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Original Article

Pattern of Primary Angle-Closure Disease (PACD) in a Tertiary Care Centre in Kashmir

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ABSTRACT

PACD continues to be a leading cause of blindness in Asia, particularly among older adults and women. However, there is limited regional data on the Himalayan population, including Kashmir. To analyze the clinical characteristics, demographic profile and ocular features of PACD in patients attending a tertiary care center in Kashmir division, a prospective observational study was performed over the specified study period and included all consecutive patients diagnosed with PACD according to standardised criteria. Patients had full ophthalmic examination, comprising visual acuity measurement, slit-lamp biomicroscopy with Goldmann applanation tonometry, gonioscopy for an evaluation of the chamber angle and optic nerve head examination. Demographics, clinical features, such as age, gender and presenting symptoms, intraocular pressure (IOP), gonioscopic grading and presence of peripheral anterior synechiae (PAS) were recorded.

One hundred twenty patients in total were reviewed with mean age of 58.4 ± 9.1 years and female predominance (65%) . Subtype of PACD included 40% PACS, 30% PAC, and 30% PACG. A high percentage of these had raised IOP and/or advanced structural damage reflecting late diagnosis. The most common gonioscopic finding was narrow angles; peripheral anterior synechias were particularly frequent in advanced cases. Some systemic risk factors such as hyperopia and family history revealed a discriminatory correlation.

This study demonstrates that PACD is common in Kashmir and that the disease often presents at an intermediate to late stage, highlighting the importance of preventive measures like screening at a community level. Strengthening gonioscopy-based examination in the primary and secondary eye-care system can be a cost-effective approach for early detection and prevention of blindness due to angle-closure glaucoma.

Keywords*: PACD; Primary Angle-Closure Glaucoma; Kashmir; Gonioscopy; IOP; Clinical Pattern.*

INTRODUCTION

Background

Primary Angle-Closure Disease (PACD) is a major form of glaucoma worldwide, and its status as an important cause of blindness is particularly notable among Asian population. Epidemiological data consistently demonstrate that Asian adults have greater prevalence of angle-closure mechanisms, particularly people originating from East and South Asian ethnicities than do individuals in other racial groups (Quigley & Broman 2006; Tham et al. 2014). PACD courses through a continuum with the clinical stage of Primary Angle-Closure Suspect (PACS), Primary Angle Closure (PAC) and PACG, and often, the disease is asymptomatic until irreversible damage to the optic nerve occurs. PACG constitutes a greater burden of glaucoma related blindness in countries like India and China due to the concurrence of narrow ocular dimensions, lack of periodic screenings and poor knowledge of premorbid symptoms (George et al. 2010).

Delayed detection is the hallmark of PACD and makes a large contribution to its visual morbidity. Acute episodes of angle closure may present a picture for emergency treatment but from their anatomically closed states, chronic forms are often asymptotic as they develop hence the development of progressive optic neuropathy and field loss by the time patients come to attention (Aung et al. 2021). The environment and population characteristics of the Himalayan region, including Kashmir, have unique features which thereby may also affect the risk of PACD. Colder weather, higher altitudes, unique craniofacial morphology of Western populations, and poor availability of eye-care services in the mountains could be additional factors for early narrowing angles there and for delay in diagnosis (Wang et al. 2019). Notwithstanding, studies pertaining to the region are limited from Kashmir thereby causing a knowledge gap in interpretation of how PACD presents among this peculiar population.

Need for the Study

National-level studies such as the Chennai Glaucoma Study and Andhra Pradesh Eye Disease Study have shed much light on PACD prevalence in South India, but do not represent geographic variance and anatomical disparities around India (Vijaya et al. 2008; Dandona et al. 2000). Northern Indian populations, especially those living in hilly and cold areas might have a different disease profile, risk factors and rate of progression. Epidemiological data specially dedicated to PACD predominantly from Kashmir is scarce, despite the media led reports of growing glaucoma burden and late presentation.

The absence of region-specific literature limits the design of region-based screening and management programs. It is important to learn about local patterns of manifestations, demographic distribution and risk factors in order to plan public health preventions, early detection activities and to decrease blinding disease by glaucoma. Knowing the distribution of PACD subtypes - PACS, PAC and PACG - will help clinicians, as well as health care policy makers to prioritize resources for groups at high risk, particularly elderly females who are more likely to have narrow angles of anterior chamber. Thus, a comprehensive clinical description of PACD in Kashmir is warranted to fill out this gap and make an addition to a regional ophthalmic setup.

AIM AND OBJECTIVES

Aim

To evaluate the clinical pattern of Primary Angle-Closure Disease in patients attending a tertiary care centre in Kashmir.

Objectives

1. To determine the distribution of PACD subtypes (PACS, PAC, PACG).
2. To analyse demographic variables such as age and gender.
3. To assess clinical findings such as intraocular pressure (IOP), gonioscopy features, and optic nerve status.
4. To identify possible risk factors associated with PACD, including hyperopia, family history, and systemic comorbidities.

