



# Strabismus Accompanying Pediatric Cataracts and the Effect of Cataract Surgery on Strabismus

© Gülsüm Genç Bozhöyük<sup>1</sup>, © Nigar Rustamlı<sup>2</sup>, © Pınar Bingöl Kızıltunç<sup>3</sup>, © Huban Atilla<sup>3</sup>

<sup>1</sup>Tatvan State Hospital, Clinic of Ophthalmology, Bitlis, Türkiye

<sup>2</sup>Maya Göz Hospital, Ankara, Türkiye

<sup>3</sup>Ankara University Faculty of Medicine Department of Ophthalmology, Ankara, Türkiye

## Abstract

**Objectives:** To examine the characteristics of preoperative strabismus, the impact of surgical treatment on existing strabismus, and the features of strabismus developing postoperatively in pediatric cataract patients.

**Materials and Methods:** The records of patients who underwent surgery for pediatric cataract and had at least 1 year of follow-up were reviewed. Preoperative strabismus types, changes in strabismus after surgery, and the characteristics of postoperative new-onset strabismus were examined.

**Results:** Seventy-seven pediatric cataract surgery patients were evaluated, 58 (75.3%) with congenital cataract and 19 (24.7%) with acquired cataract. The mean follow-up duration was 63 months (range: 13-185 months). Cataracts were bilateral in 39 patients and unilateral in 38 patients. Strabismus was present preoperatively in 21% of unilateral cases and 20.5% of bilateral cases. In unilateral cases, 50% had esotropia (ET) and 50% had exotropia, while in bilateral cases, these rates were 75% and 25%, respectively. Orthotropia was achieved postoperatively for at least for 1 year of follow-up in 25% of patients with preoperative deviation, all of whom had ET. Twenty-nine (47.5%) of 61 patients who had no deviation preoperatively developed strabismus postoperatively. The rate of new-onset postoperative strabismus in patients with unilateral cataract was 91.6% for those operated before 1 year of age and 38.5% in those operated after the age of 1 year ( $p=0.001$ ). For bilateral cases, these rates were 50% and 22.2%, respectively ( $p=0.155$ ).

**Conclusion:** Strabismus development is commonly observed in pediatric cataracts. While preoperative strabismus may resolve after

surgery, postoperative rates remain high, especially in unilateral cases operated before 1 year of age. When managing pediatric cataracts, it is important to carefully evaluate not only for deprivation amblyopia but also strabismic amblyopia. Long-term systematic follow-up after cataract surgery is essential for optimal visual outcomes

**Keywords:** Exotropia, esotropia, cataract surgery, pediatric cataract

## Introduction

Pediatric cataracts are one of the leading causes of treatable vision loss in childhood.<sup>1,2</sup> In addition to reducing vision, they also inhibit normal visual development, resulting in the development of strabismus, amblyopia, or nystagmus. While the incidence of strabismus in the general population ranges from 2-5%, it is more common in children who undergo cataract surgery, with reported rates ranging from 20.5% to 86%.<sup>3,4,5,6,7,8,9</sup> Concomitant strabismus is one of the main obstacles to achieving isometropia and binocular vision after successful cataract surgery.

The aim of this study was to examine the characteristics of preoperative concomitant strabismus, the effect of cataract surgery on existing strabismus, and its relationship with new-onset postoperative strabismus in pediatric cataract patients.

## Materials and Methods

The medical records of patients who underwent surgery for pediatric cataract in the pediatric ophthalmology and strabismus unit of our clinic between 2000 and 2021 were examined retrospectively.

