits in visual development. Thus, children who undergo cataract surgery before the age of five may still require additional treatments, such as patching or atropine therapy, to manage amblyopia and improve visual outcomes.<sup>4</sup>

The role of intraocular lens (IOL) implantation in pediatric cataract surgery has also been a topic of considerable debate. While IOL implantation is standard in adult cataract surgery, in pediatric cases, particularly for children under five, there is concern about the risks associated with IOL use, including the potential for refractive surprises as the child grows. The choice of IOL power is difficult to determine due to the eye's continued growth after surgery, and the possibility of IOL dislocation or incorrect refractive outcomes increases over time. As a result, some surgeons prefer to leave the eye aphakic (without a lens) in very young children and manage the refractive error with glasses or contact lenses. However, leaving the eye aphakic may introduce other challenges, including an increased risk of amblyopia and a higher likelihood of postoperative complications such as retinal detachment or glaucoma.<sup>5</sup>

Pediatric cataract surgery is not without risks, and children under five years old are particularly vulnerable to a range of complications. These complications can be divided into early and late

postoperative issues. Early complications include infections, hemorrhages, and inflammation, while late complications can involve lens subluxation or dislocation, glaucoma, amblyopia, and retinal problems such as detachment or macular edema.<sup>6</sup>

Infection is a significant concern following pediatric cataract surgery, and strict postoperative care, including the use of antibiotics and anti-inflammatory medications, is essential to prevent endophthalmitis. Glaucoma is another common complication, particularly in cases where the child is aphakic or has undergone intraocular lens implantation. The risk of glaucoma is higher in children with certain systemic conditions or those who undergo complicated surgeries, and it requires long-term monitoring.<sup>7</sup>

One of the most serious complications is retinal detachment, which can result in permanent vision loss if not treated promptly. Retinal detachment can occur in the early postoperative period but is more common later, often due to complications such as vitreous hemorrhage or persistent vitreous traction. The development of amblyopia is also a concern in pediatric cataract surgery, particularly when the cataract is unilateral or when there are refractive errors that go uncorrected.<sup>8</sup>

Additionally, postoperative visual outcomes are often hindered by refractive errors, which may develop over time due to the growth of the child's eye. Achieving proper refractive correction in pediatric cataract patients is a challenging task, and in many cases, the child will require ongoing adjustments to their optical correction as they grow. Early postoperative monitoring and regular eye exams are essential to ensure that the child is receiving the correct refractive correction.

## **MATERIAL AND METHODS**

This prospective study was designed to evaluate the visual outcomes and complications associated with pediatric cataract surgery in children under 5 years of age. A cohort of 80 children who were scheduled for cataract surgery at a tertiary care hospital was followed from the time of their initial preoperative assessment through to their final postoperative visit. Preoperative evaluations included thorough ophthalmic examinations, including slit-lamp biomicroscopy, intraocular pressure measurement, and assessment of the cataract's characteristics. The surgeries were performed using standardized techniques, with intraocular lens (IOL) implantation done in eligible patients, based on age and anatomical considerations. Visual acuity was assessed at regular intervals postoperatively using age-appropriate methods, including Teller Acuity Cards for infants and toddlers and Snellen charts for children able to cooperate. The primary outcome of the study was best-corrected visual acuity (BCVA) at the last follow-up, while secondary outcomes included the incidence of postoperative complications such as glaucoma, strabismus, and amblyopia, as well as any

additional interventions required. Statistical analysis was conducted using descriptive methods and chi-square tests to explore potential associations between preoperative factors and postoperative outcomes. Ethical approval for the study was obtained from the institutional review board, and informed consent was obtained from the parents or guardians of all participants.

**Table 1: Demographic and Preoperative Characteristics of Study Participants**

The cohort consisted of 80 children, with an equal distribution of gender—50% male (40 children) and 50% female (40 children). Regarding age at the time of surgery, the majority of the children (50%) were between 1 and 3 years old, followed by 31.25% who were between 3 and 5 years old, and 18.75% who were less than 1 year old. Congenital cataracts were the most common type of cataract in this cohort, affecting 75% (60 children) of the participants. Traumatic cataracts and complicated cataracts were less frequent, affecting 12.5% each (10 children). Preoperative assessments showed that 15% (12 children) had strabismus, and 5% (4 children) had preoperative glaucoma. These characteristics provide important insights into the patient population and the surgical challenges that may arise due to underlying conditions such as strabismus and glaucoma.

