

Surgical Outcomes of Nontraumatic Pediatric Cataracts

Aslihan Uzun, Huban Atilla

Department of Ophthalmology, Training and Research Hospital, Ordu University, Ordu, Turkey

Email: draslihanuzun@gmail.com

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Abstract

Purpose: To evaluate post-surgical complications in patients who were operated for nontraumatic pediatric cataracts in our clinic. **Methods:** Medical records of 62 patients (101 eyes) that underwent cataract surgery younger than 15 years of age, without history of ocular trauma and with a minimum follow-up period of 6 months, were reviewed retrospectively. **Results:** The most common initial complaint was leukocoria. Thirty-nine patients (62.9%) had bilateral cataracts and 23 patients (37.1%) had unilateral cataracts. The most common type was posterior polar cataract (22%) in patients with unilateral cataracts, and total cataract (33%) in patients with bilateral cataracts. The overall prevalence of postoperative complications was 58%, visual axis opacification (VAO) being the most common one (39%). The incidence of VAO was significantly higher in eyes with intact posterior capsules. Secondary glaucoma occurred in 12 (12%) eyes. Thirty-one (50%) patients were orthophoria, 17 (27%) patients had esotropia, and 14 (23%) patients had exotropia. Additional surgery for all of these complications was performed in 53 (53%) eyes. **Conclusions:** Despite appropriate surgical treatment of nontraumatic pediatric cataracts, post-surgical complications including VAO, glaucoma, or strabismus remain an important cause of morbidity in these patients. Posterior capsulotomy and anterior vitrectomy must be performed in all children below 6 years to reduce the need for additional surgery for VAO.

Keywords

Congenital Cataract, Pediatric Cataract, Visual Axis Opacification, Glaucoma, Surgery

1. Introduction

Pediatric cataracts are one of the main causes of treatable visual loss in childhood worldwide [1]. Congenital cataracts accounting for 5% to 20% of pediatric

blindness, are the main type of pediatric cataracts [1] [2]. The prevalence of congenital cataract has been reported as 3.0 - 4.5 per 10,000 live births in the first year of their life [3]. Because early childhood is the critical period of visual development, early diagnosis and appropriate removal of cataract are required in cases with congenital cataracts [4] [5]. Visual axis must be cleared before 6 weeks of age for unilateral cataracts and not later than 10 weeks in bilateral cataracts [4].

Management of pediatric cataracts is challenging, important and quite different from adult cataracts. Compared to adult patients, anterior lens capsule is much more elastic, cataract is much softer, posterior capsule opacification rate is higher, and anterior vitreous can serve as a scaffold for proliferation of lens epithelial cells in children [6]. Pediatric eyes have higher inflammatory activity that can lead to posterior synechiae, seclusio pupilla, iris bombe and secondary angle closure glaucoma. Duration of visual deprivation (timing of surgery), aphakia correction (spectacles, contact lenses), intraocular lens (IOL) implantation, biometric calculation, axial growth of pediatric eye resulting in refractive shift and amblyopia treatment are also controversial issues in the management of pediatric cataracts [4].

Pediatric patients are more susceptible to develop complications that can lead to deprivation and visual loss following cataract surgery compared to adult patients, consequently. In the current study, the aim was to evaluate post-surgical complications in patients who were operated for nontraumatic pediatric cataracts in our clinic. Moreover, this study aimed to examine the interrelationships of outcomes with other variables such as patient age.

2. Materials and Methods

Medical records of 62 pediatric patients who underwent cataract surgery at Ankara University, Faculty of Medicine, Department of Ophthalmology, Pediatric Ophthalmology and Strabismus Section were reviewed retrospectively. The study protocol was approved by the Research Ethics Committee of Ankara University Faculty of Medicine (approval no. 15-514-12). The study procedures were performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

The inclusion criteria were as follows: 1) being under the age 15, 2) having surgery for unilateral or bilateral cataracts, 3) not to have a history of ocular trauma, 4) undergoing surgery at our clinic and 5) follow up period of at least 6 months after surgery. All children underwent complete ocular evaluation and wherever necessary, examination under sedation was performed. Cataract and complication surgeries were performed by two surgeons. The demographics and clinical characteristics of the patients, the complaints of parents, family history, consanguinity, surgical technique, optical rehabilitation, post-surgical complications and management of these complications were recorded. Complications were considered early if they occurred within 3 months after surgery and delayed if they occurred 3 months after surgery.

