Long-term outcome and determinants of primary pediatric cataract surgery

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Abstract:

PURPOSE: This study aimed to evaluate the long-term outcomes of primary pediatric cataract surgery and to identify determinants of success and recommendations to improve the care of patients with pediatric cataracts.

METHODS: A cohort, retrospective study of cases who were operated as primary pediatric cataract surgery at King Khaled Eye Specialist Hospital. Patients who are 4 years old or younger and underwent primary cataract surgery with at least 3-year follow-up were enrolled in this study. Preoperative and postoperative evaluations were performed to determine the surgery outcomes.

RESULTS: Two hundred and two eyes of 119 patients were enrolled in the study. Seventy percentage of the patients were diagnosed with bilateral cataracts and 30% with unilateral cataracts. Postoperative evaluation showed that 20% of the patients had best corrected visual acuity of 20/30 or better, 25% had 20/40–20/50, 20% had 20/60–20/80, and 29% had 20/100 or less, 6% as fixate and follow. In addition, the mean spherical equivalent was 1.50D. Amblyopia was present in 120 eyes. Fourteen percentage showed a significant myopic shift of more than −4.00D and it was more in eyes with primary intraocular lens (IOL) implantation. Glaucoma was reported in 19% of the patients.

CONCLUSION: There was a significant postoperative myopic shift and it was more in eyes with primary IOL implantation. Glaucoma was the most common reported postoperative complication. The presence of strabismus and nystagmus may affect the visual outcomes. Early intervention might reduce the incidence of amblyopia.

Keywords:

Amblyopia, cataract surgery complications, glaucoma, intraocular lens, pediatric cataract surgery

Introduction

Pediatric cataract is one of the most common avoidable causes of blindness globally.[1] The prevalence of cataracts worldwide is estimated to be approximately 1–4/10,000 children in developed countries, and 5–15/10,000 children in developing countries, contributing to 5%–20% of childhood blindness, in which 75% of the cases can be treated or prevented.[2] It was reported that the prevalence of bilateral cataracts at birth is 1–3/10,000 births, causing blindness to nearly 200,000 children around the world.[3]

Pediatric cataract is considered congenital if diagnosed at birth, and developmental or acquired if diagnosed after birth.[4] Early diagnosis is significant in terms of preventing amblyopia and maintain sight. Furthermore, the management of pediatric cataracts is determined by some factors such as age of onset, literality, and morphology.[3]

A number of studies have been conducted in different countries to investigate the possible causes of childhood blindness. Previous reports showed that lens abnormalities were responsible for 15.5%, 9.2%, and 7.4% in West Africa, Chile, and South India, respectively.[5] Another study from Uganda, Malawi, and Kenya indicated that untreated cataracts accounted for 27.6%, 13.1%, and 9.1% of blindness,[6] while it was 9.2% in Ethiopia for the same reason.[7]

The outcome of pediatric cataract surgery has improved because of recent advances in intraocular lens (IOL) manufacturing as well as

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surgical techniques. In the case of hereditary cataracts, genetic testing and counseling can help to achieve early diagnosis.[8]

The available data in the literature about pediatric cataracts in Saudi Arabia are insufficient. One study investigated the causes of childhood blindness in the country and found that 70% of the study population became blind before the age of 2 years old, 34% had congenital cataracts, and 56% of them had related parents.[9] Another study reported that pediatric cataracts can be genetic in up to 79% of the cases.[3] In general, two studies reported that cataract is the leading cause of blindness in Saudi Arabia with an incidence of 58.2%[9] and 52.6%,[10] respectively. However, these data are relatively old and insufficient. On the other hand, the overall prevalence of cataracts in Saudi Arabia is not reported yet.

Primary pediatric cataracts can be due to familial, idiopathic, infectious, or metabolic causes. Familial cataracts can present in syndromic and nonsyndromic. It may be inherited as autosomal dominant, autosomal recessive, or X-linked traits, with autosomal dominant is the most common inheritance pattern.[11,12] Early detection of cataracts leads to proper management and visual rehabilitation, also it may be the first sign of underlying metabolic or infectious cause. Postcataract surgery aphakia correction, amblyopia treatment remains the most important factors for better visual outcome.[3,13] The objective of this study is to evaluate the long-term outcome and determinants of primary pediatric cataract surgery at King Khalid Eye Specialist Hospital (KKESH), as well as to identify determinants of success, and recommendations to improve the care of patients with pediatric cataract.