Children under 10 years of age who underwent surgery for unilateral or bilateral cataract and were followed up for at least 1 year were included in the study. Patients with traumatic cataract were excluded from the study, but those with a history of preterm birth and those with isolated ocular diseases such as persistent fetal vasculature were included. All surgeries were performed by the same surgeon (H.A.) using the same technique

**Cite this article as:** Genç Bozhöyük G, Rustamlı N, Bingöl Kızıltunç P, Atilla H. Strabismus Accompanying Pediatric Cataracts and the Effect of Cataract Surgery on Strabismus. *Turk J Ophthalmol.* 2025;55:24-28

Address for Correspondence: Gülsüm Genç Bozhöyük, Tatvan State Hospital, Clinic of Ophthalmology, Bitlis, Türkiye

E-mail: gulsumgenç91@gmail.com ORCID-ID: orcid.org/0000-0002-3989-0720

Received: 04.09.2024 Accepted: 11.01.2025

DOI: 10.4274/tjo.galenos.2025.63060



(phacoemulsification/lens aspiration + posterior capsulotomy + anterior vitrectomy ± peripheral iridectomy ± intraocular lens implantation).

The patients' age, sex, follow-up period, laterality of cataract, type of cataract, preoperative and postoperative vision in evaluable cases, anterior segment and fundus examination findings, age at cataract surgery, presence and type of strabismus preoperatively and postoperatively, and intraocular lens implantation status were recorded from their records. In addition to total cataract, partial cataract was defined as nuclear, posterior subcapsular, and posterior polar cataract obscuring the optic axis and requiring surgery. Angle of deviation was measured with the Krimsky test in non-cooperative and very young patients and with the cover test and prism alternating cover test from a distance of 6 meters for far and 30 cm for near vision in the other patients. Changes in the patients' preoperative deviations and the characteristics of new-onset postoperative strabismus were evaluated.

This study was conducted in accordance with the principles of the Helsinki Declaration and ethics committee approval was obtained from the Ankara University Faculty of Medicine Ethics Committee (dated: 21/11/2023, decision no: İ10-712-23). Necessary permissions and informed consent forms were obtained from the patients' parents or legal guardians for the use of their information and images for scientific purposes.

#### Statistical Analysis

Mann-Whitney U test, Wilcoxon test, Pearson chi-square test, and Fisher exact test were used for statistical analysis. The cases with a p value <0.05 were considered statistically significant.

#### Results

The study included 77 patients who underwent surgery for pediatric cataract. Of these, 58 (75.3%) had congenital cataract and 19 (24.7%) had acquired cataract. The mean follow-up period was 63 months (range, 13-185 months). Forty-eight (62.3%) of the patients were male and 29 (37.7%) were female. Cataracts were bilateral in 39 patients (50.6%) and unilateral in 38 patients (49.3%). The mean age at surgery was 36.8 months (range, 1.5-120 months). Cataract surgery was performed at or before 1 year of age in 47 patients (61%), between 1 and 4 years of age in 16 patients (20.8%), and after 4 years of age in 14 patients (18.2%). All 58 (75.3%) patients with congenital cataract underwent cataract surgery before 3 years of age. Preoperatively, strabismus was observed in 16 patients (20.8%), while 61 patients (79.2%) did not have strabismus. The demographic data of patients with and without strabismus before cataract surgery are shown in [Table 1](#). A total of 52 patients (67.5%) underwent intraocular lens implantation and 25 (32.5%) remained aphakic. Strabismus surgery was performed in 20 patients with an angle of deviation greater than 20 prism diopters, those with a fixation preference, or had suppression detected on Worth 4-dot test or stereopsis test.

Strabismus was present preoperatively in 8 patients (21%) with unilateral cataract and 8 patients (20.5%) with bilateral

cataract. Of these unilateral cases, 50% had esotropia (ET) and 50% had exotropia (XT). Among the bilateral cases, these rates were 75% and 25%, respectively. Of the total 16 patients with preoperative strabismus, 4 (25%) exhibited orthotropia sufficient to eliminate the need for strabismus surgery after cataract surgery. One (6.25%) of these patients had unilateral cataract, 3 (18.75%) had bilateral cataracts, and all patients with orthotropia had ET as the preoperative deviation. Among the 12 patients (75%) who did not achieve orthotropia, there was no postoperative change in the preoperative deviation type.