Postoperative optical rehabilitation involved the use of spectacles or contact lenses. The power of the spectacles was determined by careful retinoscopy.

3. Results

One-hundred one eyes of 62 patients [34 (55%) males and 28 (45%) females] were included in this retrospective study. Thirty-nine (63%) patients had bilateral cataracts and 23 (37%) had unilateral cataracts. The mean age at the time of diagnosis was 10.23 ± 16.09 months (range, 1 - 92 months) in patients with bilateral cataracts and 31.65 ± 31.36 months (range, 1 - 96 months) with unilateral cataracts. The mean age at the time of surgery was 13.15 ± 20.60 months (range, 1 - 101 months) in patients with bilateral cataracts and 33.26 ± 31.36 months (range, 1 - 96 months) with unilateral cataracts. The mean follow-up period was 32 months.

Seventeen (28%) patients had a positive family history of pediatric cataracts and 8 (13%) patients had a positive history of parental consanguinity. Fifty-five (88%) patients presented with some complaints, one patient (2%) was diagnosed prenatally, and 6 patients (10%) were diagnosed during routine examination without any complaints. Main complaints of the parents were leukocoria (37%), strabismus (24%), nystagmus (12%), lack of fixation (12%), visual loss (12%), and microphthalmia (3%). While 31 (80%) of 39 patients with bilateral cataracts had nystagmus, only 2 (9%) of 23 patients with unilateral cataracts had nystagmus. The comparison between bilateral and unilateral cases was given in **Table 1**.

The most common types of cataracts were total (28%), nuclear (19%) and posterior polar (14%) cataract in all patients (**Table 2**). The most frequent morphology was posterior polar cataract (22%) in patients with unilateral cataracts, and total cataract (33%) in patients with bilateral cataracts. While none of the patients with bilateral cataracts had persistent fetal vasculature (PFV), 22% of patients with unilateral cataracts had PFV.

During surgery, anterior capsulotomy was performed with Continuous Curvilinear Capsulorhexis (CCC) in all eyes. Lens aspiration/extraction was performed with irrigation/aspiration in 75 (74%) eyes, and with phacoemulsification in 26 (26%) eyes. Cataract surgery was combined with posterior capsulotomy and anterior vitrectomy in 84 (83%) eyes of patients under 4 years of age. Twenty-four (24%) eyes had primary IOL implantation and secondary IOL was implanted in 22 eyes (22%). Thirty-eight (61%) of all patients underwent cataract surgery in the first year of their life. In these patients, cataract surgery was routinely combined with anterior vitrectomy and posterior capsulotomy. None of these patients had primary IOL implantation combined with cataract surgery. On the other hand, all eyes of patients older than 4 years underwent primary IOL implantation and 59% of eyes of patients between 13 and 48 months of age had primary IOL implantation.

The overall incidence of postoperative complications including visual axis opacification (VAO, 39%), secondary glaucoma (12%), pupillary membrane (5%) and anterior segment hemorrhage (2%) was 58%. Moreover, 64% of all post-surgical complications occurred in eyes of patients who underwent surgery in the first

year of their life. The distribution of post-surgical complications by age was given in **Table 3**. Additional surgery for these complications was performed in 53 (53%) eyes. The most common types of cataracts in the eyes that developed post-operative complications were total and nuclear (24% and 15%, respectively).

Table 1. Comparison between unilateral and bilateral cases.

	Bilateral cases	Unilateral cases
No. of cases	39 (63%)	23 (37%)
mean age of diagnosis (months)	10.23 ± 16.09	31.65 ± 31.36
mean age of surgery (months)	13.15 ± 20.60	33.26 ± 31.36
parental consanguinity	8 (20%)	0
Family history of cataract	14 (36%)	3 (13%)
Nystagmus		
Preoperative	27 (69%)	2 (9%)
Postoperative	31 (80%)	2 (9%)
Strabismus		
Preoperative	14 (36%)	8 (35%)
Postoperative	20 (51%)	11 (48%)

Table 2. Morphological types of cataracts.

