



## PROFILE OF PRIMARY ANGLE CLOSURE DISEASE IN THE TERTIARY EYE CARE CENTRE

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### ABSTRACT

Primary angle closure glaucoma(PACG) accounted for 26% of all cases of glaucoma worldwide in 2010. PACG accounts for more than 50% of glaucoma blindness. No study has been performed in central Karnataka of which our institute is a part of. Hence this cross sectional study was undertaken to study the clinical profile and ocular biometric characteristics of patients with the spectrum of PACD at our institute. **Objectives:** To study the clinical profile and ocular biometric characteristics in patients with Primary angle closure disease (PACD) at our institute. **Methods:** We conducted a cross-sectional hospital based study on 60 eyes of 30 PACD. All patients underwent comprehensive glaucoma evaluation and ocular biometry. Ocular biometric parameters were compared between patients with Primary angle closure suspect(PACS), primary angle closure(PAC) and primary angle closure glaucoma(PACG). **Results:** The mean age was 52.2±9.6 years with a female preponderance of 66.7%. PACS, PAC and PACG was diagnosed in 23(38.33%), 11(18.33%) and 24(40%) eyes respectively, one eye(1.67%) had acute angle closure crisis and one eye(1.67%) was pseudophakic. Axial length, corrected anterior chamber depth, lens position and relative lens position values were less in all the patients. However there was no statistically significant difference in biometric parameters between the three groups of PACD. **Conclusion:** Patients with PACG had advanced to end stage disease at diagnosis, emphasizing the need for improved glaucoma screening measures to ensure early detection of PACD to reduce blindness rates. Patients with PACD have lower AXL, ACD and significantly anteriorly positioned lens, which may contribute to the development of PACD. A prospective study which follows the progression of the biometric variables may throw lights on the role of these parameters in the progression from PACS to PAC or PACG.

**KEYWORDS :** Primary angle closure suspect, Primary angle closure, Primary angle closure glaucoma, ocular biometry

### INTRODUCTION:

Primary angle closure glaucoma(PACG) accounted for 26% of all cases of glaucoma worldwide in 2010.<sup>1</sup> PACG is a major cause of world glaucoma blindness. In 2013, the prevalence of PACG in the world was 20.17 million and is stated to increase to 32.04 million by 2040.<sup>2</sup>

Primary angle closure disease(PACD) is common in Asian populations, with India accounting for 23.9% of world's angle closure glaucoma.<sup>2</sup> Although PACG accounts for only 26% of all cases of glaucoma worldwide, more than 50% of glaucoma blindness is attributable to PACG.<sup>1,2</sup>

While PACD can be detected by a simple technique of Gonioscopy which is considered as a gold standard, it requires highly trained Ophthalmologists. Gonioscopy is often omitted in the routine ophthalmological evaluation of glaucoma patients, hence majority of the patient with PACG are misdiagnosed as POAG.<sup>3</sup>

The ocular dimensions measured by A scan, USG can be used to characterise the different subgroups of PACG and also predict the risk of PACG in patients with PACS and PAC.

Several studies have been conducted in different parts of India to study the profile of PACD, no study has been performed in central Karnataka of which our institute is a part of. Hence this cross sectional study was undertaken to study the clinical profile and ocular biometric characteristics of patients with the spectrum of PACD at our institute.

### Methods-

This cross sectional Hospital based study included all the patients satisfying the inclusion and exclusion criteria and their demographic data with detailed history including ocular and family history was noted. After obtaining written informed consent, all the patients were subjected to undergo a detailed ophthalmic examination which would include- Best corrected visual acuity for distance using Snellen's chart and near vision using Jaeger chart. Refraction with streak retinoscopy or Auto Refractometer. Slit lamp examination of anterior segment with anterior chamber depth measurement using- Van Herick's grading method. Slit lamp fundus biomicroscopy examination of the optic disc with a 90D lens through undilated pupil. IOP measurement with Goldmann Applanation Tonometer. Gonioscopy was performed with a Sussman indentation gonioscopy in dim illumination using a