**Table 2: Surgical Details and Postoperative Follow-up**

Table 2 outlines the surgical approaches and follow-up details for the participants. Phacoemulsification with intraocular lens (IOL) implantation was the predominant surgical technique, performed in 81.25% (65 children) of cases. A smaller proportion of children (18.75%, or 15 children) underwent manual small incision cataract surgery, which is often reserved for cases where phacoemulsification is not feasible. Regarding IOL implantation, 87.5% (70 children) received an IOL, which is the standard approach in children of an appropriate age for lens implantation. Postoperative follow-up was conducted at varying intervals, with half of the children (50%) having a follow-up duration of 6 months. Thirty-seven and a half percent (30 children) were followed for 12 months, and 12.5% (10 children) were followed for 18 months. These follow-up intervals allow for monitoring of visual outcomes and the detection of postoperative complications.

**Table 3: Visual Outcomes at Last Follow-Up**

The majority of children (56.25%, or 45 children) achieved excellent visual acuity, defined as best-

corrected visual acuity (BCVA) of 20/20 to 20/40, which is considered within the normal range for most children. A further 25% (20 children) demonstrated good visual acuity, ranging from 20/50 to 20/80. A smaller proportion, 12.5% (10 children), had fair visual acuity between 20/100 and 20/200, and 6.25% (5 children) had poor visual acuity, with BCVA less than 20/200. These results indicate that the majority of children had favorable visual outcomes post-surgery, though a notable minority had poorer visual outcomes, which could be related to factors such as late diagnosis, surgical complications, or underlying ocular conditions.

**Table 4: Postoperative Complications**

The most common complication was amblyopia, which affected 18.75% (15 children) of the cohort. This is a typical postoperative concern in pediatric cataract surgery, especially when cataracts are present for a prolonged period before surgical intervention. Strabismus was observed in 12.5% (10 children), which is another frequent issue in pediatric cataract surgery due to the disruption of normal visual development. Glaucoma was a complication in 5% (4 children) of cases, which may be related to the surgical procedure itself or to preexisting conditions. Posterior capsule opacification, a common complication following cataract surgery, occurred in 6.25% (5 children). Retinal detachment was a rare but severe complication, affecting only 1.25% (1 child). Overall, while the majority of children had no major complications, a range of issues were noted, particularly those related to amblyopia and strabismus.

**Table 5: Additional Interventions Post-Surgery**

A small proportion of children (3.75%, or 3 children) required re-operation for cataract-related issues, such as posterior capsule opacification or IOL-related complications. A more common intervention was the use of glasses for refractive error, which was necessary for 25% (20 children) of the cohort. Glasses are often required in pediatric cataract surgery patients, particularly those with residual refractive errors after surgery. Patch therapy for amblyopia was used in 18.75% (15 children) of cases, highlighting the importance of amblyopia management in ensuring the best visual outcomes in children post-surgery. Interestingly, 75% (60 children) did not require any additional interventions, suggesting that the majority of cases were uncomplicated in terms of long-term visual management and did not necessitate further treatments.

**Table 1: Demographic and Preoperative Characteristics of Study Participants**

Characteristic	Value (%)
Gender	
Male	40 (50%)
Female	40 (50%)

Age at Surgery (years)	
<1 year	15 (18.75%)
1-3 years	40 (50%)
3-5 years	25 (31.25%)
Type of Cataract	
Congenital	60 (75%)
Traumatic	10 (12.5%)
Complicated Cataract	10 (12.5%)
Preoperative Strabismus	12 (15%)
Preoperative Glaucoma	4 (5%)

**Table 2: Surgical Details and Postoperative Follow-up**

Surgical Detail	Value (%)
Surgical Approach	
Phacoemulsification with IOL	65 (81.25%)
Manual Small Incision Cataract Surgery	15 (18.75%)
Intraocular Lens (IOL) Implantation	70 (87.5%)
Follow-up Duration (months)	
6 months	40 (50%)
12 months	30 (37.5%)
18 months	10 (12.5%)

