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A Cross-Sectional Study Of Anterior Chamber Depth In Different Subtypes Of Primary Angle Closure Disease Using Optical Biometry

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Abstract:
AIM: *To Compare Anterior Chamber Depths In Various Subtypes Of Primary Ang6le Closure Disease Using Optical Biometry*
METHODS: *40 Primary Angle Closure Disease (PACD) Cases Were Enrolled; 16 Primary Angle Closure Suspects (PACS), 15 Primary Angle Closure (PAC) And 9 Primary Angle Closure Glaucoma (PACG). Anterior Chamber Depth (ACD) Measured Using Optical Biometry.*
RESULTS: *ACD Found To Be Shallower In PACD Than Normal Population. The ACD In PACS, PAC, PACG Were 2.17 ± 0.09mm, 2.06 ± 0.11 Mm And 2.30 ± 0.20 Respectively, Suggesting Predictability Of ACD In Subtypes As Suggested By Significant P-Value Using One-Way ANOVA Test Keeping 5% Level Of Significance.*
CONCLUSION: *Thus, ACD Values Can Aid In Identifying At-Risk Groups Of PACD And Also Significant Association In ACD Values Exist Between PAC Vs PACG.*

Keywords: *Primary Angle Closure Disease, Optical Biometry, Anterior Chamber Depth.*

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I. Introduction:

Glaucoma is one of the most common causes of ocular disease and blindness around the world.[1] It was calculated that by 2020, 79.6 million people were having glaucoma, with 26 percent of those suffering from primary angle closure glaucoma (PACG).[2] Two major types of glaucoma exist: open-angle glaucoma, in which aqueous humor has free access to the trabecular meshwork, and angle-closure glaucoma, in which access of the aqueous humor to the trabecular meshwork is obstructed. Primary angle closure glaucoma (PACG) is a leading cause of blindness in the world, as well as a common type of glaucoma among Asians. Asians make up 47% of patients with POAG and 85% of those with PACG, demonstrating that Asia has a far higher frequency of PACG than the Western world.[2,4-12] In general, the probability of bilateral blindness is 2.5 times greater in PACG than in POAG.[4] As a result, diagnosing and treating PACG is a critical public health concern across Asia.

Measurement of biometric parameters like Anterior Chamber Depth (ACD) can be done using several techniques, namely A-Scan Biometry which has been a gold standard method for many years. However, with the advent of newer techniques like Laser Interferometry assisted optical biometry and anterior segment OCT, precise measurements can be obtained in real time.

II. Purpose of the Study:

This study intends to find the relationship between the Anterior Chamber Depth obtained using optical biometry and the various subtypes of Primary Angle Closure Disease namely: Primary Angle Closure Suspects (PACS), Primary Angle Closure (PAC) and Primary Angle Closure Glaucoma (PACG) so as to aid in identifying the at-risk groups of Primary Angle Closure Disease

III. Material and Methods:

This was a hospital-based, cross-sectional study, where the Anterior chamber depth and their relationship with the various subtypes of Primary Angle Closure Disease patients were studied, after being approved by the institutional review board.

40 patients satisfying the inclusion criteria i.e. Primary angle closure disease patients (16 Primary angle closure suspects, 15 Primary angle closure, 9 Primary angle closure glaucoma patients). Patients in the age group of 41-80 years were included in the study after obtaining informed consent.

For the study some patients were excluded based on the excluding criteria. Those were the patients on pupil altering drugs, patients with secondary angle closure glaucomas like phacomorphic, inflammatory, neovascular glaucoma, patients in whom angle structures are not visible secondary to opacities in the cornea,

open angle glaucoma, normotensive glaucoma and ocular hypertensive patients and patients not willing to give consent to participate in the study

A detailed history was taken including their demographic data (age, gender, address, occupation). All subjects underwent complete Anterior segment examination including visual acuity, intraocular pressure measurement by Goldmann Applanation tonometer/Schiotz tonometer/Non contact tonometer, peripheral anterior chamber and angle assessment by Van Herick method and Gonioscopy using various gonioscopic mirrors (Zeiss 4 Mirror Gonioscopic Lens). Following the gonioscopic findings, patients were categorised into further subtypes: PACS, PAC and PACG. The fundus was examined by Slit Lamp biomicroscope assisted fundoscopy with 90D lens. The eye with advanced glaucomatous change was selected and if the changes were equal in both eyes; the right eye was selected for further evaluation. After this, measurement of anterior chamber depth, by optical biometry using refraction and visual field evaluation by Humphrey's Field Analyser if disc changes noted.