shortened slit beam taking care that it does not fall on the pupil. The Shaffer's grading system was used to grade the angle of anterior chamber. This was followed by indentation gonioscopy to look for synechiae. Ocular biometry was performed under topical anaesthesia(0.5% Proparacaine Hydrochloride eye drop) using ultrasonic biometer. The axial length(AXL), anterior chamber depth (ACD), lens thickness(LT) was measured for each eye. Biometry was performed before the use of pilocarpine. Central corneal thickness (CCT) was measured using Ultrasonic Pachymetry. Visual field analysis will be done as applicable.

The measured parameters was used to calculate<sup>4,5</sup> Corrected anterior chamber depth(CACD), Lens position(LT), Relative lens position.

### Statistical analysis-

Statistical data was done using SPSS (version 17, IBM) software. Qualitative data was represented in the form of frequency and percentage. Quantitative data was represented in the form of mean and standard deviation. Associations of variables was done with Chi Square test. Comparison of mean between three groups of data was done by One way repeated measure Analysis of Variance(ANOVA). A P value of <0.005 was considered statistically significant.

### Results-

This hospital based, cross sectional study was conducted between December 2019 and April 2021 and evaluated 60 eyes of 30 patients and the following observations were made:

The average presenting age was 52.2±9.6 years. The highest incidence of cases that is, 50% were between 61-70 years. Second highest incidence of the cases that is 23% were between 51-60 years. The majority were female patients accounting for 66.7% of the total cases. 33.3% of the cases were male patients.

Table 1 shows that out of 60 eyes, 47 eyes had VH grade 1 and 12 eyes had VH grade 2. Gonioscopic quantification of AC angle by Shaffer's grading showed that 37 eyes had grade 0 Shaffer's grading, 21 eyes had grade 2 and 1 eye had grade 2. Our study contains total of 60 eyes of which 59 eyes were diagnosed with PACD.

**TABLE 1: Van Herick's and Shaffer's grading of angles**

	Grading	No of eyes	percentage

VH Grading	1	47	79.7
	2	12	20.3
Shaffer's Grading	0	37	62.7
	1	21	35.6
	2	1	1.7

24 eyes had PACG, 11 eyes had PAC, 23 eyes had PACS, 1 eye had acute angle closure crisis and 1 eye was pseudophakic(Table 2).

**TABLE 2 : DIAGNOSIS**

DIAGNOSIS	No of eyes	Percentage
PACG	24	40
PAC	11	18.33
PACS	23	38.33
AAC crisis	1	1.67
PSEUDOPHAKIA	1	1.67
Total	60	100.0

Out of 59 patients with PACD the spherical equivalent of 58 cases was documented. All 58 cases were hypermetropic. The mean spherical equivalent in PACG, PAC and PACS was 0.69±2.5D, 0.97±1.5D and 0.91±2.8D respectively. And comparison of spherical equivalent between the 3 groups of PACD was done. There was no statistically significant difference between the groups (P= 0.95). At the time of initial diagnosis, the intraocular pressure in 59 patients with PACD was noted. The IOP in patients with PACG, PAC and PACS was 38.7±17.0, 20.9±5.8 and 15.0±2.5mmHg respectively. And comparison between the three group showed the P value of <0.001. Thus there was a significant difference in the IOP values between the groups.

In our study the mean central corneal thickness in patients with PACG, PAC and PACS was 520±40µ, 530±50µ and 540±30µ respectively. This difference between the groups did not reach statistically significance (P =0.08). The mean AXL in patients with PACG, PAC and in PACS was 22.05±0.63, 22.06±0.44 and 21.90±1.05mm respectively. The mean CACD with PACG, PAC and PACS was 2.44±0.75, 2.34±0.57 and 2.37± 0.89mm respectively. And the mean lens thickness in PACG, PAC and PACS was 3.92±0.98, 3.78±0.89 and 3.74±1.00mm respectively. And P value of AXL, CACD and LT was 0.77, 0.93 and 0.80 respectively(Table-3). There was no statistically significance difference between the AXL, CACD and LT among the 3 groups of PACD.

