Original Article

Correlation of Axial Length and Anterior Chamber Depth of Eye: A Study in a Public Medical College Hospital

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ABSTRACT

Background: The axial length (AL) is the distance from the corneal surface to an interference peak corresponding to the retinal pigment epithelium/Bruch's membrane. To find out the relationship of AL and anterior chamber depth (ACD) of eye and also to see the variations of these parameters in local population.

Methods: It was a cross sectional study of 100 patients admitted at Sher-E-Bangla Medical College and Hospital, Barishal for cataract surgery with IOL implantation, between January 2021 and June 2021. Clinical data included axial length, anterior chamber depth, slit lamp evaluation were recorded. For the purpose of recording, a proforma was prepared containing patients name, age, sex, occupation, address, AL and ACD.

Results: In normal AL group mean AL was 22.74±0.47 mm and mean ACD was 2.94 ±0.34 mm. In the short AL group mean AL was 21.42±0.44 mm and mean ACD was 2.17±0.42 mm. In the long AL group mean AL was 24.47±0.46 mm and mean ACD was 3.61±0.36 mm. Based on AL normal AL group had 67 patients (67%); the short AL group had 30 patients (30%) and in the long AL group was 3 patients (3%).

Conclusion: In our study mean AL of all the patients was about 23 mm and mean ACD was 3 mm. We found that mean AL in male is more than in female.

Keywords: Anterior chamber depth, Axial length, Normal eyes, Short eyes, Long eyes

INTRODUCTION

The axial length (AL) is the distance from the corneal surface to an interference peak corresponding to the retinal pigment epithelium/Bruch's membrane.[1,2] The 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 and the anterior chamber has normally reached its maximum depth by the age of 15 years.[3] The mean adult values for axial length (AL) are 22-25 mm and mean depth of the anterior chamber (ACD) in an adult emmetropic eye is 3-4 mm.

It is established historically that there is a positive relationship between AL and ACD.[4] This relationship is followed only in normal to long eyes, which is shown in some recent studies.[5-7] There has been no relationship between AL and ACD when AL was beyond 27 mm was first reported by Hosny. [8] And then it was needed to be proven by studies in large sample size, which was later done by Hoffman and Hutz.[5]

Different studies point out that both heredity and the environment contribute to the refractive power of the eye. It has been shown in several studies that the newborn and infants exhibit considerable refractive errors which are decreased by emmetropisation process when the child grows older.

It has been proven that basic anatomical

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parameters such as AL and ACD are variable in different countries according to ethnic groups, genetics and some environmental factors.

METHODS

This cross-sectional was conducted at the Eye department of Sher-E-Bangla Medical College & Hospital, Barishal, after the approval of the ethics committee. Study period was from January 2021 to June 2021. Study population was patients presenting for cataract surgery with IOL implantation. All the patients between 21 to 90 years was included, patients with history of glaucoma, ocular surgery, uveitis, ocular trauma, corneal ulcer or the presence of posterior staphyloma were excluded. Total 100 patients were taken. Simple randomization was done with equal number of male & female. The patients were divided into 3 groups according to the AL.

Group A- (short AL) $\leq$ 22 mm

Group B- (normal AL) > 22 mm < 24.50mm

Group C- (long AL) $\geq$ 24.50 mm.

The AL and ACD of each patient were measured using the Nidek Echoscan US-500. The collected data were analyzed with SPSS.

RESULTS

In this study out of 100 patients 94 patients were above the age of 40 years shown in Tab. I. Half of our patients were male and half were female.

Tab I : Age distribution

Age group	Male	Female
21-30	1	1
31-40	4	2
41-50	6	11
51-60	16	19
61-70	12	11
71-80	7	5
81-90	4	1
total	50	50

We distribute the genders in different groups based on AL shown in Tab II. In the Normal AL group of 67 patients 36 (53.73%) were male and 31 (46.27%) were female. In the short AL group of 30 patients 13 (43.33%) were male and 17 (56.66%) were female.

Tab II: Gender distribution of the participants in groups based on AL

Sex	Normal group	Short group	Long group
Male	36 (53.73%)	13 (43.33%)	01 (33.33%)
Female	31(46.26%)	17(56.66%)	02 (66.67%)
Total	67 (100%)	30 (100%)	03 (100%)

In the long AL group of 3 patients 1 (33.33%) was male and 2 (66.67%) were female.

Normal AL group mean AL was 22.74±0.47 mm and in the Short AL group mean AL was 21.42±0.44 mm in the Long AL group mean AL was 24.47±0.46 mm shown in tab III.

