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# TO ESTABLISH RELATIONSHIP BETWEEN PRIMARY ANGLE CLOSURE GLAUCOMA WITH BIOMETRY AND BODY HEIGHT, WEIGHT & ABDOMINAL GIRTH

Ophthalmology

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## ABSTRACT

**BACKGROUND:** This study compared the general and ocular biometric characteristics of normal, primary angle closure (PAC), and primary angle-closure glaucoma (PACG) patients to better understand the possible relationship between differences in ocular parameters that might predict risk for PACG in PAC patients.

**CONCLUSIONS:** In addition to LT, a shallower ACD owing to a change in RLP may have a role in the progression from PAC to PACG. Owing to the differences of certain biometric characteristics between PAC and PACG, A-scan ultrasonography might potentially be used for the early detection of PACG in PAC eyes.

## KEYWORDS

A-scan ultrasonography, ocular biometry, primary angle-closure glaucoma, primary angle closure

## INTRODUCTION

Primary angle closure glaucoma (PACG), although less prevalent than primary open angle glaucoma, has been predicted to account for nearly half of binocular glaucoma blindness by 2020 due to its more severe visual morbidity. It is recognized that populations of East Asian origin have a higher prevalence of PACG compared with those of European or African descent. Although up to 87% of all people with PACG around the world reside in Asia, according to a recent estimation of PACG prevalence in Europe, there are 130,000 people with PACG in the UK, 1.60 million in Europe and nearly 581,000 in the USA.

Understanding the risk factors for PACG is important for the early recognition and effective prophylaxis of this potentially preventable disease. Shallower anterior chamber depth (ACD), shorter axial length (AL) and greater lens thickness are associated with narrow angles and higher risk of developing primary angle closure disease. Several studies have reported a possible association between central or limbal ACD and adult anthropometry. In a population-based cross-sectional survey, Wong and colleagues found a tendency for taller persons to have longer AL, deeper ACD, longer vitreous cavity distance, flatter corneas and thinner lenses, compared with shorter persons of similar weight, age, sex and socioeconomic status. In another population-based study from Beijing, a significant association was found between shallower limbal ACD and shorter body stature. Although ACD is widely recognized as an important anatomical risk factor for primary angle closure, gonioscopic assessment still remains the gold standard for the diagnosis of angle closure. Data regarding associations between anthropometric measures and angle configuration directly observed under gonioscopy may serve as a beneficial addition to the existing literature.

In the current analysis, based on data from a population-based prevalence survey of urban citizens in southern China, we describe the association between angle configuration measured by gonioscopy and adult anthropomorphic measures, namely height, weight and abdominal girth.

Several studies have used A-scan ultrasonography to characterize PACG, most comparing the ocular dimensions between PACG and control eyes, and some comparing ocular biometry among subgroups of PACG. However, in these studies, the term 'glaucoma' was defined only by elevated IOP, meaning that an eye without visual field defect or optic neuropathy could be classified into glaucoma based on an IOP of over 20mmHg alone. Some studies also divided PACG into subacute, acute, and chronic based on their clinical symptoms only. In this classification, an eye was defined as acute PACG because it had a sudden onset IOP elevation, even if the eye could possibly resolve to normal function without any visual field or disc change. Therefore, the nomenclature could not represent the long-term severity of disease. Another problem with these studies is that they used different PACG classification systems, resulting in overlapping or confusing diagnostic criteria. Together, these problems explain the possible reason that the results of previous studies on the A-scan biometry of PACG were inconsistent and could not be compared.

POAG less severe than PACG and could be a possible precursor to PACG. While some studies have used A-scan ultrasonography to study eye structure of PACG, most have not adopted Foster's diagnostic criteria in their classifications. Therefore, in this study, we recorded general patient characteristics and used A-scan ultrasonography to characterize ocular biometry in normal, PAC, and PACG eye groups to identify what factors might increase the risk of PACG in PAC patients. The results of such a study might make possible the early detection of PACG and help delay the possible progression of the disease.

Age, sex and race have been viewed as main demographic risk factors for PACG and all these factors are directly associated with anterior chamber depth (ACD). Aging results in the increased thickness of lens, thus decreased ACD, while Asian and Eskimos people have shallower AC than Caucasians. With respect to sex, it is well documented that in various races, females have a shallower AC than male. The reasons for this include females shorter stature and possibly underlying genetic difference. Several population based studies have shown that sex is independently associated with ACD after adjustment of body height in multivariate linear regression. However, additional factors for adjustment varied in this study, which could possibly affect the results of regression analysis.

## PATIENTS AND METHODS

Study was conducted at Indira Gandhi Institute of Medical Science patna, Ophthalmology Department. Participants in this study were recruited from patients with suspected case of angle closure glaucoma approx 100 patients attended in O.P.D. of I.G.I.M.S. Patna.