Cataract Morphology	No. of eyes
Total Cataract	29 (28%)
Nuclear Cataract	19 (19%)
Posterior Polar Cataract	14 (14%)
Posterior Subcapsular Cataract	8 (8%)
Nuclear & Anterior Polar Cataract	7 (7%)
Cortical Cataract	5 (5%)
PFV + Posterior Polar Cataract	5 (5%)
Anterior Polar Cataract	4 (4%)
Nuclear & Posterior Polar Cataract	3 (3%)
Membranous Cataract	2 (2%)
Punctate Cataract	2 (2%)
Lamellar Cataract	2 (2%)
Sutural Cataract	1 (1%)
Total	101 (100%)

PFV: Persistent Fetal Vasculature.

Table 3. The distribution of post-surgical complications by age (month).

	1 - 12 M	13 - 48 M	49 - 108 M	Total
No. of eyes	68	22	11	101
Post-surgical complications	37	11	10	58
Anterior segment hemorrhage	2	0	0	2
Pupillary membrane	2	2	1	5
Visual axis opacification	22	8	9	39
Secondary glaucoma	11	1	0	12

In the early postoperative period, one of the 5 eyes with pupillary membrane received peribulbar steroid injection, 1 patient was given oral steroid treatment, and in the remaining 3 eyes, frequency of topical steroids was increased. Pupillary membrane resolved in all patients. Anterior segment hemorrhages that were diagnosed at early postoperative period in 2 eyes, resolved spontaneously.

In all eyes, VAO developed in 26 (31%) of 84 eyes that received posterior capsulotomy and anterior vitrectomy, and in 13 (77%) of 17 eyes with an intact posterior capsule. The incidence of VAO was higher in eyes that did not receive posterior capsulotomy and anterior vitrectomy. Additional surgeries including synechotomy, anterior vitrectomy and posterior capsulotomy were performed in 21 eyes, and Neodymium: YAG laser capsulotomy was applied in 10 eyes for the treatment of VAO. The remaining 8 eyes with VAO did not require additional treatment as retinoscopy could be performed in spite of the opacification.

Although posterior capsulotomy and anterior vitrectomy was performed in 94% of eyes of 1 - 12 months group, VAO rate in this group was 32%. None of patients older than 49 months had posterior capsulotomy and anterior vitrectomy, 82% of these eyes developed VAO, consequently. While additional surgery for VAO was performed in 77% of eyes in 1 - 12 months group, all patients undergoing Neodymium: YAG laser capsulotomy were older than 72 months of age.

Secondary glaucoma developed in 12 (12%) aphakic eyes, postoperatively. In 3 (25%) of 12 eyes, peripheral iridectomy was performed as a secondary intervention. Nine eyes (75%) had primary open-angle glaucoma. Trabeculectomy was performed in 2 (17%) eyes and antiglaucomatous medications were prescribed in 7 (58%) eyes with secondary glaucoma. Additionally, 92% of eyes with secondary glaucoma was the patients who underwent cataract surgery in the first year of their life. None of the patients who had surgery after 49 months developed glaucoma.

The residual refractive errors of 46 (46%) patients who had primary or secondary IOL implantation, were corrected with spectacles. Refractive errors of 48 aphakic patients first corrected with spectacles. Although contact lenses were prescribed in 7 aphakic patients who had surgery for unilateral cataracts, contact lenses had to be changed to spectacles, because of noncompliance. Furthermore, occlusion therapy was given to 26 (26%) patients with unilateral cataracts, anisometropia or strabismus.

In the postoperative period, 31 (50%) of all patients were orthophoria, 17 (27%) patients had esotropia, and 14 (23%) patients had exotropia. Surgical treatment was performed in 6 patients for esotropia and in 2 patients for exotropia. When we evaluated the distribution of postoperative strabismus by age, we found that 78% of all patients with strabismus were the ones who had surgery before 12 months of age. Moreover, 63% of patients who underwent cataract surgery in the first year of life, developed strabismus.

