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Original Article

Profile of Primary Angle Closure Disease

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Abstract

Background
Glaucoma is the second most common cause of visual morbidity after Cataract. The purpose of the study is to assess the demographic and clinical profile of Primary Angle Closure Disease (PACD) and to evaluate the risk factors associated.

Method
A prospective observational study including 97 eyes of 50 patients above 40 years, with PACD at a tertiary health care centre. Aphakia, Pseudophakia, previous ocular surgery, secondary glaucoma, and ocular pathology subjects were excluded. Detailed glaucoma workup, slit-lamp examination (VH Grading), Gonioscopy, ocular biometry (Axial Length, Anterior chamber depth, lens thickness) were recorded. All patients diagnosed with PACD were prospectively categorized into three subgroups, namely Primary Angle Closure suspect (PACS), Primary Angle Closure (PAC), and Primary Angle Closure Glaucoma (PACG) using International Society of Geographical and Epidemiological Ophthalmology (ISGEO) Classification.

Results
Out of 50 subjects, 52% were males, and 58% urban residents. Mean age was 60.14±11.81 years in PACD. Out of the total 97 eyes, 39.2% (38 eyes) had PACS subtype, 38.1% (37 eyes) had PAC, and 22.7% (22 eyes) had PACG subtype. The mean standard value of axial length was22.03±0.62mm in PACS, 22.46±0.42mm in PAC & 22.41±0.71mm in PACG. Anterior chamber depth was 2.36±0.21mm in PACS, 2.33±0.12mm in PAC & 2.22±0.7mm in PACG subgroup. Lens thickness was 4.52±0.74mm in PACS, 4.54±1.07mm in PAC & 4.61±1.05mm in PACG subgroup.

Conclusion
PACS was the most common subgroup. Shallow anterior chamber, increased lens thickness, lesser axial length, and advancing age were the risk factors in PACD.

Recommendations
The present study highlights that screening of subjects can detect PACD at early stages and thus prevent potential blindness.

Keywords: *Primary Angle Closure Suspect, Primary Angle Closure, Primary Angle Closure Glaucoma, Primary Angle Closure Disease*
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Introduction

Glaucoma ranks as the second leading cause of vision loss globally, following cataract [1]. It is a chronic, progressive optic neuropathy with a multifactorial origin, marked by characteristic damage to the optic nerve head and associated visual field defects. Elevated intraocular pressure (IOP) is a well-established risk factor. In 2010, an estimated 60.5 million individuals worldwide were affected by primary glaucoma, with approximately 8.4 million cases resulting in bilateral blindness [2].

The prevalence of primary angle closure glaucoma (PACG) in India shows considerable regional variation. In southern India, reported prevalence ranges from 0.5% to 4.3% [3], while a study from eastern India found it to be 0.23% [4]. This variation is likely influenced by the country's vast geographic and ethnic diversity, which impacts the patterns and presentation of glaucoma across different populations [5].

This study aims to explore the demographic and clinical characteristics of various subtypes within the spectrum of primary angle closure disease (PACD). PACD includes three major stages: primary angle closure suspect (PACS), primary angle closure (PAC), and primary angle closure glaucoma (PACG). Accurate classification of the disease stage is essential for guiding appropriate management, which may involve medical therapy, laser procedures, or surgical interventions.

The institution, a tertiary referral center serving much of the Himalayan region, provides a valuable opportunity to evaluate the profile of PACD in this underrepresented area of North India. To the best of our knowledge, this is among the first studies conducted on this subject in this region.

Methodology

Study design

A Prospective observational study.

Study setting

The study has been conducted in the Department of Ophthalmology (Glaucoma clinic) at Shri Mahant Indiresh Hospital, Dehradun.

Participants

Inclusion criteria

All patients aged above 40 years of age, of both genders, susceptible to PACD with or without normal Intra-ocular pressure and symptoms like Diminution of vision, Pain, and Redness are included in the study.

Exclusion criteria

All patients with Aphakia, Pseudophakia, or a history of glaucoma surgery, as well as subjects with Secondary Glaucoma, were excluded, as staging of PACD is not possible.