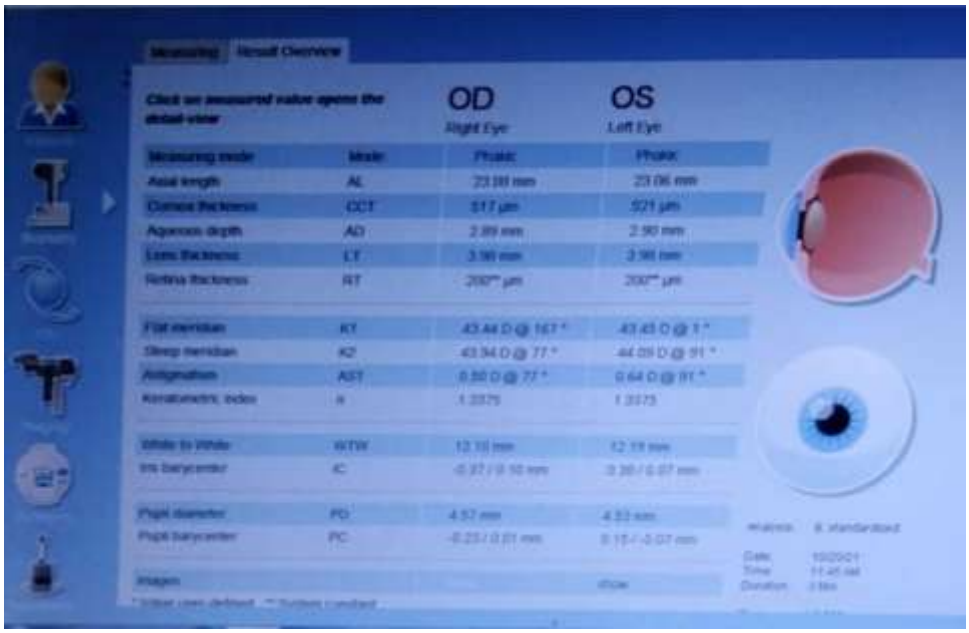


Fig : Photograph of the print-out obtained from Haag Streit Lenstar LS 900 Optical Biometer

IV. Results:

Amongst the 40 patients that were studied, maximum patients (42.50 %) belonged to the age group of 41-50 years age group, followed by 35% in 51-60 years age group, 18.5% in 61-70 years and 3.75% belonging to age > 70

Out of 40 patients, 19 (47.50%) were males and 21 (52.50%) were females and Male to Female ratio was 1:1.11

Amongst the 40 patients that were studied, 16 (40%) of the patients belonged to Primary Angle Closure Suspect subtype, 15 (37.50%) belonged to Primary Angle Closure subtype and 9 (22.50%) belonged to Primary Angle Closure Glaucoma subtype.