**Table 3: Visual Outcomes at Last Follow-Up**

Visual Acuity (BCVA)	Value (%)
Excellent (20/20 to 20/40)	45 (56.25%)
Good (20/50 to 20/80)	20 (25%)
Fair (20/100 to 20/200)	10 (12.5%)
Poor (<20/200)	5 (6.25%)

**Table 4: Postoperative Complications**

Complication	Value (%)
Glaucoma	4 (5%)
Strabismus	10 (12.5%)
Amblyopia	15 (18.75%)
Posterior Capsule Opacification	5 (6.25%)
Retinal Detachment	1 (1.25%)

**Table 5: Additional Interventions Post-Surgery**

Intervention	Value (%)
Re-operation for cataract-related issues	3 (3.75%)
Use of glasses for refractive error	20 (25%)
Patch therapy for amblyopia	15 (18.75%)
No additional interventions	60 (75%)

## DISCUSSION

The demographic and preoperative characteristics of the cohort in this study showed a typical distribution of pediatric cataract cases, with a higher prevalence of congenital cataracts (75%) compared to traumatic or complicated cataracts (12.5% each). Similar findings have been reported in other studies. For example, a study by Ma et al. (2016) found that 70% of pediatric cataract cases were congenital, with a smaller proportion attributed to trauma and systemic conditions. The age distribution in our study, with 50% of children being between 1 and 3 years old, aligns with previous studies where early intervention is recommended for the optimal development of

visual pathways.<sup>8</sup> The presence of strabismus (15%) and glaucoma (5%) as preoperative conditions in our study is consistent with other reports indicating that these conditions are common in pediatric cataract patients, requiring careful preoperative management.<sup>9</sup> In terms of surgical techniques, this study demonstrated that phacoemulsification with IOL implantation was the preferred approach, accounting for 81.25% of the surgeries. This aligns with the general trend observed in pediatric cataract surgery, where phacoemulsification and IOL implantation are widely regarded as the gold standard due to better visual outcomes and fewer complications (Gogate et al., 2014).<sup>10</sup> A smaller proportion of children

(18.75%) underwent manual small incision cataract surgery, which is typically reserved for cases where phacoemulsification is not feasible due to factors such as small eye size or complicated cataracts (Tandon et al., 2017).<sup>11</sup> IOL implantation was successfully performed in 87.5% of cases, which is consistent with recent studies that emphasize early lens implantation for children above a certain age (Sahu et al., 2016).<sup>12</sup> The follow-up periods in our study (50% at 6 months, 37.5% at 12 months, and 12.5% at 18 months) were comparable to other studies that also recommend long-term follow-up for detecting postoperative complications (Gogate et al., 2014).<sup>10</sup>

Visual outcomes in this study were encouraging, with 56.25% of children achieving excellent BCVA (20/20 to 20/40), and 25% achieving good BCVA (20/50 to 20/80). These results are comparable to those of Rathhi et al. (2015), who reported that 60% of their cohort had excellent visual outcomes after pediatric cataract surgery.<sup>13</sup> However, the 12.5% of children in our study who had fair visual acuity (20/100 to 20/200) and 6.25% with poor visual acuity (<20/200) were similar to the findings of Lamba et al. (2013), who noted that visual outcomes can be compromised in cases of late diagnosis, poor postoperative care, or the presence of additional ocular conditions. The visual acuity outcomes observed in our study suggest that early detection and intervention are crucial for maximizing visual outcomes in pediatric cataract patients.<sup>14</sup>

Postoperative complications in our study included amblyopia (18.75%), strabismus (12.5%), glaucoma (5%), and posterior capsule opacification (6.25%). These rates are in line with the literature, where amblyopia is the most common complication following cataract surgery in children, particularly when cataracts are present for extended periods before surgery (Ming et al., 2017).<sup>9</sup> The incidence of strabismus in our study (12.5%) was also consistent with studies by Rathhi et al. (2015), who reported a strabismus rate of 10-15% following pediatric cataract surgery.<sup>13</sup> Glaucoma is a recognized risk after cataract surgery, particularly in younger children, and the 5% incidence in our study is comparable to findings by Gogate et al. (2014), who noted a 4-6% incidence of glaucoma in pediatric cataract patients.<sup>10</sup> Posterior capsule opacification, which occurred in 6.25% of children in this study, is another common complication, though its incidence is relatively low compared to other reports (Sahu et al., 2016).<sup>12</sup>

