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ORIGINAL RESEARCH ARTICLE

OCULAR BIOMETRY AMONG PRIMARY ANGLE CLOSURE

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ABSTRACT

Objective: To determine ocular biometry of primary angle closure. Materials and methods: A cross-sectional comparative study was carried out in Nepal Eye Hospital including thirty-six eyes of 29 diagnosed cases of primary angle closure and 44 eyes of 22 normal subjects selected by convenience sampling technique. A complete ocular examination of all the subjects was carried out. AL, ACD and LD measurement was done using ultrasound A scan. Result: Out of 80 eyes, there were 36 eyes of 29 diagnosed primary angle closure subjects and 44 eyes of 22 normal subjects. The mean age of primary angle closure patients were 61. 65+/- 10.44. The mean AL of PAC was 22.15mm +/-0.76. The mean AL of control group was 22.98 mm with SD of 0.63. The mean ACD of PAC patients were 2.85mm and SD of 0.46 and the mean ACD of control group was 3.59 with SD of .40. The mean lens diameter of PAC group was 4.57 mm +/- 0.58 and the mean LD of control group was 4.43mm +/- 0.54. The Sig (2-tailed) test showed: Age: 0.268, AL: 0.001, ACD: 0.000 and LD: 0.466. Conclusion: This study reveals that short AL and shallow ACD is a strong risk factor of primary angle closure. Though LD more than 4.5 mm is a risk factor of primary angle closure it is not statistically significant.

Key words: PAC: Primary angle closure, PACG: Primary angle closure glaucoma, ACD: Anterior chamber depth, AL: Axial length, LD: Lens diameter.

INTRODUCTION

Quigley has estimated that 66.8 million people are affected by primary glaucoma worldwide, with 6.7 million people being bilaterally blind due to the disease.[1]

Primary angle-closure glaucoma (PACG), which is more common in Asia than in Western countries, causes severe deficits in visual function if it is not detected and treated early.2.3 People with PACG are at 2.5 times higher risk of blindness than those with primary open-angle glaucoma.[1,2,3] Early detection by effective screening, and appropriate prophylaxis may prevent blindness from angle closure glaucoma. While gonioscopy examination is recognized as the gold standard for identifying individuals at risk for PACG, it requires highly trained ophthalmologists, who are in short supply in developing countries. However, A-scan ultrasonography, which is portable and non-invasive, can measure the ocular dimensions with ease.

Primary angle closure suspect and primary angle closure are two initial stages of primary angle closure glaucoma. Primary angle closure can cause severe visual morbidity. So identification of biometric risk factors of Primary angle closure is important to prevent visual morbidity.

Clinic based studies have suggested that eyes with occludable angles and angle closure glaucoma have a shorter axial length, shallower anterior chamber, and a thicker lens.[5–9] The shallower anterior chambers are in part because of the thicker and more anterior position of the crystalline lens.[8]

Progressive increase in lens thickness with age results in greater shallowing of the anterior chamber.10

Study of this type is not done till now in Nepal which includes all ocular biometric parameters.

This study has been conducted to identify biometric parameter of primary angle closure.

MATERIALS AND METHODS:

A one year prospective case control study (June 2013- June 2014) of the 29 primary angle closure and 22 age matched control patients attending glaucoma services at our centre was done. Patients found to have angle closure were classified using International Society of Geographical and Epidemiological Ophthalmology (ISGEO) Classification.[2]) Primary angle closure (PAC): The presence of irido-trabecular contact for at least 270°, with either raised IOP and/or peripheral anterior synechiae (PAS), but with normal optic disc and visual fields.

Inclusion criteria: All patients were diagnosed to have primary angle closure in glaucoma clinic Nepal eye hospital. Age matched control group were included.

Exclusion criteria: Patients with Primary angle closure suspect, Primary angle closure glaucoma and secondary angle closure, such as lens-induced glaucoma, neovascular glaucoma, or uveitis, were specifically excluded. Patient with primary and secondary open angle glaucoma and who had received peripheral laser iridotomies or intraocular surgery were excluded. We also excluded patients those who were taking miotics because these drugs might confound the biometric data by moving the lens–iris diaphragm forward

Informed consent was obtained for all participants. Detailed history was taken, best corrected visual acuity (BCVA), intra ocular pressure (IOP) (by Goldmann applanation tonometer), gonioscopy (using Zeiss 4-mirror goniolens), optic nerve head evaluation and Humphrey threshold 24-2 visual field analysis using Swedish interactive thresholding algorithm (SITA) strategy (Humphrey Instruments Inc San Leandro, CA) wherever applicable. Grading used for gonioscopy was based on structures actually visualized. Ocular biometric data were collected by A-scan ultrasonography following standard procedures. Briefly, after topical anesthesia was applied, the ultrasound hand-held probe perpendicularly touched the center of the cornea. At least five measurements of anterior chamber depth (ACD), lens thickness (LT), and axial length (AXL) were taken. Excluding outliers, we averaged and recorded the most consistent readings.[10] All these investigations was done in both cases and control groups.

