ARTICLE

Preoperative biometry data of eyes with unilateral congenital cataract

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Purpose: To investigate the differences in biometry data of eyes with unilateral congenital cataract and the contralateral normal eyes in pediatric patients.

Setting: Pediatric Ophthalmology Division, Ophthalmology Department, Semmelweis University in Budapest, Hungary.

Design: Retrospective case series.

Methods: Data of visually significant unilateral congenital cataract patients who had cataract surgery in the ophthalmology department at Semmelweis University between 2013 and 2016 were collected. At the time of the examinations, the mean age of the patients was 36.4 weeks ± 25.3 (SD). Central corneal thickness (CCT), corneal refractive power (keratometry [K]), horizontal corneal diameter, and axial length (AL) measurement data were obtained from both eyes of each patient. The measurements were taken under general anesthesia using a handheld kerato-refractometer (Retinomax K-plus 3) and an ultrasound instrument (Ocuscan RxP) with contact applanation method and Castroviejo straight-tip calipers at the beginning of the cataract surgery. For statistical evaluation, Originlab 7.0 software was used; paired *t* tests were performed for the difference analysis between the 2 sides.

Results: Forty-two infants (50% girls) were included. In the cases of eyes with unilateral congenital cataract, a greater CCT ($P = .01330$), higher average K ($P = .00243$), and smaller corneal diameter ($P = .00010$) were found, although there was no significant difference in AL when compared with the unaffected contralateral eyes.

Conclusion: The data showed that biometric characteristics of the eyes with unilateral congenital cataract differ from the opposite normal eye before the cataract surgery. It is essential to use this biometric data in intraocular lens power calculation and to take them into account in long-term care when screening for secondary glaucoma.

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Pediatric cataract is one of the most common causes of treatable childhood blindness, with an estimated prevalence ranging from 1 to 6 per 10 000 live births. Cataract in childhood is responsible for 5% to 20% of blindness worldwide, and for 22% to 30% in developing countries.[1]

The etiology of all types of congenital cataract is diverse, including hereditary, maternal infections, and metabolic diseases and, in part, it is unknown. Idiopathic cases showed a higher proportion of unilateral cataract and additional ocular dysmorphology than cases of known etiology.[2] In another study, hereditary disease was associated with 56% of bilateral cases and only 6% of unilateral cases.[3] The lens transparency and high refractive index are achieved by the precise architecture of lens fiber cells and the homeostasis of the lens proteins, in terms of their concentration stability and supramolecular configuration. Approximately 50% of all congenital cataract cases might have a genetic risk: several genes that encode proteins such as cristallins, lens-specific connexins, aquaporin, cytoskeletal structural proteins, and developmental regulators are involved.[4]

The clinical outcome of congenital cataracts is determined on the one hand by early surgery; that is, extraction of cataracts within the first 6 to 10 weeks of life can prevent the risk for the development of stimulus deprivation amblyopia, strabismus, and nystagmus.[5] On the other hand, it also depends on the refractive correction, amblyopia, and other consecutive disorders such as secondary glaucoma management.[1] Many studies in the literature are investigating the effect of early cataract surgery with or without intraocular lens (IOL) implantation on the anterior segment during the growing period. In unilateral cases, the cornea was found to be thicker and the endothelial cell number decreased, and this continued to occur for several years after surgery as compared with the unaffected side.[6–8]

Even if the vision is not altered, increased corneal thickness could cause an alteration in the accurate intraocular pressure (IOP) assessment, which has emphasized importance in this population.[9,10] However, data regarding

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preoperative biometric measurements and comparisons of eyes with unilateral congenital cataract with the unaffected eyes are sparse.

The aim of our work was to investigate retrospectively the preoperative biometric characteristics in unilateral congenital cataract pediatric patients who had unilateral cataract surgery in our department and to compare the recorded central corneal thickness (CCT), keratometry (K) value, horizontal corneal diameter, and axial length (AL) between the affected and unaffected eyes.

PATIENTS AND METHODS

Study Design

This retrospective study was performed at the Department of Ophthalmology, Semmelweis University in Budapest, Hungary. All participants were treated in accordance with the tenets of the Declaration of Helsinki. The study was approved by the university's institutional ethical board.

The recordings of the patients with unilateral cataract, who were diagnosed and operated between January 2013 and December 2016, were reviewed. The main inclusion criteria were a visually significant unilateral congenital cataract and the availability of preoperative measurements of the investigated biometric data of both eyes.