**Table-3: Comparison of CACD, AXL and LT between different types of PACD**

DIAGNOSIS	CCT	AXL	CACD	LT
PACG	0.52±0.04	22.05±0.63	2.44±0.75	3.92±0.98
PAC	0.53±0.05	22.06±0.44	2.34±0.57	3.78±0.89
PACS	0.54±0.03	21.90±1.05	2.37±0.89	3.74±1.00
P Value	0.08, NS	0.77, NS	0.93, NS	0.80, NS

The LP in the patients with PACG, PAC and PACS was 4.80±0.63, 4.53±0.62 and 4.39±0.96 respectively. Relative lens position in patients with PACG, PAC and PACS was 2.17±0.32, 2.05±0.28 and 2.05±0.43 respectively(Table-4). Comparison of LP and RLP between the 3 groups was done with P value of 0.21 and 0.45 respectively. There was no statistically significant difference between the LP and RLP among the 3 groups of PACD.

**Table 4: Comparison of LP and RLP between different types of PACD**

DIAGNOSIS	LP (mm)	RLP (mm)
PACG	4.80±0.63	2.17±0.32
PAC	4.53±0.62	2.05±0.28
PACS	4.39±0.96	2.05±0.43
P value	0.21, NS	0.45, NS

Laser PI(LPI) was done in 67.8% of eyes, topical medications was given in 49% of patients and 3 eyes underwent triple procedure.

**Discussion-**

This hospital based, cross sectional study evaluated 59 eyes of 30 patients who were newly diagnosed with PACD. PACS was detected in 23 eyes, PAC in 11, PACG in 24 eyes and one eye had AAC crisis. Among the 24 eyes with PACG, 6 eyes had advanced glaucomatous

optic nerve head damage and 9 eyes had glaucomatous optic atrophy. A positive family history of PACD was found in only 1 patient.

Among the ocular biometric parameters studied, axial length, corrected anterior chamber depth and relative lens position was reduced and lens thickness was increased compared to the normative values mentioned in literature.

In our study the mean age was found to be 52.2±9.6 years and a significant association was found for subjects aged more than 60 years. Similar to study by Chandrima P et al mean age of patients with PACD in rural population was 59.9 years and in urban population was 59.7 years.<sup>6</sup> Increase in age is associated with angle closure disease, as reported by other studies probably due to increase in lens thickness in anatomically predisposed eyes as the age increases.<sup>7,8,9</sup>

In our study gender analysis revealed a female predominance that is among 30 patients, 20(66.7%) were female and 10(33.3%) were male patients. Similar observation of female preponderance has been observed in the study by Sihota et al where female predominance of 51.4%<sup>10</sup> and in a study by Vijaya I et al.<sup>11</sup> Predisposition to PACD as shown by ocular biometric data such as shorter AXL and decreased ocular volume leading to crowding of AC angle may explain the increased risk of PACD in women.<sup>11</sup>

At the time of initial diagnosis the mean IOP was higher in patients with PACG. Parul et al and Sirisha et al also found higher mean IOP in patients with PACG.<sup>12,13</sup> However in our study mean IOP in patients with PACG was higher compared to previous studies.

All the 58 eyes of our patients had hypermetropia. Cases with PACG, PAC and PACS had mean spherical equivalent of +0.69±2.5D, +0.97±1.5D and +0.91±2.8D respectively.