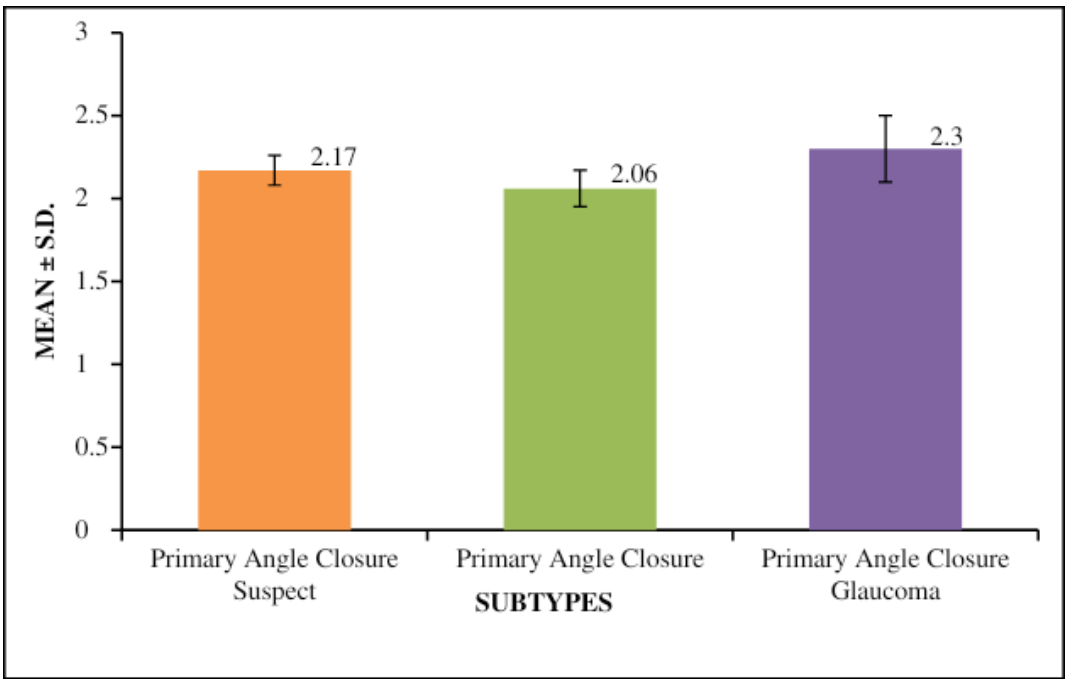
The mean anterior chamber depth was found to be 2.17mm, 2.06mm and 2.30mm in Primary Angle Closure Suspect, Primary Angle Closure and Primary Angle Closure Glaucoma respectively in our study

Table 1: Anterior Chamber Depth According To Subtype Of Primary Angle Closure Disease

SUBTYPES	NUMBER *(n)*	ANTERIOR CHAMBER DEPTH	
		Mean	*± S.D.*
Primary Angle Closure Suspect (PACS)	16	2.17	0.09
Primary Angle Closure (PAC)	15	2.06	0.11
Primary Angle Closure Glaucoma (PACG)	9	2.30	0.20
*p value**		<0.001	
Post-hoc Test... PACS vs PAC: Diff=-0.1100, 95%CI=-0.1884 to -0.0316, p=0.0035 PACS vs PACG: Diff=0.1300, 95%CI=0.0391 to 0.2209, p=0.0029 PAC vs PACG: Diff=0.2400, 95%CI=0.1481 to 0.3319, p=0.0000			

**One-way ANOVA; The p-value is significant at* 5% *level of significance.*

The mean anterior chamber depth was found to be 2.17mm, 2.06mm and 2.30mm in Primary Angle Closure Suspect, Primary Angle Closure and Primary Angle Closure Glaucoma respectively in our study.



Fig–1: Mean Anterior Chamber Depths In The Various Subtypes Of Primary Angle Closure Disease

V. Discussion:

In our study, we have measured the anterior chamber depth in different subtypes of primary angle closure disease and found that the mean anterior chamber depth was found to be 2.17 ± 0.09mm, 2.06 ± 0.11 mm and 2.30 ± 0.20 mm in in PACS, PAC and PACG respectively. The mean anterior chamber depth in the entire study population was found to be 2.16 ± 0.16 mm. The p-value when compared between PACS vs PAC, PACS vs PACG and PAC vs PACG were p-value: 0035, p-value: 0.0029 and p-value: 0.0000 respectively. Similar to our study, the measurements of mean anterior chamber depth in a study conducted by Huang J *et al*[15] in 2015 published a study in which 41 patients were studied in China and was found to be 1.97 ± 0.24mm, 1.97 ± 0.24 mm and 1.93 ± 0.233 mm in PACS, PAC and PACG subtypes respectively.