Strabismus was observed postoperatively in 41 patients (53.2%). New-onset strabismus occurred postoperatively in 29 (47.5%) of the 61 patients with no deviation before cataract surgery. Preoperative and postoperative clinical characteristics are shown for all patients included in the study in [Table 2](#) and for those who did not have strabismus preoperatively and developed strabismus postoperatively in [Table 3](#).

The relationship between cataract laterality and age at surgery among the 29 patients who did not have preoperative strabismus and developed strabismus after cataract surgery is evaluated in [Table 4](#). Strabismus developed in 91.6% of 12 unilateral cases who underwent cataract surgery before the age of 1 year, while this rate was 38.5% among the 18 patients who underwent cataract surgery after the age of 1 year. In bilateral cases, strabismus developed in 50% of 22 cases operated before 1 year of age and 22.2% of 9 patients operated after 1 year of age. When patients with unilateral cataract and those with bilateral cataract were compared amongst themselves according to the timing of surgery, the development of new-onset strabismus was more common in unilateral cataract when surgery was performed in the first year of life ( $p=0.001$ ), while there was no significant relationship between surgical timing and strabismus development in bilateral cases ( $p=0.155$ ).

#### Discussion

Our study showed that 47.5% of pediatric cataract patients developed postoperative new-onset strabismus after cataract surgery, but strabismus present before surgical treatment could be corrected after cataract surgery in 25% of patients. Analysis of the relationship between surgical timing and postoperative strabismus development revealed no relationship in bilateral cases, whereas in unilateral cases, the frequency of strabismus increased in patients who underwent cataract surgery within the first year of life. ET was observed to be more common in bilateral cases both preoperatively and postoperatively. However, despite nearly equal numbers of unilateral and bilateral cases and preoperative strabismus rates, the prevalence of strabismus postoperatively was markedly higher in unilateral cases postoperatively (60.5% vs. 47.4%).

It is known that strabismus frequently accompanies pediatric cataract. In the literature, the frequency of this association ranges from 20.5% to 86%.<sup>5,6,7,8,9</sup> In our study, this rate was found to be 20.8%, which is among the lower values in the literature data. The lower rate of strabismus in our study may be explained by

**Table 1. Examination of demographic data and cataract characteristics in patients with and without preoperative strabismus**

	Preoperative strabismus	No preoperative strabismus	Total
<b>Patients, n (%)</b>	16 (20.8)	61 (79.2)	77 (100)
<b>Sex F/M, n (%)</b>	5 (6.5)/11 (14.3)	24 (31.2)/37 (48)	29 (37.7)/48 (62.3)
<b>Mean age at diagnosis months (range)</b>	8.2 (3-29)	8.5 (1-36)	8.4 (1-36)
<b>Mean follow-up time months (range)</b>	77.9 (13-149)	59.1 (13-185)	63 (13-185)
<b>Cataract type, n (%)</b>			
Congenital	13 (16.9)	45 (58.4)	58 (75.3)
Acquired	3 (3.9)	16 (20.8)	19 (24.7)
<b>Cataract laterality, n (%)</b>			
Unilateral	8 (21)	30 (79)	38 (49.4)
Bilateral	8 (20.5)	31(79.5)	39 (50.6)
<b>Extent of cataract, n (%)</b>			
Total	4 (16)	21(84)	25 (32.5)
Partial	12 (23.1)	40 (76.9)	52 (67.5)
Nystagmus	5 (29.4)	12 (70.6)	17 (22.1)

n: Number of patients, F: Female, M: Male

**Table 2. Preoperative and postoperative clinical characteristics of all patients in the study**

	Number of patients n (%)	Frequency of strabismus n (%)	Strabismus type n (%)
<b>Preoperative cataract laterality</b>	77 (100)	16 (20.8)	
Unilateral	38 (49.4)	8 (21)	4 (50) ET, 4 (50) XT
Bilateral	39 (50.6)	8 (20.5)	6 (75) ET, 2 (25) XT
<b>Postoperative cataract laterality</b>	77 (100)	41 (53.2)	
Unilateral	38 (49.4)	23 (60.5)	11 (47.8) ET, 12 (52.2) XT
Bilateral	39 (50.6)	18 (47.4)	12 (66.7) ET, 6 (33.3) XT

n: Number of patients, ET: Esotropia, XT: Exotropia

**Table 3. Clinical characteristics of patients without preoperative strabismus who developed strabismus postoperatively**

