ABSTRACT: PURPOSE: To evaluate measurable biometric parameters like anterior chamber depth, axial length, lens thickness, relative lens position in normal, angle closure suspects in non cataractous and cataractous eyes. METHODS: A total of 345 eyes involving all age groups and both sexes with open angles, angle closure suspects with clear and cataractous lens were selected randomly among patients attending OPD during the period of August 2013 to May 2014. RESULTS: Axial length in present study was significantly less in angle closure suspects (22.41±0.52) as compared to open angles (23.23±0.51) (P<0.001). Thickness of lens in angle closure suspects (4.44±0.9) was significantly more as compared to open angles(4.28±0.28) (P<0.001). Anterior chamber depth was significantly low in angle closure suspects (2.59±0.9) as compared to open angles (3.19±0.9) (P<0.001). Lens was detected to be anteriorly placed in angle closure suspects when compared to open angles with clear lens. There were no significant differences in parametric measurements between males and females. CONCLUSION: Angle closure suspects in the study is associated with shorter axial length, thicker crystalline lenses, shallow anterior chamber, anteriorly placed lens compared to open angles. Angle closure suspects in this study group seem to be associated with shallower anterior chambers, thicker crystalline lenses, anteriorly placed lens and shorter axial length s more in eyes with cataractous lens when compared to clear lens. KEYWORDS: 32Angle closure suspects, Anterior chamber depth, Axial length, Lens thickness, intra ocular pressure.

INTRODUCTION: Glaucoma is a chronic progressive multifactorial optic neuropathy caused by a group of ocular conditions which damage the optic nerve with a resultant loss of visual function. Glaucoma is the leading cause of irreversible blindness in adult population worldwide.(1) Glaucoma is a potentially blinding disease that affects 67 million persons worldwide. It is the second leading cause of visual loss in the world.

The global prevalence of glaucoma is estimated to be 80 million in 2020. Forty- seven percent of the glaucomas worldwide would be in Asia with more than 75% being angle closure. At present 12 million Indians are affected by glaucoma accounting for 12.8% of the blindness in the country.(2)

Hospital - based data from India report 45 to 55% of primary glaucomas are angle closure type. In the glaucoma clinic of an eye hospital, 45.9% of all primary adult glaucomas were of the angle closure type.(3-4)

A considerable proportion of the population (10.35%) has "occludable angles" which is now termed primary angle closure suspect (PACS) according to more recent definitions. An
occludable angle may result in acute primary angle closure (APAC) or PACG, however some eyes
never develop any sign of glaucoma.\(^5\)

Subjects were classified as PACS if there was >270 degrees of iridotrabecular contact
without peripheral anterior synechiae, glaucomatous optic neuropathy or increased IOP.\(^5\)

The association between a shallow anterior chamber and PACG is well documented \(^6\) and
the measurement of anterior chamber depth therefore has a potential in screening for PACG.
Some investigators have also studied other biometric parameters like lens thickness (LT), axial
length (AL), relative lens position (RLP).\(^7\)

Improved detection with simple investigation techniques as a scan biometry can play a
key role in early diagnosis.

The present study is therefore conducted to evaluate the measurable biometric
parameters (ACD, AL, LT, RLP) amongst normal, ACS in non- cataractous and cataractous eyes.

**OBJECTIVES:** To measure the biometric parameters - AXL, ACD, LT, RLP in controls and cases
of ACS with and without cataract as defined in materials and methods.

**MATERIALS AND METHODS:** It is prospective and comparative study. Ethical approval for this
project was obtained from ethics review board of the hospital. Consent was obtained from all the
patients.

**SELECTION OF CASES:** A total of 345 eyes involving all age groups and both sexes with open
angles, angle closure suspects with clear lens and cataractous lens were selected randomly
among patients attending Ophthalmology OPD during the period of August 2013 to May 2014.

**INVESTIGATIONS:** All patients underwent an ophthalmologic examination including,
1. Slit lamp biomicroscopy,
2. Goldmann applanation tonometry,
3. Indentation gonioscopy with a sussman 4-mirror goniolens to detect appositional or
   synechial closure,
4. Stereoscopic assessment of the optic disc with a +90 diopter lens.
5. A scan biometry.
6. Threshold field testing using octopus automated perimeter.

**CONTROL GROUP:** Subjects with a normal ocular examination, intraocular pressure less than 22
mm of hg, open angle on gonioscopy, no lenticular opacity, and no history of intraocular surgery,
patients not on anti-glaucoma drugs were included in the normal group (control).