Patients

In the defined period, 42 pediatric patients had unilateral cataract surgery in the ophthalmology department. The mean age was 36.4 weeks ± 25.3 (SD) (range 8 to 98 weeks). The data showed additional persistent fetal vasculature in 6 cases. In 4 cases, other multisystem disorders were found: 1 case of Down syndrome, 1 case of West syndrome (infantile spasms), 1 case of Lowe syndrome (oculocerebrorenal syndrome), and 1 case of multiple hemangiomas and café-au-lait spots. In another 3 cases, toxoplasmosis-rubellla-cytomegalovirus-herpes-syphilis (TORCHS) test was positive: in 2 of them, toxoplasmosis and in 1, a positive CMV and Epstein-Barr virus reaction. In addition, in 2 cases, a positive family history was mentioned: in 1 case, the mother and in the other case, the maternal grandmother was affected with congenital cataract.

Instruments

The measurements were taken under general anesthesia at the beginning of the cataract surgery. Keratometry was performed with a keratorefractometer (Righton Retinomax K-plus 3, Right Mfg. Co., Ltd.). The average K power was calculated as the mean of the flat K and the steep K readings. The pachymetry for CCT and A-scan for AL were measured with an ultrasound instrument (Ocuscan RxP, Alcon Laboratories, Inc.) using the pachymetry and biometry scan software (version 1.15). The measuring method was contact applanation and the soundwave velocity was 1641 m/sec for pachymetry and 1532 m/sec for AL measurement. The corneal diameter was determined with ophthalmologic Castroviejo straight-tip calipers.

Statistical Analysis

The means of the analyzed biometric data evaluated in this study were compared between the eyes with cataract and fellow eyes, statistical difference was determined with a paired *t* test. The distributions of AL, CCT, corneal diameter, and K power were confirmed as normally distributed by Kolmogorov-Smirnov tests. Regression analysis was used for correlation testing between the biometric characteristics, and correlation coefficients were determined. All reported *P* values are 2-sided. A *P* value less than 0.05 was considered statistically significant. All analyses were performed using Origin Lab software (version 7.0, OriginLab Corp.).

RESULTS

Preoperative Differences in the Biometric Parameters

The study comprised 42 pediatric patients (50% girls). The corneas of the eyes with unilateral cataract were thicker than the fellow eyes ($P = .01330$). The refractive power of the cornea was higher in the cataractous eye than in the normal eye ($P = .00243$). The horizontal corneal diameter was smaller in the eyes with cataract than in the unaffected eyes ($P = .00011$). The average AL of the affected eyes was slightly shorter; however, with a large error scale, the difference between the cataract eye and fellow eye was not significant ($P > .05$) Unusual values were observed in the case of congenital cataract eyes; however, these extremely abnormal values were not observed for the contralateral unaffected eyes. (Table 1 and Figure 1).

Correlational Analysis

No correlation was found between the thicker cornea in affected eyes and the corneal diameter, refractive power, or with the age of the infants (Figure 2). The corneal diameter of the affected eyes correlated negatively with the refractive power (K) ($r = 0.54$, $P = .001$). In addition, in cataract eyes, the AL correlated with corneal diameter ($r = 0.79$, $P = .0001$) and the AL also correlated negatively with K ($r = 0.41$, $P = .005$) (Figure 3).

DISCUSSION

We found that the CCT was significantly greater in congenital cataract-affected eyes versus the contralateral unaffected eyes before the cataract surgery. The corneas of the unilateral congenital cataract-affected eyes were not just thicker, but also steeper and less wide. We found

Table 1. Biometric values of infant eyes with unilateral congenital cataract and the contralateral normal eyes.

	Unilateral Congenital Cataract Eye		Contralateral Normal Eye		
Parameter	Mean ± SD	Range	Mean ± SD	Range	*P* Value
CCT (μm)	590.2 ± 84.6	510, 934*	553.4 ± 43.5	475, 639	.01330
Average K (D)	46.45 ± 3.8	41.66, 55.43*	45.09 ± 1.43	42.62, 48.0	.00243
CD (mm)	11.0 ± 0.73	9.0*, 12.0	11.5 ± 0.43	10.5, 12.0	.00011
AL (mm)	18.9 ± 1.93	15.34*, 23.41	19.3 ± 1.28	17.32, 22.28	> .05

AL = axial length; CCT = central corneal thickness; CD = horizontal corneal diameter; K = keratometry
*Extremely abnormal values