e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(4); 1065-1071

Original Research Article

Reliability Indices of Biometric Values Compared to Gonioscopy in the Diagnosis of Primary Angle Closure Suspects

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Received: 18-01-2023 / Revised: 21-02-2023 / Accepted: 30-03-2023
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Conflict of interest: Nil

Abstract

Glaucoma is one of the leading causes of irreversible blindness. Glaucoma affects 2-3 % of people of age more than 40 years, of which 50% are undiagnosed. Angle-closure glaucoma is the predominant cause of morbidity from glaucoma in Asian populations. Hence screening programs have a large role in preventing angle-closure glaucoma.

According to estimates from the WHO from 1995, glaucoma is responsible for 51 lac blindness cases, or 13.5 percent of all cases of blindness worldwide. Since glaucoma more frequently strikes the elderly, it impacts all societal groups and has serious physical and financial ramifications, making it a major public health issue. For the purpose of making a primary angle closure suspicious assessment, we examined the central anterior chamber depth, lens thickness, and axial length in the current investigation (PACS).

Keywords: Glaucoma; Primary angle closure suspect; biometric values

Introduction

Clinic-based investigations have revealed that eyes with angle closure glaucoma and occludable angles had a shallower anterior chamber, a thicker lens, and a shorter axial length[1]. The crystalline lens's larger and more anterior position contributes to the shallower anterior chambers. Age-related progressive increase in lens thickness causes the anterior chamber to become more shallow[2-3]. The inner surface of the cornea, which is on the anterior side, and the lens, which is on the posterior side, are both on the middle and periphery edges of the anterior chamber. Through the pupillary aperture, it interacts with the trabecular meshwork, ciliary body, extracellular space of the iris, and posterior chamber of the eye. The typical depth of the anterior chamber is 0.315 cm, and its capacity is about 220 µl. The chamber depth is shallower in the hypermetropic than the myopic eye and decreases by 0.001cm per year of life. The anterior chamber's diameter ranges from 1.13 to 1.24 cm. Between the iris and the vitreous, the eye's lens is a clear,

biconvex, elliptical, semisolid, avascular substance with a crystalline texture. The mature lens has an equatorial diameter between 0.9 and 1.0 cm. Its axial sagittal width is directly measured to be between 0.35 and 0.4 cm at birth, 0.4 cm at forty years age, and slowly grows to 0.45 to 0.5 cm at the extremes of life. Its equatorial diameter, on the other hand, is 0.65 cm at child birth, 0.9 to 1.0 cm in the second decade, and remains quite stable after that[4-5].

Materials and Methods

It was a Hospital based cross sectional study. Patients attending the OPD of the Department of Ophthalmology in a tertiary care centre in Alappuzha for a period of 18 months were included. The permission to conduct the study was obtained from Institutional Research Committee and Institutional Ethics Committee of the hospital. Informed written consent was obtained from the participants prior to the start of study All patients of age more than 40 years, attending the OPD of the Ophthalmology department were subjected to torch light examination for eclipse sign. Participants who had a positive eclipse sign were enrolled in the study with their acknowledged signed agreement. An auto refractometer was used to determine the cornea's white to white diameter. A-scan ultrasonography was used to determine the axial length, lens thickness, and depth of the central anterior chamber.

One individual performed every test for every patient. The formula used to determine the lens position (LP) was LP = anterior chamber depth + 1/2 lens thickness. The formula RLP = LP/axial length was used to get the relative lens position (RLP). Additionally, the lens thickness to axial length ratio (LT/AL) was computed. SPSS 22 software was used for analysis after the data was entered into MS office Excel.

Frequency and % were used to represent the qualitative factors. To determine sensitivity, specificity, positive and negative predictive values, and positive and negative probability ratios, diagnostic test evaluation has been conducted. Analysis of the Receiver Operating Characteristic curve (ROC curve) was performed. Using an independent t-test and an ANOVA, the quantitative variables were compared and represented as mean and standard deviation. Statistics were considered significant for p-values under 0.05.