Methods

The retrospective review included children aged 4 years old or younger who had undergone cataract surgery at KKESH, with at least 3 years postoperative follow-up. Patients with traumatic cataracts, secondary cataracts, major ophthalmic disorders, and systemic illnesses were excluded from the study. Preoperative evaluation included demographic data such as gender, date of birth, age of the patient when cataract was noticed by the family, age of the patient on clinical presentation, family history of cataract, and consanguinity. Preoperative visual acuity (VA) was recorded using projected Snellen distance or Allen picture charts. In infants and preliterate young children, VA was recorded subjectively as blink to light, fixate and follow, or central steady maintained. Ophthalmic assessment also included aliment, the presence of nystagmus, bilaterality, type of cataract, and anterior segment examination including corneal diameter and clarity as well as posterior pole assessment. The procedure performed was lens aspiration and posterior capsulorhexis with anterior vitrectomy. Depending on the age, patients underwent either primary or secondary IOL implantation. Further Preoperative assessment were included such as intraocular pressure (IOP), visual axis clarity, and cycloplegic refraction. Postoperative follow-up assessment included age, best-corrected VA (BCVA), IOP, the presence of amblyopia, strabismus, nystagmus, cycloplegic refraction, complications, and any intervention.

The study was approved by the Institutional Review Board at KKESH in Riyadh and was conducted in accordance with the tenets of the Declaration of Helsinki for research involving human participants and in line with current legislation on clinical research.

Statistical analysis

The data were analyzed through the Statistical Package for the Social Sciences version 24 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive analysis and suitable statistical tests of significance were used to determine the results, and $P < 0.05$ is considered significant.

Results

Two hundred and two eyes of 119 patients were enrolled in the study, 65 males and 54 females. All subjects were younger than 4 years old, and the mean age at clinical presentation was 16 months for males and 15 months for females. Eighty-three patients (70%) were diagnosed with bilateral cataracts versus 36 patients (30%) presented with unilateral cataracts. One hundred and thirty-eight eyes were diagnosed with nuclear cataracts, making it the most common type of cataract in our study. In addition, 80% of the patients have no family history of cataracts [Table 1].

In preoperative assessment, VA was reported as fixate and follow in 103 eyes (35.6%), 30 eyes (51%) as blink to light, 57 eyes (23%) as poor fixate and follow, and uncentral, unsteady, and unmaintained in 12 eyes. In terms of cataract type, 68% of the cases were nuclear, followed by cortical in 7%, anterior polar in 4%, and 3% as posterior polar [Figure 1]. One hundred and five eyes (52%) had primary IOL implantation, 61 eyes (30%) had secondary IOL implantation, and 36 eyes (18%) were aphakic [Figure 2]. Patients who underwent primary IOL implantation showed relatively better VA than patients who had secondary IOL. However, it was not statistically significant ($P = 0.119$).

Seven eyes (3.5%) showed persistent fetal vasculature. Sixty-four eyes (31.7%) showed nystagmus, and strabismus was reported in 53 eyes (26%). Moreover, congenital cataract was associated with Down syndrome in 8 subjects (6.7%).

Regarding BCVA (aided, postoperative), 40 eyes (20%) of the subjects had BCVA 20/30 or better, 51 eyes (25%) had 20/40–20/50, 40 eyes (20%) had 20/60–20/80, 59 eyes (29%)

Table 1: Demographic information for the patients

Gender	Male	Female
Number of patients, *n* (%)	65 (54.6)	54 (45.4)
Age range (months)	1–48	1–48
Age (months), mean±SD	11±11.5	15.8±15.5
Bilateral cataract (patients)	45	38
Unilateral cataract (patients)	20	16
Cyclo refraction - postoperative, mean±SD	0.6±6.8	2.4±7.8

