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RESEARCH ARTICLE

SONOGRAPHIC AXIAL LENGTH OF THE EYE IN HEALTHY NIGERIANSAT THE JOS UNIVERSITY TEACHING HOSPITAL

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ABSTRACT

Introduction: Ultrasonography of the eyeball has become very important as a diagnostic tool in ophthalmology practice, because it is a rapid, safe and atraumatic method of examination. The Axial Length (AL) is the distance from the corneal surface to the retinal pigment epithelium/Bruch's membrane.
Method: The study was a retrospective analysis of all the normal ocular ultrasound scan at the Jos University Teaching Hospital. A 10 MHz linear transducer of the LOGIC 5, GE ultrasound machine was placed over the closed eyelid and scanning was done in the transverse and vertical or cranio-caudal planes of the eye. Basic statistics were performed using the Statistical Analysis System (SAS) and the analyzed data were expressed in descriptive statistics such as frequency tables, percentages, mode, median and mean. Correlative analysis, Students' t-test, was used to test for significant differences. A statistical significance level of p-value of <0.05 was adopted.
Results: The mean right axial length is 2.15±0.42 and that of the left was 2.05±0.39. The right axial length was higher than that of the left in both sexes. The right and left axial lengths were higher in females compared to males. There is significant correlation between age and the right and left axial length.
Conclusion: The right axial length was higher than that of the left in both sexes. The right and left axial lengths were higher in females compared to males. The axial length was lower than the international value.

INTRODUCTION

Ultrasonography of the eyeball has become very important as a diagnostic tool in ophthalmology practice because it is a rapid, safe and atraumatic method of examination (Ogbeide and Omoti, 2008). Ultrasonography is cheap, readily available, easy to perform, and can be carried out easily in the clinic. There is great improvement in orbital sonography, this led to prominence being attached to its benefits in the determination of eyeball biometry (Ogbeide and Omoti, 2008). Also due to the global acceptance of eyeball ultrasonography, there is a need for local values for eyeball biometry in our environment to serve as a reference (Ogbeide and Omoti, 2008). Amplitude-scan ultrasound biometry is believed to be the conventional method for the measurement of axial length (AL) in children.

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Many A-scan instruments are available, and ensuring that the unit you used has been calibrated and is capable of accurate measurements is important. Instruments that merely report a numerical reading of the AL do not allow clinical decision making during the examination and are fraught with potential errors (Hoffer, 2011). Ultrasonography was used in this study to ascertain the biometry of the eye due to the following reasons. The eye is located at the body surface and during ultrasonography it normally reflects only few echoes that can easily be identified. Magnetic resonance imaging (MRI) can also be used in measuring the axial length of the eye (Oliveira *et al*., 2007). It is however not easily available and expensive.The AL is the distance from the corneal surface to an interference peak corresponding to the retinal pigment epithelium/Bruch's membrane (Ogbeide and Omoti, 2008). The majority of axial length elongation takes place in the first 3 to 6 months of life and a gradual reduction of growth over the next two years, and by three years the adult size is attained.

It is found that the depth and volume of the anterior chamber diminish with age and are related to the degree of ametropia. There are three phases of eye growth in children: A rapid, postnatal phase from birth to 6 months of age, followed by a slower, infantile phase from 6 to 18 months of age, and finally a slow, juvenile phase from 18 months forward (Wilson and Trivedi, 2012).

Ultrasound biometry typically uses high frequency transducers of 10-MHz and above ultrasonic waves to obtain optical parameters such as AL, anterior chamber depth (ACD) and lens thickness (LT). Ultrasound can be done with either contact or immersion method. In the contact method, the probe touches the cornea and may result in corneal compression and a shorter AL (Trivedi and Wilson, 2011). Corneal compression is more likely in pediatric eyes because of low corneal and sclera rigidity. Using the immersion technique, the ultrasound probe does not come into direct contact with the cornea, but instead uses a coupling fluid between the cornea and the probe preventing corneal indentation. Immersion A-scan has been shown to be superior to contact biometry in children (Trivedi and Wilson, 2011). In the adult, axial length remains practically unaltered. A slight but steady change towards hyperopia is the rule, especially after the age of 40. The human eye grows extensively after birth. The full term newborn eye has a mean axial length of 16-18 mm & mean anterior chamber depth 1.5-2.9 mm. The mean adult values for axial length are 22-25 mm (Veena *et al*., 2013).