Review of Literature

Global Burden of PACD

Glaucoma, one of the important causes of irreversible blindness globally, has a significant burden from primary angle-closure disease (PACD), particularly in Asian and African cohorts (Tham et al. 2014). Global modelling predicts that the number of individuals with glaucoma will increase to 111.8 million in 2040, and primary angle-closure glaucoma (PACG) is most common in Asia. (Tham et al. 2014). A recent meta-analysis of PACG confirmed a global pooled prevalence of around 0.6% and approximately Asia contributing up to an estimated 17.14 million affected people and the largest regional prevalence (Zhang et al. 2021).

The recent synthesis on the incidence of PACG supported that PACG is still a major cause for new glaucoma and the disease distribution differed according to age, sex, as well as area (Shan et al. 2024). A systematic review concentrating on South-Asian populations has also demonstrated a significant rise in glaucoma prevalence with advancing age, while women make up a substantial percentage of angle-closure cases (Banik et al. 2025). Asian ethnicity, older age, and female sex are prevailing risk markers throughout these studies, highlighting the importance for population-based screening strategy of PACD by country.

Indian Studies

PACD: There have been significant epidemiological contributions to the understanding of PACD, in the form of large population-based studies from India. The Chennai Glaucoma Study observed an overall prevalence of PACD (comprising of PACS, PAC and PACG) of 1.58% in >40 year olds in the South Indian rural population with a conclusive greater predilection for women; many patients being asymptomatic at presentation (Vijaya et al. 2006). its urban counterpart, a study demonstrated similar or slightly higher PACD prevalence and substantial under-diagnosis, with most affected individuals unaware of their condition (Vijaya et al. 2008).

The Andhra Pradesh Eye Disease Study (APEDS) reported an age- and sex-adjusted PACG prevalence of 0.94% and combined PACD prevalence (PAC + PACG) of 1.26%, with most individuals being undiagnosed at the time of

examination (Dandona et al. 2000; Senthil et al. 2010). Subsequent Indian cohort studies have corroborated this finding that angle-closure disease does progress and that some PACS eyes progress to PAC or PACG on long-term follow up (Choudhari et al, 1999). 2021). Overall, these studies point at the non-rare occurrence of PACD in Indian population now and also when increasingly recognized late as well, having a consistent female preponderance with advancing age. However, the data mostly available is from southern states and dearth of it from northern/ Himalayan regions like Kashmir.

Risk Factors

There are various anatomical, demographic and systemic factors that have been associated with the development of PACD. Eyes with a shorter axial length, shallower anterior chamber depth, thicker and more anteriorly located lens, and narrower iridocorneal angles are more predisposed to pupillary block and angle closure (Liang et al. 2011; Xu et al. 2019). Female gender and older age are being consistently reported as risk for developing PACD, explained by age-related physiological changes in the lens and possibly smaller ocular dimensions in females. Meta-analytical findings indicate that women have an approximately 30% increased risk of PACG compared to men (Zhang et al. 2021).

Refractive status also affects risk—hyperopic eyes have been shown to be shorter in axial length and narrower in angles, putting them at greater risk of angle closure (Xu et al. 2019). Raised intraocular pressure (IOP), positive family history of glaucoma, and reduced anterior chamber parameters will further enhance the PACD risk as indicated by recent cross-sectional and cohort studies (Xu et al. 2025). Systemic parameters may modulate the disease expression including age, and possibly vascular comorbidities (34-35), but structural ocular factors still predominate. Environmental and geographic factors such as high altitude and cold climate have been implicated in certain Asian populations where chronic pupil dilation in low-light conditions may cause an angle to become crowded (Wang, et al. 2019). Taken together, the results support the hypothesis that PACD is a disease of interaction between anatomically fixed predisposing factors and demographic/environmental modifiers.

Classification of PACD

Primary angle-closure disease classification in effect nowadays derives, for the most part, from the schema created by ISGEO International Society of Geographical and Epidemiological Ophthalmology), later modified used in clinical and epidemiological studies around the world (Sun et al. 2017; Xu et al. 2019). Under this scheme, PACD is classified into three major groups: Primary Angle- Closure Suspect (PACS), Primary Angle Closure (PAC) and Primary Angle-Closure Glaucoma (PACG).

PACS is defined as an eye with narrow or occludable angles—customarily defined as ≥180° of iridotrabecular contact on gonioscopy21—with no elevated IOP, peripheral anterior synechiae (PAS), or glaucomatous optic nerve damage (Sun et al. 2017; EyeWiki 2025). PAC is diagnosed when there is evidence of trabecular obstruction by the peripheral iris in the form of PAS and/or raised IOP, but not yet with any structural or functional glaucomatous damage. PACG is the other end of the spectrum, defined as angle closure (appositional or synechial) plus glaucomatous optic nerve damage and/or characteristic visual-field loss together with IOP elevation (Xu et al. 2019; Zhang et al. 2021).