SD: Standard deviation

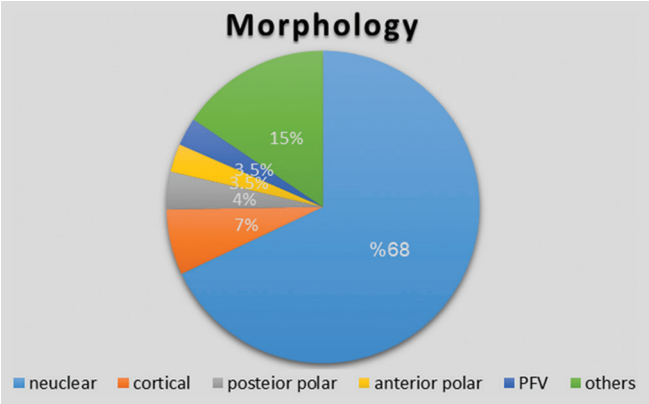

Figure 1: Percentages of cataract type incidence. PFV: Persistent fetal vasculature

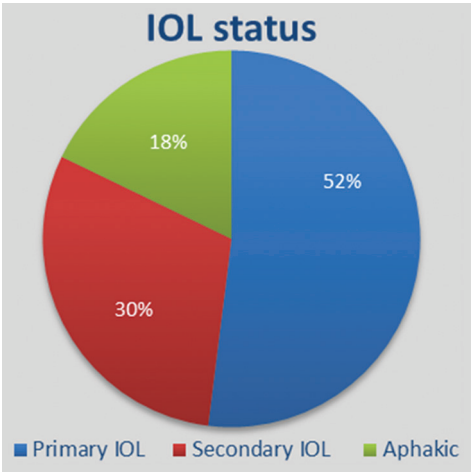

Figure 2: The status of intraocular lens implantation. IOL: Intraocular lens

had 20/100 or less, and 12 eyes (6%) as fixate and follow. In terms of BCVA and laterality, 6 patients had 20/30 or better and 12 patients had 20/40–20/50 (unilateral) and 16 patients had 20–30 or better and 12 patients had 20/40–20/50 (bilateral).

Eyes without strabismus (24%) had BCVA (20/30–20/50), while eyes with strabismus (10%) had BCVA of 20/60–20/80. Furthermore, BCVA in eyes without nystagmus (23%) was 20/30–20/50, whereas it was 20/60–20/100 in eyes with nystagmus (11%) had BCVA. Amblyopia was present in 120 eyes (59%).

One eye underwent primary IOL implantation at age of 7 months. This eye had BCVA of 20/200 with considerable myopic shift of −8.50D. Another two eyes underwent secondary IOL implantation, and myopic shift of −11.50D was noticed in one eye. In addition, two eyes developed visual axis opacification (VAO) and underwent membranectomy and anterior vitrectomy. All these cases developed glaucoma where IOP was controlled by topical antiglaucoma.

The postoperartive mean spherical equivalent of the subjects group was 1.47D, ranged from −19.5D to +26D (median = −0.25D). Twenty-nine eyes (14%) showed a significant postoperative myopic shift of more than −4.00D and it was more with primary IOL implantation (19 eyes) compared with secondary IOL implantation (10 eyes). Glaucoma was the most common reported postoperative complication (40 eyes). About 60% of the eyes that developed glaucoma underwent lens aspiration and anterior vitrectomy. Aphakic or pseudophaykic glaucoma was reported as early as 3 months postcataract surgery and as late as 7 years postoperatively. Posterior capsular opacity was present in 6 eyes, and it was managed with membrane excision and anterior vitrectomy. One eye developed retinal detachment 8 years postoperatively.

Discussion

The present study reported that congenital cataract is most commonly bilateral in agreement with previous publications.[11,13] Bilateral cataracts could be familial or associated with metabolic, infectious causes, or idiopathic. In this study, no metabolic or infectious cause was found. Familial congenital cataract accounts for one-third of the bilateral cataract cases in the literature.[11,13] In this study, there was no genetic analysis to investigate the inheritance pattern, and 80% of the patients have no family history of cataracts. Down syndrome was reported to be one of the most common syndromes to be associated with infantile cataracts.[14,15] In this study, 8 patients were enrolled with Down syndrome and bilateral cataracts. In agreement with previous research,[15,16] nuclear cataract was the most common type of cataract in our study.