Results

A total of 100 participants were included in the study.

Table 1: Distribution of sample according to the age

Age class	Frequency	Percentage
41-50	24	24%
51-60	39	39%
61-70	30	30%
71-80	7	7%
Total	100	100%

Gender wise distribution of biometric values

Table 2: Gender wise distribution of biometric values

		Mean	Std. Deviation	p value
Anterior chamber depth	Male	2.53	0.31	0.339
	Female	2.57	0.29	
Lens thickness	Male	4.66	0.56	<0.001*
	Female	4.3	0.72	
Axial length	Male	22.52	0.66	<0.001*
	Female	22.04	0.56	
Corneal diameter	Male	11.58	0.41	0.002*
	Female	11.37	0.47	
Lens Position	Male	4.86	0.36	0.02*
	Female	4.73	0.4	
Relative Lens Position	Male	0.216	0.015	0.602
	Female	0.215	0.018	
LT/AL	Male	0.21	0.025	0.006*
	Female	0.19	0.032	

The mean central anterior chamber depth in males and females were 2.53 and 2.57 respectively, which was statistically insignificant (p value = 0.339). The mean lens thickness was 4.66 in males and 4.3 in females, which was statistically significant with a p value of less than 0.001. The mean axial length in males and females were 22.52 and 22.04 respectively and this difference had a p value less than 0.001. The mean of corneal white-to-white diameters was 11.58 and 11.37 in males and females respectively. This difference was also significant statistically with a p value less than 0.002.

The mean lens position (LP) was 4.86 in males and 4.73 in females with a standard deviation 0.36 and the difference was statistically significant with a p value 0.02. The mean relative lens position (RLP) was 0.216 in males and 0.215 in females which was statistically insignificant (p=0.602). The mean value of ratio of LT and AL also had a statistically significant difference between the two genders with a p value 0.006 (male 0.21 and female 0.19).

In females, axial length and lens position has statistically significant difference between at least one of the age groups. Post hoc analysis reveals that age groups 41-50 years & 71-80 years have statistically significant difference (p=0.007) in axial length which were 21.84 and 22.77 respectively. The age groups 41-50 years and 61-70 years has statistically significant difference (p=0.01) (4.6 and 4.87) in mean lens position values.

In males, corneal diameter only has statistically significant difference between at least one of the age groups. Post hoc analysis reveals that age groups 41-50 years & 71-80 years have statistically significant difference (p=0.036) (11.93 and 11.29).

Discussions

Central anterior chamber depth in the diagnosis of PACS

In the study done by Choudhari *et al*.[6], the sensitivity was 58.7 and specificity 91.1% with a cut off of 2.64. The area under the curve was 0.75 (0.72, 0.78). Both sensitivity (18.4%) and specificity (71.2%) were less in our study with a cut off 2.76. The area under the curve was 0.276 with 95% CI (0.206-0.347) with a p value of <0.001.