Loh CC *et al*[12] in 2020 in Malaysia did a study where they studied 268 eyes and their mean ACD values were comparable to our present study. The values in their study were found to be 2.51 ± 0.23mm,2.60 ± 0.33 mm and 2.54 ± 0.34 mm in primary angle closure suspect, primary angle closure and primary angle closure glaucoma respectively.

Chen YY *et al*[14] also conducted a similar study in 2013 and found the mean ACD values to be 2.58 ± 0.22 mm and 2.32 ± 0.17 mm PAC and PACG respectively. However, they didn't study the ACD values in the PACS subtype.

However, unlike the above-mentioned studies, in our study we could see an increase in the anterior chamber depth in the PACG group. A similar rise in the ACD in the PACG group was identified in a study conducted by Khayoom NS *et al*[13] which was conducted in 2016 in Bengaluru, India where they studied 59 patients. The mean ACD values in various subtypes in the Khayoom NS *et al*[13] study was found to be 2.623 ± 0.44mm, 2.367 ± 0.49 mm and 2.3745 ± 0.51 mm in PACS, PAC and PACG respectively.

Table 2: Anterior Chamber Depth In Different Studies:

STUDY	**YEAR**	**ANTERIOR CHAMBER DEPTH** (in mm)		
		PACS*	**PAC***	**PACG**
Huang J *et al*[15]	2013	1.97 ± 0.24	1.97 ± 0.24	1.93 ± 0.23
Chen YY *et al*[14]	2013	-	2.58 ± 0.22	2.32 ± 0.17
Khayoom NS *et al*[13]	2016	2.623 ± 0.44	2.367 ± 0.49	2.745 ± 0.51
Loh CC *et al*[12]	2020	2.51 ± 0.23	2.60 ± 0.33	2.54 ± 0.34
Present Study	2020	2.17 ± 0.09	2.06 ± 0.11	2.30 ± 0.20

*__Huang J__ *et al*[15] in their study considered cases of PACS and PAC as a single group.

Optical Biometry has been useful in studying anterior chamber depth in the study population. Thus, it can be considered a very important tool to study ocular biometric parameters for diagnostic evaluation.

In our study, the anterior chamber depth measured in different subtypes of primary angle closure

disease was found to be 2.17 ± 0.09mm, 2.06 ± 0.11 mm and 2.30 ± 0.20 mm in primary angle closure suspect, primary angle closure and primary angle closure glaucoma respectively. The p-value when compared between PACS vs PAC, PACS vs PACG and PAC vs PACG were p-value: 0035, p-value: 0.0029 and p-value: 0.0000 respectively.

Thus, from the study we now know that significant association in the measurement of Anterior Chamber Depth exists between PAC vs PACG.

VI. Conclusion:

Primary Angle Closure Disease is one of the most common causes of preventable blindness in India and Asia. Asians make up 47% of patients with POAG and 85% of those with PACG, demonstrating that Asia has a far higher frequency of PACG than the Western world.[2,3-11] In general, the probability of bilateral blindness is 2.5 times greater in PACG than in POAG.[4] As a result, diagnosing and treating PACG is a critical public health concern across Asia.

In the present study, the utility of Optical Biometry was used to measure the Anterior Chamber Depth (ACD) amongst the various subtypes of Primary Angle Closure Disease (PACD). It was found that early detection of at-risk groups of PACD can be identified since ACD was found to be shallower in cases of PACD than in normal population. Also, from the study we now know that significant association in the measurement of Anterior Chamber Depth exists between PAC vs PACG.

Thus, the findings of our study suggest that optical biometry has the potential to provide useful information regarding Primary Angle Closure Disease detection much before other clinical signs and symptoms appear, thereby enabling early diagnosis as well as early intervention.

However, the small sample size and short follow up period of our study limits the ability to assess the proper association. Furthermore, there is a need for large-scale studies to derive a specific cut off value in the Anterior Chamber Depth parameters amongst the various subtypes of Primary Angle Closure Disease as well as those who are at risk of developing Primary Angle Closure Disease.

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