In the study by R Sihota<sup>8</sup> the refractive error in patients with PACD was found to be hypermetropic which was comparable to our study and also in a study by R Lowe et al where maximum number of patients were hypermetropic and very few were myopic.<sup>14,15</sup>

In various studies angle closure glaucoma and narrow angles occur most frequently in emmetropic or hypermetropics.<sup>15,16</sup> The smaller ocular dimensions and forward insertion of the root of iris onto the anteromedial surface of the ciliary body account for shallowness of the AC angle in hypermetropics which predispose them to PACD.

We found that 62.7% of eyes with PACD had Shaffer's grade 0 on gonioscopy, out of which 76.6% of eyes had VH grade 1 and 8.3% had VH grade 2. 35.6% of eyes had Shaffer's grade 1 on gonioscopy among which 23.4% were VH grade 1 and 83.4% were VH grade 2. We found a good association between Van Herick's grading and Shaffer's grading system which was statistically significant(P<0.001). This observation is similar to the study by Kenji et al who suggested that Van Herick's technique can be used as a simple method in evaluating narrow angles.<sup>17</sup>

In our study the mean central corneal thickness in patients PACD was within the normal range. In a study by Mohammad Reza et al<sup>18</sup> the CCT in APAC and PACG was 555µm and 524µm respectively. Patients with CCT greater than 540.5µm were at higher risk of APAC with sensitivity of 74.2% and specificity of 70.8%. However we demonstrated that CCT in all the 3 groups were within the normal range hence CCT is not found to be significant in our study.

**Axial length-**

In the present study the mean AXL in patients with PACG, PAC and in PACS was relatively on lower side in all the groups. Similar to our study Mohammad Reza et al and R George et al also found AXL to be significantly less than the normal.<sup>18,19</sup> Hence the shorter axial length was seen in our study and in various studies suggests an anatomical predisposition to occludable angle and angle closure glaucoma.<sup>11,20,21</sup>

**Corrected anterior chamber depth-**

The corrected anterior chamber depth in our study was calculated by the difference between the anterior chamber depth and central corneal thickness. The mean CACD in our patients with PACG, PAC and PACS was 2.44±0.75, 2.34±0.57 and 2.37± 0.89 respectively.

In a study by Mohammad Raza et al<sup>18</sup> corrected anterior chamber depth (CACD) was less than in our study which appears to play a role in the

development of an acute attack. CACD less than 2.02mm was associated with a greater risk of developing APAC with sensitivity of 70% and specificity of 68.1%. Shallower CACD will lead to crowding of angle structure and is a risk factor for peripheral anterior synechiae.

#### Lens position and Relative lens position-

The lens position and relative lens position was found to be less in our study compared to Yu-Wen-Lan et al and Mohammad Raze et al.<sup>22,18</sup> Merula et al evaluated 30 patients with APAC and reported a difference only in LP between affected and fellow eye.<sup>23</sup>

The significantly less RLP in our study supports the concept that an anteriorly situated lens was responsible for crowding of anterior segment and may predispose the eye to PACD. However there was no significant difference in LP and RLP between the groups in our study. The RLP is determined not only by the thickness of the lens but also by the position of the ciliary processes and the configuration of the zonules. Anteriorly situated ciliary processes have been suggested as playing a role in angle-closure glaucoma.<sup>23,21</sup>

#### LIMITATIONS OF OUR STUDY

A Smaller sample size. Cross sectional study design without follow up of the patients to know the course of PACD. We did not have a subgroup of normal individuals to compare the biometric parameters in our subset of the population.

#### CONCLUSION

Majority of patients with PACD tend to have PACG and PAC at presentation. Patients with PACG had advanced to end stage disease at diagnosis, emphasizing the need for improved glaucoma screening measures to ensure early detection of PACD to reduce blindness rates. Patients with PACD have lower AXL, ACD and significantly anteriorly positioned lens, which may contribute to the development of PACD. Although the ocular biometric parameters did not differ between the three groups of PACD, they were less than the normally reported data. A prospective study which follows the progression of the biometric variables may throw lights on the role of these parameters in the progression from PACS to PAC or PACG.

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