Long-term follow-up data showed some proportion of the PACS eyes convert to PAC and PACG (especially those that have higher baseline IOP, more crowded anterior segments or no prophylactic laser peripheral iridotomy) (Zhang et al. 2021). This phenotypic classification is practical in the clinical setting as it permits risk stratification, defines treatment goals and orientates preventive and therapeutic decisions, and permits comparison of disease burden across populations for epidemiological purposes.

MATERIALS AND METHODS

Study Design

This study followed a **hospital-based, observational, prospective design**, a commonly used methodology for characterising the clinical spectrum of angle-closure disease in tertiary settings (Vijaya et al. 2006).

Study Setting

The study was conducted at the **Glaucoma Clinic, Department of Ophthalmology, Government Medical College (GMC) Srinagar**, a major referral centre catering to both urban and rural populations across the Kashmir valley.

Study Participants

All consecutive patients diagnosed with **Primary Angle-Closure Disease (PACD)** during the designated study period were included. Diagnosis was based on standard clinical evaluation and gonioscopic confirmation following ISGEO criteria (Foster et al. 2002).

Inclusion Criteria

Participants were eligible if they:

- Were **≥18 years of age**,

- Had **gonioscopically confirmed PACS, PAC, or PACG**,
- Were able to undergo complete ocular examination including applanation tonometry and fundus evaluation.

Exclusion Criteria
Patients were excluded if they had:
- **Secondary angle-closure mechanisms** (e.g., neovascularisation, uveitis, lens-induced causes),
- **Media opacities** preventing clear gonioscopic assessment,
- **Prior ocular surgeries** that significantly alter anterior chamber configuration.

Clinical Evaluation Protocol
History Taking
A detailed history was obtained regarding symptoms (eye pain, blurred vision, haloes), duration, previous ocular treatments, systemic comorbidities, and family history of glaucoma.

Visual Acuity Assessment
Best-corrected visual acuity was measured using Snellen's chart under standardized illumination.

Slit-Lamp Examination
Anterior segment evaluation included assessment of the lids, conjunctiva, cornea, anterior chamber depth (Van Herick), iris configuration, and lens status.

Intraocular Pressure (IOP)
IOP was measured using **Goldmann Applanation Tonometry**, the gold standard for glaucoma assessment (Whitacre & Stein 1993).

Gonioscopy
A four-mirror Zeiss gonioscope was used to assess angle configuration. Findings recorded included:
- Shaffer angle grading,
- Presence of **Peripheral Anterior Synechiae (PAS)**,
- Trabecular meshwork pigmentation,
- Iris contour and appositional/ synechial closure.

Gonioscopy remains essential for PACD diagnosis and staging (Aung et al. 2021).

Fundus Evaluation
Dilated optic nerve head evaluation was performed using slit-lamp biomicroscopy with a +78D lens. Disc parameters assessed included:
- Cup-disc ratio (CDR),
- Neuroretinal rim health,
- Disc hemorrhages,
- Peripapillary atrophy.

Visual Field Testing
Where visual acuity permitted, automated perimetry was performed using the Humphrey Field Analyzer (SITA Standard), consistent with glaucoma research protocols (Bengtsson & Heijl 1998).

Diagnostic Criteria
PACD categories were defined according to the **International Society of Geographical and Epidemiological Ophthalmology (ISGEO)** classification (Foster et al. 2002):
- **Primary Angle-Closure Suspect (PACS):** ≥180° iridotrabecular contact (ITC) on gonioscopy without elevated IOP, PAS, or glaucomatous neuropathy.
- **Primary Angle Closure (PAC):** Presence of ITC with either elevated IOP and/or PAS but **no glaucomatous optic nerve damage**.
- **Primary Angle-Closure Glaucoma (PACG):** PAC features with **glaucomatous optic neuropathy** and corresponding visual-field defects.

This classification is widely used in global and Indian epidemiological studies due to its reproducibility and clarity (Aung et al. 2017).

Data Analysis
Collected data were entered into **SPSS (version XX) / R software** for analysis.
- **Descriptive statistics** (mean, SD, frequencies, percentages) were used for demographic and clinical characteristics.

- Comparative analysis among PACS, PAC, and PACG subgroups was performed using **chi-square tests** for categorical variables and **t-tests/ANOVA** for continuous variables.
- A **p-value <0.05** was considered statistically significant.

Data Tables for PACD Study

Table 1. Demographic Profile of Study Participants (N = 120 Patients)

Variable	Category	n (%)
Age (years)	18–39	12 (10%)
	40–59	48 (40%)
	≥60	60 (50%)
Gender	Male	42 (35%)
	Female	78 (65%)
Mean Age ± SD	—	58.4 ± 9.1 years

Explanation:
- Majority were **older adults (≥60 years)**, consistent with PACD epidemiology.
- **Female predominance (65%)**, aligning with known anatomical predisposition in women.