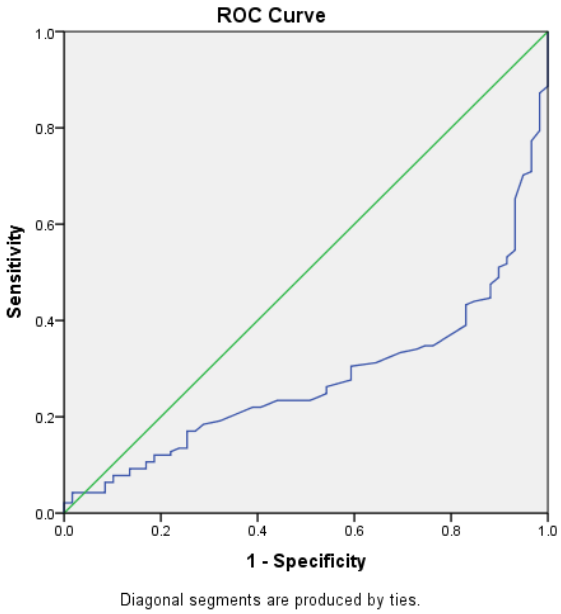

Figure 1: ROC curve for central anterior chamber depth

Lens thickness in the diagnosis of PACS

The lens thickness showed sensitivity of 64.5% and specificity of 50.5% with a cut off of 4.4 in our study. The area under the curve was 0.545 with 95% CI (0.458-0.633). The p value was 0.311, which is not statistically significant. In our study the sensitivity was better, but specificity was lesser. The previous study done by Choudhari *et al*.[6] showed a sensitivity of 23.6 and 89.5 % with cut off 4.68. The area under the curve was 0.57 (0.54, 0.59).

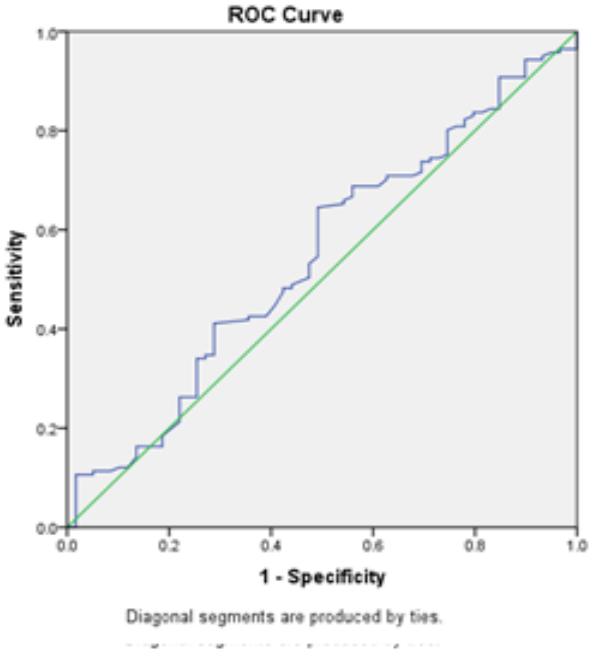

Figure 2: ROC curve for lens thickness

Axial length in the diagnosis of PACS

In our study, the sensitivity was 42.6% and specificity 47.5% for axial length with a cut off 22.3. The area under the curve was 0.435 with 95% CI (0.35-0.52). The p value was 0.149 which was statistically not significant. The sensitivity was 43.2% and specificity 83.1% with cut off 21.94 and the area under the curve was 0.63 (0.60, 0.66) in the study conducted by Choudhari *et al*.[6]. We obtained a comparable sensitivity, but our specificity was less.

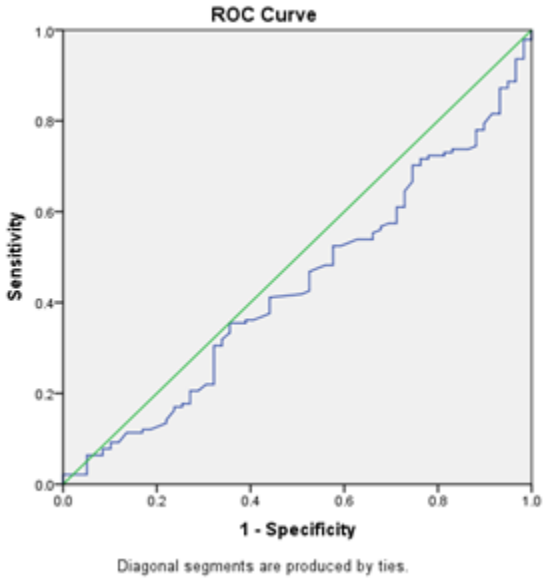

Figure 3: ROC curve for axial length

Corneal diameter in the diagnosis of PACS

The sensitivity was 41.1% and specificity 47.5% with a cut off 11.55 in our study. The area under the curve was 0.406 with 95% CI (0.32-0.49). The p value was 0.037.