	Number of patients n (%)	Frequency of strabismus n (%)	Strabismus type n (%)
<b>Cataract laterality</b>	61 (100)	29 (47.5)	
Unilateral	30 (49.1)	16 (53.3)	8 (50) ET, 8 (50) XT
Bilateral	31 (50.2)	13 (41.9)	9 (69.2) ET, 4 (30.8) XT

n: Number of patients, ET: Esotropia, XT: Exotropia

**Table 4. Relationship between cataract laterality and timing of surgery in patients without preoperative strabismus who developed strabismus after cataract surgery (n=29)**

	Frequency of strabismus		p
	≤1 year	>1 year	
<b>Cataract laterality</b>			
Unilateral	11/12 (91.6%)	5/18 (38.5%)	<b>0.001</b>
Bilateral	11/22 (50%)	2/9 (22%)	0.155

the low mean age at surgery and the difficulty in identifying and measuring the angle of preoperative deviations in affected patients due to cataract.

Studies evaluating the frequency of preoperative strabismus separately in unilateral and bilateral cataract have yielded strikingly different results.<sup>10,11,12</sup> Tartarella et al.<sup>10</sup> reported the prevalence of preoperative strabismus as 47.3% in bilateral and 52.7% in unilateral cases. In contrast, Awner et al.<sup>11</sup> determined the frequency of preoperative strabismus to be 29% in unilateral cases, while O'Keefe et al.<sup>12</sup> reported this rate as 30% in bilateral cases. Although these studies indicated that strabismus was more common in unilateral than bilateral pediatric cataract, Kong et al.<sup>13</sup> reported that their rates were similar. In our study, the frequency of strabismus did not differ between unilateral and bilateral cases, as in the study by Kong et al.<sup>13</sup>

In terms of the relationship between cataract laterality and the frequency of strabismus development after cataract surgery, there are many different studies in the literature.<sup>6,9,11,14,15</sup> The incidence of postoperative new-onset strabismus in unilateral cataract was reported as 60.7% by Bothun et al.<sup>14</sup> and 75% by Lambert et al.<sup>6</sup> In bilateral cataract, the frequency of postoperative strabismus was reported by Lee and Kim<sup>9</sup> as 17.2% and by Park et al.<sup>15</sup> as 55.4%. In our study, this rate was found to be 53.3% in unilateral cases and 41.9% in bilateral cases. Differences between studies may be related to the characteristics of the selected patient group. Factors such as age at cataract diagnosis, age at cataract surgery, cataract type and laterality, and surgical technique are thought to impact the incidence of strabismus.

Several studies have also reported different results regarding the type of strabismus seen in pediatric cataracts.<sup>7,8,14,15,16,17,18,19</sup> Demirkilinc Biler et al.<sup>16</sup> found that ET was more common in postoperative follow-up in both unilateral (66.7%) and bilateral (68.6%) congenital cataract patients without strabismus in the preoperative period. Similarly, other studies also demonstrated that ET was more common in the presence of congenital cataracts.<sup>7,8,14,17,18</sup> France and Frank<sup>5</sup> reported that unilateral congenital cataract patients had approximately equal rates of ET and XT, whereas ET was more common in bilateral cases. On the other hand, Park et al.<sup>15</sup> and Weisberg et al.<sup>19</sup> reported that XT was more common than ET. In our study, both types of strabismus were observed at approximately equal rates preoperatively and postoperatively in unilateral cataract cases, while in bilateral cases, ET was observed more frequently, at rates of 75% preoperatively and 66.7% postoperatively. Spanou et al.<sup>17</sup> reported that ET was more common in congenital cases. As most of the cases in our study had congenital cataract, ET was found to be more common in bilateral patients. Ethnic characteristics may also be a factor in the higher incidence of ET.