**EXCLUSION CRITERIA:** Subjects giving a history of previously diagnosed glaucoma, intraocular
surgery, laser iridotomy or refractive surgery, use of anti-glaucoma medication, or evidence of
active keratitis or anterior segment pathology precluding examination were excluded.

Subjects who were unable to undergo biometry for any specific reason.

If both eyes of a subject were eligible, both eyes were selected for analysis.
RESULTS: This cross sectional study consisting of 345 patients were undertaken to study the difference of parameters (AXL, LT, ACD, RLP) among open angle, ACS with clear lens and lens with cataractous changes.

| Gender | Number | %   |
|--------|--------|-----|
| Male   | 185    | 53.6|
| Female | 160    | 46.4|
| Total  | 345    | 100.0|

Table 1: Gender distribution of patients studied

### Study parameters

| Without cataract | Open angle | Angle closure suspect | P value |
|------------------|------------|-----------------------|---------|
| MALES            |            |                       |         |
| Axial length     | 23.23±0.51 | 22.41±0.52            | <0.001  |
| Lens thickness   | 4.28±0.28  | 4.44±0.09             | <0.001  |
| Anterior chamber depth | 3.19±0.29 | 2.59±0.09             | <0.001  |
| Relative lens position | 5.31±0.31 | 4.81±0.10             | <0.001  |
| FEMALES          |            |                       |         |
| Axial length     | 23.04±0.15 | 22.45±0.15            | <0.001  |
| Lens thickness   | 4.08±0.13  | 4.37±0.09             | <0.001  |
| Anterior chamber depth | 3.06±0.14 | 2.34±0.12             | <0.001  |
| Relative lens position | 5.11±0.14 | 4.48±0.12             | <0.001  |

Table 2: Comparison of study parameters, open angle, angle closure suspect with clear lens in males and females

### Study parameters

| With cataract | Open angle | Angle closure suspect | P value |
|--------------|------------|-----------------------|---------|
| MALES        |            |                       |         |
| Axial length | 22.85±0.15 | 22.36±0.09            | <0.001  |
| Lens thickness | 4.93±0.08  | 5.14±0.11             | <0.001  |
| Anterior chamber depth | 2.77±0.09 | 2.11±0.11             | <0.001  |
| Relative lens position | 5.22±0.10 | 4.68±0.13             | <0.001  |
| FEMALES      |            |                       |         |
| Axial length | 22.92±0.16 | 22.17±0.14            | <0.001  |
| Lens thickness | 4.91±0.15  | 5.05±0.14             | <0.001  |
| Anterior chamber depth | 2.72±0.11 | 2.09±0.09             | <0.001  |
| Relative lens position | 5.17±0.13 | 4.62±0.15             | <0.001  |

Table 3: Comparison of study parameters, open angle, angle closure suspect with cataractous lens in males and females
Graph 1: Comparison of mean axial length in males and females with clear lens in open angles and angle closure suspects (P value <0.01)

Graph 2: Comparison of mean lens thickness in males and females with clear lens in open angles and angle closure suspects (P value <0.001)
Graph 3: Comparison of mean lens thickness in males and females with clear lens in open angles and angle closure suspects (P value <0.001)

Graph 4: Comparison of relative lens position in males and females with clear lens in open angle and angle closure suspects (P value <0.001)
Graph 5: Comparison of mean axial length in males and females with cataractous lens in open angle and angle closure suspects (P value <0.001)

Graph 6: Comparison of mean lens thickness in males and females with cataractous lens in open angle and angle closure suspects (P value <0.001)
Graph 7: Comparison of maximum mean anterior chamber depth in males and females with cataractous lens in open angle and angle closure suspects (P value <0.001)

Graph 8: Comparison of the maximum mean relative lens position in males and females with cataractous lens in open angle and angle closure suspects (P value <0.001)
DISCUSSION: The major cause of blindness (80.1%) in India is cataract. Cataract is treatable by a highly successful operation and has therefore justifiably received most attention from health planners. The other causes of blindness in India include refractive errors, glaucoma and corneal blindness: however with the focus on cataract, these other causes have been neglected. Glaucoma is the second leading cause of blindness globally\(^8\) and third most common cause in India.\(^9\)

Glaucoma is estimated to affect 12 million Indians and causes 12.8% of the blindness in the country. Hospital – based studies from India have reported that PACG is almost as common as POAG, with 46% to 55% of all primary glaucomas being PACG. This finding may be explained by the fact that gonioscopy is not routine in Indian clinics and clinic based reports may have detected angle closure only in patients with disc and field damage.