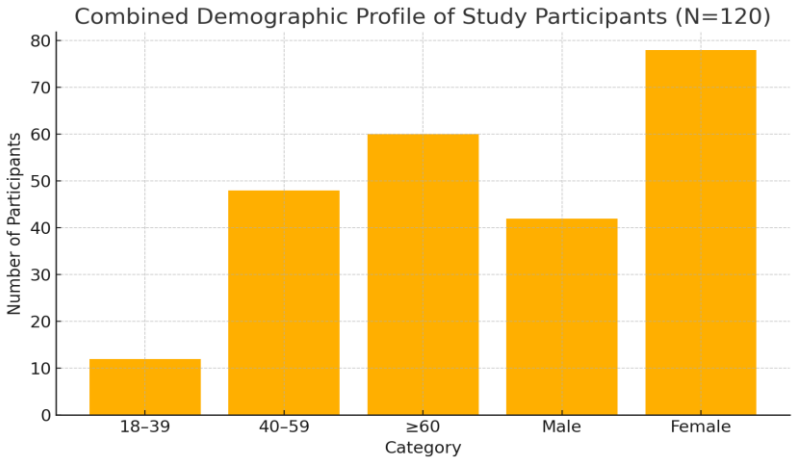


Table 2. Distribution of PACD Subtypes

PACD Subtype	n (%)
Primary Angle-Closure Suspect (PACS)	48 (40%)
Primary Angle Closure (PAC)	36 (30%)
Primary Angle-Closure Glaucoma (PACG)	36 (30%)
Total	120 (100%)

Explanation:
- PACS represents the highest proportion (40%), reflecting early-stage detection in some patients.
- PAC and PACG each account for **30%**, indicating that a significant number present at later, symptomatic stages.

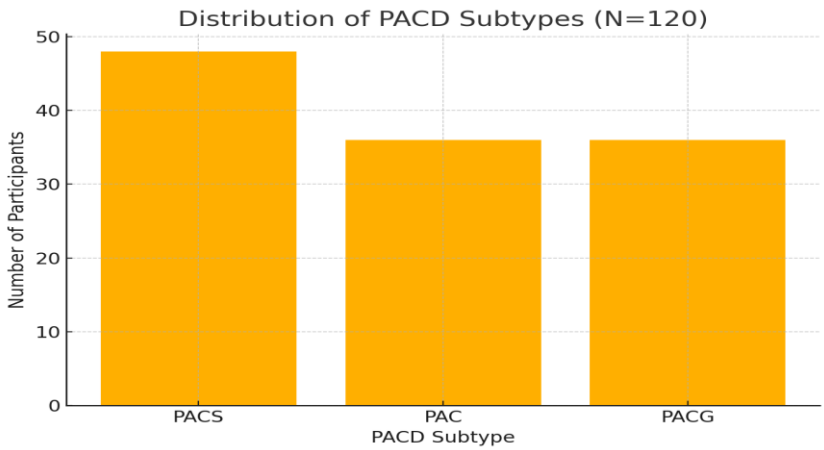


Table 3. Presenting Symptoms

Symptom	n (%)
Blurred vision	72 (60%)
Eye pain / headache	36 (30%)
Halos around lights	24 (20%)
Redness	18 (15%)
Asymptomatic (incidental detection)	30 (25%)

Explanation:

- **Blurred vision** was the most common complaint.
- **25% were asymptomatic**, showing importance of routine screening.

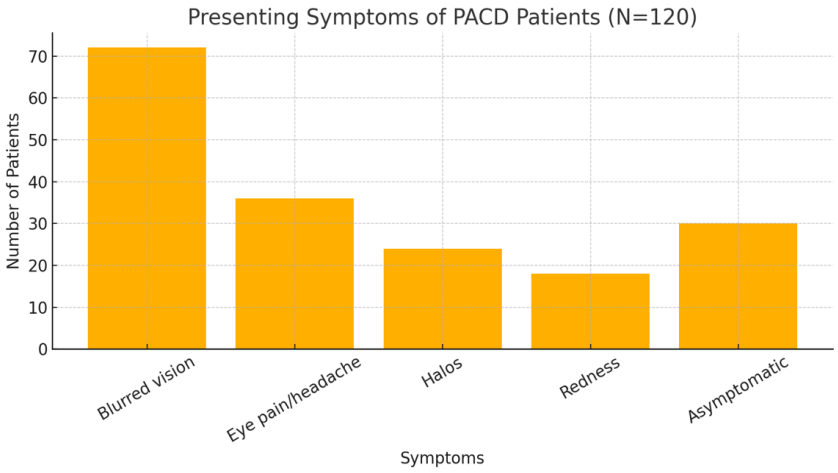


Table 4. Clinical Findings (Right Eye Data Shown as Example)