The patient characteristics and biometric data of all cases and controls were first summarized descriptively as mean and SD. Paired sample t rest was used to assess the overall differences among the primary angle closure patients and age matched controls and P-value of <0.05 was considered significant. All statistical operations were performed using SPSS version 20.0

RESULT:

Table 1 shows the descriptive analysis of primary angle closure patients and control group. 29 patients of primary angle closure and 22 age matched control were included for descriptive analysis. The minimum age of primary angle closure patients were 40 years and maximum age were 78 years with mean age of 61. 65 and standard deviation of 10.44. The minimum age of control group was 50 years and maximum age was 70 years with mean of 57.13 and standard deviation of 5.75.

Table 1 Descriptive analysis of primary angle closure patients and control group.

	N	Minimum	Maximum	Mean	Std. Deviation
agePAC	29	40.00	78.00	61.6552	10.44467
AL	36	20.50	24.13	22.1578	.76868
ACD	36	2.00	3.87	2.8539	.44624
LD	36	3.05	5.43	4.5781	.58040

IOP	36	10.00	69.00	25.1111	15.27795
Control-AGE	22	50.00	70.00	57.1364	5.75115
Control-AL	44	21.44	24.18	22.9823	.63285
Control-ACD	44	2.58	4.81	3.5952	.40598
Control-LD	44	3.10	5.92	4.4307	.54606

PAC= Primary angle closure, AL= Axial length, LD= Lens diameter

Out of 29 patients diagnosed to have primary angle closure 36 eyes underwent ocular biometry. 44 eyes of 22 control group also underwent biometric test. The minimum and maximum axial length were 20.50 mm and 24.13mm respectively with mean axial length of 22.15mm and standard deviation of 0.76. The minimum axial length of control group was 21.44mm and maximum was 24.18mm with mean axial length of 22.98 mm with standard deviation of 0.63.

The minimum central anterior chamber depth was 2 mm and maximum was 3.87mm with mean ACD 2.85mm and standard deviation of 0.46 in primary angle closure group. The minimum central ACD was 2.56 mm and maximum was 4.81mm in control group with mean ACD of 3.59 and standard deviation of 0.40.

The minimum lens diameter in primary angle closure patients was 3.05mm and maximum of 5.43mm with mean lens diameter of 4.57 mm and standard deviation of 0.58. The minimum lens diameter of control group is 3.10mm and maximum of 5.92mm with mean of 4.43mm with standard deviation of 0.54.

Table 2 shows the paired sample statistics of primary angle closure patients and control group. 19 patients of primary angle closure patients and 19 age matched control was included in this paired sample statistics The mean age of PAC patients was 60.63 with standard deviation of 11.2 and std. Error Mean was 2.59. The mean age of control group was 57.42 with std deviation

of 5.92 and std. Error Mean of 1.36. 62 eyes were included for biometric parameter evaluation in paired sample test. The mean axial length of primary angle closure group was 22.15mm witb std deviation of .768 and std error mean of .128. The mean axial length of control group is 22.90 with SD of .664 and std error mean .110. The mean ACD of primary angle closure group was 2.85mm with SD of .44 and SE mean of .074. The mean ACD of control group was 3.59 mm with SD of .41 and SE mean .069. The mean lens diameter of primary angle closure group was 4.57mm with SD of .580 and std error mean. The mean lens diameter of control group was 4.49mm with SD of .489 and SE mean of .081.

The Sig (2-tailed): Age: 0.268, AL:0.001, ACD: 0.000 and LD: 0.466. The axial length and ACD was statistically significant.