Certain factors may contribute to the final visual outcome, even after performing uneventful cataract surgery. In the current study, eyes without strabismus and/or nystagmus were associated with relatively better VA. Although the difference was not statistically significant (P = 0.169). Moreover, strabismus was reported more with unilateral cataracts which is consistent with previous work.[17,18] The presence of strabismus or nystagmus with cataracts is a clinical indicator that the vision is affected, where it is associated with impaired visual outcomes.[19-22]

Myopic shift post-IOL implantation is a major concern postpediatric cataract surgery. In this study, myopic shift was more in eyes that underwent primary IOL implantation compared to eyes with secondary IOL implantation, although this was not statistically significant (P = 0.124). The youngest age with primary IOL was 5 months old (1 patient). This patient underwent lens aspiration with anterior vitrectomy and primary IOL implantation at 5 months old. At 6 years old, the child was myopic (−19.00D), and BCVA was documented as poor fixation. McClatchey *et al*. reported −7D shift after 8 years of follow-up in pseudophakic eyes undergoing surgery from 3 to 6 months of age.[23] Lambert *et al*. reported a −5.5D mean myopic shift over an average of 1-year postcataract surgery in 11 pseudophakic eyes of infants operated at a mean age of 10 weeks.[24]

Regarding to postcataract surgery complications, glaucoma was the most common reported complication in this study. Aphaykic or pseudophykic glaucoma is one of the most common sight-threatening long-term complications after pediatric cataract surgery with incidence reported to be 5% to 41%.[25-28] The risk increases with early surgery, microcornea, anterior segment dysgenesies, chronic inflammation, and Rubella and Lowe syndrome.[29-32] In addition, it was reported that 54% of the children who developed glaucoma underwent cataract surgery when they were younger than 2 months of age.[33]

Mechanisms that may explain aphakic glaucoma include chronic trabeculitis related to postoperative inflammation, retained lens material, or chemical mediators from the vitreous.[34] This study showed that eyes with primary IOL implantation have less incidence of glaucoma (17%) compared to eyes with secondary IOL implantation (33%) and aphaykic eyes (50%), and this was statistically significant ($P = 0.032$). Implanting IOL may provide a barrier that protects the trabecular meshwork from the vitreous, and it may provide support to the trabecular meshwork.[35] A multicenter retrospective review showed a lower incidence (0.3%) of open-angle glaucoma in eyes receiving a primary IOL implant compared to those that remained aphykic (11.3%) after cataract surgery.[35] Further, children can develop glaucoma more than 10 years after uneventful cataract surgery.[36] In this study, glaucoma was reported as late as 7 years postuneventful cataract surgery. The second common complication we reported was VAO which is a well-known complication postcataract surgery, with prevalence ranging from 50% to nearly 100%.[37-39] Posterior capsulotomy with anterior vitrectomy was recommended to be performed in all children up to 6–7 years old to reduce the incidence of posterior capsule opacification.[40] However, VAO could sometimes still be observed. This opacification may be related to lens reproliferation, a pupillary membrane, or tissue proliferation as a result of an inflammatory reaction. In the present study, all patients underwent posterior capsulotomy and anterior vitrectomy at the time of cataract surgery and yet 6 eyes developed VAO.

Rhegmatogenous retinal detachment has been found to be a common late complication after pediatric cataract surgery. It has been reported to occur 20 years or more after the primary surgery, where one-third of the cases occurred during the first 10 years.[41-43] Overall incidence of postoperative retinal detachment was reported as 2.5% at 5 years, and the cumulative risk of retinal detachment at 10 years was estimated to be 5.5%. Increased risk of retinal detachment was associated with intellectual disability and with high myopia.[44] In the current study, one eye developed retinal detachment 8 years postcataract surgery.

Conclusion

The presence of nystagmus or strabismus is an important clinical predictor of visual outcomes after pediatric cataract surgery. Their presence indicates significant visual deprivation and amblyopia due to cataracts. Aphakia correction after cataract extraction is a major concern. Early lOL implantation below 6 months of age is associated with more complications such as glaucoma and more myopic shift. Lifelong follow-up is recommended due to the risk of developing glaucoma and retinal detachment.

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Conflicts of interest

There are no conflicts of interest.

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