Looking at the effect of pediatric cataract surgery on existing deviation, David et al.<sup>20</sup> reported that 32.3% of patients with strabismus before cataract surgery became orthotropic. Kong et al.<sup>13</sup> found that 72% of 54 pediatric cataract patients with strabismus at the time of diagnosis exhibited orthotropia after cataract surgery. In both studies, at least 1-year follow-up data were examined for both unilateral and bilateral pediatric cataract.

In our study, we observed that orthotropia was achieved for at least 1 year after surgery in 25% of the cases with strabismus preoperatively. In all patients with orthotropia, the deviation was ET. In cataract patients with strabismus at baseline, it is more appropriate to treat the cataract before strabismus and make decisions about strabismus surgery after cataract treatment.

Regarding the relationship between strabismus development and the timing of cataract surgery, most studies have shown that strabismus occurred more frequently in children who underwent early cataract surgery than late surgery.<sup>9,15,21,22</sup> David et al.<sup>20</sup> reported that age at surgery was the main risk factor for developing strabismus. In their study, strabismus developed in 80% of patients with unilateral cataract and 64.29% of bilateral patients who underwent surgery before 36 months of age. Park et al.<sup>15</sup> detected strabismus in 51.6% of bilateral cases operated before 12 months. In contrast, Magli et al.<sup>23</sup> reported that the age at cataract diagnosis and age at surgery were not significantly associated with strabismus. In our study, the prevalence of strabismus among patients who underwent surgery at or before 1 year of age was 91.6% among unilateral cases and 50% among bilateral cases. For patients operated after the age of 1 year, the prevalence of strabismus was lower, at 38.5% in unilateral cases and 22% in bilateral cases. The reason for this may be that patients operated earlier have greater cataract density, and the resulting deprivation has a more negative effect on binocular vision development. In addition, the higher rate of postoperative strabismus despite early surgery among cases operated at 1 year or earlier suggests that visual rehabilitation may not have been adequately implemented due to these patients' young age.

## Conclusion

As a result, strabismus development is common in pediatric cataract. Despite successful surgical treatment, strabismus occurs at a high rate in the postoperative period, especially in unilateral cases operated within the first year of life. This increases the risk of cataract-related deprivation amblyopia as well as strabismus-related suppression and amblyopia.

## Ethics

**Ethics Committee Approval:** This study was conducted in accordance with the principles of the Helsinki Declaration and ethics committee approval was obtained from the Ankara University Faculty of Medicine Ethics Committee (dated: 21/11/2023, decision no: İ10-712-23).

**Informed Consent:** Obtained.

## Declarations

### Authorship Contributions

Surgical and Medical Practices: H.A., Concept: G.G.B., N.R., P.B.K., H.A., Design: G.G.B., N.R., P.B.K., H.A., Data Collection or Processing: G.G.B., N.R., Analysis or Interpretation: G.G.B., N.R., P.B.K., H.A., Literature Search: G.G.B., Writing: G.G.B.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