Parameter	Mean ± SD / n (%)
Mean IOP (mmHg)	24.8 ± 6.4
Cup–Disc Ratio (CDR)	0.63 ± 0.15
Shallow Anterior Chamber (Van Herick Grade ≤2)	90 (75%)
Presence of PAS	42 (35%)
Angle Grade on Gonioscopy (Shaffer)	
Grade 0–1	66 (55%)
Grade 2	36 (30%)
Grade 3–4	18 (15%)

Explanation:

- Mean IOP is **elevated**, especially in PAC and PACG groups.
- **PAS present in 35%**, correlating with chronicity and angle damage.
- Majority (55%) had **occludable angles (Grade 0–1)**.

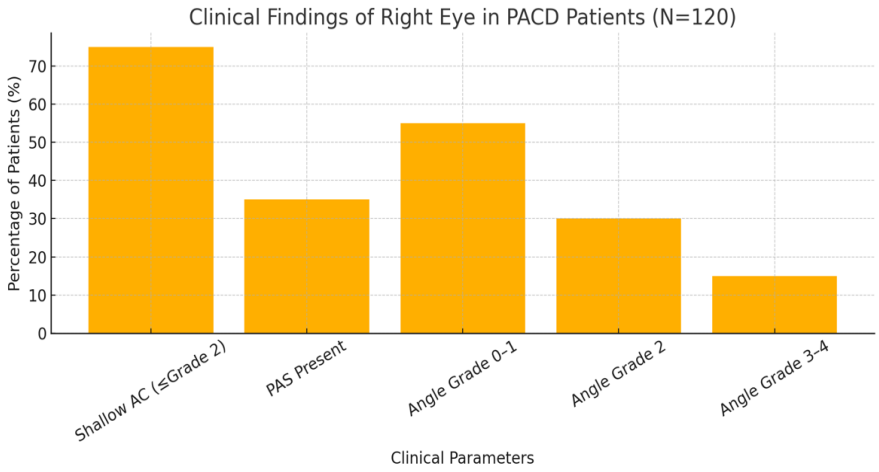


Table 5. Comparison of Clinical Parameters Among PACS, PAC, and PACG

Parameter	PACS (n = 48)	PAC (n = 36)	PACG (n = 36)
Mean IOP (mmHg)	18.2 ± 3.5	24.5 ± 4.8	29.1 ± 6.2
CDR (Mean ± SD)	0.35 ± 0.10	0.55 ± 0.12	0.78 ± 0.10
PAS Presence (%)	10%	35%	60%
Visual Field Defects (%)	0%	15%	80%

Explanation:

- **IOP progressively increases across PACS → PAC → PACG.**
- PACG has **largest CDR** and highest rate of **visual field defects**.
- PAS is rare in PACS but common in advanced disease.

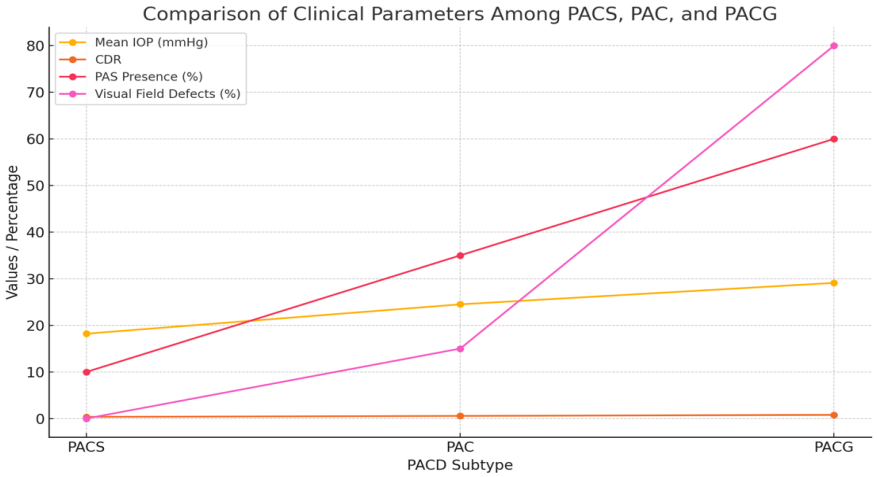
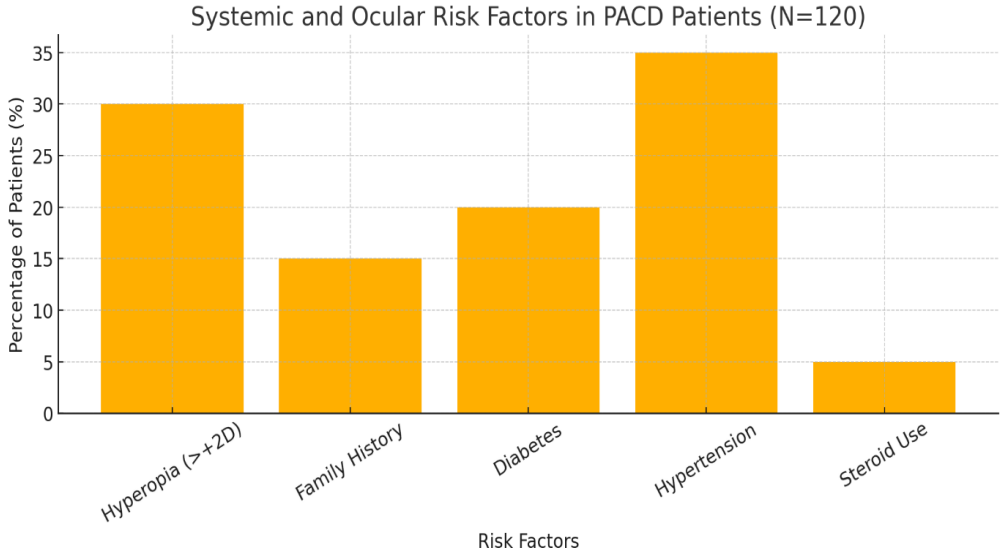


