

Effect Of Trabeculectomy On Ocular Biometry And Refractive Errors In Pediatric Glaucoma

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Abstract

Background: Pediatric glaucoma triggers refractive errors by modifying the biometry of the eye. This study was conducted with the objective of estimating the short-term biometric and refractive changes prior to and post trabeculectomy in pediatric glaucoma.

Material and Methods: A 12-month, descriptive, cross-sectional study was carried out from January to December 2019, using patients operated on for pediatric glaucoma. Pre- and post-operative biometric and refraction measurements were noted. Visual acuity, axial length, corneal diameter and refraction were obtained. All ethical requirements (anonymity, free, informed, and continuous consent) were satisfied. Data analysis was done using SPSS 20.0.

Results: In the present study, 47 eyes of 27 patients were surgically operated upon, from January 2019 to December 2019 at CHU-IOTA. The predominant sex was male (17 patients) at 63%, giving a sex ratio (M / F) of

1.7. The mean age was 5.04 ± 4.24 . Preoperatively, the mean corneal diameter, and D90 were respectively 13.83 ± 1.51 and 12.55 ± 0.99 . Preoperatively, the mean axial length, and D90, were 23.87 ± 1.29 and 22.28 ± 1.07 , respectively. Preoperatively and at three month, the mean myopia (n = 36), were respectively -3.13 ± 1.83 and -1.59 ± 0.97 . The mean preoperative astigmatism (n = 47) and D90 were respectively, -1.59 ± 0.77 and -1.23 ± 0.57 . A statistically significant relationship ($p < 0.05$) was found to exist between the preoperative and postoperative data of the axial length, corneal diameter, and refractive errors.

Conclusions: Trabeculectomy significantly exerts a short-term positive impact on the biometrics and refraction by modifying the initial measurements and diopters.

Keywords: Trabeculectomy, Biometry, Refractive Errors, Axial Length, Corneal Diameter

Background

Pediatric glaucoma (from birth to 18 years of age) is potentially blinding, with ocular hypertension present either at the time of birth or as a secondary occurrence caused by iridocorneal angle or anterior segment abnormality (Chraibi, 2017; Detry-Morel, 2001; Papadopoulos, 2014; Beck, 2001). Pediatric glaucoma shows annual incidence in the range of 0.3 to 1 per 10,000 births and is manageable mainly by surgical intervention (Papadopoulos, 2014; Ho, 2004).

Across the globe, the major causes for visual impairment are refractive errors (ametropia) (Resnikoff, 2008). In fact, pediatric glaucoma triggers refractive errors by modifying the biometry of the eye (Papadopoulos, 2014; Boulze-Pankert, 2012; Dehghanian, 2020; Tokoro, 1990; Youn, 1990). From a study performed in Cameroon, pediatric glaucoma appears to bear a relationship to ametropia in 51.9% of the cases (Moune, 2007).

After Cairns introduced trabeculectomy in 1968 (Cairns, 1968), this procedure has been recognized as the standard first-line of surgical procedure for patients with pediatric glaucoma. Trabeculectomy comprises subconjunctival fistulization of the aqueous humor (Papadopoulos, 2014; Cairns, 1968), inducing changes in the biometry producing modifications in the initial refraction (Youn, 1990; Moune, 2007; Cairns, 1968). Several studies indicated the induction of anatomical and / or functional modifications post trabeculectomy (Tokoro, 1990; Zhang, 2009; El-Saied, 2014; Tourame, 2009; Soltani, 2019); however, changes connected to refractive errors, in general, have not been reported often in pediatric glaucoma.

This study was conducted with the objective of estimating the short-term biometric and refractive changes prior to and post trabeculectomy in pediatric glaucoma.

Material and Methods

A 12-month, descriptive, cross-sectional study was performed from January to December 2019, using patients operated on for pediatric glaucoma at CHU-IOTA, in Mali. Patients who underwent trabeculectomy for pediatric glaucoma were included. The exclusion criteria included those patients having a history of trauma, ophthalmic surgery, or other related eye pathologies. Some clinical data like intraocular pressure and fundus were left unrecorded, to keep within the strict framework of this work.

Pre- and post-operative biometric and refraction measurements were noted. The visual acuity was evaluated using the Monoyer scale, while the axial length was acquired employing the QUANTEL MEDICAL biometer. The corneal diameter was assessed with a compass and TOPCON KR-800A keratometer. Refraction was obtained by an optometrist using the HEINE BETA 200 autorefractometer and skiascope.

For all the patients in the study, trabeculectomy was performed under general anesthesia. Post the limbal conjunctival dissection, a 4 mm x 3 mm scleral flap was done, following which paracentesis was performed. Next, resection was done of a 1.5 x 2 mm deep scleral flap, followed by iridectomy. The scleral flap was closed with 10/0 monofilament, ensuring that two adjustable sutures were present. At the end of surgery, the anterior chamber was re-formed. All the patients were monitored postoperatively for three months. At one month and three months postoperatively, the data were analyzed.

The parents and children (based on age) were provided with all the information concerning this study and all ethical requirements (anonymity, free, informed, and continuous consent) were satisfied. A descriptive data analysis was done by using SPSS 20.0. All P-values <0.05 were considered statistically significant.