Tab III: Description of the AL in the different groups

AL	Normal group (67)	Short group (30)	Long group (03)
Mean±SD	22.74±0.47	21.42±0.44	24.47±0.46
Range	22.01-23.72	20.53-21.93	24.12-24.77

In this study mean of ACD was 3.13 mm with a standard deviation of 0.36 in Normal ACD in 51 patients, mean was in Low ACD group was 2.72 mm with a standard deviation of 0.46 mm in 06 patients and High ACD group of 43 patients had mean ACD of 3.39 mm with a standard deviation of 0.38 mm. shown in Tab IV

In our study mean AL of all the patients is 22.87±0.45 mm and mean ACD was 2.91±0.37 mm. We also found that mean AL

Tab IV: Description of the ACD in the different groups

ACD	Normal ACD (51)	Low ACD (06)	High ACD (43)
Mean±SD	3.13±0.36	2.72±0.46	3.39±0.38
Range	2.44-3.73	2.1-3.7	2.14-3.93

in male is more than in female with 22.42±0.45 mm in male and 21.87±0.36 mm in female. In our study we found mean ACD in male is slightly more compared to female with in male mean ACD 3.21±0.0.46 and in female 3.16±0.36 mm.

Tab V Relationship of AL & ACD

	Normal AL	Short AL	Long AL	Total
Normal ACD	29 (43.28%)	21 (70%)	01 (33.33%)	51 (51%)
Low ACD	04 (5.97%)	02 (6.66%)	0 (00%)	06 (6%)
High ACD	34 (50.74%)	07 (23.33%)	02 (66.66%)	43 (43%)
Total	67 (100%)	30 (100%)	03 (100%)	100 (100%)

The relation between AL and ACD was the main goal of this study. Tab V shows this relationship.

We found 51 patients had normal ACD (51%), 6 patients had low ACD (6%) and 43 (43%) patients had high ACD. In our study among Long AL group of 3 patients 01 had normal ACD (33.33%), none had low ACD (00%) and 02 (66.66%) patients had high ACD.

Our finding in the Normal AL group of 67 patients, 29 patients had normal ACD (43.28%), 04 patients had low ACD (5.97%) and 34 patients had high ACD (50.74%). In the Short AL group of 30 patients, 21 patients had normal ACD (70%), 02 had low ACD (6.66%) and 07 patients had High ACD (23.33%).

DISCUSSION

In a study by Rafik El-Ghazaway in Egypt of 90 eyes of patients presenting for IOL implantation, in the normal eyes group, the mean AL was 23.21±0.48 mm and the mean ACD was 3.13±0.36 mm; in the short AL group, the mean AL was 21.18±0.77 mm and the mean ACD was 2.72±0.46 mm; in the long AL group, the mean AL was 27.15±2.60 mm and the mean ACD was 3.39±0.38 mm. [9] In Indonesia, Titiek Ernawati found the mean AL was 23.81±1.46 mm In this study, the mean ACD was 3.25±0.70 mm.[10] In another study in Iran by Sedaghat showed the mean(SD) AL was 23.3± 2.35 mm and the mean (SD) ACD was 2.8± 0.48 mm. [11]

Sedaghat found 477 patients had normal ACD (68.3%), 117 patients had high ACD (16.8%) and 104 patients had low ACD (14.9%).[11]

Holladay found that among long AL patients, 90% have normal ACD, 10% have high ACD and none of them have short ACD.[12] In the study by Sedaghat it was 59.8%, 37.9% and 2.3% respectively). So in the high AL group low ACD is less common.

In the group of patients with normal AL, Holladay found that 90% of patients had normal ACD, none of them had low ACD and 10% had high ACD (in study by Sedaghat it was 71.3%, 13.5% and 15.2% respectively).[11] So these studies show patients with normal AL has more normal ACD but our finding was that patient in these group had high ACD.

In patients with short AL Holladay found that 20% have low ACD, 80% have normal ACD and none of them have high ACD (in the study by Sedaghat it was 27.1%, 63.9% and 9% respectively). Our findings differed in these short AL group as high ACD in these group was higher than the other studies, where Holladay found none and Sedhaghat found 9% we found 23.33%. The limitations

of this study was the sample size, which is small. Additionally, lens thickness and corneal diameter were not included, which may have affected the AL & ACD.

CONCLUSION

In our study mean AL of all the patients is 22.87±0.45 mm and mean ACD was 2.91±0.37 mm. We also found that mean AL in male is more than in female with 22.42±0.45 mm in male and 21.87±0.36 mm in female. Based on AL Normal AL group had 67 patients (67%); the short AL group had 30 patients (30%) and in the long AL group was 3 patients (33.33%) .So in our study we found that Long AL (03%) and Low ACD (06%) is uncommon in our population. A bigger sample size and use of optical biometry rather than ultrasonic biometry would give better results.

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