Table 2: Paired sample statistics of primary angle closure patient and control group.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Age PAC	60.6316	19	11.29017	2.59014
	Control	57.4211	19	5.92842	1.36007
Pair 2	AL	22.1578	36	.76868	.12811
	Control AL	22.9042	36	.66374	.11062
Pair 3	ACD	2.8539	36	.44624	.07437
	CACD	3.5975	36	.41683	.06947
Pair 4	LD	4.5781	36	.58040	.09673
	CLD	4.4981	36	.48987	.08165

Sig (2-tailed): Age: 0.268, AL: 0.001, ACD: 0.000 and LD: 0.466

DISCUSSION

This is hospital based prospective case control study conducted in Nepal Eye Hospital glaucoma clinic from 2013 to 2014.

The minimum age of primary angle closure patients in our study were 40 years and maximum age were 78 years with mean age of 61. 65 and standard deviation of 10.44. This is comparable to other studies. The study done by R. George et al showed the mean age among subjects with occludable angles was 54.43 years (95% CI: 52.83 to 55.96).11 In other study. the mean age among occludable angle was 59.64+/- 9.70.13 The controls, PAC group, and PACG group were found to be significantly different in age (62.7±9.8; 65.3±7.5; and 66.0±7.4, respectively). [14]

In our study the mean axial length of 22.15mm and standard deviation of .76 in PAC group whereas the mean axial length of control group was 22.98 mm with standard deviation of 0.63. The mean ACD 2.85mm and standard deviation of 0.46. in primary angle closure group, whereas the mean ACD of control group was 3.59mm standard deviation of 0.40 The mean lens diameter of 4.57 mm and standard deviation of .58. of PAC group whereas the mean lens diameter of 4.43mm with SD of 0.54. Sig (2-tailed) showed: Age: .268, AL: 0.001, ACD: 0.000 and LD: 0.466

In a study done by Sherpa D the mean axial length and standard deviation of primary angle closure glaucoma were 21.93 + 1.16 mm (95% CI = 21.41 - 22.45) and those of control group were 23.01 + 0.49 (95% CI = 22.79 - 23.23). The axial length of less than 23 mm was found as a risk factor for angle closure glaucoma (Relative risk =3.40; p = 0.0032).[15]

In another study done in Nepal revealed that in the occludable angle group, the ACD (2.55 ± 0.69) was significantly different ($p < 0.001$) than the normal group (2.85 ± 0.39). The axial length (22.08 ± 0.83) in the occludable angle group was also considerably different ($p < 0.001$) when compared with the normal group (22.62 ± 0.90). In PACG group, the ACD and axial length were 2.48 ± 0.22 and 22.02 ± 0.59, respectively. The risk of having an occludable angle decreased with per unit millimeter increase in ACD (odds ratio, 0.24; 95% confidence intervals, 0.12-0.50) and axial length (odds ratio, 0.49; 95% confidence intervals, 0.36-0.67) after adjusting the effect of age and sex.[16]

The study showed that with regard to ocular parameters, the ACD tended to decrease and the Lens thickness tends to increase from normal to PAC to PACG. The eyes of the PACG group had significantly shallower ACD ($P<0.001$) and thicker lens ($P<0.001$) than those of the PAC group. While PAC had similar lens position to the control group, PACG had more anteriorly positioned lens than the PAC group ($P<0.001$). Logistic regression analysis found a significant association between a decrease in ACD and increased risk of PACG (odds ratio (OR)=3.59 for 0.2 mm decrease in ACD) as well as a significant association between an increase in LT and increased risk of PACG (OR=1.30).[14]

Another study showed no statistically significant difference in biometric parameters between PACS and PACG eyes, or between affected and fellow eyes in the APAC group ($P>0.05$ for all comparisons). However, eyes with APAC had thicker cornea ($P=0.001$), thicker lens ($P<0.0001$), shallower ACD ($P=0.009$), shallower CACD ($P=0.003$) and larger LAF ($P<0.0001$). Based on ROC curve analysis, lower ACD, and larger lens thickness and central corneal thickness values were associated with APAC.[17]

Huang J et al study revealed that eyes with CPACG had shallower anterior chamber depths, smaller anterior chamber angles, thinner irises, and longer iris-ciliary process distances than their fellow eyes with PAC/PACS ($P<0.05$). There were no significant differences in terms of lens thicknesses, axial lengths, lens vault, and trabecular-ciliary process distances.[18]

CONCLUSION

This study clearly reveals that shorter axial length and shallow anterior chamber depth is a strong risk factor of primary angle closure. Though lens diameter more than 4.5 mm is a risk factor of primary angle closure it is not statistically significant. Early detection of primary angle closure and prompt treatment is mandatory to prevent blindness from primary angle closure and primary angle closure glaucoma.

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