### Inclusion Criteria

**1.** All patients of angle closure suspect who attended eye O.P.D. of I.G.I.M.S. Patna.
**2.** Patients willing to follow up.

### Exclusion Criteria

1. Patient who had already undergone any ocular surgery.
2. Aphakic patients.

## METHODS:

Height was measured with the subject standing up straight without shoes and recorded in meters. Weight was measured with the patient dressed but after removing coats and shoes and was recorded in kilograms. Abdominal girth were measured by removing coat or any

thick clothes in centimeter. The scales used for measuring anthropomorphic parameters were calibrated on a daily basis.

In brief, static gonioscopy was performed using a Goldmann-type, three-Anterior chamber Angle was seen with 3-mirror goniolens, body weight was measured with weighing machine, body height and abdominal girth was measured with measuring was tape, gonio lens with low ambient illumination and a 1 mm narrow beam. Care was taken to avoid the beam falling on the pupil in order to prevent alteration of the angle configuration. If trabecular meshwork could not be seen because of marked iris convexity, an "over the hill" view was obtained by slightly tilting the lens towards the trabecular meshwork without causing inadvertent corneal indentation. Angle width was estimated in the superior and inferior quadrants as the angle in between a tangent line to the surface of the trabecular meshwork and another tangent line to the peripheral third of the iris, and then recorded in Schaffers grade (0, I, II, III and IV). Mean angle width of each eye was calculated from the angle width of the superior and inferior quadrants.

The status of narrow anterior chamber angle in this study referred to eyes in which the pigmented posterior trabecular meshwork was not visible in at least three quadrants (270°) under static gonioscopyand biometry done with A scan which measures axial length, anterior chamber depth and lens thickness.

**Examination Performed**

1. Vision
2. Refraction
3. I.O.P measurement by goldmanapplanation tonometry
4. Gonioscopy with three mirror goniolens
5. Measurement of height abdominal girth with measuring tape
6. Weight with weighing machine
7. Axial length and anterior chamber depth with A-scan.

**METHOD OF STATISTICALANALYSIS**

The following methods of statistical analysis have been used in this study.

The results were averaged (mean±standard deviation) for continuous data, and number and percentage for dichotomous data are presented in Table and Figure.

**1. One way Analysis of Variance (ANOVA)**

One way analysis of variance was used to test the difference between groups.Analysis of Variance is a technique by which the total variation is split into two parts one between groups and the other within the groups. If 'F' value is significant, there is a significant difference between group means. To find out which of the two groups means is significantly different post hoc test of LSD test is used. In case F value is not significant it indicates that there is no significant difference between the groups and stops the analysis at this stage and does not use LSD test.

The formula used:
$LSD = t\sqrt{2MS/n^*}$

Where,
LSD =Least significant difference;
t=Critical, tabled value of the t-distribution with the df associated with MSE, the denominator of the F statistic;
MS=Mean Sum of Square;
n*= number of scores used to calculate the means of interest.

2. Univariate analysis of the dichotomous variables encoded was performed by means of the Chi square test with Yates correction if required.

$$\text{Chi square test } \chi 2 = \frac{(ad-bc)^2(a+b+c+d)}{(a+b)(c+d)(b+d)(a+c).}$$

**Chi-Square ($\chi 2$) test for (2 x 2 tables)**

| Group | Attribute Characteristic finding | | Total |
|---|---|---|---|
| | Absent | Present | |
| Male | a | b | a+b |
| Female | c | d | c+d |
| Total | a+c | b+d | N |

a, b, c, d are the observed numbers.
N is the Grand Total $\chi 2$ with 1 DF = 3.841.
DF=(r-1)*(c-1) .

Where
r = no. of rows and
c=no. of columns.
DF=Degrees of Freedom (Number of observation that are free to vary after certain restriction have been placed on the data).

**3. Student "t' test**

The student 't' test was used to determine whether there was a statistical difference between male and female subjects in the parameters measured.
Student's t test is as follows:
$t = \sim\sim\sim t\, n_{1+n2}\text{-}2$
Where

$$s^2 = \frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{(n_1+n_2-2)}.$$

In all the above tests, p values less than 0.05 were taken to be statistically significant.

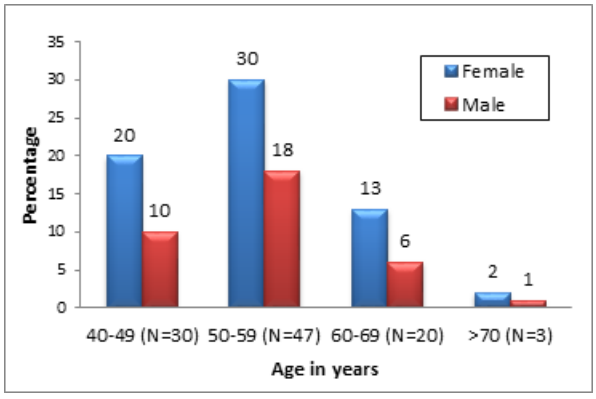
The data was analyzed using SPSS package (Stastistical package for social science).

