DISTRIBUTION OF AXIAL LENGTH READINGS IN PATIENTS UNDERGOING CATARACT SURGERY

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ABSTRACT

Purpose: To find the axial length distribution in patients undergoing cataract surgery with the comparison between genders and age groups.

Study Design: Cross sectional study.

Place and Duration of Study: Lahore General Hospital & Yaqin Vision Eye Center, Lahore from February 2000 to May 2018.

Material and Methods:

All patients undergoing routine cataract surgery who were more than 20 years of age were included in the study. Patients with corneal scars were excluded. Biometry readings included K reading, axial length and IOL number in diopters aimed for emmetropia using the SRK-T Formula. The patients were divided into 4 groups according to age, Group V (20-39 years), Group X (40-59 years), Group Y (60-79 years) and Group Z (80-99 years). Moreover the patients were also divided into 6 groups according to Axial length, Group A (20.7-21.5 mm), Group B (21.6-22.5 mm), Group C (22.6-23.5 mm), Group D (23.6-24.5 mm), Group E (24.6-25.5 mm) and Group F (25.6-27.6 mm). Cross tabulation between age groups versus axial length and axial length versus gender was done using SPSS version 20.

Results: There were 2146 patients included in the study out of which 1073 were male and 1073 were female patients. The mean axial length of all the patients was 23.36 ± 1 mm. The most common axial length seen in 40.7% of the patients was in the range of 22.6 to 23.5 mm. This was followed by 23.6-24.5 mm and was seen in 26.7% patients. The least common axial length seen in 2.3% patients was in the range of 20.7-21.5 mm. High Hypermetropia (20.7-21.5 mm) was more common in females and was seen in 80% of the patients. However, High Myopia (25.6-27.6 mm) was more common in males and was seen in 74.6% the patients.

Conclusion: In our population High Hypermetropia is common in females while High myopia is common in males. The most common axial length seen is between 22.6-23.5 mm.

Key Words: Axial Length, Biometry, Cataract Surgery

INTRODUCTION

Cataract is among the leading reasons of blindness that is reversible while surgery for Cataract is the most frequently performed procedure in Ophthalmology. After removing the cataract, posterior chamber intra ocular lens is implanted at the time of surgery. To calculate the power of posterior chamber intraocular lens, Biometry is done. Accurate calculation of IOL power using latest biometry techniques increases the chances that the patient will be emmetropic after cataract surgery and is now used as a standard goal in cataract surgery. We can achieve in more than 90% cases within ± 1 D of target refraction[1]. Biometry is the process of calculation of IOL power by measuring various anatomical characteristics of the eye such as Keratometry Reading (K-Reading), axial length (AXL) etc. Keratometry is the measurement of corneal curvature and axial length is the antero-posterior diameter of the eye measured from the center of cornea. K1 and K2 readings correspond to the corneal curvature in horizontal and vertical meridians. K readings are measured by Keratometers, Axial length is measured with different techniques[2,3]. Ultrasound A-Scan is popular in Pakistan for being economical. It produces better results when used with the emersion technique[4]. Optical biometry is also available in selected centers in Pakistan and has the advantage of being more reliable as the cornea is not indented during the process of measurement[5,6]. Correct calculation of IOL power is crucial in cataract surgery so as to determine the

refractive status of the patient after surgery. Also, Cycloplegia[7,8] pupil dilation[9] and trabeculectomy[10] have been associated with effect on AL and K readings.

This valuable biometry data (acoustic and optical) was used in our study to find the axial length values in a large group of patients. The rationale of the study was to find the pattern of axial length in our population. The purpose of our study was to find the distribution of axial length readings in patients undergoing cataract surgery with the comparison between genders and age groups.

MATERIALS AND METHODS

This was a cross sectional study conducted at Lahore General Hospital & Yaqin Vision Eye Center, Lahore from February 2000 to May 2018 using convenient sampling technique. Equal number of males and females were recruited in the study. All patients undergoing routine cataract surgery who were more than 20 years of age were included in the study. Patients with corneal scars were excluded. Patient details including age, gender and side were recorded initially in a dedicated electronic medical record. Later biometry was performed and K readings, axial length and IOL number in diopters was calculated. Intraocular lens was chosen using the SRK-T Formula aiming for emmetropia. The patients were divided into 4 groups according to age, Group V (20-39 years), Group X (40-59 years), Group Y (60-79 years) and Group Z (80-99 years). Moreover the patients were also divided into 6 groups according to Axial length, Group A (20.7-21.5 mm), Group B (21.6-22.5 mm), Group C (22.6-23.5 mm), Group D (23.6-24.5 mm), Group E (24.6-25.5 mm) and Group F (25.6-27.6 mm). Biometry was done using acoustic biometery (Quantel Axis II, France) or optical biometry using IOL Master 5 (Carl Zeiss, Germany). Cross tabulation between age groups versus axial length and axial length versus gender was done using SPSS version 20. Chi square test was used to find the p value.