Aim

To investigate axial length in normal eyes in Jos University Teaching Hospital.

MATERIALS AND METHODS

The study was a retrospective analysis of all the ocular ultrasound scan at the Jos University Teaching Hospital (JUTH), Jos, Plateau State. Over a one year period of January 2nd 2013-January 24th 2014.

All the ocular ultrasound scans were retrieved from the archive of the department after necessary approval. Information gathered include patient age, sex and the axial lengths. The ocular ultrasound scan were done with the subject lying in the supine position, they were asked to close the eyelid and coupling gel was applied over the lid. The subjects were instructed to fix their gaze at the ceiling. The 10 MHz linear transducer of the LOGIC 5,GE ultrasound machine was placed over the closed eyelid and scanning was done in the transverse and vertical or cranio-caudal planes of the eye. On the transverse plane, the axial length of the globe is measured (Figure 1). Basic statistics were performed using the Statistical Analysis System (SAS) and the analyzed data were expressed in descriptive statistics such as frequency tables, percentages, mode, median and mean. Correlative analysis, Students' t-test, was used to test for significant differences. A statistical significance level of p-value of <0.05 was adopted.

Inclusion/Exclusion criteria

Subjects with normal orbital findings were recruited while those with positive ophthalmic pathology like tumors or fractures affecting the facial bones, proptosis and refractive errors such as hypermetropia and myopia were excluded. Also excluded were subjects with any previous history of ophthalmic surgery, subjects with orbital cellulites or past history of chronic glaucoma and subjects whose age could not correctly be ascertained. Subjects with trauma to the eye where contact with the transducer was impossible were also excluded. Similarly subjects with other systemic disorders such as toxic goiter, hypertension and diabetes mellitus were also not included in the study.

RESULTS

A total of 98 subjects were scanned in which males (52) were more than females(46) Figure 2. The mean right axial length is 2.15±0.42 and that of the left was 2.05±0.39.The right axial length was higher than that of the left in both sexes. The right and left axial lengths were higher in females compared to males. Table I

Table 1. Comparison of gender with respect to right and left axial length

Gender	Frequency	Right axial length	Left axial length
Male	52	2.13±0.42	2.04±0.30
Female	46	2.16±0.43	2.07±0.28
Total	98	2.15±0.42	2.05±0.39
P		0.660	0.705

Values are presented as Mean ± SD

Table 2. Comparison of right and left axial length with respect to age group

Age group	Frequency	Right axial length	Left axial length
≤ 10	47	2.00±0.52	1.99±0.35
11-20	11	2.42±0.27	2.12±0.14
21-30	24	2.27±0.19	2.09±0.20
>30	16	2.19±0.22	2.14±0.27
Total	98	2.15±0.29	2.05±0.29
P		0.005	0.224

Values are presented as Mean ± SD
Group with different superscripts are significantly different at p < 0.05

Table 3. Correlation between age, right and left axial length

Variables	Age	Right axial length	Left axial length
Age	1		
Right axial length	0.208* (P=0.040)	1	
Left axial length	0.210* (P=0.038)	0.506* (P=0.001)	1