4. Discussion

Early diagnosis and prompt referral to surgery are crucial to prevent deprivation amblyopia and to achieve a good visual outcome in patients with pediatric cata-

racts [7] [8]. Pediatric eyes have mitotically active lens epithelial cells leading to higher incidence of VAO [9]. The inflammatory response is severe in children and fibrous membranes that form on the intact anterior vitreous acting as a scaffold result in VAO. Opacified posterior capsule is also very common after cataract extraction in children, and can be an amblyogenic hazard. Hosal *et al.* reported that 79% of eyes with an intact posterior capsule, 43% of eyes having posterior capsulectomy, 23% of eyes having posterior capsulectomy and anterior vitrectomy developed VAO following pediatric cataract surgery [9]. The incidence of VAO was reported lower than 10% in patients who had congenital cataract surgery combined with posterior capsulotomy and anterior vitrectomy in previous studies [10] [11]. Correspondingly, 82% of eyes of patients with intact posterior capsules developed VAO, in our study. Formerly, we have not performed posterior capsulotomy and anterior vitrectomy in children that were older than 4 years, routinely. That can be the underlying cause of higher rate of postoperative VAO (39%). In such cases, strategies to provide a clear visual axis are necessary to achieve visual rehabilitation. Nevertheless pediatric patients can develop VAO even if a posterior capsulotomy and anterior vitrectomy are performed, anyway [6]. In our study, 32% of eyes of patients who underwent cataract surgery combined with posterior capsulotomy and anterior vitrectomy in the first year life, developed VAO.

Although the clearance of visual axis, correction of refractive errors and treatment of amblyopia are the keys to a good visual outcome in pediatric cataracts, the avoidance and management of complications are also vital [4]. Kuhl-Hattenbach *et al.* reported that the incidence of postoperative complications in aphakic patients following congenital cataract surgery was 35% and 26% of eyes required additional surgery for complications [10]. In our study, the rate of postoperative complications was 58% and 53% eyes required additional surgery for these complications. Furthermore, as seen in **Table 2**, post-surgical complications were higher in patients who underwent cataract surgery in the first year of their life.

Glaucoma following pediatric cataract surgery can develop in the early postoperative period or as late as decades after surgery [4]. The incidence of glaucoma following congenital cataract surgery was reported as 1% - 41% in previous studies [12]-[17]. Different studies have suggested that performing early surgery is a risk factor for the development of glaucoma [10] [12]. Vishwanath *et al.* reported that the incidence of aphakic glaucoma was significantly higher in patients who had surgery before 4 weeks of life [17]. In our current study, 12 (12%) of our cases developed glaucoma and they were aphakic. None of the patients who had surgery after 49 months developed glaucoma, and 11 (92%) of eyes with secondary glaucoma were the eyes of patients who underwent surgery during the first year of life. Lower incidence of glaucoma in our study can be due to our relatively short term follow-up period (32 months).

Park *et al.* reported that 55% of patients developed strabismus following bilateral pediatric cataract surgery and age at the time of surgery was significantly

lower in these patients [18]. Postoperative strabismus rate was 66% (78% esotropia, 7% intermittent esotropia, 7% exotropia, 7% intermittent exotropia) in children treated for dense congenital or developmental cataracts and early onset was found to be a significant risk factor for strabismus in Birch *et al.*'s study [19]. In our study, 50% of patients were orthophoria, 27% had esotropia and 23% had exotropia, postoperatively. Similarly, 78% of all patients with strabismus were the ones who had surgery in the first year of life, in our study.

The presence of preoperative or postoperative nystagmus has been strongly correlated with worse visual outcome. Delayed surgery results in nystagmus especially in children with bilateral congenital cataracts due to severe visual deprivation [7]. In Magli *et al.*'s study, nystagmus was present in 26.6% of patients with bilateral cataracts [20]. In our study, 53% of patients had postoperative nystagmus. Correspondingly, nystagmus rate was higher (80%) in patients with bilateral cataracts. In addition, the mean age at the time of diagnosis was earlier in patients with bilateral cataracts.

Retrospective design and relatively short term follow up (32 months) were the limitations of our study. Nevertheless, this study highlights to the importance of appropriate management of posterior capsule during pediatric cataract surgery. Posterior capsulotomy and anterior vitrectomy must be performed in all children below 6 years to reduce the need for additional surgery. Patients older than 6 years can cooperate for Neodymium: YAG laser capsulotomy. Further studies with longer follow-up period can clarify the exact incidence of post-surgical complications.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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