## References

- Gilbert C, Foster A. Childhood blindness in the context of VISION 2020--the right to sight. *Bull World Health Organ.* 2001;79:227-232.
- Foster A, Gilbert C, Rahi J. Epidemiology of cataract in childhood: a global perspective. *J Cataract Refract Surg.* 1997;23(Suppl 1):601-604.
- Donnelly UM, Stewart NM, Hollinger M. Prevalence and outcomes of childhood visual disorders. *Ophthalmic Epidemiol.* 2005;12:243-250.
- Friedman DS, Repka MX, Katz J, Giordano L, Ibrionke J, Hawes P, Burkom D, Tielsch JM. Prevalence of decreased visual acuity among preschool-aged children in an american urban population: the baltimore pediatric eye disease study, methods, and results. *Ophthalmology.* 2008;115:1786-1795.
- France TD, Frank JW. The association of strabismus and aphakia in children. *J Pediatr Ophthalmol Strabismus.* 1984;21:223-226.
- Lambert S, Lynn M, Drews-Botsch C, Loupe D, Plager D, Medow N, Wilson ME, Buckley EG, Drack AV and Fawcett SL. A comparison of grating visual acuity, strabismus, and reoperation outcomes among children with aphakia and pseudoaphakia after unilateral cataract surgery during the first six months of life. *J AAPOS.* 2001;5:70-75.
- Lundvall A, Kugelberg U. Outcome after treatment of congenital bilateral cataract. *Acta Ophthalmol Scand.* 2002;80:593-597.
- Merino P, Gómez-de-Liaño P, Gil M, Fernandez A, Yanez C, Cortes C. Strabismus and congenital cataracts. *Arch Soc Esp Oftalmol.* 2007;82:623-628.
- Lee SJ, Kim WS. Factors associated with strabismus after cataract extraction and primary intraocular lens implantation in congenital cataracts. *Int J Ophthalmol.* 2014;7:522-527.
- Tartarella MB, Britez-Colombi GF, Milhomem S, Lopes MCE, Fortes Filho JB. Pediatric cataracts: clinical aspects, frequency of strabismus and chronological, etiological, and morphological features. *Arq Bras Oftalmol.* 2014;77:143-147.
- Awner S, Buckley EG, DeVaro JM, Seaber JH. Unilateral pseudophakia in children under 4 years. *J Pediatr Ophthalmol Strabismus.* 1996;33:230-236.
- O'Keefe M, Mulvihill A, Yeoh PL. Visual outcome and complications of bilateral intraocular lens implantation in children. *J Cataract Refract Surg.* 2000;26:1758-1764.
- Kong L, Shoss BL, Alvarez KA, Yen KG. Outcome of strabismus in children with cataracts. *Open J Ophthalmol.* 2013;3:122-126.
- Bothun ED, Cleveland J, Lynn MJ, Christiansen SP, Vanderveen DK, Neely DE, Kruger SJ, Lambert SE; Study, I. A. T. One-year strabismus outcomes in the infant aphakia treatment study. *Ophthalmology.* 2013;120:1227-1231.
- Park SH, Na JH, Shin SY. Strabismus following bilateral cataract surgery in childhood. *JPN J Ophthalmol.* 2010;54:272-277.
- Demirkilinc Biler E, Bozbiyik DI, Uretmen O, Kose S. Strabismus in infants following congenital cataract surgery. *Graefes Arch Clin Exp Ophthalmol.* 2015;253:1801-1807.
- Spanou N, Alexopoulos L, Manta G, Tsamadou D, Drakos H, Paikos P. Strabismus in pediatric lens disorders. *J Pediatr Ophthalmol Strabismus.* 2011;48:163-166.
- Çavdar S, Berk T, Kaynak S, Çingil G. Factors affecting visual prognosis in bilateral congenital cataracts. *Turkiye Klinikleri J Ophthalmol.* 1996;6:231-236.
- Weisberg OL, Sprunger DT, Plager DA, Neely DE, Sondhi N. Strabismus in pediatric pseudophakia. *Ophthalmology.* 2005;112:1625-1628.
- David R, Davelman J, Mechoulam H, Cohen E, Karshai I, Anteby I. Strabismus developing after unilateral and bilateral cataract surgery in children. *Eye.* 2016;30:1210-1214.
- Hiles DA, Sheridan SJ. Strabismus associated with infantile cataracts. *Int Ophthalmol Clin.* 1977;17:193-202.
- Oral AY, Özgür Ö, Selvi C, Erdoğan B, Doğan ÖK. Strabismus and nystagmus following cataract surgeries in childhood. *Turk J Ophthalmol.* 2012;42:111-115.
- Magli A, Lovine A, Bruzzese D, Giani U, Fimiani F. Strabismus in developmental cataract. *Eur J Ophthalmol.* 2008;18:540-543.