Thus there is a need to develop screening tests that will both identify persons with occludable angles and also those who are likely to develop frank angle closure and ACG.

Primary angle closure suspects are persons with bilateral, narrow angles, while primary angle closure is defined when narrow angles are combined with:

1. IOP above the 97.5\(^{th}\) percentile for the population,
2. Peripheral anterior synechiae,
3. A past acute attack.

PACG denotes bilateral narrow angles and glaucomatous optic nerve damage, indicated by a cup/ disc exceeding the 97.5th percentile for the population and the presence of an automated visual field defect.\(^{10}\)

The present study is aimed at detecting the significance of difference in the values of axial length, lens thickness, anterior chamber depth, relative lens position among eyes with open angles, occludable angles in eyes with clear lens and cataractous lens. On the basis of clinical examination, scan biometry findings the patients were divided in to

GROUP 1: OPEN ANGLES.

Sub group (a) clear lens (CL).
Sub group (b) cataractous lens.

GROUP 2: OCCLUDABLE ANGLES.

Sub group (c) clear lens (CL).
Sub group (d) cataractous lens.

GROUP 1: OPEN ANGLES: There were total 72 patients (34 male, 38 females) in this group distributed as,

Sub group (a) eyes with clear lens: The mean value of axial length, lens thickness, anterior chamber depth, relative lens position among both genders in the present study found to be consistent with the findings of standard Indian study\(^{11}\) though relative lens position showed lower value in the present study when compared to the above said study.
**ORIGINAL ARTICLE**

**Sub group (b) eyes with cataract:** The result of present study showed shorter axial length, shallower anterior chamber, thicker lens though similar lens position when compared to males in a standard Indian study.\(^{[11]}\) The present study shows similar axial length, shallower anterior chamber, thicker lens and similar lens position when compared to females in above said study.

**GROUP 2: ANGLE CLOSURE SUSPECTS:** There were total 73 patients (36 male, 37 females) in this group distributed as,

**Sub group (c) eyes with clear lens:** In the present study the axial length in both genders among angle closure suspects was found shorter (\(P <0.001\)) when compared to open angles. Lens thickness was found to be higher (\(P <0.001\)), anterior chamber depth was found to be shorter (\(P <0.001\)), and relative lens position lower (\(P <0.001\)) in both genders when compared to open angles. The above findings of the present study concur well with the standard Indian study.\(^{[11]}\)

**Sub group (d) eyes with cataract:** In the present study the axial length in both genders among angle closure suspects was found shorter (\(P <0.001\)) when compared to open angles. Lens thickness was found to be higher in males (\(P <0.001\)) and females (\(P =0.002\)) among angle closure suspects when compared to open angles. The anterior chamber depth in the present study was found shorter (\(P <0.001\)) in both genders, among angle closure suspects when compared to open angles. The relative position lower in both genders when compared to open angles. The above findings of the present study are comparable to the standard Indian study.\(^{[11]}\)

**DISCUSSION:** Primary angle-closure glaucoma is one of the major causes of blindness worldwide. It is a disease of ocular anatomy that is related to papillary- block, angle crowding mechanisms of filtration angle closure. Eyes at increased risk for primary angle closure are small with decreased axial length, anterior chamber depth and filtration angle width, associated with a proportionately large lens. Angle closure is an anatomical disorder where symptomatology does not specify the involved mechanism. Various western studies have studied the biometric parameters of ocular structures in primary angle closure glaucoma. Biometry and clinical examination of angle closure suspect patients identifies anatomical risk factors for angle closure and supports the pivotal role of the potential anatomical mechanism of closure.

There are few studies available on Indian eyes that have studied the association between axial length, anterior chamber depth, and lens thickness, relative lens position in primary angle closure glaucoma and angle closure suspects. Moreover no Indian study is available over study of above parameters in eyes with cataract. The present study was undertaken to measure the biometric parameters – axial length, anterior chamber depth, lens thickness, relative lens position in selected cases and to analyze whether the observed differences of the values in different subgroups depending on gender among angle closure suspects in cataractous and non-cataractous eyes have any statistical significance.
CONCLUSION: Angle closure suspects in this study group seem to be associated with shallower anterior chamber, thicker crystalline lenses, anteriorly placed lens and shorter axial length s more in eyes with cataractous lens than with clear lens.

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