*Correlation is significant at the 0.05 level

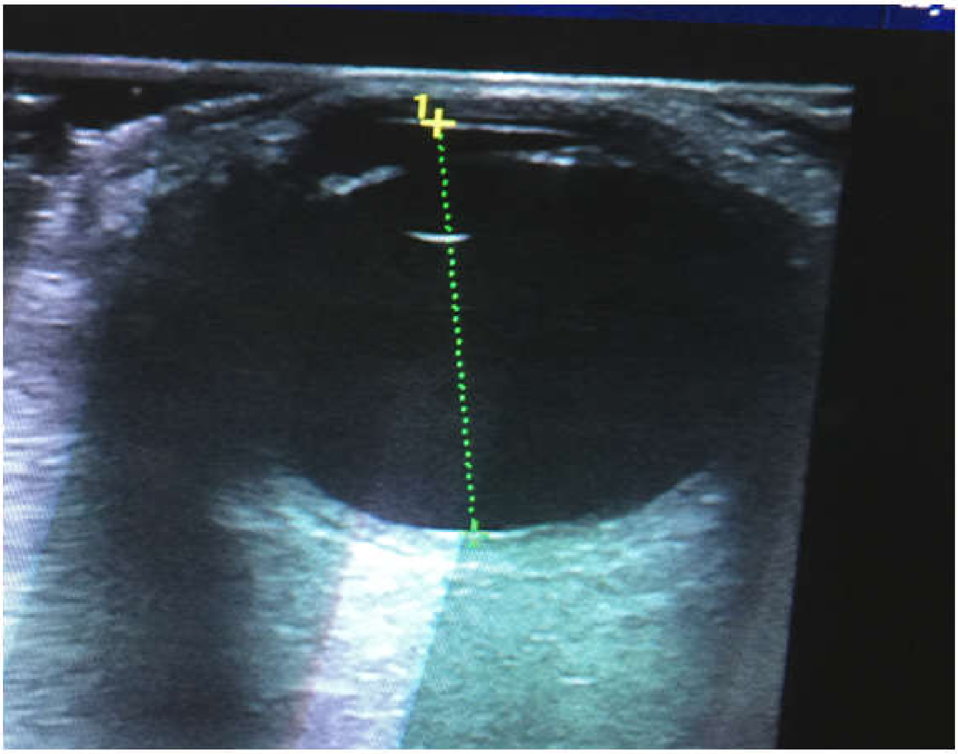

Figure 1. Transverse ocular sonogram showing the axial length of the globe

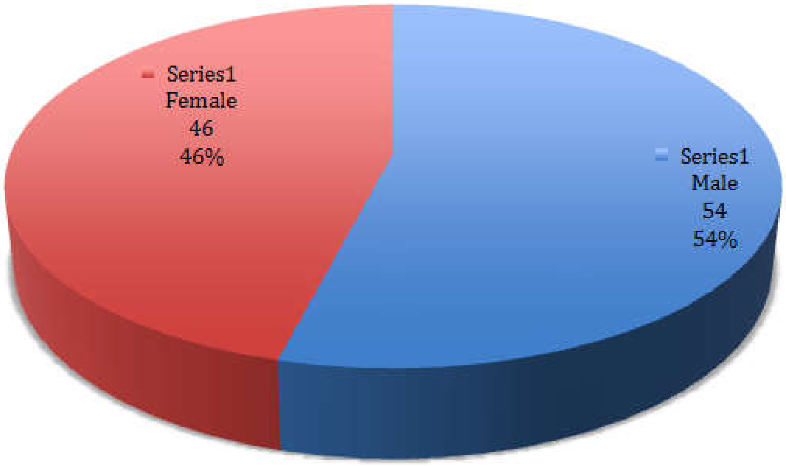

Figure 2. Pie chart showing the sex distribution of the subjects

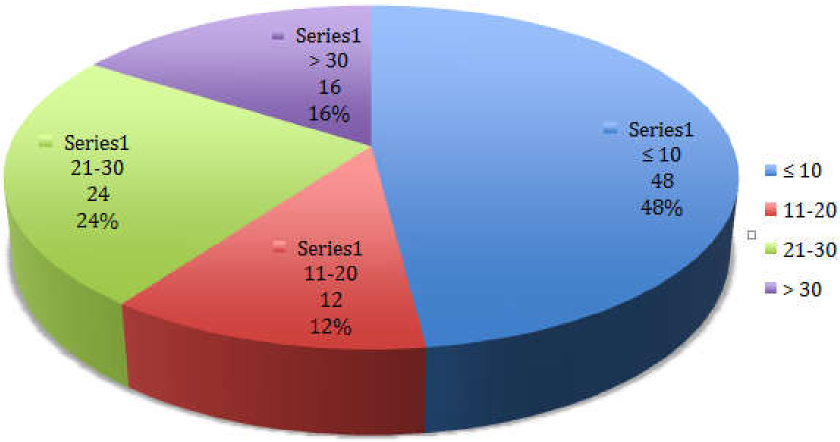

Figure 3. Pie chart demonstrating the age distribution of the subjects

The age range was 3 months-59years and overall mean age was 17.23 ± 4.38 years for both sexes. The mean age was 18.40 ± 5.04 years for males and 16.07 ± 3.73 years for females. There was no statistically significant difference in the mean age between both sexes (P=0.521). Subjects within the age group <10 years constituted the majority (n=47) of the study population, followed by those within the age group 21-30 years (n=24) Table II and Figure 3. There is significant correlation between age and the right and left axial length Table 3.

DISCUSSION

Global advances in ophthalmology have created a greater need for ocular parameters in different clinical and diagnostic fields. One important ophthalmic parameter is the axial length (AL) which is usually needed for intraocular lens power calculation before cataract and refractive surgery and helps ophthalmologists in the diagnosis of several eye conditions such as staphyloma, and risk of retinal detachment (Hassan *et al*., 2012). The study had 98 participants with males (52) and females (46). We had more males in the study. No reason could be adduced for the difference. This study showed that there was a gradual increase in axial length of eyeball with age, with the older age group having the highest values in both males and females. This can be explained by continued growth of the eyeball with age. Similar finding was noted in Benin, by Ogbeide *et al*. (2008). But found the steady growth in males. A study showed that age positively correlated with axial length, vitreous chamber depth and negatively correlated with anterior chamber depth. Subjects with higher BMI tended to have refractions that were more hypermetropic (Santodomingo–Rubido *et al*., 2002). Our finding also showed a positive correlation between age and axial lengths in both males and females.