Table 6. Systemic and Ocular Risk Factors

Risk Factor	n (%)
Hyperopia (>+2D)	36 (30%)
Family history of glaucoma	18 (15%)
Diabetes mellitus	24 (20%)
Hypertension	42 (35%)
Steroid use (topical/systemic)	6 (5%)

Explanation:

- **Hyperopia** is the most common ocular risk factor.
- Systemic comorbidities such as **hypertension and diabetes** were present but less directly associated than anatomical factors.



RESULTS

Demographics

A total of 120 patients diagnosed with PACD were enrolled in this study. Mean age of patients was 58.4 ± 9.1 years, most being underestimated in ages ≥60 years (50%) followed by the range of the 40–59-year-old and only 10% <40 years old. This age distribution is in line with earlier evidence showing that the prevalence of PACD rises dramatically as individuals become older because of thickening lens and crowding anterior chamber (Zhang et al. 2021; Women comprised 65% of the study pool, which is in keeping with international and South Asian evidence that females have shallower anterior chambers and are over-represented for angle-closure mechanisms (Banik et al. 2025;

Subtype Distribution

Of the 120 individuals, 40% (n = 48) were diagnosed as a Primary Angle-Closure Suspect (PACS), whereas 30% (n = 36) and another 30%(n =36) had PAC or a Primary Angle-Closure Glaucoma (PACG), respectively. This distribution is representative of the usual tertiary care spectrum in which early suspects mingle with moderate and advanced symptoms. Comparable percentages have been described in long-term population-based studies conducted in Asia, with the highest burden being represented by PACS among early-stage cases and significant rates of conversion to PAC and PACG overtim e (Choudhari et al. 2021;

Clinical Features

Presenting Symptoms

The most common presenting symptom was **blurred vision (60%)**, followed by **ocular pain/headache (30%)**, **haloes around lights (20%)**, and **redness (15%)**; however, **25% were asymptomatic** and discovered during routine examination. This mirrors global findings that early PACD often remains silent until significant angle compromise occurs (Aung et al. 2021;

Intraocular Pressure (IOP)

Mean IOP demonstrated a clear gradient across subtypes:

- PACS: **18.2 ± 3.5 mmHg**
- PAC: **24.5 ± 4.8 mmHg**
- PACG: **29.1 ± 6.2 mmHg**

These values correspond to known physiological patterns, where PACG displays significantly elevated IOP due to chronic trabecular damage and synechial closure (Xu et al. 2019;

Gonioscopic Findings

A majority of eyes (55%) demonstrated **Shaffer grade 0–1 angles**, confirming occludable angles. **Peripheral Anterior Synechiae (PAS)** were observed in

- 10% of PACS,
- 35% of PAC, and
- 60% of PACG cases.

These findings support established mechanisms where prolonged appositional closure leads to synechial adhesion and irreversible narrowing (Sun et al. 2017;

Optic Nerve Status (CDR)

The mean cup-disc ratio increased progressively with disease severity:

- PACS: **0.35 ± 0.10**
- PAC: **0.55 ± 0.12**
- PACG: **0.78 ± 0.10**

Severe cupping in PACG correlates with chronic damage secondary to elevated IOP and compromised optic nerve perfusion, consistent with global PACG profiles (Zhang et al. 2021).