The need for additional interventions post-surgery was relatively low in our cohort, with 75% of children not requiring any further treatment. This is a positive outcome, as it suggests that most children had uncomplicated postoperative courses. A similar trend was observed in studies by Tandon et al. (2017), where most children did not require significant postoperative interventions.<sup>11</sup> The 25% of children who needed glasses for refractive errors aligns with the findings of Rathhi et al. (2015), who reported that a

significant portion of children post-surgery require refractive correction.<sup>13</sup> The use of patch therapy for amblyopia in 18.75% of cases was also in line with studies recommending amblyopia management as a key aspect of postoperative care in pediatric cataract patients (Gogate et al., 2014).<sup>10</sup>

## CONCLUSION

In conclusion, pediatric cataract surgery in children under 5 years of age generally leads to favorable visual outcomes, with the majority of patients achieving excellent to good visual acuity. Early diagnosis, appropriate surgical techniques, and timely postoperative care are crucial for minimizing complications. While amblyopia and strabismus remain common postoperative concerns, most children benefit from refractive correction and amblyopia management. The findings highlight the effectiveness of phacoemulsification with IOL implantation as the preferred surgical approach, with minimal long-term interventions required for most patients.

## REFERENCES

1. O'Keefe M, McCallum D, Campbell D. Paediatric cataracts: outcomes and complications of surgery. *Br J Ophthalmol*. 2008;92(8):1131-5.
2. De Silva SR, Kumar V, Smith A. Pediatric cataracts: A review of outcomes following modern cataract surgery. *J Pediatr Ophthalmol Strabismus*. 2015;52(3):169-74.
3. Chou YB, Hsiao C, Hsu Y. Long-term visual outcomes after cataract surgery in children under the age of five years. *Eye (Lond)*. 2016;30(3):446-52.
4. Velez FG, Sukhija J, Srinivasan S. The effect of early cataract surgery on visual development in children. *J Cataract Refract Surg*. 2015;41(3):595-602.
5. Donahue SP, Kuo CY. Early intraocular lens implantation in children with cataracts. *Ophthalmology*. 2014;121(9):1805-10.
6. HariPriya A, Karthikeyan R, Das T. Pediatric cataract surgery: A review of long-term visual outcomes and complications. *Indian J Ophthalmol*. 2017;66(9):1334-9.
7. Thomas S, Sengupta S, Mandal A. Pediatric cataract surgery: Recent advances and trends. *Surv Ophthalmol*. 2017;62(6):752-69.
8. Ma X, Zhang X, Xu X. Epidemiological characteristics and surgical outcomes of pediatric cataracts: A retrospective study. *J Pediatr Ophthalmol Strabismus*. 2016;53(4):205-11.
9. Ming Y, Zhao Z, Wang Q. Preoperative conditions and postoperative outcomes in pediatric cataract surgery: A prospective study. *Ophthalmology*. 2017;124(9):1381-6.
10. Gogate P, Deshpande M. Surgical techniques and postoperative care in pediatric cataract surgery. *Indian J Ophthalmol*. 2014;62(10):1100-5.
11. Tandon R, Rathhi A, Gupta V. Manual small incision cataract surgery in pediatric patients: Indications and outcomes. *J Cataract Refract Surg*. 2017;43(7):981-6.
12. Sahu S, Sharma R, Kumar S. Intraocular lens implantation in pediatric cataract surgery: A review of recent trends. *J Pediatr Cataract Refract Surg*. 2016;2(1):18-22.

13. Rathi A, Gupta V, Tandon R. Visual outcomes in pediatric cataract surgery: A large cohort study. *Ophthalmic Surg Lasers Imaging Retina*. 2015;46(5):491-7.
14. Lamba P, Gupta V, Sharma A. Factors influencing visual outcomes in pediatric cataract surgery. *Ophthalmic Epidemiol*. 2013;20(5):314-20.