The age range was 3 months-59years and overall mean age was 17.23 ± 4.38 years for both sexes. The mean age was 18.40 ± 5.04 years for males and 16.07 ± 3.73 years for females. The standard value of the axial length of the eyeball was taken to be 24mm internationally, in an adult, irrespective of the sex, race and other body measurements (Sutton, 2003). A large scale studies on the growth of the ocular components suggest that the eye has reached its adult emmetropic axial length by the age of 13 years (Atchison, 2008). We noted the maximum axial length in the age group of 11-20 years. This present work focuses on the axial length of the eyeball. As the central part of the retina provides the greatest acuity of vision, the antero-posterior axial length of the eyeball is of greatest importance in refraction. The mean axial lengths of males (21.15mm) and females (20.05mm) in this study was lower than the international standard. (Yuen *et al*., 2010) However, other researchers did not observe any change in axial length with increase in age (Shufelt *et al*., 2005). The axial length in this study revealed that the value was higher in the right than that of the left. This was similar to what was obtained by other researchers (Eysteinsson *et al*., 2005; Wu *et al*., 2007). We observed that the axial length was higher in females when compared to males. Thisis at variance with what was found by other researcher (Ogbeide and Omoti, 2008). In conclusion, this study has provided axial length of eyeball in a sample of Nigerians that can be used as reference values for Nigerians. These values are lower than what has been reported in Caucasian eyes and there is a gradual increase in ocular axial length with age.

Limitation of study

Refraction of the eyes were not done.

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