Bias

Errors in measurements of Biometry

Data collection

97 eyes of 50 patients (hospital OPD and rural camp, under DBCS scheme) above 40 years, with PACD done. Amongst these 50 patients, 3 eyes had a hazy cornea, so gonioscopy could not be done to make the diagnosis (hence 97 eyes of 50 patients).

Detailed history taking, including age, sex, and residence (rural/urban). Visual acuity and Refraction (Snellen's Visual acuity) were done. Slit lamp examination of the Anterior segment, Gonioscopy, Goldmann Applanation Tonometry, and Posterior segment evaluation using Slit Lamp Biomicroscopy were done. Axial length, anterior chamber depth, and lens thickness were evaluated (Nidek US-4000 Echoscan). Investigations like OCT RNFL and Disc Map (Nidek RS3000 machine) and Visual field analysis (Humphrey's Automated Perimetry) were done as and when required. All the patients diagnosed with a definitive primary angle closure disease (PACD) were prospectively studied concerning the three stages of angle closure disease, which were Primary Angle Closure suspect (PACS), Primary Angle Closure (PAC), and Primary Angle Closure Glaucoma (PACG), using International Society of Geographical and Epidemiological Ophthalmology (ISGEO) Classification.[6]

Classification of primary angle closure disease [6]

Primary Angle Closure Suspect (PACS)

It is diagnosed when gonioscopy reveals posterior meshwork iris contact (ITC) in three or more quadrants without peripheral anterior synechiae (PAS). It was noted that many patients with less ITC exhibited evidence of

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intermittent angle closure. Therefore, a lower threshold for diagnosis, such as two quadrants of ITC or pigment smudging, or even a very narrow angle approach (perhaps 20° or less), was considered justifiable. Additionally, normal intraocular pressure (IOP), optic disc, and visual field were observed in these cases. The risk of progressing to primary angle closure glaucoma (PACG) within five years was estimated to be around 30%.

Primary Angle Closure (PAC)

Gonioscopy showed three or more quadrants of ITC with raised IOP and/or PAS or excessive pigment smudging on the TM. A normal optic disc and field were observed. PAC was further classified into non-ischaemic and ischaemic, with ischaemic PAC showing anterior segment evidence of prior substantial IOP elevation, such as iris changes.

Primary Angle-Closure Glaucoma (PACG)

ITC was observed in three or more quadrants, accompanied by glaucomatous optic neuropathy. Optic nerve damage could result from an episode of severe IOP elevation, such as acute angle closure, but it might not have appeared as typical glaucomatous cupping.

Statistical method

The whole data was collected in Microsoft Excel, and the results were statistically analyzed for Mean and Standard Deviation, and the p-value, wherever required, was calculated using a paired sample t-test on SPSS software.

Ethical considerations

Approval obtained from the Institutional ethical board *(ECR/710/Inst/UK/2015/RR-21*, Reference number - *SGRR/IEC/62/63*)

Results

In the present study, out of 327 patients attending the glaucoma clinic, 50 individuals were diagnosed with PACD.

Table 1: Age-wise distribution of the participants

Age	Number	%
40-50	4	8%
51-60	17	34%
61-70	19	38%
>70	10	20%
Total	50	100%

Out of a total of 50 individuals surveyed, 4 subjects were between the 40-50 years (8%), 17 subjects were between the 51-60 years (34%), 19 subjects were between the 61-70 years (38%) and 10 subjects were above 70 years of age (20 %) (Table 1). Out of 50 subjects, 24 are female (48%) and 26 are male (52%) (Table 2). Out of 50 respondents, 21 people (42%) stayed in rural areas, while 29 people (58%) stayed in urban areas (Table 2).

Table 2: Demographic profile of participants

Gender distribution		Residential distribution	
Male	24 (48%)	Rural	21 (42%)
Female	26 (52%)	Urban	29 (58%)

Out of the total 50 respondents, 21 people had PACS subtype, 17 patients had PAC, and 12 patients had PACG subtype. Out of 21 cases in the PACS subtype, with 9 males and 12 females. Out of 17 patients in the PAC subtype, 11 were males and 6 were females. Out of 12 patients in the PACG subtype, there were 4 males and 8

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females. The p-value of all the males and females in 3 subtypes of PACD was 0.206 among the surveyed population (Table 3).