**RESULTS**

100 patients with 65 (65.0%) females and 35 (35.0%) males were included in the study. All the subjects were studied in terms of age, biometry, body height, abdominal girth and body height. The observations were made in both eyes of all the subjects.

**Table 1 Age And Sex Distribution Of Diabetics In The Study Group**

| Age Group | Sex | | Total |
|---|---|---|---|
| | Female | Male | |
| 40-49 | 20 | 10 | 30 |
| 50-59 | 30 | 18 | 48 |
| 60-69 | 13 | 6 | 19 |
| >=70 | 2 | 1 | 03 |
| Total | 32 | 68 | 100 |
| **Statistic** | **DF** | **Value** | **Prob** |
| **Chi-Square** | **3** | 2.1319 | 0.5455 |




In present study (table1) the population consists of 65 (65.0%) females and 35 (35.0%) males in the age range from 40-73 years with mean age of 53.4±8.28 years. The total number of patients observed in 40 to 49 years is 30 (30.0%), 50 to 59 years 48 (48.0%), 60-69 years 19 (19.0%) and >70 years 3 (3.0%). The majority of the patients are above 50 years age.

The age specific patients in females was **66.6**% (20 out of 30) in the age group of 40 to 49 years followed by 62.5% (30 out of 48) in the age group 50 to 59 years, 68.4% (13 out of 19) in 60-69 years and 66.7% (2 out of 3) in >70 years.

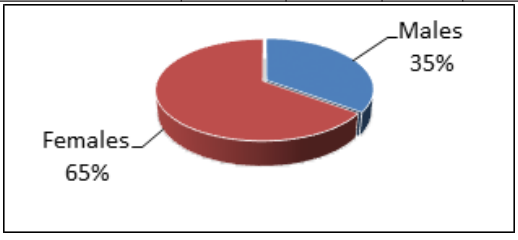
The age specific patients in males was 33.3% (10 out of 30) in the age group of 40 to 49 years followed by 31.9% (18 out of 48) in the age group 50 to 59 years, 31.5% (6 out of 19) in 60-69 years and 33.3% (1 out of 3) in >70 years.

The table shows the majority of patients in the study are above 50 years

(70%). The difference observed was statistically significant (p>0.05). Age and sex distribution was similar in the study.

**Table 2 Sex-wise Distribution Of Patients With PACD**

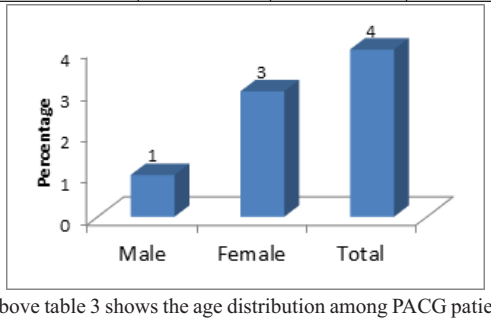
| Sex | Total No. of patients | Diagnosed | | | |
|---|---|---|---|---|---|
| | | PACG | RACS | RAC | Normal |
| Males | 35 | 1 (2.85%) | 0 | 01 (2.85%) | 33 |
| Females | 65 | 3 (4.6%) | 2 (3.07) | 0 | 60 |
| Total | 100 | 4 (4%) | 2 (2%) | 1 (1%) | 93 (93%) |
| Percentage | | Statistic | *DF* | Value | Prob |
| | | Chi-Square | 3 | 3.16 | 0.3677 |




This table 2 shows the proportion of cases diagnosed among patients in the study population. Overall proportion of PACG cases observed was 4.0% (4 out 100), PACS observed 2.0% (2 out of 100) and 1.0% PAC cases were observed remaining 93%were normal. Among the females 4.61% (3 out of 65) and males 2.85% (1 out 35) PACG cases were diagnosed. The proportion of cases diagnosed between females and males was not statistically significant (p>0.05). The proportion of PACG cases diagnosed between males and females was not statistically significant (p>0.05).

**Table 3 Age-wise Distribution Of PACG Among The Diabetic Population Studied**

| Age group | Male | Female | Total |
|---|---|---|---|
| 40-49 | - | - | - |
| 50-59 | 1 | 2 | 3 |
| 60-69 | 0 | 1 | 1 |
| >=70 | - | - | 0 |
| Total | 1 | 3 | 4 |




The above table 3 shows the age distribution among PACG patients (4 out of 100). The mean age of the patients was 54.5±4.80 ranging from 50 yrs to 61 yrs. The mean age of female patients was 56.0± 4.58 ranging from 52 yrs to 61 yrs. The mean age of male patients was 50.0 years.