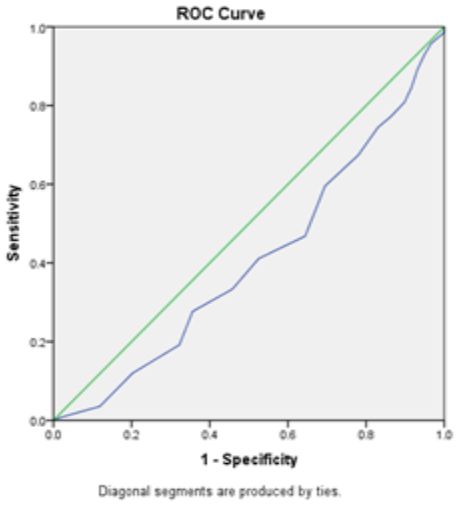

Figure 4: ROC curve for corneal white to white diameter

LP and RLP in the diagnosis of PACS

The sensitivity was 71.6% and specificity 22% for lens position (LP) with a cut off 4.58 in our study. The area under the curve was 0.38 with 95% CI (0.29-0.47). The p-value was 0.008. The sensitivity for RLP was 73.8% and the specificity 18.6% with a cut off 20.4. The area under the curve was 0.398 with 95% CI (0.309-0.487). The p value was 0. 023. The study conducted by Nongpiur [7] using AS-OCT, no differences were noted in the position of the lens or RLP between eyes with and without angle closure.

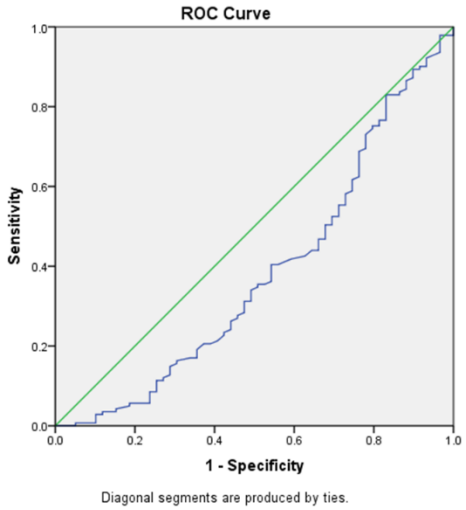

Figure 5: ROC curve for lens position

LT/AL in the diagnosis of PACS

A study conducted by Markowitz[8] found out that lens thickness/axial length factor values were found to be age dependent and were greater than normal for most age groups with angle-closure glaucoma. In our study, the sensitivity was 59.6% and the specificity 52.5% with cut off 0.2 for the ratio of LT by AL. The area under the curve was 0.553 with 95% CI (0.464-0.642). The p value was 0.237

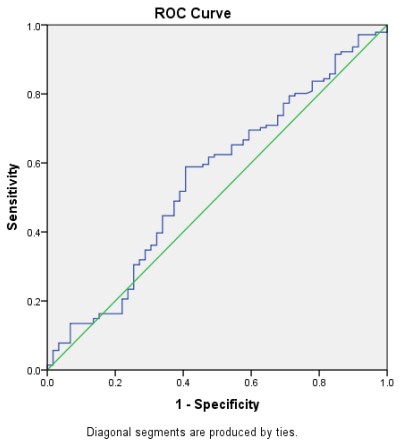

Figure 6: ROC curve for LT/AL ratio

Conclusion

- In younger age group, shorter axial length is the risk factor for primary angle closure suspect (PACS).
- In older age groups increased lens thickness is contributing more to the risk of developing PACS. Hence in this age group early lens extraction may be considered as a treatment option.

The lens position, relative position, and lens thickness/axial length (LT/AL) ratio are measured parameters that cannot be utilised alone to screen for occludable angles, but they do provide further knowledge on the probability of developing PACS.

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