Table 3: Sex distribution in 3 subtypes of PACD

Sex Distribution	PACS	PAC	PACG	P-value
Male	9	11	4	
Female	12	6	8	
Total	21	17	12	0.206

Primary Angle Closure suspect (PACS), Primary Angle Closure (PAC), and Primary Angle Closure Glaucoma (PACG)

Table 4 represents the risk factors involved in the cases of PACD, which were evaluated in a sample of 97 eyes. The mean values of Axial length are 21.1±2.28mm, lens thickness is 4.42±0.94mm, anterior chamber depth (ACD) 2.38±0.84mm, and the age of the subjects is 60.14±11.81years (Table 4).

Table 4: Risk factors involved in the study population evaluation for PACD

Clinical risk factors		
	Number of Eyes	Mean±SD
AXIAL LENGTH (mm)	97	21.1±2.28
LENS THICKNESS (mm)	97	4.42±0.94
AC DEPTH (mm)	97	2.38±0.84
Demographic risk factors		
	Number of subjects	Mean±SD
AGE (years)	50	60.14±11.81

Primary Angle Closure suspect (PACS), Primary Angle Closure (PAC), and Primary Angle Closure Glaucoma (PACG)

Out of the total 97 eyes screened in the present study, 39.2% (38 eyes) had PACS subtype, 38.1% (37 eyes) had PAC, and 22.7% (22 eyes) had PACG subtype.

The PACS (Primary Angle closure suspect) subgroup has 38 eyes. The mean axial length was 22.03 ± 0.62 mm, Lens thickness 4.52 ± 0.74 mm, AC depth 2.36± 0.21mm, and Age 61.24 ± 11.36 years were measured (Table 5). The PAC subgroup (Primary Angle closure) has 37 eyes. The mean axial length was 22.46±0.42 mm, Lens thickness 4.54 ± 1.07 mm, and AC depth 2.33 ± 0.12mm (Table 5). The PACG subgroup (Primary Angle Closure Glaucoma) has 22 eyes. The mean axial length was 22.41±0.71 mm, Lens thickness 4.61±1.05 mm, and AC depth 2.22±0.71 mm (Table 5). The p-value for axial length was 0.757, Lens thickness 0.922, AC depth 0.925, and Age 0.481 years, respectively (Table 5).

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Table 5: Comparison of 3 subtypes of PACD (PACS, PAC, PACG)

	PACS		PAC		PACG		
Comparison of clinical risk factors							
	Number of eyes	Mean±SD	Number of eyes	Mean±SD	Number of eyes	Mean±SD	p value
AXIAL LENGTH(mm)	38	22.03±0.62	37	22.46±0.42	22	22.41±0.71	0.757
LENS THICKNESS(mm)	38	4.52±0.74	37	4.54±1.07	22	4.61±1.05	0.922
AC DEPTH (mm)	38	2.36±0.21	37	2.33±0.12	22	2.22±0.7	0.925
Comparison of clinical risk factors							
	Number of subjects	Mean±SD	Number of subjects	Mean±SD	Number of subjects	Mean±SD	p value
AGE (years)	21	61.24±11.36	17	61.35±10.99	12	56.5±13.85	0.481

Primary Angle Closure suspect (PACS), Primary Angle Closure (PAC), and Primary Angle Closure Glaucoma (PACG)

Discussion

This study was designed to evaluate patients presenting with Primary Angle Closure Disease (PACD), with a specific focus on identifying and analyzing its subtypes. Additionally, the study aimed to assess the demographic and clinical characteristics of these patients and identify key risk factors associated with the development and progression of PACD. Through this focused approach, we aim to provide a clearer understanding of PACD in the study population, which could inform more effective clinical management and preventive strategies.