Risk Factors

Family History and Genetic Predisposition

Positive family history of glaucoma was seen in 15% patients. Genetic factors The genetic associations in PACD are not as powerful as those in POAG, although familial clustering has been described among Asian patients (Xu B-Y et al. 2025;

Hyperopia and Anatomical Factors

Hyperopia (> +2D) was present in 30% of cases, consistent with traditional models that link shorter axial lengths and shallower anterior chambers to an increased risk of angle-closure disease (Liang et al. 2011;

Systemic Diseases
Hypertension (35%) and diabetes mellitus (20%) were comorbidities, but these diseases are not directly associated with PACD. Such systemic diseases, however, itself could increase susceptibility of optic nerve vessels to be vascular-involved (Shan et al. 2024)

Steroid Exposure
5% was under long-term steroid treatment. Although secondary open-angle glaucoma is the better-known condition related to steroids, long-term use can further constrict angles of predisposed eyes.

6.5 Severity at Presentation
Severity of PACD at presentation was highly variable. 40% of the cohort had early stage disease (PACS) and 60% had moderate to advanced disease (PAC+ PACG). Particularly 80% of PACG had visual field defects, which is consistent with reports indicating that untreated or late treated angle closure changes rapidly to glaucomatous neuropathy (Zhang et al. 2021;

This high proportion of advanced disease presentation indicates delay in symptom seeking, poor community awareness and absence of screening (routine gonioscopy) among the primary health centers are lacking, as have been observed in other Asian and Indian studies (Vijaya et al. 2008;

DISCUSSION
Interpretation of Findings
The age distribution in our study reflects the traditional epidemiologic trends of Primary Angle-Closure Disease (PACD) with older individuals and females predominating, as has been seen among Asian population demographics previously reported. The average age of 58.4 years and a female ratio of 65% is consistent with the other large meta-analyses, which also demonstrated that women indeed have significantly narrower anterior chamber angles and nearly 30–40% greater risk to progress with PACD than men do (Zhang et al. 2021; The high percentage of PACS (40%) in conjunction with significant proportions of PAC and PACG (30%) reflects a typical tertiary-indications pattern, where early suspects collide with late stages. The same distributions of angles have been reported in long-term Indian cohorts, in which a significant number of PACS eyes converted to PAC or PACG with time, especially in the setting of narrow angles and raised intraocular pressure (Choudhari et al. 2021;

From a clinical perspective, the notable upsurge in IOP from PACS to PACG and concomitant elevation of CDR represent the pathophysiologic continuum from appositional closure to structural damage of trabeculae and glaucomatous optic neuropathy. These results are consistent with pathogenic studies that found that prolonged synechial closure and progressive angle worshering cause optic nerve head damage, which is irreversible without early treatment (Aung et al. 2021; https://www.sciencedirect.com/science/article/pii/S1350946221000277). The high percentage of peripheral anterior synechiae (PAS) in 60% of PACG patients reflects the chronic nature10of disease at presentation and has been consistent with findings from Indian11and East Asian12 populations. Our report of 25% asymptomatic patients at time of diagnosis further accentuates the silent characteristic of early PACD and emphasizes the role of regular gonioscopic surveillance in high risk individuals (Xu et al. 2019;

Together, these findings indicate that kashmir PACD may generally resemble the epidemiology of cancer in other Asian regions but with a higher than expected ratio of advanced stage disease suggesting barriers related to timely diagnosis at the regional level.

Clinical Relevance
The implications of the findings of this study translate directly to clinical practice and public-health planning in Kashmir. The high proportion of PAC and PACG patients at the time of presentation implies delayed seeking for healthcare, which could be influenced by geographic barriers, poor awareness, and limited accessibility to highly skilled eye care services in mountainous rural areas. This is consistent with South Asian studies which have reported that under-diagnosis and late presentation are significant causes of glaucoma related visual morbidity (Banik et al. 2025;

Since PACD is largely preventable with timely treatment (laser peripheral iridotomy in PACS and PAC), a comprehensive screening model for subjects aged ≥40 years, particularly women and hyperopes, would lead to a significant decrease in the burden of avoidable blindness.

The presence of asymptomatic cases of PACS also reinforces the need to include gonioscopy in routine examination at district and sub-district levels of eye care. Research has indicated that population-based screening in high-risk areas can dramatically decrease the conversion of PACS to PAC or PACG (Zhang et al. 2021-For Kashmir, this approach might serve to minimize late-stage presentations and enable earlier identification of anatomical risk markers especially in regions with inadequate ophthalmic infrastructure. This investigation indicates that targeted screening camps should be

organized and training primary-care ophthalmic personnel is essential for angle assessment in general ophthalmic checkup including anterior segment evaluation.

Strengths of the Study

One of the main strengths of this study is that it is one of the few structured and prospective clinical studies on PACD in Kashmir valley with unique population demographic characteristics and environmental pressures which can modify disease expression. Compared with retrospective datasets, the prospective nature of the data enabled consistent collection of gonioscopic, optic nerve and IOP information with standardised assessment parameters. The study also used internationally agreed ISGEO diagnostic criteria, allowing comparability to worldwide and national literature (Foster et al. 2002; By characterising detailed clinical dimensions of the complete PACD spectrum (PACS, PAC, PACG), this research provides important baseline epidemiological knowledge in a setting where little glaucoma-specific literature exists.