**Table - 4. Comparison Of Biometric Variable Between Primary Angle Clouser Glaucoma And Normal Subject**

| Parameter | PACG (n=4) | Normal (n= 96) |
|---|---|---|
| Axial length | 20.53 ± 1.05 | 22.75 ± 0.67 |
| ACD | 2.10 ± 0.19 | 2.61 ± 0.10 |
| Lens thickness | 4.96 ± 0.34 | 4.13 ± 0.19 |

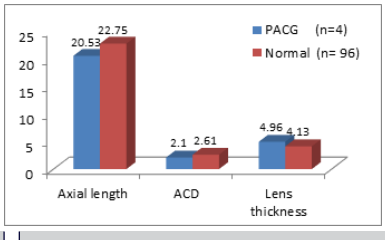



Table -4 shows comparison of biometric variable between PACG and normal subjects. The Mean Axial length values of Normal were 22.75 ± 0.67 ranging from 22.08 to 23.42whereas mean axial length values of PACG 20.53 ± 1.05 ranging from 19.48 to 21.58.The mean ACD values of normal were 2.61 ± 0.10 ranging from 2.51 to 2.71 whereas the mean ACD values of PACG were 2.10 ±0.19 ranging from 1.81 to 2.29. The mean lens thickness values of normal were 4.13 ± 0.19 ranging from 3.94 to 4.22, whereas in PACG 4.96 ± 0.34 ranging from 4.62 to 5.30. The difference observed in mean values among the group was statistically significant (p<0.05).

## DISCUSSION

The suggestion of an association between biometry & anthropometry and primary angleclosureglaucoma (PACG) is not new.

Statistically significant association of ACD with PACG has been suggested by Weekers and Grieten Tomlinson and Leighton, Lowe and Clarkand Lee, Brubaker and Ilstrup. A similar association of LT with PACG was demonstrated by Lowe.

In present study the diabetic patients above 40 years of age were briefly explained about the study and the tests they would have to undergo. These patients were subjected to detailed eye examination in the Department of Ophthalmology, Indira Gandhi Institute of Medical Science, Patna.

### Examination Performed

1. Vision
2. Refraction
3. I.O.P measurement by goldmanapplanation tonometry
4. Gonioscopy with three mirror goniolens
5. Measurement of height abdominal girth with measuring tape
6. Weight with weighing machine
7. Axial length and anterior chamber depth with A-scan.

In present study the results were averaged (mean±standard deviation) for continuous data, and number and percentage for dichotomous data. In present study 100 PACD patients with 65 (65.0%) females and 35 (35.0%) males were included. All the subjects were studied in terms of age biometry, body height, weight and abdominal girth. The observations were made in both eyes of all the subjects.

In present study (table1) the population consists of 65 (65.0%) females and 35 (35.0%) males in the age range from 40-73 years with mean age of 53.4±8.28 years. The total number of patients observed in 40 to 49 years is 30 (30.0%), 50 to 59 years 48 (48.0%), 60-69 years 19 (19.0%) and >70 years 3 (3.0%). The majority of the patients are above 50 years age. In present study the difference observed was statistically significant (p>0.05). Age and sex distribution was similar in the study.

This table 2 shows the proportion of cases diagnosed among patients in the study population. Overall proportion of PACG cases observed was 4.0% (4 out 100), PACS observed 2.0% (2 out of 100) and 1.0% PAC cases were observed remaining 93% were normal. Among the females 4.61% (3 out of 65) and males 2.85% (1 out 35) PACG cases were diagnosed. The proportion of cases diagnosed between females and males was not statistically significant (p>0.05).

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Several limitations should be considered when interpreting our results. Anthropometry data were only available for 64 of the 100 phakic subjects examined in the population-based prevalence survey. While

excluded participants were relatively older and had deeper ACD, it is not likely that the associations we described would be systematically different in these people. Another limitation is that gonioscopy is dependent on the examiner's skills, experience and subjective judgments.

## CONCLUSION

Primary angle closure glaucoma is associated with irreversible blindness. Thus, the public health importance of detecting undiagnosed and treatable glaucoma is important, as blindness has economic and societal consequences for the rest of an individual's life.

Several studies have shown an association between PACG and Biometry, body height, weight but not with abdominal girth.

Our findings suggest that height was not independently associated with narrow angle in this cohort, once adjusted for age and sex. However, persons of our study lower body weight were more likely to have narrow anterior chamber angles, independent of age, sex, central ACD, AL, and education level. Small axial length, short ACD and thick lens directly associated with PACG. This association was detected only in women, whereas no association with abdominal girth.

Our findings suggest that lower body weight may provide important information to the decision making process for referring people for further assessment of angle configuration, especially when combined with other well recognized risk factors such as female sex, old age, certain ethnic groups and hyperopia.

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