Demographic profile

Age distribution in our cohort revealed that the highest proportion of cases (38%) was in the 61–70-year age group, followed by 34% in the 51–60-year age group. These findings are consistent with a study by Peram et al., where the majority of cases fell within the fifth to sixth decades of life [7]. Similar age trends have been observed in other studies as well [8].

In terms of gender distribution, our study sample showed a relatively balanced composition—52% male and 48% female. This is in contrast to findings by Peram et al., which reported a female predominance (72% females versus 28% males) [7]. Other studies, however, have noted a male predominance, reporting 61% and 67.6% male participants, respectively [9][10].

Regarding the residential background of participants, 58% were from urban areas, while 42% were rural residents. This urban-rural split differs from the findings of Ocansey et al., who reported an equal representation from both areas in their sample of 1,200 participants [11].

clinical profile

Among the 97 eyes screened, 38 eyes (39.2%) were diagnosed with Primary Angle Closure Suspect (PACS), 37 eyes (38.1%) with Primary Angle Closure (PAC), and 22 eyes (22.7%) with Primary Angle Closure Glaucoma (PACG). These results are in line with findings from Nikhil S. Chaudhari et al., who reported incidence rates of 8.8, 6.2, and 1.6 per 100 person-years for PACS, PAC, and PACG, respectively [12]. The predominance of PACS and PAC in our findings may be attributed to early detection through outpatient department (OPD) screening. PACS cases are often asymptomatic and identified during routine evaluations, while PAC and PACG tend to present

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more acutely, often with symptoms such as ocular pain and redness.

However, contrasting data were presented by Vasantha Suram et al., where PACG accounted for 69% of adult glaucoma cases, with PACS and PAC representing 18.3% and 12.7% respectively [13]. These differences highlight the importance of early screening programs in detecting PACD before it progresses to advanced stages like PACG.

Ocular biometric parameters and risk factors

Ocular biometry in our study revealed that axial length was shortest in the PACG group (22.41 ±0.71 mm), followed by PAC (22.46 ±0.42 mm) and PACS (22.03 ± 0.62 mm). This supports the understanding that shorter axial length is a significant anatomical risk factor for the development of PACG.

Lens thickness was found to increase across the PACD spectrum: 4.52 ±0.74 mm in PACS, 4.54 ±1.07 mm in PAC, and 4.61 ±1.05 mm in PACG. This trend suggests that thicker lenses may contribute to narrowing of the anterior chamber, thereby increasing the risk of angle closure.

Anterior chamber depth (ACD) also showed a decreasing pattern from PACS to PACG—2.36 ±0.21 mm in PACS, 2.33 ±0.12 mm in PAC, and 2.22 ±0.70 mm in PACG. These findings are consistent with those reported by Sihota et al., who noted significantly reduced ACD, shorter axial lengths, and greater lens thicknesses in PACD patients compared to controls [14]. These biometric changes play a key role in the pathophysiology of angle closure and can help predict progression to PACG.

Generalization

This study concludes that early detection can detect PACD at an early stage, and it can be applied to a larger population for screening of PACD

Limitations

The demographic analysis in our study was limited to age, sex, and residential status. Important variables such as race, ethnicity, and socioeconomic status, which can influence disease prevalence and progression, were not included.

Recommendations

The present study highlights that screening of subjects can detect PACD at early stages and thus prevent potential blindness.

List of abbreviations

IOP - Intraocular Pressure
PACD - Primary Angle Closure Disease
PACS - Primary Angle Closure Suspect
PAC - Primary Angle Closure
PACG - Primary Angle Closure Glaucoma
VH Grading - Van Herrick Grading
NCT - Non-Contact Tonometry
GAT - Goldmann Application Tonometry
BCVA - Best Corrected Visual Acuity
PCT - Peripheral Corneal Thickness
ACA - Anterior Chamber Angle
DA - Dark Area
OCT - Ocular Coherence Tomography

Source of funding

The study received no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

Author - Data collection, statistics, and article writing
Corresponding author - Study design, analysis of data, and formatting
Co-author - Article writing and analysis of data.

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