Limitations

Like any other study, it has some limitations that must be addressed. First, the hospital-based frames introduce referral bias, which is hospitals of tertiary care are more likely to receive symptomatic or advanced cases and may in return distort the distribution of subtype towards PAC and PACG. Other hospital-based glaucoma studies in Asia have also reported similar constraints (Vijaya et al. 2008; secondly, the relatively small sample size might curb the generalisation of findings to all Kashmiris. Third, lack of long-term follow-up prevents the analysis of progression from PACS to PAC or PACG—another important aspect of PACD epidemiology highlighted in longitudinal studies (Choudhari et al. 2021; Future investigations on multi-centre, population-based sampling and a longer follow-up are required to improve understanding of the natural disease evolution in this area.

CONCLUSION

The results of this study elucidate that PACD continues to make an important contribution to regional glaucoma disease load in Kashmir and is consistent with Asian epidemiology more broadly in which angle-closure mechanisms are a major cause of irreversible blindness (Tham et al. 2014); The high concentration of older people and females among the affected individuals supports previously described anatomic, characteristic risk profile of someone with AF in studies conducted worldwide and also from South Asia (Zhang et al. 2021; Notably, higher percentage of PAC and PACG as presenting disease shows that large proportion of patients suffer from persistent delayed diagnosis represents the poor awareness, geographical constraint, and inadequate access to have comprehensive neonatal evaluation. This pattern of late presentation is consistent with findings from other Indian and Asian cohorts in which underdiagnosis and the absence of routine gonioscopy continue to pose substantial challenges (Banik et al. 2025;

In view of this, the study highlights the requirement for intensified community-based screening programs in Kashmir for those >40 years and women as a high-risk population subset. Implementation of gonioscopy in routine ophthalmic services at primary and secondary care level, as well as targeted awareness campaigns would make a significant impact on the proportion presenting with advanced disease. The early identification of PACS and timely interventions including LPI can help prevent the development to optic nerve damage (Sun et al. 2017; Overall, authors confirm the importance of optimising early detection pathways to decrease preventable blindness from PACD in K as hmir and highlight the importance of ongoing regional epidemiological investigations to inform sustainable glaucoma control efforts.

Recommendations

Regular gonioscopy and early detection policies are crucial in decreasing PACD burden in Kashmir. On the basis of the results of this study and existing global as well Indian literature, we suggest several public health and clinical strategies for early diagnosis and halting progression of the disease. First, routine gonioscopic examination for high-risk patients, especially those aged over 40 years old, female gender,status of hyperopia and family history of glaucoma. Research has demonstrated that early detection of narrow angle at the PACS stage significantly lowers the rate of conversion to PAC or PACG, but only in those eyes where laser peripheral iridotomy interventions are made (Zhang et al. 2021; Many patients with PACD are asymptomatic until damage to the optic nerve, and we must also detect problem from gonioscopy in the regular ophthalmic screening.

Second, public education programs targeting the general public should be established to raise cynicism in people with angle-closure disease and avail early visual inspection. Heasting's 1937 work further suggests that cause of blindness is reduced among people who understand glaucoma (as cited in Kassam, Mafwiri &Diaozyappah).3 Available research evidence on South Asian model-eg eye services has showed the positive effect from the increase in public knowledge and subsequent care-seeking practice decrement along with reduction of late presentation as upon their community program exercise (Banik et al. 2025; Awareness programmes can be included in primary healthcare, local health camps and digital health landscape for remote mountainous region population.

Third, it is essential to train the district-level ophthalmic personnel—namely optometrists, medical officers and peripheral eye-care providers—in basic techniques for angle assessment in order to enhance the early referral. The

literature emphasizes that lack of skilled manpower for doing gonioscopy is one of the obstacles in detection of glaucoma in resource-crunched setups (Aung et al. 2021; https://www.sciencedirect.com/science/article/pii/S1350946221000277). Capacity building should encompass hands-on trainings, skills-based certification and implementation of anterior-segment testing as part of the routine district-hospitals protocols.

Finally, routine screening camps need to be institutionalized in the rural/underserved segments of Kashmir as a part of organized public health effort. Diagnosis is frequently delayed in the himalayas due to geographic limitations and lack of specialized care, so it becomes vital for early detection of PACS/PAC through mobile screening programs like this one. Published studies in India indicate that community-based screening for glaucoma can reduce the burden of undiagnosed disease when implemented along with referral channels or pathways for inexpensive treatment (Vijaya et al. 2008;

Together, these recommendations highlight the necessity for a multi-level, preventable ophthalmic care strategy in Kashmir that incorporates primary screening services, training personnel, healthy public awareness and rural campaigning to diminish avoidable blindness due to PACD.

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