RESULTS

There were 2146 patients included in the study out of which 1073 were male and 1073 were female patients. The most common axial length seen in 40.7% of the patients was in the range of 22.6 to 23.5 mm. This was followed by 23.6-24.5 mm and was seen in 26.7% patients. The least common axial length seen in 2.3% patients was in the range of 20.7-21.5 mm (Table 1, 2 and Figure 1). High Hypermetropia (20.7-21.5 mm) was more common in females and was seen in 80% of the patients. However, High Myopia (25.6-27.6 mm) was more common in males and was seen in 74.6% the patients. Results are shown in table 3,4 and figure 2. The mean axial length of all the patients was 23.36 ± 1 mm (Figure 3). Although both genders had axial lengths in all the groups ranging from 20.7 to 27.6 mm it was found that patients having axial length between 23.6 to 27.6 mm were more commonly males.

Table 1: Age group versus Axial length cross tabulation.

			Axial Length Group in mm						Total
			A (20.7-21.5)	B (21.6-22.5)	C (22.6-23.5)	D (23.6-24.50	E (24.6-25.5)	F (25.6-27.6)	
Age Group in years	V	Count	2	7	10	13	4	4	40
		Percent	5.0%	17.5%	25.0%	32.5%	10.0%	10.0%	100.0%
	X	Count	14	112	237	172	60	22	617
		Percent	2.3%	18.2%	38.4%	27.9%	9.7%	3.6%	100.0%
	Y	Count	29	262	576	356	113	30	1366
		Percent	2.1%	19.2%	42.2%	26.1%	8.3%	2.2%	100.0%
	Z	Count	5	14	50	31	16	7	123
		Percent	4.1%	11.4%	40.7%	25.2%	13.0%	5.7%	100.0%
Total		Count	50	395	873	572	193	63	2146
		Percent	2.3%	18.4%	40.7%	26.7%	9.0%	2.9%	100.0%

Table 2: Statistical analysis between age group and axial length

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.697[a]	15	.018
Likelihood Ratio	25.580	15	.043
Linear-by-Linear Association	.949	1	.330
N of Valid Cases	2146		

Table 3: Cross tabulation between axial length groups and gender.

			Gender		Total
			M	F	
Axial Length Group In mm	A (20.7-21.5 mm)	Count	10	40	50
		Percent	20.0%	80.0%	100.0%
	B (21.6-22.5 mm)	Count	120	275	395
		Percent	30.4%	69.6%	100.0%
	C (22.6-23.5 mm)	Count	420	453	873
		Percent	48.1%	51.9%	100.0%
	D (23.6-24.5 mm)	Count	348	224	572
		Percent	60.8%	39.2%	100.0%
	E (24.6-25.5 mm)	Count	128	65	193
		Percent	66.3%	33.7%	100.0%
	F (25.6-27.6 mm)	Count	47	16	63
		Percent	74.6%	25.4%	100.0%
Total		Count	1073	1073	2146
		Percent	50.0%	50.0%	100.0%

Table 4: Statistical analysis between axial length groups and gender.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	142.770[a]	5	.000
Likelihood Ratio	146.991	5	.000
Linear-by-Linear Association	134.849	1	.000
N of Valid Cases	2146		

Figure 1: Bar chart analysis between age group and axial length.

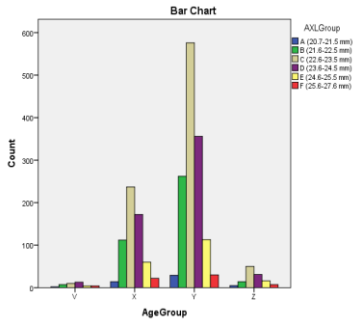


Figure 2: Bar chart analysis between axial length groups and gender.

