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Original article

Normal values of intraocular pressure in full-term Nigerian newborns

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Abstract

Purpose: To determine the normative range of intraocular pressure (IOP) in full-term newborns and possible association with birth parameters during the first week of life.
Methods: This was an observational cross sectional study in which IOP was measured in 1000 eyes of 500 normal full-term newborns using the Perkins applanation tonometer under topical anesthesia. An average of three readings was taken as the IOP value. The relationship between IOP and birth parameters was analyzed.
Results: The male to female ratio was 1:1 with 254 (50.8%) male and 246 (49.2%) female babies. The (mean ± SD) value of IOP in the right eyes was 11.93 ± 1.80 mmHg, ranging between 9.00 and 16 mmHg. In the left eyes, the mean value of IOP was 11.84 ± 1.77 mmHg with a range of 8.00–15.00 mmHg. IOP in males (12.02 ± 1.84 mmHg) was not significantly different from that in females (11.89 ± 1.75 mmHg). There was no significant difference between right and left eyes ($p = 0.42$). The 95% range (mean ± 2 SD) was 15.53 mmHg for the right eye and 15.38 mmHg for the left. Correlational analysis showed that birth weight and gestational age were positively correlated with IOP.
Conclusion: This study provides useful normative data on IOP among Nigerian full-term newborns. Further studies on possible ethnic/geographic variations of IOP in children may be beneficial.

Keywords: Intraocular pressure, Newborn, Birth weight, Gestational age, Full-term

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Introduction

The diagnosis of congenital/pediatric glaucoma is usually clinically obvious from the characteristic symptoms/signs of tearing, photophobia, blepharospasm, corneal haze or enlargement, optic nerve changes and raised intraocular pressure (IOP). Tonometry is of great importance in the management of these patients which is basically aimed at lowering the IOP.[1] It is an important tool in early diagnosis and monitoring of this significant cause of childhood blindness.

From previous studies, varying values of IOP have been reported in newborns using different instruments. Radtke and Cohan[2] documented a mean value of 11.4 ± 2.4 mmHg in newborns. A Korean[3] study among newborns on the second day of life found a mean value of 13 ± 3.4 mmHg with tonopen while Reddy and Rosnita[4] reported a higher mean IOP value of 15.99 ± 2.79 mmHg also using the Tonopen in

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a group of Malaysian newborns. Another study[5] however, observed a mean much lower IOP value of 9.59 ± 2.3 mmHg also at birth.

In spite of this variability, data on normative values of IOP in African, Nigerian children and newborns in particular are not well-documented. Presently, the values used for African children are those obtained from Caucasians; hence, the present study was carried out to determine normal values of IOP in Nigerian newborns.

Materials and methods

This observational cross-sectional study was carried out between August and October 2011 in a University teaching hospital in the north central geopolitical zone of Nigeria. Healthy full-term neonates born in the hospital within the study period were enrolled into the study. Ethical approval was obtained from the ethical review committee of the Hospital and informed consent was taken from all mothers.

A total of 500 consecutive babies of consenting mothers had IOP measurement in both eyes. All newborns included were products of full-term normal (37–42 weeks of gestation) pregnancies, and had no ocular or systemic congenital anomalies. Exclusion criteria were uncertain gestational age, products of multiple pregnancy, history of antenatal conditions likely to cause intrauterine growth retardation and stillbirth. Some babies were also excluded due to small palpebral fissures interfering with IOP measurement. Neonates were certified healthy by a pediatrician before enrollment into the study.

Intraocular pressure was measured in 1000 eyes of 500 newborns under topical anesthesia within the first week of life while subjects were still in the postnatal wards. Amethocaine hydrochloride eyedrops (0.5%) and sodium fluorescein dye (0.25%) were instilled and measurements were taken with the Perkins handheld applanation tonometer (Clement-Clarke, Inc., Columbus, OH). Measurements were made when the babies were quiet and put up no resistance. Three readings were taken from each eye and an average of the readings was taken as the IOP. Povidone iodine drops (5%) were instilled into both eyes after the measurements.

Eyelid speculum was not used but the eyelids were gently parted with the examiner's index finger and thumb taking care not to put pressure on the globe. All measurements were taken by one of the authors (VAO; an Ophthalmologist) between 10 am and 1 pm in order to maintain standardization.

Anthropometric measurements (birth weight, head circumference, baby length) were taken by trained staff within the first hour of life. Postnatal age and gender were also recorded. Gestational age was estimated from the last menstrual period and recorded in days.

Statistical analysis: Analysis of data was performed with SPSS (Statistical Package for Social Sciences) version 16. Mean, standard deviation, median and range were calculated. Differences between data sample means were determined using Student's *t*-test. To analyze the association between IOP and birth parameters, Pearson's correlation coefficients were calculated. *P* value of less than 0.05 was considered statistically significant.

Results

All the patients were Nigerians. Majority (84%) of them belonged to the 'Yoruba' ethnicity, a major ethnic group in the country. Out of the 500 babies examined, there were 254 (50.8%) males and 246 (49.2%) females, with male to female ratio being 1:1. Table 1 shows the mean gestational age, mean birth weight and other parameters. There was no significant gender difference in these parameters.

The IOP in the right eye ranged from 9.00 to 16.00 mmHg with a mean of 11.93 ± 1.80 mmHg while in the left eye, IOP ranged from 8.00 to 15.00 mmHg with a mean value of 11.84 ± 1.77 mmHg. A comparison of the right and left eye values showed that there was no statistically significant difference between the two eyes ($p = 0.42$). Figs. 1 and 2 show the distribution of IOP in the right and left eyes. IOP was similar between the genders, showing no statistically significant difference (Table 2).

The correlation coefficient of IOP with birth weight was 0.45 ($p < 0.001$), while for gestational age it was 0.31 ($p < 0.001$). Other birth parameters showed no significant correlation with IOP. Table 3 depicts that babies with birth weight above 3.5 kg had significantly ($p < 0.05$) higher IOP in either eye than babies with low or normal birth weight.

Discussion

Our study evaluated IOP among a large group of healthy full-term newborns. The mean IOP as found among full-term newborns in this study was 11.93 ± 1.80 mmHg in the right eye and 11.84 ± 1.77 mmHg in the left eye with a range of 8–16 mmHg.

Table 1. Birth parameters.

	Total	Males	Females	*p* value
Number	500	254 (50.8%)	246 (49.2%)	
Mean ± SD (range)				
Post natal age (h)	47.1 ± 4.9 (1.0–156.0)	52.7 ± 4.9 (1.0–156.0)	42.6 ± 4.7 (1.0–156.0)	0.06
Gestational age (day)	271.3 ± 10.8 (259.0–294.0)	271.3 ± 10.9 (259.0–294.0)	270.8 ± 10.6 (259.0–294.0)	0.35
Birth weight (kg)	3.06 ± 0.4 (2.2-4.5)	2.98 ± 0.4 (2.2-4.0)	3.12 ± 0.5 (2.3–4.5)	0.07
Length (cm)	50.7 ± 6.1 (42.0–62.0)	51.2 ± 5.9 (42.0–62.0)	50.2 ± 6.2 (44.0–62.0)	0.06
Head circumference (cm)	34.1 ± 1.8 (31.0–38.0)	34.4 ± 1.9 (31.0–38.0)	34.2 ± 1.6 (31.0–38.0)	0.96