Results

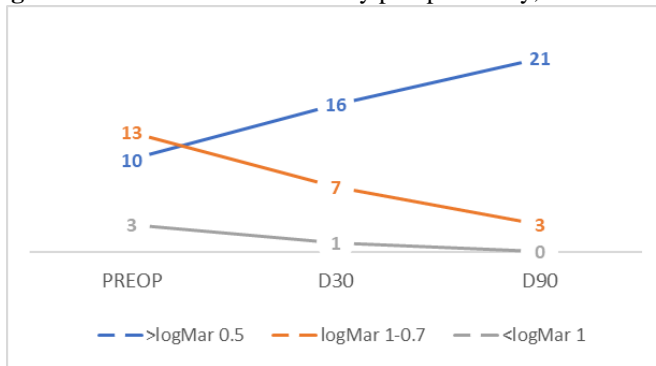
In the present study, 47 eyes of 27 patients were surgically operated upon, from January 2019 to December 2019 at CHU-IOTA. The predominant sex was male (17 patients) at 63%, giving a sex ratio (M / F) of 1.7. The mean age was 5.04 ± 4.24 , with most cases being found in 0 to 1-year age group, i.e., in 40.74% of the cases (table I).

Table I. Age of patients

Age group	n(%)
0 – 1	11 (40,74)
2 – 5	4 (14,81)
6 – 9	5 (18,52)
≥10	72 (5,93)
Total	27 (100)

Visual acuity > logMar 0.5 preoperatively, D30 and D90 were 33.33%, 66.67% and 87.5% respectively, as shown in Figure 1.

Figure 1. Evolution of visual acuity preoperatively, D30 and D90



Preoperatively, the mean corneal diameter, D30 and D90 were respectively 13.83 ± 1.51 ; 12.79 ± 1.08 and 12.55 ± 0.99 . Preoperatively, D30 and D90, the mean axial length, were 23.87 ± 1.29 , 22.79 ± 1.11 and 22.28 ± 1.07 , respectively. Preoperatively, the mean myopia (n = 36), D30 and D90 were respectively -3.13 ± 1.83 ; -2.23 ± 1.22 and -1.59 ± 0.97 . The mean preoperative hyperopia (n = 11), D30 and D90, were $+ 1.57 \pm 0.61$, $+ 1.96 \pm 0.43$ and $+ 1.92 \pm 0.52$, respectively. The mean preoperative astigmatism (n = 47), D30 and D90 were respectively, -1.59 ± 0.77 ; -1.83 ± 0.62 and -1.23 ± 0.57 .

A statistically significant relationship (p <0.05) was found to exist between the preoperative and postoperative data of the axial length, corneal diameter, and refractive errors. Trabeculectomy caused significant modifications by decreasing the dioptric power of the refractive errors, size of the corneal diameter and axial length, as shown in Table II.

Table II. Biometric and refractive mean value preoperatively, D30 and D90

	Axial length	corneal diameter	Myopia	hyperopia	Astigmatism
Preop*	$23,87 \pm 1,29$	$13,83 \pm 1,51$	$-3,13 \pm 1,83$	$+ 1,57 \pm 0,61$	$-1,59 \pm 0,77$
D30	$22,79 \pm 1,11$	$12,79 \pm 1,08$	$-2,23 \pm 1,22$	$+ 1,96 \pm 0,43$	$-1,83 \pm 0,62$
D90 (M3)	$22,28 \pm 1,07$	$12,55 \pm 0,99$	$-1,59 \pm 0,97$	$+ 1,92 \pm 0,52$	$-1,23 \pm 0,57$
p value	0,000	0,000	0,000	0,004	0,002

*Preop: preoperatively; D30: day 30; D90: day 90

Discussion

Glaucoma accounts for 5-10% of the causes of childhood blindness (Zhang, 2009; Gilbert, 2003; Haddad, 2007). In Mali, it is responsible for 11.3% of the causes of blindness in children in a school for the blind (Guirou, 2018). Our study was concerned with the biometric and refractive aspects of trabeculectomy in children. The mean age was 5.04 ± 4.24 years in our series. The mean age for our cases was higher than most studies that included only congenital glaucoma (Zhang, 2009; Soltani, 2019; Detry-Morel, 2001). In our study, most of the patients were male (62.96% of the cases). This is consistent with most studies carried out in different countries (Soltani, 2019; Qiao, 2009; Tchabi, 2007; Makita, 2017; Hoguet, 2016). This male predominance reported by several authors can be explained by the genetics of the disease (Vithana, 2009).

Preoperatively, and three months later, the mean corneal diameter was 13.83 ± 1.51 and 12.55 ± 0.99 , respectively. Preoperatively, in Zhang's series, the mean corneal diameter was 13.10 ± 0.99 mm and 11.84 ± 0.87 mm five years after surgery (Zhang, 2009). Preoperatively, and three months later, the mean axial length was 23.87 ± 1.29 and 22.28 ± 1.07 , respectively. Several authors reported a noteworthy decrease in the axial length and corneal diameter post trabeculectomy (Boulze-Pankert, 2012; Zhang, 2009). Post trabeculectomy, the refractive errors also showed significant modification. However, the average astigmatism had escalated to D30, after which it declined to less than the preoperative threshold. Alterations in the refraction have been demonstrated in studies in Iran (Dehghanian, 2020), in France (Boulze-Pankert, 2012), in China (Zhang, 2009) and Egypt (El-Saied, 2014).

Conclusions

In pediatric glaucoma, several important anatomical changes are evident underlying the functional improvement. Trabeculectomy significantly exerts a short-term positive impact on the biometrics and refraction by modifying the initial measurements and diopters. Further studies are required to estimate the long-term effects.

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