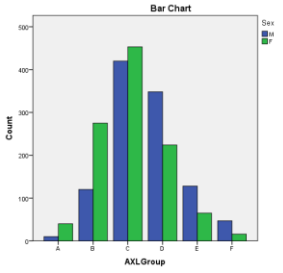
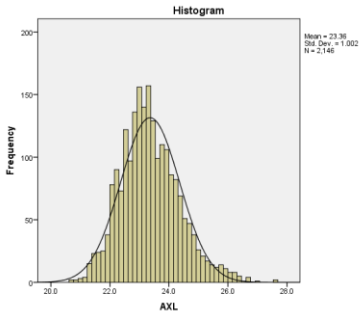


Figure 3: Histogram of Axial Length distribution.



DISCUSSION

In different countries and regions, the readings of Axial Length (AL) and Corneal Curvature are different. When we compare the Axial Length readings in Pakistani population we observe that in our study the most commonly occurring Axial Length readings are in the range of 22.6 to 23.5 mm in all age groups and the mean Axial Length is 23.36 ± 1 mm.

In West, Norfolk Island residents (descended from the English Bounty mutineers and their Polynesian wives) findings for AL were 23.5mm[11] making them slightly myopic than the Pakistani Population. In another European study (Portugal) the mean AL was 23.87 ± 1.55 mm (19.8–31.92 mm)[12] rendering them more myopic than Norfolk Island residents.

A Chinese study revealed the most common AL measurement to be 24.07 ± 2.14 mm[13]. This showed that Chinese population has a higher Axial Length measurement than the Pakistani Population. However, in Beijing study mean Axial Length was 23.25 ± 1.14 mm (range: 18.96-30.88 mm)[14] which is comparable to Pakistani population. In another study in Taiwan mean

AL finding was 24.75 ± 2.71 mm[15] showing a myopic trend. Chinese in Singapore had mean AL of 23.23 ± 1.17 mm[16] and in Mongolian adults aged 40 years or more, the mean AL was 23.13 ± 1.15 mm[17] showing that in both of these populations the mean Axial Length is shorter than the Pakistani Population according to our study. A central rural Indian study showed mean Axial Length of 22.6 ± 0.91 mm (18.22 – 34.20 mm)[18] which is much shorter and hence hypermetropic as compared to our findings. Measurements for mean AL from Nepal, were 22.96 ± 0.95mm[19]. These were lesser than the mean Axial Length findings in our study. According to a study conducted in Hyderabad, Pakistan the mean Axial Length was found to be 22.96 ± 1.04mm[20] . These readings were also lesser than our readings.

In a study from Gomal University the range of axial length was 19.50 to 28.0mm[21] with 581 patients (58.1%) having an Axial Length between 22 to 23.50mm and 10 patients (1.0%) being highly myopic with an Axial Length greater than 26mm.This study, however, does not give a mean value for Axial Length hence it is not possible to compare the two.

Our findings are in agreement with the trend observed[20] that our eyes are shorter than European eyes and comparable to Chinese eyes. However our study differed from Indian eyes which have been found to be shorter and hypermetropic and therefore, not comparable.

The mean AL for Chinese males was 23.38 mm (22.83-24.00) while for females mean AL was 22.83 mm (22.32-23.46)[22]. This is comparable to our study where high myopia was more common amongst male patients and high hypermetropia amongst female patients. Los Angeles study also found that females had significantly shorter Axial Lengths than males[23]. In Rajasthan, India mean Axial Length in emmetropic males ranging from 40 to 60 years of age, was 22.33 mm and in females it was 22.99 mm[24]. These readings are lesser than readings in our male patients but more than our female patients. According to another study conducted in Pakistan, the axial length in female patients undergoing cataract surgery was shorter than their male counterparts[25].

The limitation of our study is that it is a single center study from one region of Pakistan. Multicenter studies are needed from across Pakistan to give us a better picture.

CONCLUSION

In Pakistani population Axial Length is lesser than that of Europeans and Chinese but more than that of Indians and Nepalese and the most common axial length observed in our study is between 22.6 to 23.5 mm with a mean of 23.36 ± 1 mm. In Pakistani population high hypermetropia is common amongst females while high myopia is more common amongst males. Although both genders had axial lengths in all the groups ranging from 20.7 to 27.6 mm it was found that patients having axial length between 23.6 to 27.6 mm were more commonly males.

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